SPEECH-LANGUAGE ACQUISITION AND SCHOLASTIC OUTCOMES OF CHILDREN WITH HEARING IMPAIRMENT FOLLOWING EARLY INTERVENTION IN SOUTH AFRICA: A COMPARATIVE STUDY

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IN FULFILMENT OF THE REQUIREMENTS OF THE DEGREE

PHD IN AUDIOLOGY (BY PUBLICATION)

BY

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Declaration

I, Aisha Casoojee, hereby declare that this submission is my own original work and that the assistance which I have received is detailed in the acknowledgements of this report. To the best of my knowledge and belief, this work contains no material that has been accepted for the award of any other degree or diploma at any university or other institution of higher learning, except where due acknowledgements have been made in the text. I am responsible for the study and conclusion reached.

________________________________	26/03/2025
Aisha Casoojee	Date

Dedication

“Read! In the name of thy Lord and Cherisher, Who created man out of a (mere) clot of congealed blood: Proclaim! And thy Lord is Most Bountiful, He who taught (the use of) the pen, Taught man that which he knew not (Qur’aan, 96: 1-5)”

This divine command to "Read in the name of your Lord" serves as my constant reminder to strive and seek knowledge. I am deeply grateful for the ability to read, write, and seek understanding, as these gifts from God enable us to improve ourselves. Acquiring knowledge is not merely an intellectual pursuit but a form of worship—an opportunity to show gratitude for the countless blessings He has bestowed upon me. May this small effort in seeking knowledge and greater understanding be pleasing to Him and contribute to the betterment of the hard-of-hearing child everywhere.

“My Lord! Be merciful to them as they raised me when I was young, Ameen!”

To my parents, whose love, wisdom, and selfless sacrifices have shaped the person I am today. This work is a testament to your dedication and love that you have invested in me.

Oh Allah, I ask you for Aafiyah. Ameen!

To my dear husband, Dr. Ismail Ebrahim Patel, where do I begin? Through love, sweat, tears, and finally, smiles, you have been by my side every step of the way. Together, we crisscrossed the country, explored dusty archives, pushed prams and changed diapers, and spent long days and even longer nights reading my drafts and meticulously editing my manuscripts. I am deeply grateful for your unwavering support, patience, and dedication. Thank you for walking this PhD journey with me.

“My Lord! Increase me in knowledge (Qur’aan 20:114).”

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as living arrows are sent forth.
The archer sees the mark upon the path of the infinite
And He bends you with His might
that His arrows may go swift and far."

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List of Abbreviations

AVT - Auditory Verbal Therapy

AVUK - Auditory Verbal UK

CMV - Cytomegalovirus

DALYs - Disability-Adjusted Life Years

DHH – Deaf-and-Hard-of-Hearing

ECD - Early Childhood Development

EHDI - Early Hearing Detection and Intervention

EI - Early Intervention

GBD - Global Burden of Diseases

HICs – High Income Countries

HPCSA - Health Professions Council of South Africa

IHF - Infant Hearing Framework

JCIH - Joint Committee on Infant Hearing

LSL-SA - Listening and Spoken Language-South Africa

LMIC - Low-middle-income country

NDP - National Development Plan

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analysis

SASL - South African Sign Language

SACIG – South African Cochlear Implant Group

SLTs – Speech-Language Therapists

TSLT - Traditional Speech-Language Therapy

UNHS – Universal Newborn Hearing Screening

WHO - World Health Organization

ZPD - Zone of Proximal Development

Abstract

Background: Children with congenital or early-onset sensorineural hearing impairment are at significant risk for delayed speech and language development, which can hinder their scholastic outcomes, particularly when early intervention (EI) is delayed or inadequate. Early Hearing Detection and Intervention (EHDI) has long been a critical focus within audiology; however, its effectiveness, particularly in Low-Middle Income Countries (LMICs) like South Africa, remains underexplored, with a lack of comparative research on Listening and Spoken Language–South Africa (LSL-SA) and Traditional Speech-Language Therapy (TSLT). Understanding the speech-language acquisition and academic trajectories of children receiving these interventions, and the role of parental involvement, is critical for optimising clinical and educational practices.

Purpose: The primary purpose of this study was to investigate and compare the outcomes of therapeutic communication approaches, with a specific focus on the LSL-SA (adapted Auditory Verbal therapy) approach and TSLT, while considering the perspectives of parents in South Africa. The research further examined the challenges and barriers to implementing these interventions within resource-limited settings. The specific objectives at special schools for children who are deaf-and-or-hard of hearing (DHH) in South Africa included: to describe the therapeutic communication approaches to EI implemented; to describe the frequency and nature of the therapeutic communication intervention approaches; to determine the speech-language acquisition and scholastic outcomes of children who received LSL-SA; to determine the speech-language acquisition and scholastic outcomes of children who received traditional speech-language therapy; to compare the speech-language acquisition and scholastic outcomes of DHH who received TSLT versus those who received LSL-SA; to identify the barriers and strengths of the communication intervention approaches based on the needs and goals of families of DHH children.

Methods: Generally, a quantitative, comparative, cross-sectional research design was adopted; however, each paper (presented as chapters in this thesis) outlines its specific research design and methodology. A non-probability, purposive sampling was used to select the records of DHH children enrolled in an EI programme, receiving either TSLT or LSL-SA at special schools in South Africa, as well as their parents. These records comprised audiology and therapy records, academic performance data, and parental questionnaires. Data were analysed using SAS version 9.4 for Windows. Generally, descriptive and inferential statistical analyses, including independent samples t-tests, chi-square tests, and logistic regression models, were conducted, as well as qualitative analysis using thematic analysis. For each paper (presented as chapters in this thesis), specific statistical analyses were employed and detailed in each chapter.

Results: The findings revealed significant differences in communication outcomes between children who received LSL-SA and those who received TSLT. DHH children in the LSL-SA group demonstrated significantly higher gains in speech intelligibility, receptive and expressive language, and vocabulary development than those who underwent TSLT ($p < 0.05$). Specifically, 63% of children in the LSL-SA group achieved age-appropriate speech intelligibility, compared to 45% in the TSLT group ($p = 0.046$). Similarly, higher percentages of children in the LSL-SA group showed age-appropriate expressive vocabulary (58% vs. 39%, $p = 0.048$) and receptive language (60% vs. 39%, $p = 0.043$). Furthermore, 66% of children in the LSL-SA group were recommended for mainstream schooling, compared to 39% in the

TSLT group ($p = 0.0023$). LSL-SA also resulted in a higher proportion of children achieving age-appropriate language milestones within shorter intervention durations. These results highlight the effectiveness of LSL-SA in improving speech and language outcomes and supporting mainstream school placement. Children in the LSL-SA group not only achieved better language outcomes but also demonstrated superior scholastic outcomes. Learners from the LSL-SA group had better literacy and numeracy skills, with shorter durations of therapy before discharge and a higher likelihood of transitioning to mainstream schooling compared to the TSLT group ($p < 0.05$). Children in the TSLT group required longer intervention durations before progressing to grade-level academic competencies. This is particularly notable in the context of LMICs, where resource limitations often affect the duration and accessibility of interventions. Parental engagement was a critical determinant of intervention success. Higher parental participation in LSL-SA correlated with stronger communication and academic gains. While parents expressed a preference for the LSL-SA approach, they reported receiving limited counselling regarding communication intervention options. Despite this, parental commitment to the intervention was strong, driven by their aspirations for their child's development. However, barriers to effective implementation of LSL-SA included linguistic mismatches, limited access to trained professionals, and resource constraints in public healthcare and education settings.

Conclusion: This study provides empirical evidence supporting the efficacy of the LSL-SA approach over TSLT in enhancing both speech-language acquisition and scholastic outcomes for DHH children in South Africa. The findings provide compelling, context-specific evidence supporting policy reforms towards the integration of LSL-SA in EI programmes in South Africa; expansion of LSL-SA training programmes for clinicians and educators; improvement of multilingual therapy resources to bridge language accessibility gaps; strengthening of EHDI programme implementation to ensure timely intervention; and enhancement of parental support programmes to maximise intervention success. Ensuring effective collaboration between parents, professionals, and educators is essential for optimising the outcomes for children with hearing impairment. Furthermore, the findings highlight the pressing need to scale up EI services, making LSL-SA interventions more widely accessible and adaptable to the diverse cultural landscape of South Africa. By fostering stronger partnerships between families, educators, and early interventionists, these services can be significantly improved, ultimately enhancing the quality and reach of communication interventions for children with hearing impairment.

Implications: These findings contribute to clinical practice, policy development, and future research in early intervention audiology. They emphasize the importance of adapting intervention models to the socio-cultural and linguistic diversity of South Africa. Further, longitudinal studies are recommended to track the long-term academic and social integration of DHH children across different intervention modalities.

Keywords: early intervention; hearing loss; Listening and Spoken Language; communication outcomes; South Africa; contextual healthcare, family-centred care, auditory verbal therapy, inclusive education, Speech-Language Outcomes

Chapter 1

CHILDHOOD HEARING IMPAIRMENT AND COMMUNICATION INTERVENTION APPROACHES: AN OVERVIEW

Chapter 1 offers a brief overview of childhood hearing impairment and communication intervention approaches. It also provides a statement of the research problem, rationale for the study and statement of originality. Lastly, this chapter provides an overview of the research methodology adopted in the study, including the main aim and objectives, followed by an overall outline of this thesis.

1.1 Background

"Children who hear acquire language without any particular effort; the words that fall from others' lips they catch on the wing, as it were, delightedly, while the little deaf child must trap them by a slow and often painful process. But whatever the process, the result is wonderful. Gradually, from naming an object, we advance step by step until we have traversed the vast distance between our first stammered syllable and the sweep of thought in a line of Shakespeare" - Helen Keller (Miller, 2016). This powerful statement by Helen Keller, who acquired hearing loss at 19 months old and was the first deaf-blind person to obtain a Bachelor of Arts Degree, illustrates the obstacles children with hearing impairment encounter in developing speech and language skills relative to their normal hearing peers.

Almost 142 years later, acquiring spoken language remains a challenge when auditory access is restricted due to hearing impairment (Persson et al., 2021). As a result, 34 million children need rehabilitation to address this disabling condition (World Health Organization [WHO], 2024). Without appropriate interventions, hearing impairment severely impacts effective language learning, cognitive development, educational progress, employment opportunities, social integration, and impacts on the economy (WHO, 2024; Health Professions Council of South Africa [HPCSA], 2018). Beyond language and cognitive development, the impact of early intervention (EI) extends into educational attainment. Academic success is heavily dependent on a child's ability to develop foundational literacy and numeracy skills, which are intricately linked to language acquisition (Moeller et al., 2024). Children with hearing impairment who do not receive timely intervention often experience persistent gaps in reading comprehension, written language, and classroom engagement, leading to poor scholastic outcomes (Maluleke et al., 2021). In the South African context, where multilingualism and educational disparities present additional challenges, it is critical to examine how different therapeutic approaches influence not only communication development but also broader academic performance. According to the Global Burden of Diseases (GBD) Injuries and Risk Factors Study 2019, hearing impairment is the third largest cause of disability, primarily affecting low- and middle-income countries (LMICs) (Haile et al., 2021).

In South Africa, an LMIC, approximately 12 million people live with some form of hearing impairment (WHO, 2021). The prevalence of hearing impairment presents significant challenges, particularly in underserved rural areas and disadvantaged communities (Joubert, 2022). A large proportion of South Africans depend on the public healthcare system, yet only about 16% of the population has adequate access to these services (Madela, 2023). This disparity creates a critical gap in healthcare delivery, resulting in hearing impairments—especially in children—going undiagnosed or untreated (Joubert, 2022). Consequently, affected individuals face increased challenges in language development, education, and social integration (HPCSA, 2018).

Amidst these significant challenges posed by hearing impairment, there are available and cost-effective methods to address it (Haile et al., 2021; WHO, 2024). These methods include 1) hearing screening models (Hoeve, 2023), 2) the provision of hearing amplification devices (Gosnell & Winters, 2023; Orji et al., 2020), and 3) early rehabilitation (Emmet & Francis, 2015; Moeller et al., 2024):

The Joint Committee on Infant Hearing (JCIH) proposed the Early Hearing Detection and Intervention (EHDI) programme to maximise language development and literacy in infants and young children with hearing impairment (JCIH, 2019). EHDI involves screening every newborn for hearing impairment within one month of birth, diagnosis of hearing impairment by three months old, and enrollment into an EI programme by six months old (JCIH, 2019). Investment in EHDI initiatives is based on mathematical models predicting 133 million disability-adjusted life-years (DALYs) averted at a global return on investment of US$14,81 for every US$1 in both LMICs and high-income countries (HICs) (Tordrup et al., 2022; Haile et al., 2021; Baltussen & Smith, 2012). One DALY represents the loss of one year of full health (WHO, 2024).

A study conducted by Orji et al. (2020) based on GBD data found that 401.4 million people globally require hearing amplification devices, 90% of whom live in African regions. It is estimated that if everyone in need utilised a hearing amplification device, the GBD would drop from 25 million to 10.3 million DALYs, a 59% reduction (Orji et al., 2020).

Early rehabilitation services encompass audiological management, family counselling, educational support, and communication intervention (Sass-Lehrer & Honingfield, 2022). Studies in LMICs show that communication intervention, despite the initial large costs associated with technology investments (Emmet & Francis, 2015; Drennan et al., 2015; Bichey & Miyamoto, 2008).

Two communication intervention approaches are implemented for children with hearing impairment and their families in South Africa: 1) Traditional Speech-Language Therapy (TSLT) – which incorporates sign language, total communication or cued speech, and 2) Listening and Spoken Language—South Africa (LSL-SA) – based on Auditory Verbal therapy principles (Casoojee, 2024). Various factors, including parental knowledge, cultural context, and the severity of hearing impairment, often influence the choice of communication intervention (Ching et al., 2018). However, what remains unclear is the extent to which these different intervention approaches lead to tangible differences in educational attainment and classroom performance. As South Africa continues to grapple with inequities in access to EHDI services, evidence-based decision-making is needed to determine which intervention approach offers the most sustainable academic benefits for children with hearing impairment. The rationale for this study, therefore, lies in its potential to provide empirical data on the long-term impact of EI, allowing policymakers, educators, and audiologists to optimise service delivery models for improved academic and life outcomes. For many parents, a key challenge after a hearing impairment diagnosis is deciding whether their child's speech and language skills will be best developed through speech, sign language, or both (Ching et al., 2018; Marschark et al., 2007). This decision is incredibly complex for parents without prior experience in hearing impairment or communication methods other than spoken language (DesGeorges, 2016; Harris et al., 2021; Mitchell & Karchmer, 2004). Studies in South Africa have highlighted that parents prefer an LSL communication modality, but the implementation of this approach is hindered by the lack of culturally sensitive and linguistically appropriate care (Casoojee et al., 2025). While research has extensively examined the effectiveness of various communication interventions, there remains a significant gap in understanding how these approaches influence scholastic outcomes in children with hearing impairment, particularly within the South African context. Most studies focus on speech-language acquisition without extending their analysis to measure how these interventions translate into academic performance. Given the pivotal role of education in long-term social and economic integration, this study seeks to compare two predominant intervention approaches—Traditional Speech-Language Therapy (TSLT) and Listening and Spoken Language–South Africa (LSL-SA)—to determine their relative effectiveness in supporting speech-language acquisition and scholastic outcomes. This comparative analysis is crucial for informing future clinical and educational strategies in the country. This is especially important in multilingual and multicultural contexts like South Africa. These findings highlight the need for communication interventionists to consider parental decision-making, cultural contexts, and linguistic sensitivity for effective collaboration.

The latest findings on TSLT indicate that infants with hearing impairment have the potential to acquire sign language or total communication when provided with exposure to these modalities during the critical period for language acquisition (Emmorey, 2023). However, many children with hearing impairment lack full access to sign language in their early years, often because they are born to hearing parents (Krebs et al., 2020). As a result, these children frequently experience language deprivation, which can significantly impact their speech-language development and academic outcomes (Hall et al., 2019; Humphries et al., 2014). In contrast, global studies on the speech-language acquisition and scholastic outcomes of children with hearing impairment who utilise the Listening and Spoken Language (LSL) approach report positive results (Akçakaya & Tavşancıl, 2016; Ching et al., 2017; Cupples et al., 2017; Dettman et al., 2016; Fulcher et al., 2015; Hitchins & Hogan, 2018; Lew et al., 2014; Moeller & Tomblin, 2015; Mortazavi & Mortazavi, 2017; Percy-Smith et al., 2017).

1.2 Statement of the Problem

Communication intervention is essential for mitigating the adverse effects of hearing impairment on a child's speech-language acquisition and academic success, as well as on broader societal outcomes (Smith et al., 2017). The South African Cochlear Implant Group (SACIG), in collaboration with Auditory Verbal-UK (AVUK), has adapted the Auditory Verbal Therapy (AVT) approach for the South African context. This adaptation has led to the development of Listening and Spoken Language-South Africa (LSL-SA), which is modelled after the LSL Certified Auditory-Verbal Therapist (LSLS Cert. AVT®) qualification by the AG Bell Academy (Casoojee, 2024).

However, implementing a first-world intervention approach in a diverse country necessitates contextually relevant intervention approaches and resources, which are currently lacking within the South African context. Additionally, there is insufficient context-specific research on the effectiveness of LSL in the South African setting. Furthermore, the comparative effectiveness of LSL versus Total Communication or Sign Language Therapy (approaches used in TSLT) in fostering speech-language development and academic achievement among children with hearing impairment remains unexplored. This research gap is particularly critical in resource-constrained environments such as South Africa, where challenges like limited access to trained professionals, financial constraints, and infrastructure limitations often hinder effective service delivery (Bureau of Economic Research, 2021). In these environments, optimising intervention strategies becomes essential to ensuring that available resources (i.e. personnel, funding, or facilities) are used in the most impactful way possible. Effective service delivery is not only about the availability of interventions but also about ensuring that those interventions are tailored to the unique needs of the population, culturally appropriate and scalable within the local context. Consequently, there is an urgent need for studies that evaluate and compare the impact of LSL and TSLT on speech-language outcomes and academic performance, with a focus on the cultural and linguistic diversity inherent within the South African context. This study sought to address this gap by assessing and comparing the effectiveness of LSL and TSLT interventions specifically adapted to the South African context.

By examining the efficacy of these adapted approaches, this study aimed to provide evidence on the most effective EI practices for children with hearing impairments, ensuring that interventions are culturally appropriate, linguistically relevant, and feasible in resource-constrained settings.

1.3 Motivation for the study

Despite significant research over the past 29 years in South Africa on the implementation of screening within EHDI programmes, there remains a notable gap in understanding and addressing the effectiveness of EI services following the diagnosis of hearing impairment. While research in high-income countries (HICs) has consistently demonstrated the positive outcomes associated with immediate access to effective EI (Ching et al., 2017; Stika et al., 2021; Yoshinaga-Itano, 2018), South African studies have predominantly focused on hearing screening, with limited exploration of intervention practices beyond this initial stage (Le Roux et al., 2015; Moodley & Storbeck, 2015; Storbeck & Pittman, 2008; Swanepoel & Almec, 2008; Van der Spuy & Pottas, 2008).

Historically, research by Storbeck and Pittman (2008) demonstrated the benefits of EI services for children with hearing impairment and their families, showing positive impacts on child development, family functionality, and family satisfaction. However, their study did not fully explore the progression to comprehensive EI services, including amplification. Despite recognising these benefits, follow-up studies that advance EI practices in South Africa have not emerged, leaving a critical gap in understanding how to effectively implement and assess these services (Moodley & Storbeck, 2015).

Given the global expansion of LSL programmes and their adaptation to the South African context, it is crucial to gather unbiased evidence on the effectiveness of these interventions. Although the Cochrane Collaboration's 2014 review criticised the lack of conclusive evidence regarding LSL benefits, the approach remains widely endorsed for its potential to support children with hearing impairment through effective use of hearing technology and strong partnerships between early interventionists and parents (White & Brennan-Jones, 2014). Therefore, rigorous research is required regarding the speech-language acquisition and scholastic outcomes of children receiving LSL-SA.

The existing literature often relies on anecdotal evidence and lacks controlled comparisons, resulting in limited and inconclusive findings regarding the effectiveness of LSL intervention approaches (Eriks-Brophy, 2012; Fairgray et al., 2010). To fill this void, this study compared speech-language and scholastic outcomes between TSLT and the LSL-SA approach. The study aimed to enhance the evidence base critical for evaluating intervention practices within the South African context by providing essential efficacy data.

Effective healthcare interventions require cognisance of contextual factors and adapting to their implementation and outcomes (Coles et al., 2020; Hlayisi et al., 2024). This is especially relevant in South Africa, where high rates of congenital hearing impairment intersect with significant disparities in healthcare access and resources. Although the LSL-SA approach shows promise for improving communication and scholastic outcomes, it faces challenges such as inadequate resource allocation, workforce shortages, and cultural and linguistic incongruency. These barriers can undermine the effectiveness of early hearing intervention programs and hinder equitable access to care.

In light of these challenges, this study sought to address critical gaps by comparing the TSLT and LSL-SA approaches, specifically within South Africa's socio-cultural and multilingual landscape. This study aimed to provide valuable insights into how linguistic diversity and socio-economic factors impacted the efficacy of adapted intervention approaches. This was an identified area for improvement in early communication interventions. The study also explored how the LSL-SA approach could be optimised to overcome barriers such as resource limitations and workforce shortages. Ultimately, the study aimed to provide actionable insights and evidence-based recommendations to enhance early communication intervention practices, foster continuity of care and improve societal integration for children with hearing impairment in South Africa. Through advancing evidence-based practices and informing policy development, this research aimed to surmount existing barriers, improving the implementation and effectiveness of EHDI approaches within the South African context.

1.4 Statement of Originality

The HPCSA, in its 2018 EHDI guidelines, highlights the critical importance of early detection and intervention for children with hearing impairment, drawing on established benefits seen in HICs regarding speech-language acquisition and scholastic outcomes. In South Africa, establishing EHDI programs has increased access to hearing technologies, enabling families to pursue LSL outcomes even for children with profound hearing impairment (Houston & Bradham, 2022). This context offered a unique opportunity for this study to evaluate the effectiveness of the LSL-SA approach in a multilingual and multicultural South African setting.

Despite the advancements, there is a notable gap in research on the LSL-SA approach, particularly in relation to technological advancements and their integration with family and cultural contexts. This study is pioneering in addressing this gap, as it is the first to investigate and compare the speech-language acquisition and scholastic outcomes of children with hearing impairment receiving LSL-SA versus TSLT in special schools for children with hearing impairment in South Africa. Currently, there are no efficacy studies on these interventions within this context or comparative studies available.

The findings from this study aimed to provide crucial insights for policymakers regarding the relevance and efficacy of the LSL-SA approach, potentially guiding EHDI protocols and advocating for earlier and more appropriate interventions for children with hearing impairment. By focusing on comparing the outcomes of LSL-SA and TSLT, this study aimed to provide a comprehensive understanding of both approaches, their relative effectiveness, and how they can be optimised to meet the needs of children with hearing impairment in South Africa. The goal is to inform policy and practice to improve access to appropriate interventions, expand the availability of trained professionals, and ensure that the chosen approach aligns with the diverse needs of the population, consistent with global trends in early communication intervention.

Additionally, the study addresses a significant research gap regarding parental involvement in EI. While the HPCSA emphasises the family's role as central to EI (HPCSA, 2018), limited research exists on parental views and their impact on intervention outcomes internationally and locally. This study aimed to explore these perspectives, offering novel insights into the strengths and barriers of intervention approaches based on individual family needs and goals.

In summary, this study compared the effectiveness of LSL-SA and TSLT, examining the cultural and contextual implications of EI in South Africa. Evaluating the outcomes of both approaches provides valuable insights into shaping the way forward in early hearing intervention. The findings suggest a shift in focus from screening to intervention within the South African EHDI framework, offering this LMIC an opportunity to establish a benchmark for inclusive and responsive healthcare practices.

1.5 Theoretical and Conceptual Framework

There is consensus in the literature that EI is crucial to the success of any EHDI programme, affirming that detection without subsequent intervention is of limited value (Khoza-Shangase, 2022). Current research in the South African context largely focuses on hearing screening, which, while essential, is insufficient for improving developmental outcomes. Effective management of hearing impairment must include comprehensive intervention strategies, including family support, to be truly impactful (Khoza-Shangase, 2022).

This research was framed within the Infant Hearing Framework (IHF) by Fitzpatrick (2010), which provides a structured approach to evaluating EI by examining a) the impact of early identification of hearing impairment and b) factors affecting the outcomes through both objective communication development measures and parental perspectives. The IHF framework is particularly suitable for this study as it extends the understanding of infant hearing research to encompass the current emphasis on EI and contextual factors.

The study explored the outcomes of EI for children with hearing impairment, focusing on multiple variables, including the severity of hearing impairment, the type of communication intervention, service models, family involvement, and the incongruence between therapists' and patients' languages and cultures within the South African context. The IHF framework categorises EI outcomes into four interrelated domains:

1) Communication outcomes: Empirical evidence of language outcomes from EI remains limited due to the lack of control groups in existing studies and the failure to compare communication intervention approaches (Casoojee et al., 2021; White & Brennan-Jones, 2014). This research aimed to identify the factors influencing speech-language acquisition and scholastic outcomes in children with hearing impairment.

2) Life Skills Outcomes: Learning and using new knowledge and skills is an outcome measure used by early interventionists and early childhood special education programmes to measure the young child's progress (NC Department of Public Instruction, 2020). This outcome evaluates how children with hearing impairment develop speech-language and cognitive skills to succeed in school and beyond (NC Department of Public Instruction, 2020).

This research aggregated data on scholastic outcomes to evaluate the effectiveness of implemented communication intervention approaches.

3) Process Outcomes: EI services aim to optimise each child's potential (Yoshinaga-Itano, 2020). In addition to tracking the individual progress of children with hearing impairment, evaluating the outcomes of communication intervention approaches is essential (Liu, 2016). This research assessed the effectiveness of two communication intervention approaches—TSLT and LSL-SA—in promoting speech-language acquisition and academic progress.

4) Family Outcomes: A foundational principle of EI is to focus on the child, family, and environment (American Speech-Language-Hearing Association, 2008; Crossman et al., 2018; Dalmau et al., 2017; Guralnick, 2011). Despite this, family-centred models often still focus on the child while considering family involvement complementary to the rehabilitation process (Dalmau et al., 2017). This study evaluated the strengths and barriers of the communication intervention approaches from the perspective of individual families and identified improvements based on their needs and goals.

This research identified gaps in knowledge and practices in EI. As a population health intervention, EHDI has brought congenital and early-onset hearing impairment under the international and national health spotlight. Alongside the IHF, Vygotsky's theoretical framework—the zone of proximal development (ZPD)—enabled this research to identify the outcomes of EI for children with hearing impairment. Vygotsky's ZPD focuses on the relationship between a child's current development level and potential development through guided problem-solving with more capable peers (Vygotsky, 1978). This concept guided this study in assessing how intervention plans within TSLT and LSL-SA are developed collaboratively between interventionists and parents to monitor progress and adjust interventions effectively.

The child with a hearing impairment's auditory functioning and use of communication in meaningful contexts are recorded to assist the LSL-SA interventionist in finding the child's ZPD and planning the next intervention steps (Estabrooks et al., 2016). By implementing the ZPD, the LSL-SA interventionist thus creates an auditory neural infrastructure in the child's brain upon which higher-level linguistic skills are scaffolded (Estabrooks et al., 2016). An explicit definition of the ZPD by Vygotsky is the relationship between learning and development: "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem-solving under the guidance or in collaboration with more capable peers" (Vygotsky, 1978).

An interpretation of Vygotsky's ZPD includes:

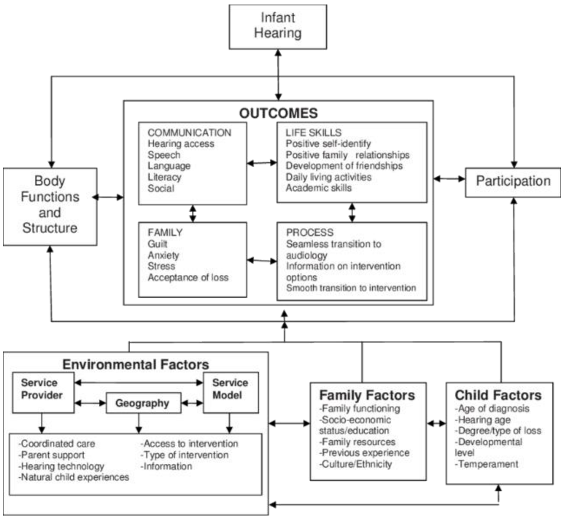
The distance between individual performance and assisted performance (Lave & Wenger, 1991) highlights how the interventionist and parent support the child with hearing impairment until they can internalise the skills and knowledge and begin to perform individually (Eun, 2019).

The ZPD has been interpreted as the distance between understood knowledge and active knowledge (Vygotsky's formulation of scientific concepts) (Lave & Wenger, 1991). Understood knowledge is acquired via formal instruction in an LSL-SA session. Active knowledge refers to knowledge gained by informal interactions between the child with hearing impairment and the world (Vygotsky's notion of everyday and spontaneous concepts) (Eun, 2019), emphasising the transition from formal instruction to informal, everyday interactions.

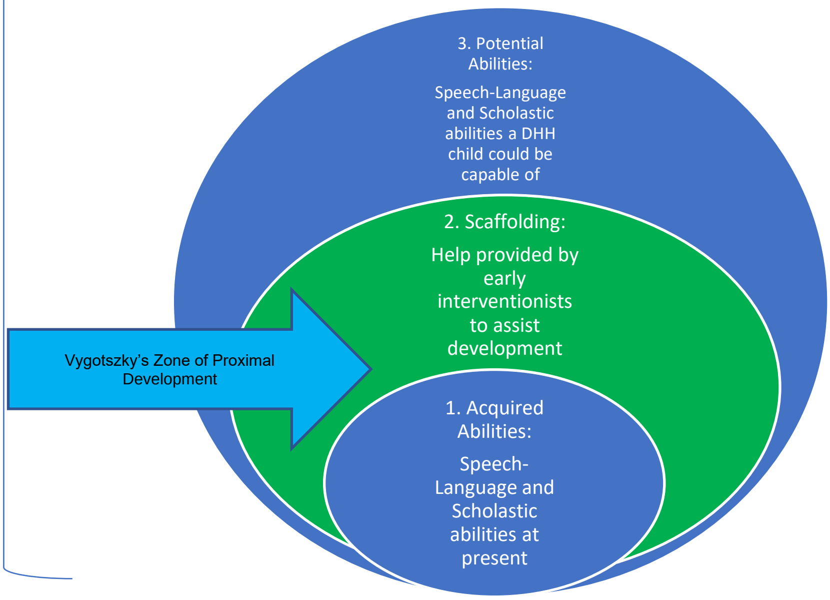
The distance between individual activity and societal activity (Engestrom, 2015) emphasises the continuous collective journey of children with hearing impairment striving to arrive at transformative understandings of the world (Vygotsky's envisaged nature of development as a continuous process) (Eun, 2019).

This time-dependent developmental mechanism framework (ZPD) of performance before competence represents a hierarchy of tasks and skills a child with hearing impairment can complete with the highest level of adult support during intervention that maximises a child’s learning potential to establish what they can do independently and increase the complexity of their communicative competency (Eun, 2019). Framing this study on the conceptual IHF and theoretical ZPD frameworks allowed the researcher to assess and compare the speech-language acquisition and scholastic outcomes of children with hearing impairment following EI, tailored to individual families' specific needs and goals within the South African context.

RESEARCH QUESTION
What are the speech-language acquisition and scholastic outcomes of DHH children following early communication intervention in South Africa?



Conceptual Framework by Fitzpatrick, 2010, p.29



Theoretical Framework of Vygotsky's Zone of Proximal Development (Adapted)

APPLICATION TO RESEARCH QUESTION:
The above combined frameworks assisted the researcher to implement the specific objectives of the study to determine and compare the speech-language acquisition and scholastic outcomes of DHH children following early intervention, contextually based on the needs and goals of individual families.

The Design includes quantitative, cross-sectional (descriptive and analytical) research.

Figure 1-1: Application of Framework to Methodology

While EI has been widely acknowledged as essential for mitigating the effects of hearing impairment, limited research has directly compared intervention approaches within the South African context. In particular, the differential impact of LSL-SA versus TSLT on both speech-language acquisition and scholastic outcomes remains underexplored. This study addresses this gap by providing empirical evidence on the effectiveness of these intervention models, contributing to the optimisation of EI frameworks in South Africa.

1.6 Research Aim

The primary objective of this study was to investigate and compare the speech-language acquisition and scholastic outcomes of children with hearing impairment following early intervention in South Africa.

1.7 Research Objectives

- To describe the therapeutic communication approaches to early intervention implemented at special schools for children with hearing impairment in South Africa from 2008 to 2019
- To describe the frequency and nature of the therapeutic communication intervention approaches at special schools for children with hearing impairment in South Africa from 2008 to 2019
- To determine the speech-language acquisition and scholastic outcomes of children who received LSL-SA at special schools for children with hearing impairment in South Africa
- To determine the speech-language acquisition and scholastic outcomes of children who received traditional speech-language therapy at special schools for children with hearing impairment in South Africa

- To compare the speech-language acquisition and scholastic outcomes of children with hearing impairment who received traditional speech therapy versus those who received LSL-SA at special schools in South Africa
- To identify the barriers and strengths of the communication intervention approaches based on the needs and goals of families of children with hearing impairment

1.8 Research Question

What are the speech-language acquisition and scholastic outcomes of children with hearing impairment following early intervention in South Africa?

1.9 Overview of the Research Methodology

1.9.1 Research Design

A research design articulates the collection, analysis, and interpretation of data to produce answers to the research question (Van Wyk, 2012). It guides the logic and purpose of enquiry and provides the plan for connecting the conceptual research problems to the pertinent empirical research (Van Wyk, 2012). This section provides an overview of the research methodology used in this study. Detailed methodology sections are available in the individual manuscripts forming part of this thesis, so only the key aspects relevant to this research are highlighted here.

This study adopted a quantitative, comparative, cross-sectional research approach. Quantitative research involves collecting and analysing numerical data to evaluate measurable variables (NCOR, 2014). The self-developed data collection tools enabled the researcher to establish associations between variables without manipulating the population (Price & Lovell, 2018).

A cross-sectional design was employed to compare multiple variables at a single point in time. This approach is commonly used in health sciences and was used to gather data on speech-language acquisition and scholastic outcomes, assessing the exposure to and effects of the intervention approaches (Jacobsen, 2017; Setia, 2016). While cross-sectional studies cannot establish cause-and-effect relationships, they provide valuable insights into potential associations between intervention types and outcomes (Cherry, 2024; Price & Lovell, 2018). The comparative nature of the design enabled the analysis of outcomes between the two intervention approaches, facilitating a deeper understanding of their effectiveness (Alexander et al., 2015).

1.9.2 Research Context

This study was conducted at special schools for children with hearing impairment in 1) Johannesburg, Gauteng; 2) Pretoria, Gauteng; 3) Morningside, KwaZulu-Natal; 4) Cape Town, Western Cape; and 5) Port Elizabeth Central, Gqeberha. All the special schools identified equally offer children with hearing impairment and their families a structured Family-Centred Early Intervention programme, with therapeutic communication intervention that includes Speech-Language Therapy, Audiology and Social Work, a structured pre-primary grade, and a foundation phase school environment. The educational approach combines an adapted curriculum where core skills appropriate to the grade are taught and evaluated in a small class setting with therapeutic support. Additionally, a rehabilitation approach provides communication interventions within the school. The special schools involved in this study utilise consistent measures for assessing speech-language and academic outcomes, ensuring alignment between educational and rehabilitation strategies.

1.9.3 Participants and sampling strategy

Sampling is the process of selecting individuals or sample units from the target population (Martinez-Mesa et al., 2016). Purposive, non-probability sampling was employed in the study. Purposive sampling is a technique widely used for identifying and selecting information-rich cases that can be logically assumed to represent a cross-section of the population and where the study participants are chosen based on the study's purpose (Palinkas et al., 2015). In non-probability sampling, subjective methods decide which elements are included in the sample according to the researcher's judgement or knowledge (Crossman, 2020; Etikan et al., 2016).

The sampling process involved careful consideration of factors that ensured the study objectives were met, and these included:

a) the selection of special schools in South Africa, based on the availability of the school

b) the selection of records of children with hearing impairment from the listed special schools, i) to determine the speech and language outcomes following either TSLT or the LSL-SA intervention approach, and ii) to determine the scholastic outcomes

c) the selection of parents of children with hearing impairment from these special schools as participants, to explore the parental perspectives of the intervention approach followed (Creswell & Plano Clark, 2018; Martinez-Mesa et al., 2016).

Although this purposive sample does not represent the entire population, it is not considered a weakness in the design because the researcher is interested in the specific speech-language acquisition and scholastic outcomes characteristic of the intervention approach being investigated (Lund Research Ltd, 2012).

1.9.4 Recruitment

Recruitment for research includes identifying, approaching, and obtaining consent of potential participants to participate in the study (Preston et al., 2016). The researcher identified special schools for children with hearing impairment in South Africa for inclusion in the study. The following specific steps were followed:

a) The researcher obtained permission from the management **(Appendix B)** of the special schools for children with hearing impairment to:

- Obtain access to the records of learners (therapy files and grade 3 academic reports) who have completed the foundation phase of primary school. This facilitated the collection of speech and language outcomes data of children with hearing impairment following EI.

- Disseminate information to the parents/caregivers of the identified learners about the purpose of the study to obtain their consent to share their contact details with the researcher, should they be willing to participate by:

  1) displaying a poster (**Appendix C**) at the school premises developed by the researcher explaining the purpose of the study,
  2) sending an email drafted by the researcher (**Appendix D**) to the parents/caregivers explaining the purpose of the study and

- obtaining the contact details of parents/caregivers of learners who have completed the foundation phase of primary school, and inviting them to participate in the study.

b) Potential parent/caregiver participants were recruited telephonically and/or via email. Informed consent forms (**Appendix E**) were disseminated to the parents/caregivers on confirmation of their willingness to participate in the research study to:

- complete a self-administered questionnaire (**Appendix F**) to identify their experiences of the strengths and barriers of the communication intervention approach followed.
- obtain access to the learners' school records and academic progress reports to collect formal scholastic outcomes data (**Appendix G**) of children with hearing impairment following EI.

1.9.5 Inclusion and Exclusion Criteria

1.9.5.1 Inclusion Criteria:

a) For the record review:

- Children diagnosed with congenital or early onset, bilateral, severe to profound hearing impairment.
- Children enrolled in an EI programme receiving either TSLT or LSL-SA
- Children with hearing impairment fitted with hearing amplification devices (hearing aids or cochlear implants).
- Children who have completed the foundation phase of primary school at a special school for children with hearing impairment.

b) For the participant aspect:

- Parents/caregivers of children with hearing impairment whose records were reviewed

1.9.5.2 Exclusion Criteria:

- Records of children with hearing impairment enrolled in special schools for children with hearing impairment before the inception of LSL-SA in 2008.
- Parents/Caregivers of children with hearing impairment enrolled in special schools before the inception of LSL-SA in 2008.

- Parents of children whose records were not reviewed as part of the study.
- Children who have not completed the foundation phase of primary school at a special school for children with hearing impairment.
- Pilot study participants.
- Records of children with hearing impairment presenting with additional comorbidities, such as cognitive impairment.

1.9.6 Data Collection Instruments

Assessment instruments are a critical component of research studies and must be both reliable and valid for study results to be credible (Sullivan, 2011). Data collection instruments developed by the researcher to gather information for the study included:

(i) A self-developed questionnaire (**Appendix H**), designed to address sub-aim six of the study, was utilised to identify the strengths and barriers of the communication intervention approach in relation to the needs and goals of individual families. The questionnaire was distributed to parents/caregivers of children with hearing impairment attending the designated special schools. The questionnaire featured a mix of closed and open-ended questions aimed at gathering comprehensive data. It included sections on participant and family demographics, EI services accessed (details about the EI services that families engaged with), EI outcomes (outcomes achieved through EI services), experiences of the communication intervention approach implemented with their child (insights into the families' experiences with the communication intervention approach implemented for their children), and the child's outcome level at discharge (information on the child with hearing impairment's progress and outcomes levels upon discharge from both the special school and the communication intervention approach). The data collected from this questionnaire provided valuable insight into the effectiveness and alignment of the communication intervention to the family's needs and goals.

(ii) A retrospective data compilation form (**Appendix I**), developed to address sub-aims 1 – 5 of the study, described the therapeutic communication approaches to EI to determine and compare the speech and language outcomes of these therapeutic communication intervention approaches. The data compilation form utilised information from the school records, tracking each child with a hearing impairment from diagnosis through intervention and up to graduation from the foundation phase at school. The data compilation form included 1) a review of therapy reports, including Speech-Language Therapy and Audiology. The form also assessed whether other relevant therapies (such as Occupational Therapy) were attended 2) Comparison of baseline (entry-level) scores obtained during the initial assessments prior to the start of the communication intervention programmes with exit scores recorded at the conclusion of the interventions 3) Analysis of the speech-language acquisition scores between children with hearing impairment who received TSLT or LSL-SA, providing outcomes data for each communication intervention approach.

(iii) Scholastic outcome data compilation form (**Appendix J**), designed to address sub-aims 1 – 5, was utilised to evaluate and compare the scholastic outcomes associated with different therapeutic communication approaches to EI. This form provided 1) a structured academic performance review (as documented through school records and performance assessments) following therapeutic communication interventions and 2) a comparative analysis (comparison of academic data between children who received either TSLT or LSL-SA. This comparison aimed to identify differences in scholastic outcomes related to therapeutic communication intervention.

1.9.7 Data collection procedure

The following procedures were employed to collect and record the data obtained, as depicted in Figure 2 below:

- The researcher submitted an ethics application to the Human Research Ethics Committee (Non-Medical) of the University of the Witwatersrand for ethical clearance to conduct the study (**Appendix K**) (**Protocol Number: H20/06/03**). Data collection for the study commenced once ethical clearance was obtained.
- A letter requesting permission (**Appendix L**) describing the purpose of the study and the processes involved was provided to the educational facility director/manager of each special school. The researcher sought permission from the special school to access the records of children with hearing impairment from 2008 to 2019.
- The researcher requested the facility manager of each special school to disseminate information (**Appendix K**) to the parents/caregivers of learners regarding the purpose of the study to obtain their consent to share their contact details with the researcher should they be willing to participate. This information was disseminated by displaying a poster at the school premises (developed by the researcher) explaining the purpose of the study and by sending an email (drafted by the researcher) by the school to the parents/caregivers explaining the purpose of the study.

- Once consent and permission were granted, a retrospective record review of the therapy files and academic reports of children with hearing impairment was conducted (**Appendix H**). This aimed to describe the therapeutic communication intervention approaches, and the subsequent speech-language acquisition and scholastic outcomes based on the intervention approach received. This compared the speech and language outcomes following TSLT versus the LSL-SA approach.

- The researcher compiled a list of parent/caregiver participants who agreed to participate. They were informed regarding the purpose of the study and the processes involved in an information letter (**Appendix K**) and consent form (**Appendix E**). Once informed consent was obtained, a self-administered questionnaire (**Appendix F**) was disseminated to the parents/caregivers via the school and/or researcher using a hardcopy or softcopy link via email for completion. The researcher probed into the parental perspectives and experiences regarding the communication intervention approaches (Jacobsen, 2017).

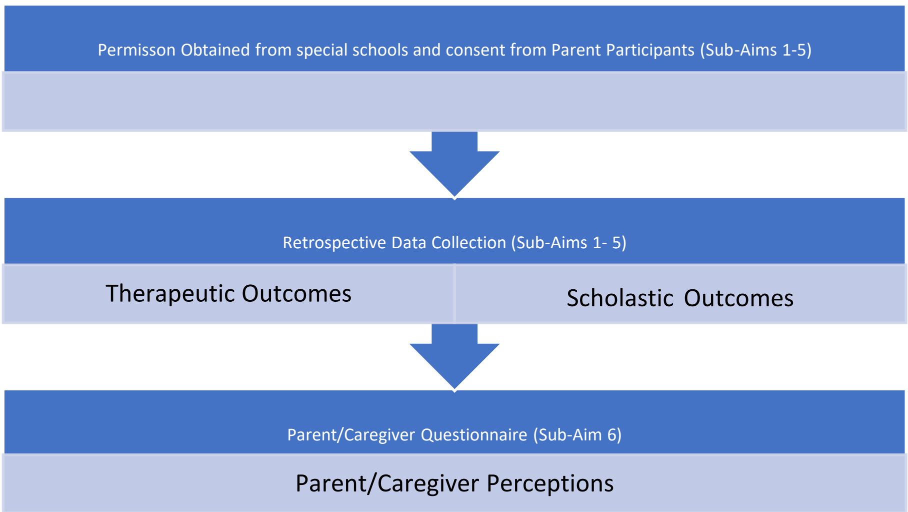


Figure 1-2: Data Collection Procedures

1.9.8 Data management

All data for the study were systematically recorded in Microsoft Excel spreadsheets, utilising numeric values for accuracy and consistency. Electronic data were stored on a password-protected computer designated explicitly for this study. Access to this computer and its password was restricted solely to the researcher, ensuring that sensitive information remained confidential. The computer was securely stored in a designated, locked office to prevent unauthorised access. In addition, hard copies of data were stored in the researcher's office and secured within a locked cabinet. This cabinet was exclusively accessible to the researcher, ensuring that all physical data remained protected and confidential throughout the study.

1.9.9. Data Analysis and Statistical Procedures

Specific statistical analysis methods are detailed in each manuscript of this thesis. Overall, raw data were first converted and organised into an Excel spreadsheet in Office 365. This data was then converted into SAS version 9.4 for Windows for analysis. Both descriptive and inferential statistics were performed to analyse and interpret the data. Descriptive statistics and measures of central tendency, such as means and standard deviations, were utilised to summarise the data. Inductive analysis was used to identify, interpret and analyse patterns in the qualitative data. Direct quotes, percentages, tables, and figures were also used to present the findings effectively (Ali & Bhaskar, 2016). Inferential statistics, such as X^2 test and independent samples t-tests, were applied to establish associations between groups.

In instances where the assumptions of these tests were not met, alternative methods such as Fisher's Exact Test or the Wilcoxon rank-sum test were used. Additionally, logistic regression was employed to assess relationships among variables.

1.9.10 Pilot Study

A pilot study is a preliminary, small-scale study conducted to improve the quality and efficiency of the main study (In, 2017). The researcher conducted a pilot study to 1) assess the appropriateness of the data collection tools, 2) assess the clarity of the questionnaire and whether participants understood the questions, 3) assess whether the response items have been placed in the best order 4) estimate the length of time taken to complete the questionnaires and complete the retrospective record review 5) estimate how much time and dissipation of resources will be necessary to complete the main study (Bhattacherjee, 2019; Crossman, 2020).

1.9.10.1 Context

The pilot study was conducted at the preselected special school at a time that was convenient for both the researcher and the participant.

1.9.10.2 Participants

Participants for the pilot study met the same inclusion criteria as for the main study. Before the pilot study was conducted, permission was obtained from the special school for children with hearing impairment. All ethical protocols applicable to the main study were observed in the pilot study, including informed consent, beneficence and non-maleficence, assurance of confidentiality, justice and guarantee of participants' rights to withdraw without penalty. Only participants who met the inclusion criteria and completed and signed the Informed Consent forms were included in the pilot study. The selection of at least three records of children with hearing impairment from the listed special schools and two parents of children with hearing impairment from these special schools formed the pilot study participants. Importantly, pilot study participants were not included in the main study.

1.9.10.3 Procedures

The pilot study commenced once ethical clearance was obtained from the Human Research Ethics Committee (Non-Medical) of the University of the Witwatersrand. Thereafter, permission was sought from the special schools. The procedures outlined in the main study were followed in the pilot study. Written informed consent was obtained from the special schools and the parents/caregivers who agreed to participate in the pilot study.

1.10 Ethical Considerations

Ethical considerations are an important criterion prior to commencing any research as they provide guidelines for gathering, processing and disseminating research information in projects (Human Sciences Research Council, 2019; Walliman, 2015). Professional associations and agencies have adopted codes, laws, regulations and policies that outline ethical behaviour and guide researchers. The World Medical Association (WMA) has developed the Declaration of Helsinki (1964) as a statement of ethical principles for research involving human subjects, identifiable human material and data, as adopted by the 64th WMA General Assembly in Brazil in 2013 (WMA, 2013). As per the WMA, the ethical reference points considered in the planning of this proposed research included the following:

1. ***Autonomy***

The researcher protected the autonomy of the research participants by adhering to the informed consent process. The researcher provided the potential research participants with information regarding a) the full disclosure of the nature of this study and its purpose, b) that there were no risks associated with participating in this study, c) no compensation was waged for participating in this study d) benefits e) an opportunity to ask questions before deciding whether or not to participate in the study f) participation was voluntary and no penalties were involved in refusal to participate g) their right to withdraw from the study was applicable at any stage without any penalty (Adams et al., 2014; Fouka & Mantzorou, 2011). This information was made available to the special schools for children with hearing impairment and potential participants in an Information letter (**Appendix M**) and Informed Consent form (**Appendix E)**

2. ***Beneficence and Non-Maleficence***

Beneficence relates to the benefits associated with research, and this study's benefits were attributed to new knowledge gained in the field of EI, especially since limited research is available within the South African context (Fouka & Mantzorou, 2011). Non-maleficence relates to the potential risks of participation, and no risks were associated with participating in this study (Fouka & Mantzorou, 2011).

3. Anonymity and Confidentiality

Anonymity and Confidentiality are closely linked to participant' rights of beneficence and respect for their dignity and fidelity (Fouka & Mantzorou, 2011). The researcher adhered to the principle of anonymity by ensuring that data record forms did not include identifying information that could link responses to the participants' identity (Fouka & Mantzorou, 2011). A participant reference number was assigned to data record sheets instead of participant names. Confidentiality refers to managing private information, whereby the researcher stored the data record forms in a secure area (Fouka & Mantzorou, 2011).

4. Justice

Justice requires that researchers are always fair and equitable to the participants in their research (AVAC, 2019; Gelling, 2015). For this study, the researcher ensured the principle of justice by not excluding individuals or groups based on culture, language, gender, race, ethnicity, age or disability (Gelling, 2015).

1.11 Reliability, Validity, Trustworthiness and Rigor

The extent to which researchers work to enhance the quality of their studies is an essential component in critiquing the research (Heale & Twycross, 2015). This research study adopted a comprehensive and rigorous approach to ensure the robustness and credibility of both quantitative and qualitative aspects (Stahl & King, 2020). Detailed information on the methodologies and quality assurance processes is provided in each manuscript:

- Content, construct, and face *validity* were ensured through a pilot study.
- *Internal Consistency*: Cronbach's alpha was used to assess the internal consistency of the test items, with a value exceeding 0.7, indicating reliable consistency.
- *Inter-Rater Reliability*: The consistency of estimates across different raters was evaluated using a kappa statistic of 0.7, reflecting substantial agreement (McHugh, 2012).
- *Credibility*: The findings were validated with research participants to ensure they accurately represented their experiences.
- *Transferability*: The study provided a detailed description of the context and participants, allowing others to assess the applicability of the findings to their settings (Stahl & King, 2020).
- *Dependability*: The research process was meticulously documented, facilitating understanding of how conclusions were drawn and enabling replication of the study if needed (Nosek & Errington, 2020).
- *Confirmability*: During the inductive analysis phase, themes were refined and validated through inter-rater agreement to ensure reliability (Gisev et al., 2013).
- *Triangulation*: Multiple data sources, methods, and investigators were employed to cross-check data and interpretations.

1.12 Outline of Thesis

Chapter 1: Childhood Hearing Impairment and Communication Intervention Approaches: An Overview

This chapter provides an overview of childhood hearing impairment, including its prevalence and the significance of Early Hearing Detection and Intervention (EHDI). It introduces the various communication intervention approaches, including Traditional Speech-Language Therapy (TSLT) and Listening and Spoken Language South Africa (LSL-SA), and outlines the problem statement, the motivation for the study, and its rationale within the South African context. The chapter also presents the main aim, study objectives, and research questions. A detailed explanation of the research design, participants, and methods used in the study is provided, including justification for the comparative approach used. Finally, it includes a brief outline of the subsequent chapters in the thesis.

Chapter 2: Congenital or Early-Onset Hearing Impairment and the Various Communication Intervention Approaches Employed: A Critical Review

This chapter provides a critical and comprehensive review of the literature on congenital or early-onset hearing impairment, focusing on EHDI programmes. It explores the theoretical frameworks underpinning EI, the implementation and effectiveness of EHDI across low- and middle-income countries (LMICS) and high-income countries (HICS), and the challenges and gaps in current service delivery models. The chapter also examines multiple communication intervention strategies and their outcomes, addressing key debates regarding their efficacy and implications for clinical practice and policy development.

Chapter 3: Paper I - Therapeutic Approaches to Early Intervention in Audiology: A Systematic Review

This chapter presents a systematic review of published research on current trends and evidence in therapeutic approaches to early intervention. The review critically analyses the impact of AVT, LSL-SA, and other interventions on speech, language, and scholastic outcomes. It highlights the limited evidence base in the South African context and the need for comparative studies to determine the effectiveness of different therapeutic communication approaches.

Chapter 4: Paper II - A comparative study of learning outcomes for hearing-impaired foundation phase learners

This chapter presents an investigation into the learning outcomes of children with severe to profound hearing impairment during the foundation phase, who received LSL-SA versus TSLT. The study examines academic performance, language development, and the duration of intervention needed to achieve age-equivalent outcomes. The results indicate that children receiving LSL-SA achieved superior learning outcomes compared to TSLT, with more learners progressing to mainstream schooling in a shorter duration.

Chapter 5: Paper III - Exploration of parental perspectives and involvement in therapeutic communication approaches for children with hearing impairment at special schools in South Africa.

This chapter examines the role of parents in early intervention, exploring parental knowledge, involvement, and perceptions regarding communication modalities. It highlights the lack of informational counselling provided to parents, the barriers to effective family-centred intervention, and the importance of culturally and linguistically appropriate therapeutic services. The findings suggest that while parents express a preference for LSL-SA, implementation challenges persist.

Chapter 6: Paper IV - Communication outcomes of children with hearing loss: A comparison of two Early Intervention approaches.

This chapter compares the communication outcomes of children who received LSL-SA with those who received TSLT, focusing on speech intelligibility, receptive and expressive language, and vocabulary development. The findings indicate statistically significant improvements in communication outcomes for children enrolled in LSL-SA, with a higher proportion achieving age-appropriate speech and language skills compared to TSLT.

Chapter 7: Paper V - Communication Intervention in South Africa: Advocating for the Listening and Spoken Language Approach

This chapter explores the implementation of EHDI in South Africa, addressing barriers to service delivery and proposing strategies for optimising LSL-SA implementation. It examines policy gaps, resource constraints, and the need for collaboration among stakeholders. The chapter advocates for tailored healthcare strategies to enhance access to LSL-SA and improve outcomes for children with hearing impairment.

Chapter 8: Synthesis of Findings

This chapter synthesises the findings from Chapters 3 to 7, consolidating evidence from multiple studies to provide a holistic understanding of the impact of early intervention on children with hearing impairment. It discusses theoretical and practical implications for audiology, clinical practice, and policy development. The chapter also highlights the limitations of the study, provides recommendations for future research, and emphasises the need for further investigation into contextually relevant communication intervention strategies in South Africa.

1.13 Roles and Responsibilities

With a strong focus on EHDI and the outcomes of communication intervention approaches, particularly LSL-SA, the PhD candidate, in close collaboration with her supervisors, conceptualised and defined the scope and objectives of the research project. The candidate was responsible for drafting and submitting the research proposal to the University's Human Research Ethics Committee (HREC) (Medical), successfully obtaining ethical approval in June 2020. This approval was essential for ensuring the research adhered to ethical standards.

The onset of the COVID-19 pandemic in March 2020 led to a hard lockdown in South Africa, which impacted the data collection timeline. Consequently, data collection commenced in February 2021 and concluded in June 2022, extending over 16 months. The candidate managed and cleaned the data meticulously to ensure its accuracy and integrity. To address the statistical needs of the research, the candidate enrolled in a biostatistics RedCap Introductory Workshop and sought expert guidance to ensure the robustness of the analysis. Due to her significant contributions throughout the research process, the candidate is listed as the first author in all resulting publications and presentations, with her supervisors acknowledged as the second and third authors. The supervisors provided supervision, guidance, and critical feedback, supporting the candidate in achieving the research outcomes.

CHAPTER 2

CONGENITAL OR EARLY-ONSET HEARING IMPAIRMENT AND THE VARIOUS COMMUNICATION INTERVENTION APPROACHES EMPLOYED: A CRITICAL REVIEW

Chapter 2 presents an expansive literature review on congenital and early-onset hearing impairment, with a particular focus on Early Hearing Detection and Intervention (EHDI) programmes. It critically examines the implementation and effectiveness of these programmes across both low- and middle-income countries (LMICs) and high-income countries (HICs). The chapter explores the various communication intervention strategies employed for children with hearing impairment, assessing key debates surrounding their efficacy. It further addresses the challenges in service provision, particularly the disparities between global settings, and evaluates the impact of different intervention approaches. This review aims to establish the theoretical and empirical context for the study, highlighting the factors influencing intervention outcomes and the need for further investigation in this field. Given the critical role of early intervention in mitigating the long-term effects of hearing impairment, this chapter explores the global and South African literature on EHDI programmes and their impact on both speech-language and scholastic outcomes. While previous reviews have focused primarily on linguistic development, fewer studies have examined the direct academic implications of different intervention strategies. This chapter will also highlight the gap in comparative studies assessing Listening and Spoken Language–South Africa (LSL-SA) and Traditional Speech-Language Therapy (TSLT) to determine their relative effectiveness in the South African context.

2.1. Congenital and Early-Onset Hearing Impairment

Congenital or early-onset hearing impairment can be classified based on the time of onset, with congenital hearing loss present at birth or detected shortly after and early-onset hearing loss manifesting before the age of three (Renauld & Basch, 2021). The prevalence of hearing impairment identified through universal newborn hearing screening programmes ranges between 1 to 2 per 1000 live births in HICs (Choe et al., 2023). Research data indicates the prevalence of hearing impairment may reach as high as 3 to 6 per 1000 live births in LMICs (Khoza-Shangase, 2021).

2.1.1. Factors contributing to congenital or early-onset hearing impairment

Congenital or early-onset hearing impairment in HICs is primarily attributed to genetic, environmental, and prenatal factors (Khan & Joseph, 2024). Genetic mutations are among the leading causes, with research suggesting that up to 80% of cases are linked to genetic factors, while the remaining 20% are associated with environmental or acquired causes (Choe et al., 2023; Shave et al., 2022). Environmental factors such as prenatal TORCH infections (toxoplasmosis, syphilis, rubella, cytomegalovirus, and herpes) and postnatal bacterial meningitis contribute to congenital hearing impairment (Ko et al., 2021). Notably, congenital cytomegalovirus infection is increasingly recognised as the primary environmental cause of hearing loss in HICs.

In contrast, research in South Africa highlights region-specific and emerging risk factors that may not be as prevalent in developed countries. These include maternal conditions such as HIV infection, hypertension, and recurrent otitis media (Khan & Joseph, 2024). Other significant medical risks in the South African context include prematurity, low birth weight (LBW), exposure to viral diseases, and the use of ototoxic medications during pregnancy (Khan & Joseph, 2024). While these factors share similarities with those identified in HICs, their co-occurrence may compound the likelihood of hearing impairment in affected children.

Further analysis of syndromic profiles in South Africa shows that a majority of children with congenital or early-onset hearing impairment presented with Down's syndrome, followed by Treacher-Collins syndrome, followed by other less common syndromes (Khan & Joseph, 2024). Maternal infections, particularly cytomegalovirus (CMV) and rubella, also played a significant role in these cases (Khan & Joseph, 2024).

These findings underscore the importance of considering both genetic and environmental factors in understanding congenital hearing impairment. They also highlight the unique, region-specific risk factors in South Africa that may influence prevalence and outcomes.

2.1.2 Consequences of Congenital or Early-Onset Hearing Impairment

Congenital or early-onset hearing impairment is a leading cause of developmental delay in children (Korver et al., 2017). The critical period for language acquisition, particularly spoken language, occurs within the first three years of life (National Institute on Deafness and Other Communication Disorders, 2022). During this period, the absence of auditory input disrupts language acquisition, leading to delays in both expressive and receptive language (Black et al., 2017; Feder et al., 2017). Language delays often result in cognitive deficits, including difficulties with reading, writing, learning, and problem-solving (Porcar-Gozalbo et al., 2024). If not identified and managed early, hearing impairment can also impact socialisation, academic achievement, and emotional development (Latifah et al., 2023).

While extensive research has been conducted on the impact of EHDI on speech and language outcomes, fewer studies have explored the implications for scholastic achievement. Academic success is strongly linked to early language development, with delays in intervention often resulting in long-term literacy and learning challenges (Gibson et al., 2020). Moreover, while LSL-SA and TSLT are both employed in early intervention, comparative research evaluating their efficacy within the South African context remains limited (Casoojee et al., 2021). This chapter critically examines existing literature on early intervention, its impact on academic and language outcomes, and the disparities in service provision affecting children with hearing impairment in LMICs like South Africa.

The prevalence of hearing impairment in South Africa is influenced by disparities in access to healthcare and screening programmes, with a higher prevalence in rural or underserved areas (Kgare & Joubert, 2024). Although early screening programmes are available in urban centres, many children in rural regions do not receive timely diagnosis and intervention, exacerbating developmental delays (Kgare & Joubert, 2024). The country's limited healthcare resources, compounded by socio-economic challenges, present significant barriers to addressing the needs of children with hearing impairment (Casoojee, 2024). This contrasts with HICs, where earlier identification and more comprehensive healthcare systems tend to mitigate some of the developmental impacts associated with hearing impairment.

This section highlights the critical importance of early hearing detection and intervention (EHDI) for congenital and early-onset hearing impairment, emphasising how timely identification and appropriate management can mitigate developmental delays and foster positive long-term outcomes for affected children. Addressing the unique barriers in

South Africa, such as limited healthcare access and language diversity, is essential for improving outcomes and reducing the developmental impact of hearing impairment.

2.2 Early Hearing Detection and Intervention (EHDI) Programmes

EHDI programmes aim to identify congenital or early onset hearing impairment as early as possible, typically through newborn hearing screening (by 1 month old), diagnosis (by 3 months old), and subsequent intervention (by 6 months old) (Joint Committee on Infant Hearing [JCIH], 2019). In South Africa, EHDI implementation remains inconsistent, with disparities in screening coverage between private and public healthcare sectors (Khoza-Shangase, 2022). The adjusted 1-4-8 model (6 weeks- 4 months- 8 months) proposed by the Health Professions Council of South Africa (HPCSA) aims to account for local challenges but remains underutilised in practice (HPCSA, 2018). This adjustment, while considered a pragmatic adaptation to the local healthcare environment (Khoza-Shangase, 2022), is not universally adopted across LMICs, and literature on this adjustment remains sparse. The existing literature often fails to critically examine the effectiveness or applicability of these altered timelines in countries facing resource constraints, offering little insight into how healthcare systems with limited infrastructure can feasibly meet such recommendations. The lack of systematic screening often leads to delays in intervention, which in turn affects children's long-term communication and educational outcomes. This delay disproportionately affects learners in low-resource settings, where access to specialised intervention services such as LSL-SA is often limited. The absence of comparative data on the academic impact of different early intervention approaches further underscores the need for this study.

The primary goal of EHDI programmes is early detection, ensuring that affected children receive timely support and services, which enables more effective intervention that facilitates speech and language development, allowing children to progress alongside their hearing peers (JCIH, 2019). Research consistently highlights the benefits of early identification in HICs, where robust healthcare infrastructures allow for comprehensive universal newborn hearing screenings and early intervention services (Gina et al., 2021; Grey et al., 2021). Studies conducted in these regions demonstrate the success of multidisciplinary approaches involving audiologists, speech-language pathologists, and educational specialists in fostering language outcomes and cognitive development for children with hearing impairment (National Deaf Children's Society, 2015). However, while literature demonstrates positive outcomes, it rarely engages with the significant challenges posed by the stark differences in healthcare systems between HICs and LMICs, leaving a critical gap in understanding how these strategies might translate across different socio-economic contexts.

While South Africa has made strides in implementing EHDI, critical challenges remain in ensuring equitable access to high-quality intervention services. Studies from HICs demonstrate that auditory-verbal approaches, such as LSL, yield superior language outcomes; however, the extent to which these findings are applicable in resource-constrained settings remains unclear. There is a pressing need for context-sensitive research that evaluates the impact of early intervention within multilingual and socio-economically diverse populations, such as those in South Africa.

2.3 Disparities in Service Provision

A significant challenge in managing congenital or early-onset hearing impairment lies in the global disparities in service availability and quality, especially between HICs and LMICs. In HICs, early detection systems such as universal newborn hearing screening (UNHS) are widely implemented, allowing children diagnosed with hearing impairment to receive prompt interventions, including hearing aids, cochlear implants, and specialised speech-language therapy. Research by Mushtaq et al. (2024) and Yoshinaga-Itano (2020) shows that early intervention significantly improves speech and language development, academic achievement, and social integration outcomes.

In contrast, delays in communication interventions are common in LMICs, often due to inadequate diagnostic services and underdeveloped healthcare infrastructure (Bezuidenhout et al., 2018; Joshi et al., 2023). Research by Ndegwa et al. (2024) and Louw et al. (2024) indicates that diagnostic equipment is frequently scarce, and access to auditory technologies, such as hearing aids and cochlear implants, is inconsistent. This lack of resources contributes to delayed or missed diagnoses, which hampers the timely implementation of early hearing detection and intervention (EHDI) programmes, as well as therapeutic communication interventions.

South Africa’s public healthcare sector serves 82.6% of the population, yet only a fraction of children with hearing impairment receive timely intervention (Statistics South Africa, 2016). In rural and underserved areas, geographic and socio-economic barriers delay service delivery, leading to significant developmental gaps (Casoojee et al., 2024). A critical shortage of audiologists and speech-language therapists—with only 22% working in public healthcare—limits the availability of specialised intervention (Pillay et al., 2020). Additionally, language diversity further complicates intervention, as most speech therapy resources are developed in English, which may not align with the linguistic backgrounds of many children. This disparity underscores the urgent need for research comparing intervention approaches in diverse linguistic and socio-economic contexts to determine which yields better outcomes in the South African setting. Geographic and socio-economic disparities often lead to delays in service delivery, with many families struggling with issues such as transportation and limited access to healthcare services. These challenges highlight the need to better understand the specific barriers families encounter in remote areas when accessing essential services.

A significant issue in LMICs is the shortage of trained professionals, including audiologists, speech-language therapists, and early intervention specialists (Casoojee, 2024). While the need for professional development is well-documented, the long-term impact of these shortages on the quality and sustainability of EHDI programmes remains underexplored. Moreover, scaling training programmes to reach rural and remote regions and addressing workforce shortages in underfunded healthcare systems are key challenges that require further investigation.

Cultural and linguistic factors also play a critical role in the success of EHDI programmes in LMICs. According to Grandpierre et al. (2018), cultural perceptions of disability and language barriers significantly affect the effectiveness of interventions. Additionally, the social stigma surrounding disability and hearing loss may discourage families from seeking appropriate services.

Linguistic diversity poses another socio-cultural challenge to implementing EHDI programmes in LMICs. Many of these countries are home to numerous languages and dialects, often with limited access to standardised sign language or alternative communication strategies (Nakamura et al., 2023; Ngobeni et al., 2020). For instance, in South Africa, where there are 11 official languages, access to interpreters or specialised language resources is often insufficient (Khoza-Shangase, 2022). As a result, children with hearing impairment may not receive language development interventions in their native languages, further exacerbating developmental delays and cognitive difficulties (Kamenov et al., 2018).

Furthermore, poverty and limited healthcare infrastructure intersect with socio-cultural factors, creating additional barriers to the success of EHDI programmes. In resource-constrained settings, families may prioritise immediate needs such as food and shelter over healthcare, resulting in delays in seeking hearing screening and diagnostic services (Schuh & Bush, 2022). When healthcare services are distant, unaffordable, or of low quality, families may turn to alternative, culturally familiar treatments that are not evidence-based. These challenges are especially significant in rural or marginalised communities, where limited healthcare access and socio-cultural barriers may further hinder engagement with formal health services (Nyande et al., 2022). While the literature on EHDI in LMICs often highlights structural and logistical barriers, socio-cultural determinants of health are not always adequately addressed.

Despite significant progress in HICs in addressing hearing impairment through early detection and intervention, LMICs continue to face considerable challenges in service delivery, which disproportionately affect the success of EHDI programmes. Addressing these disparities is crucial to improving global outcomes for children with hearing impairment. Ensuring equitable access to timely and effective communication interventions for all children, regardless of their socio-economic background, is essential for mitigating the long-term impact of hearing impairment.

In conclusion, the impact of socio-cultural factors on the success of EHDI programmes in LMICs is often overlooked. A better understanding of cultural perceptions of disability, language diversity, and the broader social context is necessary for developing more effective, contextually relevant intervention programmes. Future research should explore these socio-cultural dimensions in greater depth and advocate for culturally sensitive and linguistically appropriate interventions. These factors are pivotal to ensuring the success of early hearing detection and communication intervention efforts in LMICs.

2.4 Communication Intervention Approaches for Children with Hearing Impairment

Effective communication interventions for children with congenital or early-onset hearing impairment are paramount to ensuring optimal developmental outcomes. Early intervention (EI) is particularly crucial in mitigating the well-documented negative effects of hearing impairment on various domains, including speech, language, cognition, education, literacy, psychosocial well-being, and future vocational prospects (JCIH, 2019; WHO, 2024). Given the significant impact of these interventions, the choice of communication approach is a critical decision that influences the trajectory of development for children with hearing impairment. Factors such as the severity of hearing impairment, availability of resources, family preferences, and the socio-cultural context shape the approach taken in each case (van der Zee & Dirks, 2022).

In the South African context, EI services for children with hearing impairment are frequently delivered within special school environments due to the systemic challenges associated with implementing inclusive education in mainstream settings. Despite national policy efforts, inclusive education has not been fully realised, primarily due to under-resourced schools, limited staff training, and infrastructure constraints (DoE, 2001; Casoojee et al., 2024). As a result, special schools have become the default setting for structured EI programmes. These schools typically offer multidisciplinary services—such as speech-language therapy, audiology, social work, physiotherapy and occupational therapy—often within foundation-phase settings that accommodate learners aged 4 to 9 years old. Service delivery is primarily on a one-to-one basis to allow for individualised, intensive support; however, group sessions may be used to supplement therapy. Importantly, these structural limitations are compounded by delays in the identification and diagnosis of hearing loss. A national systematic review reported a pooled mean age of identification at 30 months, significantly beyond the 6-month benchmark recommended by EHDI guidelines (Phanguphangu et al., 2025). Consequent to these delays, many children are only referred to intervention services at school-entry age. Their developmental outcomes are thus compounded by the time intervention begins. These systemic barriers—namely, the delayed onset of intervention and the reliance on special schools—shape the landscape of early communication intervention in South Africa. As such, these realities must be considered when evaluating the suitability and effectiveness of different approaches. It is within this complex service delivery landscape that two predominant intervention models—Listening and Spoken Language–South Africa (LSL-SA) and Traditional Speech-Language Therapy (TSLT)—have emerged, each reflecting distinct theoretical underpinnings and practical considerations.

LSL-SA, adapted from Auditory Verbal Therapy (AVT), emphasises maximising auditory input, training children to develop spoken language through listening, and relies heavily on early cochlear implantation and parental coaching (Estabrooks, Maclver-Lux & Rhoades, 2016). In contrast, TSLT incorporates multiple communication modalities, including speechreading, gestures, and sign language, making it more accessible in resource-constrained environments (Casoojee et al., 2021). While international studies suggest that LSL-based approaches yield better speech-language outcomes, there is little comparative research examining whether LSL-SA leads to better academic performance compared to TSLT in South Africa. This gap in evidence forms the basis of the current study. This comparative analysis explores two predominant intervention approaches used in South Africa: Traditional Speech-Language Therapy (TSLT) and the Listening and Spoken Language–South Africa (LSL-SA) approach, both of which are tailored to address the unique needs of children with hearing impairment in the local context.

2.4.1 Traditional Speech-Language Therapy (TSLT)

Traditional Speech-Language Therapy (TSLT) is a commonly employed intervention approach for children with hearing impairment in South Africa, particularly in public healthcare settings. This approach encompasses a broad range of techniques aimed at developing speech, language, and communication skills in children with hearing loss. TSLT can involve auditory methods (such as auditory training and amplification use) and manual methods (such as sign language or cued speech), either individually or in combination. TSLT's flexibility allows for customisation depending on the child's degree of hearing impairment, age, and family preferences.

One of the significant advantages of TSLT is its adaptability. The approach can incorporate both auditory and visual cues, accommodating a variety of communication needs. For example, children with severe hearing impairment may benefit from the use of sign language as a primary mode of communication, while those with milder hearing loss may rely more on auditory training and lip reading. Research has shown that this flexible approach allows for individualised intervention plans, which are crucial in addressing the varied needs of children with hearing loss (Casoojee & Khoza-Shangase, 2022). Moreover, TSLT is more widely accessible in resource-constrained settings, such as public healthcare systems in South Africa, where specialised services and resources for hearing loss are often limited.

However, TSLT also has notable limitations. One of the primary criticisms of this approach is its reliance on sign language and visual communication, which, although effective in certain contexts, may hinder the development of oral language skills in children. Some critics argue that this approach can limit the potential for children to integrate into mainstream educational systems, where spoken language is typically the dominant mode of communication (Archbold & Lamb, 2024). Additionally, TSLT may not be as effective in promoting early language acquisition, particularly when compared to approaches that focus on listening and spoken language (LSL). The use of sign language, while a valuable tool, may inadvertently delay the acquisition of spoken language in some children, potentially limiting their opportunities for social integration and communication in a wider range of settings.

2.4.2 Listening and Spoken Language – South Africa (LSL-SA)

The Listening and Spoken Language – South Africa (LSL-SA) approach is an adaptation of Auditory Verbal Therapy (AVT), a well-established intervention model in high-income countries. Central to the LSL-SA approach is the principle that family involvement is crucial for successful therapy outcomes. This approach emphasises the use of residual hearing, with the goal of helping children develop spoken language skills to integrate fully into mainstream educational environments (Casoojee & Khoza-Shangase, 2022). The belief underpinning LSL-SA is that with early intervention, appropriate technology (such as hearing aids or cochlear implants), and active family participation, children with hearing impairment can develop speech and language skills comparable to their hearing peers.

One of the key advantages of the LSL-SA approach is its focus on auditory learning and spoken language acquisition. This is particularly vital in the South African context, where mainstream schools and social settings typically use spoken language as the primary mode of communication. Early development of spoken language allows children to participate more fully in academic and social spheres, thus reducing the risk of social isolation and educational disadvantage (du Toit et al., 2020). Additionally, LSL-SA promotes the use of hearing technology, such as hearing aids and cochlear implants, which enhance auditory access for children with hearing loss. This focus on auditory skills aligns with global trends in early hearing detection and intervention (EHDI) programmes, where there is an increasing emphasis on ensuring that children with hearing impairment are equipped with the tools necessary for developing spoken language (JCIH, 2019).

Despite its advantages, the LSL-SA approach also presents challenges, particularly in low-resource settings. Cochlear implants and advanced hearing aids, while effective, can be prohibitively expensive, often putting them out of reach for families in economically disadvantaged contexts (van der Zee & Dirks, 2022). Furthermore, the success of the LSL-SA approach is heavily dependent on the availability of qualified professionals who can provide ongoing support and guidance. In South Africa, there is a significant shortage of trained audiologists, speech-language therapists, and other professionals specialising in LSL-SA, limiting the potential impact of this intervention (Khoza-Shangase, 2022).

In conclusion, the LSL-SA approach holds great promise for children with hearing impairment, but its success hinges on family engagement, the availability of appropriate resources, and a trained professional workforce. Addressing these challenges is crucial to the broader implementation and effectiveness of the LSL-SA approach in South Africa and other LMICs.

2.4.3 Comparative Analysis

The decision between TSLT and LSL-SA hinges on several factors, including the severity of hearing loss, available resources, and the family's preferences. Both approaches have their merits and limitations, and it is important to recognise that no single approach is universally applicable to all children with hearing impairment. TSLT offers a more flexible, inclusive approach that accommodates various degrees of hearing loss and cultural preferences, especially in rural or underserved areas where access to advanced technologies is limited. Conversely, LSL-SA focuses on spoken language and auditory learning and offers promising outcomes for children who have access to cochlear implants or advanced hearing aids and whose families prioritise integration into mainstream educational systems.

Both Traditional Speech-Language Therapy (TSLT) and the Listening and Spoken Language – South Africa (LSL-SA) approach offer valuable frameworks for early intervention in children with hearing impairment. The choice of approach should be individualised, taking into account the severity of the child’s hearing loss, the available resources, and the family’s preferences. While TSLT provides a flexible and accessible option, particularly in resource-constrained settings, LSL-SA offers a more specialised approach aimed at fostering spoken language acquisition through auditory learning. Ultimately, a comprehensive and contextually relevant intervention plan may involve elements of both approaches, ensuring that children with hearing impairment receive the best possible support for their communication development.

2.4.4 Effectiveness of Communication Intervention Strategies

The effectiveness of communication intervention strategies is critical to the developmental outcomes of children with hearing impairment, particularly in terms of speech-language acquisition, literacy, and academic performance. This section will explore the impact of different communication interventions, drawing from studies conducted in both high-income and LMIC contexts.

2.4.4.1 Evidence from High-Income Countries (HICs):

In HICs, early intervention approaches such as auditory-verbal therapy and LSL have proven effective in promoting spoken language development and academic success. Studies by Auditory Verbal UK (2023), Grey et al. (2021) and Stika et al. (2022) highlight the positive impact of early detection and intervention on children's speech-language outcomes. For instance, children who receive early auditory-based interventions such as LSL show significant improvements in language development and are more likely to integrate successfully into mainstream schools. The effectiveness of these approaches is underpinned by access to advanced diagnostic tools, hearing technologies, and well-trained professionals.

2.4.4.2 Evidence from Low-Middle Income Countries (LMICs):

In contrast, the evidence from LMICs, including South Africa, presents a more complex picture. Due to the late detection of hearing impairment, often coupled with limited access to diagnostic equipment and rehabilitation services, children in these settings tend to experience slower language acquisition and face greater challenges in their academic development. Research by Farid et al. (2023) and Porcar-Gozalbo et al. (2024) indicates that late detection and the lack of consistent follow-up services significantly hinder the efficacy of early interventions in LMICs.

In South Africa, both LSL-SA and TSLT have been employed in special schools for children with hearing impairment. LSL-SA, which emphasises auditory-verbal approaches, has been associated with positive outcomes in children with access to hearing aids or cochlear implants, as demonstrated in the work of Casoojee et al. (2024). However, TSLT, which incorporates sign language as a primary communication method, is more commonly used in areas with limited resources. While TSLT is a practical solution in resource-poor settings, it can limit the development of oral language skills, which are crucial for integration into mainstream educational settings. Dlamini (2021) has discussed how children who receive TSLT may struggle with literacy and social integration as they grow older, especially in environments where spoken language is prioritised.

2.4.4.3 Long-Term Outcomes:

The long-term outcomes of communication interventions are crucial for assessing the overall success of early intervention programmes. In HICs, the benefits of early auditory-based interventions extend beyond childhood into adulthood, with children showing higher rates of academic success, social participation, and employment (Auditory Verbal UK, 2022). However, in LMICs, the picture is more nuanced. The limited follow-up services and resource constraints in these regions often result in poorer long-term outcomes, with children facing greater challenges in acquiring literacy and integrating into society.

Thus, while the effectiveness of communication interventions is well-documented in high-income countries, it remains a topic of ongoing research in LMICs, where late detection, resource constraints, and socio-cultural factors complicate the evaluation of long-term outcomes.

2.5 Theoretical and Empirical Context for the Study

This section aims to establish the theoretical and empirical foundations for the study, focusing on the factors that influence the outcomes of intervention programmes for children with hearing impairment. Several key developmental and intervention theories inform the theoretical framework for this study. One such theory is Vygotsky's Interactionist Theory (1978), which emphasises the critical role of social interaction and environmental factors in language acquisition. According to Vygotsky, early and consistent intervention within a supportive environment plays a crucial role in fostering children's speech and language development.

Additionally, the conceptual framework developed by Fitzpatrick (2010) provides another important lens for understanding the dynamics of language development in children with hearing impairment. Fitzpatrick's framework emphasises the importance of a family-centred approach and highlights the interplay of environmental, familial, and community factors in shaping children's communication outcomes. This framework aligns with the broader understanding that effective intervention programmes should not only focus on the child but also on the family and community as active participants in the intervention process.

Empirically, studies highlighted in the Auditory Verbal UK (2022) Position Paper have demonstrated the positive effects of early identification and intervention on speech-language outcomes for children with hearing impairment. However, significant empirical gaps remain, particularly in South Africa, where the comparative effectiveness of different intervention strategies (e.g., LSL-SA vs. TSLT) has not been fully explored. Furthermore, the role of socio-cultural factors in shaping the success of these interventions requires further investigation, particularly in contexts where access to resources and professional expertise is limited.

The current study addresses these gaps by comparing the speech-language acquisition and academic outcomes of children who received LSL-SA and TSLT in South African special schools. It also identifies the strengths and barriers of these interventions, contributing to a deeper understanding of how communication strategies can be optimised in resource-limited settings.

2.6 Conclusion

In conclusion, the literature on congenital and early-onset hearing impairment underscores the critical importance of early detection and intervention in shaping developmental outcomes. While HICs have made significant progress in providing comprehensive EHDI services, disparities in service provision continue to affect LMICs, particularly in South Africa, where access to diagnostic tools, hearing aids, and specialised communication interventions remains inconsistent.

The effectiveness of communication interventions, particularly LSL-SA and TSLT, is evident in high-income and LMIC contexts, though each approach has advantages and limitations. LSL-SA offers strong outcomes in language and academic development, but is dependent on resource availability, while TSLT provides a practical solution in resource-limited settings, but may hinder oral language acquisition. As such, the comparative effectiveness of these interventions in the South African context remains an area for further exploration.

This study contributes to the ongoing dialogue on EHDI and communication interventions by evaluating the outcomes of LSL-SA and TSLT in South Africa. By filling empirical gaps and exploring the long-term impacts of early intervention strategies, this research informs the development of more effective and accessible intervention programmes for children with hearing impairment in LMICs.

While numerous studies confirm the benefits of early intervention for speech-language acquisition, few have directly examined the impact on scholastic outcomes. Additionally, research in South Africa has primarily focused on intervention access and feasibility rather than evaluating the comparative efficacy of LSL-SA and TSLT. Given that academic success is strongly tied to language proficiency, this study seeks to fill this critical gap by assessing the long-term educational outcomes of children with hearing impairment who received different intervention approaches. By providing empirical evidence on which method yields better communication and academic success, this research will inform clinical practices, educational planning, and policy development for early intervention in South Africa

Despite evidence supporting both LSL and TSLT approaches, limited comparative studies have evaluated their impact in the South African context. This study seeks to fill this gap by systematically comparing the outcomes of children receiving these two interventions, offering insights that can inform best practices for early intervention in the country.

Chapter 3: Paper I - Therapeutic Approaches to Early Intervention in Audiology: A Systematic Review

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3.1 Abstract

Babies born with a congenital sensorineural hearing impairment or acquire early-onset permanent bilateral hearing impairment are at risk for delayed speech and language development and poor scholastic outcomes. Auditory Verbal Therapy (AVT) has become the primary intervention approach for developing spoken language in children with hearing impairment, and South Africa has also adopted this approach. The outcomes of AVT within the South African context have not been thoroughly investigated. As part of a larger study, the objective of this systematic review was to describe the speech, language and scholastic outcomes of hearing-impaired children enrolled in AVT as a therapeutic approach to early intervention. This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Electronic databases searched included Google Scholar, Science Direct and PubMed. Selected studies were published in English and focused on the outcomes of early intervention for children with hearing impairment. The selected date range of the included articles ensured that the latest research was reviewed. Due to the limited evidence base, the review cannot conclude definitively that AVT yields positive speech, language, and scholastic outcomes in children with hearing impairment. Of the reviewed articles, only one study compares the outcomes of therapeutic intervention approaches, an important consideration, particularly in Low- and Middle-Income countries (LMICs). Current findings provide a strong rationale for the larger study by highlighting that further research comparing AVT to standard speech-language habilitation is required. Research in contexts with linguistic and cultural diversity in countries such as South Africa is required.

3.2 Introduction

The incidence of congenital permanent sensorineural hearing impairment is estimated at five infants for every 1000 live births in high-income countries [1]. Statistics for the developing world are higher due to constrained economic and health resources [2]. This common congenital disability impedes speech and language skills development with consequent scholastic, social and vocational challenges [3]. The early identification of hearing impairment minimizes its lifelong impact, leading to the advent of and advocacy for Universal Newborn Hearing Screening (UNHS), facilitating Early Hearing Detection and Intervention (EHDI) programs globally [4].

There are three components to EHDI: newborn hearing screening, reducing the age of diagnosis of the hearing impairment, and enrolling the infant in an early intervention (EI) program [5]. The Joint Committee on Infant Hearing (JCIH) [6] and Health Professions Council of South Africa (HPCSA) [5] assert that EHDI maximizes linguistic competence, literacy development and scholastic outcomes in children with hearing impairment. Evidence of the continuous excellent outcomes in infants in whom hearing impairment is identified early and intervention initiated early is seen in their rate of language development akin to their hearing peers [4,7–9].

All therapeutic approaches to EI strive to encompass the three components of EHDI. EHDI is a public health initiative in high-income countries, whilst this is the case in 11% of LMICs (ten of 91 LMICs) [10,11]. Olusanya's [10] review of the status of newborn hearing screening programs in LMICs indicates neonatal hearing screening services were constrained by several factors: failure in recognizing infant hearing impairment as a critical health condition, insufficient financial resources for neonatal hearing screening services, absence of appropriate risk-based selective screening, unsuitable environment and conditions for hearing tests. South Africa has an inadequately resourced and funded public healthcare system, functioning alongside a well-developed private healthcare system. Khoza-Shangase [12] lists the following reasons for the current status of EI in South Africa: lack of a government mandate for UNHS, significant resource constraints, a high burden of disease with which EHDI has to compete, and significantly poor social determinants of health. Khoza-Shangase, Kanji and Ismail [13] highlight resource allocations and availability and limited contextually responsive strategic planning as gaps in the public and private healthcare sector. These gaps are compounded by the failure to implement knowledge, policies, and guidelines into practice [13]. These lacunae require attention by the South African audiology community for measurable progress to be made in EI [13].

Of the 900 000 children born in South Africa annually, 17 babies are born daily with permanent sensorineural hearing impairment [14]. South Africa, an LMIC, has been unsuccessful in implementing UNHS or systematic and uniform targeted neonatal hearing screening [15]. South African Speech-Language Therapists and/or Audiologists are trained to provide timely fitting and monitoring of hearing amplification devices, educate and counsel families of hearing-impaired children, and provide therapeutic interventions to these children and their families [6,16]. The implementation of EI services should be achievable. EI enjoys scant priority, and consequently, more than 90% of hearing-impaired babies born in South Africa annually do not have the prospect of early identification and intervention [12,17]. Budgetary constraints impede health policy development, exacerbated by a lacuna of research evidence. Small scale studies fail to embody the South African context, failing to support the prioritization of EHDI [17,18]. Research evidence should corroborate South Africa's healthcare priorities and aim toward evidence-based intervention practices that ensure optimal speech, language, and scholastic development of children with hearing impairment [19].

In South Africa, various intervention approaches are being implemented by Early Interventionists (i.e., Speech-Language Therapists and/ or Audiologists and Teachers of the Deaf) within the public and private healthcare sector. These include auditory approaches such as auditory–verbal therapy (AVT) incorporating listening and spoken language (LSL) principles; the oral-aural approach (the use of amplification and speechreading/natural gestures/visual cues), and cued speech (a system of manual gestures which accompany speech production in real-time). It also includes more visual approaches such as total communication (a variety of communication methods, including sign, speech and listening, lip reading, fingerspelling, facial expression and gesture, in a combination that is best suited for a particular child), or sign language (a visual, gestural approach) [20]. The chosen mode(s) of communication extends beyond the therapy session, based on the educational placement of children with hearing impairment or those who are cochlear implant candidates [20]. Evidence remains limited regarding the outcomes of intervention approaches that do not specify the early fitting and monitoring of amplification devices, especially in Sub-Saharan Africa [14]. Despite this lack of local research in intervention outcomes, two intervention practices are implemented for children with hearing impairment and their families within contextual constraints [20].

Amidst the number of family-centered intervention approaches aiming to improve the speech, language, and scholastic outcomes of children with hearing impairment, AVT, a first-world technique, has been adapted to South Africa. This intervention approach is delivered by Early Interventionists who have undergone post-graduate training to become LSL Specialists [21]. Members of the South African Cochlear Implant Group (SACIG) with Auditory Verbal-UK (AVUK) adapted the AVT approach and implemented training in recent years. The principles of AVT were modified for LSL-South Africa (LSL-SA) in 2005 [22]. A limited number of LSL trained therapists (i.e., 51) provide EI to children with hearing impairment, resulting in incomplete penetration in South Africa [23]. AVT is a parent-coaching program aimed at stimulating auditory brain development, encompassing listening and spoken conversations. It facilitates the utilization of hearing amplification devices, teaching children with hearing impairment to use their residual hearing optimally [24,25]. Traditional Speech-Language Therapy is the more cost-effective intervention approach, given the cultural diversity and challenges within South Africa [20].

South Africa is seeking cost-effective solutions within an already overburdened health care system. Late identified hearing impairment places financial stress on the health system and country at large [12,17]. It is estimated that a severe to profound hearing loss cost-to-society is approximately $300,000 over the lifetime per individual [24]. This cost is especially high in a resource-constrained context like South Africa, where economic inequalities exist [22]. It is vital to establish which therapeutic interventions are cost-effective and efficacious, hence the current review–forming part of a larger study investigating the speech, language and scholastic outcomes of children with hearing impairment following early intervention in South Africa. Furthermore, there is an incongruence of disability in relation to the number and distribution of professionals in South Africa [26]. Statistics indicate a total of 1589 Speech-Language Therapists and Audiologists and 642 Audiologists registered with the HPCSA [5]. Not all children with hearing impairment may be enrolled in an AVT program, let alone receive standard habilitation. The advocacy for the training of additional therapists to address the capacity-demand challenge is thus justified. This systematic review highlights current research and outcomes on the two therapeutic approaches in early intervention.

3.3 Methods

3.3.1 Search strategy

A systematic review of published literature related to intervention approaches and language outcomes for children with hearing impairment was conducted, in line with the

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) [27]. The following online databases were searched: Google Scholar, Science Direct and PubMed. Additionally, a manual review of scientific publications identified from presentations at the World Congress of Audiology in October 2018 was included. The following key terms were used: auditory verbal therapy, early intervention, hearing impairment, language outcomes, speech therapy. To be included, articles had to be peer-reviewed scientific papers published in English between 2015 and 2021. The selected date range ensured current research was included, reflecting the latest intervention approaches and best practices [28,29]. Furthermore, it corresponds to the introduction of LSL-SA (2015) in South Africa [22]. Articles needed to report speech, language or scholastic outcomes of hearing-impaired children following AVT or traditional habilitation. Two independent reviewers identified articles for inclusion, enhancing reliability.

3.3.2 Inclusion and exclusion criteria

Published articles with no stated design, evaluation methods and no clearly stated therapeutic approach were excluded. Articles selected for inclusion were original pieces of scientific work or reports published in peer-reviewed scientific journals. The methodological design criteria of the articles were outcomes-research (comparative clinical), providing evidence regarding the benefits, risks, and results of therapeutic approaches for children with hearing impairment. All the articles were published in English. Furthermore, grey literature (i.e., literature published informally or non-commercially, or unpublished due to a lack of peer-review) was excluded [30]. An initial search was conducted in February 2019 and repeated on 12 January 2021 to include updated developments.

The Newcastle-Ottawa scale (NOS) was used as an evaluation tool to assess the methodological rigor of the non-randomized studies included in this review. The NOS categorized studies as strong (7–9), satisfactory (4–6), or unsatisfactory (0–3) based on the inclusion of the following quality indicators: selection of study group, comparability of groups (variables) and ascertainment of exposure/outcomes (potential bias and blinding) [31]. Only studies that attained ratings of strong were included.

3.3.3 Data extraction and synthesis

Fourteen thousand nine hundred and ninety-four articles were retrieved. Of these, 105 articles were identified for possible inclusion. One hundred and two articles were identified from the databases, and three were identified from manual reviews of scientific publications at the World Congress of Audiology in October 2018. Eight records were excluded due to duplication. Fifty-two records were excluded post title and abstract review. Thirty-three full-text articles were screened for eligibility.

Eventually, twelve peer-reviewed research studies were included. These included three longitudinal comparative studies, two survey cohorts, one descriptive-analytical research design, one multiple baseline across subjects cohort, one outcomes-based study, one collective case design, two prospective research designs, one retrospective research design study. First, articles to be selected for inclusion were independently identified by all investigators using pre-defined abstraction. Disagreements on papers selected for inclusion were resolved through discussion and consensus. Where consensus was not reached, the lead author made the final decision. Second, the authors provided a narrative synthesis of the findings from studies that met the inclusion criteria. The synthesis included the location of the study, sample size, results, conclusions, and recommendations.

The PRISMA flow diagram, showing the process of selecting studies for inclusion in this review, is included (Fig. 3.1).

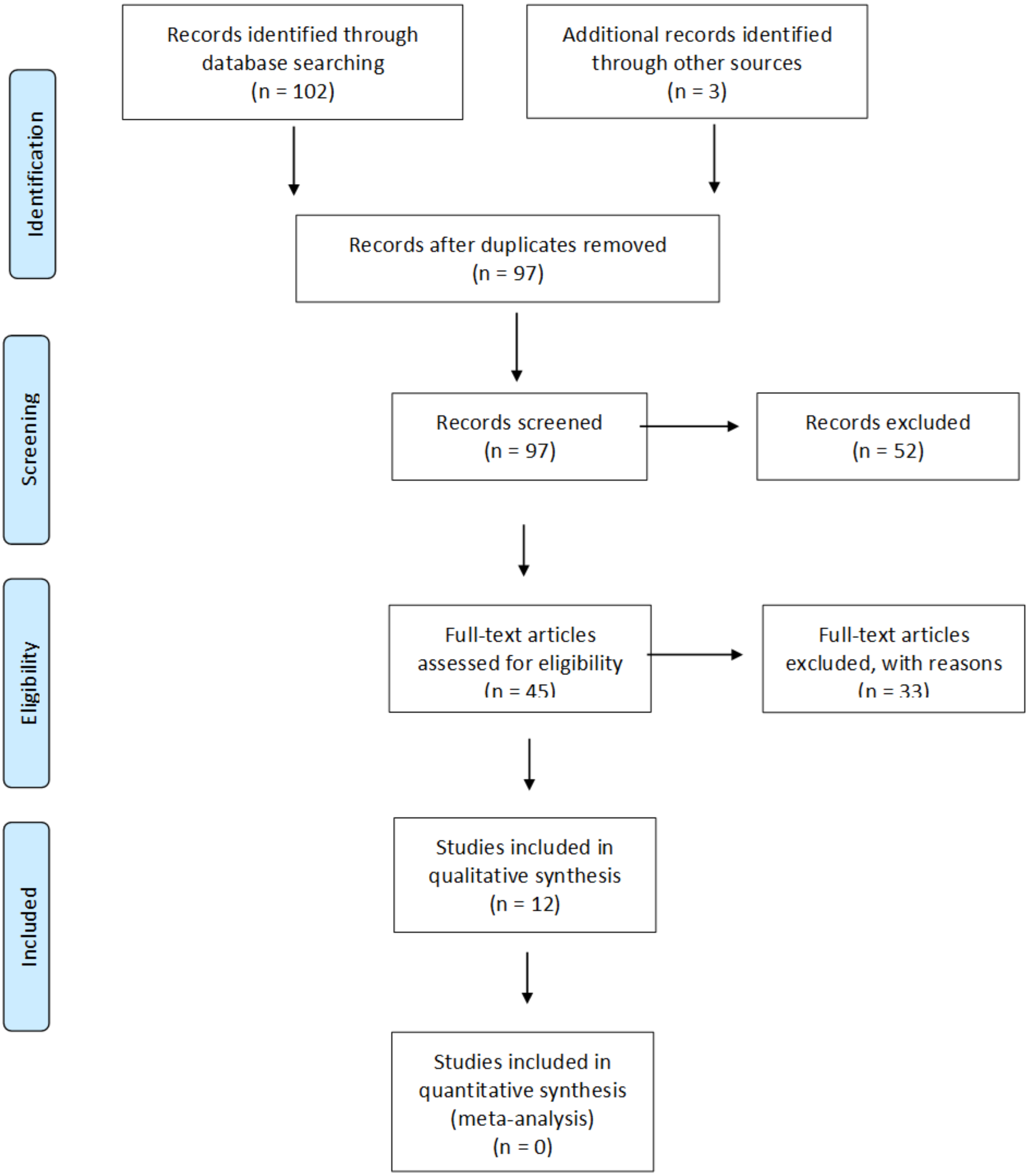

Figure 3-1: The PRISMA 2009 flow diagram for included studies

3.4 Results and discussion

Study findings of the 12 articles reviewed are tabulated in Table 1. A descriptive analysis approach was employed in analyzing qualitative data [32]. Despite the widespread use of AVT, this systematic review found no single- or quasi-randomized controlled trials. Furthermore, some studies did not specifically evaluate AVT but focused on other factors such as the age of fitting of hearing aids or cochlear implants. Evident from the published literature, internationally, AVT is considered the therapeutic approach of choice for children with hearing impairment [4,7–9,33–39]. All the articles revealed positive language outcomes from AVT as an EI approach [4,7–9,33–40].

One of the reviewed studies indicated that approximately 80% of children with hearing impairment receiving amplification before one year old demonstrate normal receptive vocabulary by school entry [8]. Another study indicated that positive language outcomes are solely attributed to the early fitting of cochlear implants before 12 months of age and are not related to the implementation of AVT techniques [34]. On the contrary, Mortazavi and Mortazavi [39] advocate that AVT is a legitimate communication approach for children with hearing impairment regardless of the type of hearing amplification devices. Evident from the above, it can be argued that the successful outcomes of EI programs are dependent on the communication approach and technology, due to the central role of hearing in a child's development.

Data indicates early exposure to AVT incorporates a) early identification of hearing impairment, b) the use of high-tech amplification to enhance access to the speech signal, c) providing early intense (re)habilitation whilst presenting auditory stimuli as the primary sensory input, and d) family involvement as critical aspects of success with AVT [4,7,32–34,36,38,41]. South Africa has, since 1995, recommended the implementation of EHDI; however, the focus to date has been on screening programs, to the detriment of intervention. A small number of studies exist focusing on the age of identification of hearing impairment in South Africa; with the mean age of identification ranging from 1 year 3 months to 2 years 3 months, and a mean age of initiation of EI services at 2 years 5 months old [42,43]. Various reasons for this have been proffered.

AVT emphasizes fitting children with state-of-the-art hearing technologies, teaching them to use their residual hearing optimally. One reviewed study indicated that children receiving cochlear implants younger than 12 months presented with language outcomes within the normal range compared to their typically developing hearing peers [34]. Other reviewed studies indicate that early use of hearing amplification devices is associated with age-appropriate verbal communication outcomes for children with hearing impairment [4,9]. Furthermore, Cupples et al. [35] discuss the extent to which hearing aids improved the speech production and language outcomes of children. The results indicated significant improvements in their speech and language outcomes, suggestive of the clear benefit of amplification [7,35]. It suggests the benefits of early intervention persist into school age, postulating that future studies of the same cohort of children will provide robust predictors of outcomes at school age [35].

Conversely, Percy-Smith et al. [37] report that the language outcomes achieved within their study were regardless of hearing technology. In South Africa, state-of-the-art hearing technologies, such as cochlear implantation, are not widely available within the public healthcare sector. Hearing aid technology has progressed; unfortunately, the costs remain prohibitive. The delayed age of identification of hearing impairment, coupled with the sub-optimal provision of amplification devices further delays the age of initiation of EI services [42]. These factors conspire to delay definitive intervention, with no particular emphasis on AVT [44].

Only one study compared the language outcomes of children enrolled in different intervention programs. Percy-Smith et al. [36] studied two cohorts who received either standard habilitation (i.e., traditional speech-language therapy) or AVT. Results indicated that children in the AVT program outperformed those in the standard habilitation program, yielding higher odds at performing at age-equivalent speech and language levels [36]. EI, in general, is associated with positive language outcomes in children with hearing impairment [45]. Whilst the therapeutic approaches may vary, there is congruence among the strategies suggested to families [45]. A comparative study is essential between the adapted AVT approach (LSL-SA) to the standard habilitation approach that is mostly implemented.

Studies reviewed were limited by the lack of control or comparison groups and failure to compare therapeutic intervention approaches. Most of the studies reviewed were conducted in high-income countries, raising serious implications for extrapolating findings to South Africa. The linguistic and cultural diversity further poses a challenge to the family-centered approach. Unbiased research regarding the effectiveness of AVT for hearing-impaired children must be conducted.

Table3-1: Findings of reviewed studies

Reference	Location	Sample Size	Therapeutic Approach	Results and Conclusions	Recommendations
[4] Lew, J., Purcell, A.A., Doble, M. and Lim, L.H. (2014). Hear here: Children with hearing loss learn words by listening. *International Journal of Pediatric Otorhinolaryngology*. 78. 1716-1725.	Singapore	N = 3	• AVT	• The early use of hearing devices and family participation in AVT has been associated with gains made in speech perception skills, vocabulary, and speech development. • Therapy directed at listening alone, without incorporating additional goals into a therapy program showed a positive impact on speech and vocabulary development	• A larger study is necessary for more conclusive findings
[7] Fulcher, A.N., Purcell, A., Baker, E. and Munro, N. (2015). Factors influencing speech and language outcomes of children with early identified severe/profound hearing loss: Clinician-identified facilitators and barriers. *International Journal of Speech-Language Pathology*. 17(3). 325-333.	Australia	N = 6	• AVT	• Results indicate early identification of children with severe/profound hearing impairment, early amplification and commencing AVT under 6 months facilitates child progress	• An EHDI approach (including AVT) will empower clinicians to facilitate optimal speech and language outcomes for children with hearing impairment.

[8] Akçakaya, H., and Tavşancıl, E. (2016). Teacher opinions about auditory verbal therapy. *Journal of Qualitative Research in Education.* 4(2), 1-25. doi: 10.14689/issn.2148-2624.1.4c2s1m	Turkey	N = 10	• AVT	• Results indicate working with the child's family (a premise of AVT) has a positive impact on speech perception, language development and speech production.	The researchers advocate that: • AVT training should occur during the undergraduate education of Therapists and Educators of Hard of Hearing • AVT should be widespread as it is useful for children with hearing impairment and their families.
[9] Ching, T.Y.C., Dillon, H., Button, L., Seeto, M., Van Buynder, P., Marnane, V, Cupples, L. and Leigh, G. (2017). Age at Intervention for Permanent Hearing Loss and 5-Year Language Outcomes. Pediatrics. 140(3). E20164274.	Australia	N = 350	• AVT	• EI improves language outcomes of children with Permanent Childhood Hearing Loss	• Research that focuses on post-diagnostic intervention, capitalizing on the opportunity offered by UNHS to improve language development. • Research monitoring early outcomes with amplification, so that children at risk for language delays can receive intervention at the earliest age possible
[33] Hitchins, A.R.C. and Hogan, C. (2018). Outcomes of early intervention for deaf children with additional needs following an	UK	N = 129	• AVT	• Families who have access to EI increases the chances of achieving age-appropriate language when a:	Comparisons across studies from different centers around the world are required and may be

Auditory Verbal Approach to communication. *International Journal of Pediatric Otorhinolaryngology*. 115. 125-132. doi: 10.1016/j.ijporl.2018.09.025				- suitable communication approach is adopted at the earliest opportunity - child with additional needs will acquire listening and spoken language at a rate commensurate with their full potential • Results of hearing-impaired children on the AVT program: - 79% achieved age-appropriate spoken language scores - 1 in 2 with additional disabilities (N=52) reached age-appropriate spoken language scores after being in the program for two years - The mean Rate of Language Development (N=52) indicated a significant increase	achieved by categorizing children's additional needs
[34] Dettman, S.J., Dowell, R.C., Choo, D., Arnott, W., Abrahams, Y., Davis, A., Dornan, D., Leigh, J., Constantinescu, G., Cowan, R. and Briggs, R.J. (2016). Long-term Communication Outcomes for Children Receiving Cochlear Implants Younger Than 12 Months: A Multicenter Study. *Otology & Neurotology*. 37: e82-e95.	Australia	N = 403	• AVT • Oral-Aural • Sign-Bilingual	• The fitting of cochlear implants before 12 months old: - facilitated speech production accuracy and language acquisition comparable to hearing peers - 80% of children demonstrated receptive vocabulary knowledge within the normal range by school entry	• Further research is currently underway in examining literacy development and academic outcomes due to the importance of vocabulary and oral language in the development of literacy skills

[35] Cupples, L., Ching, T.Y.C., Button, L., Seeto, M., Zhang, V., Whitfield, J., Gunnourie, M., Martin, L. and Marnane, V. (2018). Spoken language and everyday functioning in 5-year-old children using hearing aids or cochlear implants. International Journal of Audiology. 57(2). S55-S69. doi: 10.1080/14992027.2017.1370140.	Australia	N = 339	• AVT • Combined sign/mixed	• The use of an oral communication mode in EI is associated with better receptive language performance. • Earlier amplification, higher non-verbal cognition, lesser degrees of hearing loss and higher maternal education were associated with better language outcomes	• Research considering confounding variables influencing outcome measures.
[36] Percy-Smith, L., Tonning, T.L., Josvassen, J.L., Mikkelsen, J.H., Nissen, L., Dieleman, E., Hallstrom, M. and Caye-Thomasen, P. (2018). Auditory verbal habilitation is associated with improved outcome for children with cochlear implant. *Cochlear Implants International. An Interdisciplinary Journal.* 19(1). 38-45. doi: 10.1080/14670100.2017.1389020.	Denmark	N = 130	• AVT • Traditional Speech Language Therapy	Children with hearing impairment enrolled in AVT scored age-appropriately and outperformed children with hearing impairment enrolled in traditional speech-language therapy.	• All children with hearing impairment should be offered AVT. • National boards of Health and Social Affairs should recommend basing habilitation principles on AVT
[37] Percy-Smith, L., Hallstrom, M., Josvassen, J.L., Mikkelson, J.H., Nissen, L., Dieleman, E. and Caye-Thomasen, P. (2018). Differences	Denmark	N = 55	• AVT	• Equal progress in both cohorts of an AVT program, i.e., cochlear implants and hearing aids, were noted	• AVT is recommended as a relevant EI practice

and similarities in early vocabulary development between children with hearing aids and children with cochlear implant enrolled in 3-year auditory verbal intervention. *International Journal of Pediatric Otorhinolaryngology*. 108. 67-72. doi: 10.1016/j.ijporl.2018.02.030.					
[38] Moeller, M.P. and Tomblin, B. (2016). An Introduction to the Outcomes of Children with Hearing Loss Study. Ear Hear. 36(01). 4s-13s. doi: 10.1097/AUD. 0000000000000210.	USA	N = 434	Cumulative Linguistic Experience – encompassing all therapeutic approaches that maximize audibility through amplification and family involvement	Results indicate that children with hearing impairment experience limitations in access to linguistic input, leading to a decrease in uptake of language exposure and an overall reduction in linguistic experience.	Intervention approaches should: • Maximize audibility with hearing amplification. • Coach families to provide high-quality conversational interactions. • Provide high-quality early intervention
[39] Mortazavi, Z. and Mortazavi, S. (2016). Auditory-Verbal Therapy (AVT) and Evidence-Based Practice (EBP). BMJ Open. 7(0). A1-A78. doi: 10.1136/bmjopen.2016.015415.26.	Iran	N = 20	• AVT	This study employed the following hypothesis to conduct an evidence-based AVT program evaluation: 1. Evidence-Based research 2. Clinical skills	The researchers advocate that the AVT approach is a legitimate communication approach for children with hearing impairment, regardless of the

				3. Stakeholder perspectives, including families. Results indicated: • 80% of children with hearing impairment reached a language development level comparable with normal hearing children. • Considerable receptive language development was seen within the first six months of attending the AVT program. • Considerable expressive language development was seen within the second six months of attending the AVT program	type of hearing amplification devices.
[40] Ching, T.Y.C., Dillon, H., Leigh, G. and Cupples, L. (2017). Learning from the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study: summary of 5-year findings and implications. *International Journal of Audiology*. 57(sup2):1-7. doi: 10.1080/14992027.2017.1385865	Australia	N = 470	• AVT	Better language outcomes are associated with: • The use of spoken language for communication • Less severe hearing loss • Higher non-verbal cognitive ability • Higher maternal education Absence of additional disabilities	To achieve parity of outcomes with normal hearing peers further research should address: • How spoken language is best learnt in the presence of hearing impairment. Effective ways for parents to promote communication

3.5 Conclusion and recommendations

Findings indicated only one study that directly compared language outcomes between or among different programmes. Due to the limited evidence base, the review cannot conclude definitively that AVT yields positive speech, language, and scholastic outcomes in children with hearing impairment but supports the hypothesis that early provision of AVT yields positive outcomes for hearing-impaired children. Further, this benefit appears dependent upon family-centered care and appropriate hearing amplification, factors that impact the success of an EI programme and vary widely across countries. There is a need for rigorous country-specific research comparing family-based intervention approaches for hearing-impaired children. A determination of the most effective approach to EI can be made only by examining different approaches with consideration for economic, cultural, and/or linguistic differences across regions or countries. This review highlights the need to investigate the speech-language acquisition and scholastic outcomes of children receiving AVT (LSL), particularly within South Africa. The dearth of research into AVT highlights the need for controlled studies and raises important implications for policy development.

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Chapter 4: Paper II - A comparative study of learning outcomes for hearing-impaired foundation phase learners

(Reprinted with permission: Appendix M)

4.1 Abstract

Background: Two intervention approaches are implemented in South Africa to alleviate the deleterious consequences of congenital or early onset hearing impairment on language acquisition and subsequent poor learning outcomes.

Aim: This study investigated the learning outcomes of foundation phase learners with severe to profound hearing impairment who received Listening and Spoken Language – South Africa (LSL-SA) (adapted Auditory Verbal Therapy) therapy compared to those who received Traditional Speech-Language Therapy (TSLT).

Setting: The study was conducted at four early intervention (EI) schools for children with hearing impairment across three provinces in South Africa.

Methods: Data were collected through record reviews of their Speech-Language Therapy Outcomes and South African National Department of Basic Education academic report cards. Data were analysed using quantitative statistics.

Results: Findings demonstrated that children with hearing impairment enrolled in LSL-SA outperformed those enrolled in TSLT in achieving age-equivalent language outcomes. A higher percentage of learners enrolled in LSL-SA achieved meritorious to outstanding learning outcomes. While a comparable number of learners progressed to mainstream schooling, children with hearing impairment enrolled in LSL-SA are enrolled for a shorter duration until discharge than those enrolled in TSLT. This is an important finding, particularly in low-middle income countries (LMICs).

Conclusion: Listening and Spoken Language – South Africa graduates achieved superior learning outcomes dependent on language attainment, providing contextually relevant evidence supporting the effectiveness of the LSL-SA EI approach.

Contribution: These context-specific outcomes stress the obligation to upscale and fast-track EI services. Implications for investment in LSL-SA are proposed through collaboration between families, educators, and early interventionists.

Keywords: academic achievement; auditory-verbal therapy; early hearing detection and intervention; early intervention; hearing impairment; listening and spoken language – South Africa; learning outcomes; schooling.

4.2 Introduction

The pathways for future academic success are often shaped during early childhood. 'Early childhood is defined as the period from prenatal development to 8 years of age' (World Health Organization [WHO], 2007), as young children learn essential skills that serve as the foundation for the development of later academic skills (Gertler et al. 2014; Hanover Research 2016; Woodhead et al. 2014). Evidence indicates that a hearing impairment denies children access to appropriate stimulation, impacting the development of cognitive abilities, language, and psychosocial skills needed for classroom learning (Black et al. 2017; Feder et al. 2017; Lang-Roth 2014).

Language is the foundation of all communication and influences how we express ourselves, analyse, process, decode, and understand information (Sherred 2021). Language abilities are among several important factors contributing to academic success (Antia et al.

2020; Goldblat & Pinto 2017; Mahmud 2014; Moeller et al. 2007). Auditory input is critical to language development. Consequently, early identification of a child's hearing impairment is important for implementing early amplification and intervention (Korver et al. 2010).

The Joint Committee on Infant Hearing (JCIH) endorses the 1-3-6 principle for Early Hearing Detection and Intervention (EHDI) that prescribes hearing screening be conducted before 1 month of age, confirmation of hearing impairment before 3 months of age for infants that do not pass their hearing screening, and fitting and management of appropriate hearing technology and individualised family centred intervention be implemented by a maximum of 6 months of age (JCIH 2019). Based on contextual factors, the South African adjusted 1-4-8 principle aims to provide children with hearing impairment the opportunity to develop an effective communication system and literacy development on par with children with normal hearing (Health Professions Council of South Africa [HPCSA] 2018; Smith et al. 2017). Despite this, evidence remains limited regarding implementing intervention approaches and related outcomes in sub-Saharan Africa (Casoojee & Khoza-Shangase 2022; Kanji 2016; Khoza-Shangase 2019).

Two intervention approaches are implemented for children with hearing impairment and their families by suitably trained Early Interventionists (i.e., Speech-Language Therapists and/or Audiologists and Teachers of the Deaf) within the public and private healthcare sector in the South African context (Casoojee & Khoza-Shangase 2022). The first approach is the Traditional Speech-Language Therapy (TSLT) approach, ranging from auditory to manual or a combination of these approaches. The second approach, a first-world technique, Auditory Verbal Therapy (AVT), has been adapted to the South African context (i.e., Listening and Spoken Language – South Africa [LSL-SA]). The LSL-SA approach is premised on creating a partnership between educators and parents of children with hearing impairment and teaching the children to use their residual hearing optimally. It is based on the belief that even children with minimal hearing can be taught to listen and learn spoken language with the use of the most current hearing technologies. This, in conjunction with specific therapeutic strategies, fosters listening and spoken conversations through guidance and coaching of the child's parents (Estabrooks, MacIver-Lux & Rhoades 2016). There are limited educational institutions where these Early Intervention (EI) approaches are implemented in South Africa.

A minority of foundation-phase schools in South Africa incorporate a language-enriched learning environment for children with delayed language development and/or hearing impairment (Sewpersad 2014). Unfortunately, there is a significant gap between the evidence base that supports inclusive education resulting in the South African educational system utilising specialised environments to meet the learner's best interests and access to education to maximise their potential (Department of Education [DoE] 2001).

Primary education in South Africa includes mandatory education years, that is, from Grades 0 to Grade 9, which are managed and regulated by the Department of Basic Education (DBE 2021). Primary education is split into three phases: (1) the foundation phase that covers Grades R to three, and includes learners from 6–9 years of age; (2) the junior primary or intermediate phase that covers Grades 4–6; and (3) the senior phase that covers Grades 7–9 (Umalusi 2022). The grading system is on a scale of 1–7. The qualification equivalents of marks on the scale are 1 (0–29: fail); 2 (30–39: elementary); 3 (40–49: moderate); 4 (50–59: adequate); 5 (60–69: substantial), 6 (70–79: meritorious), and 7 (80–100: outstanding).

Academic success is a critical determinant of quality of life for children with hearing impairment (Motasaddi-Zarandy et al. 2009). Multiple studies illustrate that possessing competent spoken language forms the basis of reading and literacy (Burgess 2002 Duff & Tomblin 2018; Reeder & Baxa 2020; Tunick & Pennington 2002). Only a few studies have focussed on learning outcomes among children enrolled in AVT programmes, that is, reading outcomes (Fairgray, Purdy & Smart 2010), writing skills (Yasamsal, Yucel & Sennaroglu 2013), literature grade outcomes (Goldblat & Pinto 2017), language and literacy scores (Geers et al. 2019), and the inclusive education of children with hearing impairment (Eriks-Brophy et al. 2007).

Research suggests that the learning outcomes of children with hearing impairment result from a complex interplay of many factors (Marschark et al. 2015). Factors that may influence the learning outcomes within the South African context include: (1) Linguistic diversity: Mdladlo et al. (2016) indicated that the average Speech-Language Therapist in the South African context is still predominantly an English or Afrikaans-speaking female, not conversant in an African language. Khoza-Shangase and Mophosho (2018) highlighted that only 5% of speech-language therapists and audiologists in South Africa speak an African language as a mother tongue, a significant incongruency to the South African population's linguistic profile; (2) Language of Learning and Teaching (LOLT). Myburgh, Poggenpoel and Van Rensburg et al. (2004) posit that authentic teaching and learning fail to occur when learners do not speak the language of instruction. This, combined with the limited penetration of trained interventionists and the predominance of English in the profession, creates an obstacle in meeting the demands of families while implementing an LSL-SA approach in the context where the majority either do not speak English or speak it as an additional language (EAL) (Mdladlo et al. 2016). Furthermore, the language skills of children with hearing impairment are already below their hearing peers (Hawken et al. 2005); (3) First Additional Language (FAL) is mandatory in South African schools: Lenyai (2011) established that teachers in the foundation phase of schools do not necessarily have the skills to teach literacy in the FAL, failing to produce competent learners; (4) Age at diagnosis of hearing impairment: Diagnosis of permanent congenital or early-onset hearing loss is severely delayed in South Africa, undermining the prospect of positive outcomes through EI (Kuschke et al. 2020); (5) Financial costs of hearing impairment and its effect on EI success: Although AVT is available in South Africa, it continues to be delivered primarily by the private healthcare sector and often at a significant financial cost to the patient and their family (Maluleke 2022; White & Brennan-Jones 2014). Knowledge of the economic costs associated with a hearing impairment is a powerful tool for policymakers in planning the best use of their healthcare budgets, especially in LMICs (World Health Organization [WHO] 2017).

Children with better oral communication skills perform better academically (Sherred 2021). Fairgray et al. (2010) investigated the effects of AVT on school-aged children with hearing impairment, and their findings support the notion that AVT techniques improve outcomes of children aged 5–17 years old with hearing impairment in receptive language, phonological development, articulation, and listening in noise. In a study examining the effects of the frequency of EI on spoken language and literacy outcomes, Geers et al. (2019) concluded that greater availability of EI services (0–36 months old) yielded higher spoken language and literacy scores at the foundation phase. Furthermore, studies consistently show that children with hearing impairment enrolled in an LSL EI programme attain significantly higher levels of language and learning outcomes relative to age-matched peers than children without EI (Davidson, Osman & Geers 2021). Positive outcomes prevail across auditory verbal centres; however, these data are based on limited empirical evidence (Rhoades 2010). Additionally, all the positive reviews and documented outcomes of AVT globally have emanated from studies conducted in high-income countries (HICs).

The education of learners with hearing impairment is controversial, particularly regarding the type of school placement and, relatedly, the intervention approach adopted (Marschark et al. 2015). There is a dearth of evidence regarding the learning outcomes of children with hearing impairment enrolled in TSLT programmes compared to LSL approaches. In a systematic review by Erbasi, Hickson and Scarinci (2017), findings indicated that communication outcomes in children with hearing impairment were highly variable and evidence regarding the impact of the different EI approaches on learning outcomes was inconclusive. This scarcity of evidence is further influenced by the lack of control and/or comparison groups and the failure in available studies to compare therapeutic intervention approaches (Casoojee, Kanji & Khoza-Shangase 2021; Goldblat & Pinto 2017; White & Brennan-Jones 2014). There is a necessity for research surrounding the use and effectiveness of these different intervention approaches for children with hearing impairment in sub-Saharan Africa (Khoza-Shangase 2019).

This study aimed to contribute towards filling this identified lacuna in the context of research on the effectiveness of an LSL approach for children with hearing impairment, specifically extrapolating the findings to South Africa, a LMIC.

4.3 Methods

A quantitative, cross-sectional research approach was adopted to address the study's objectives. This study forms part of a larger study titled 'Speech-language acquisition and learning outcomes of children with hearing impairment following EI in South Africa: A comparative study'. The main aim was to investigate the learning outcomes of foundation phase learners (Grade 3) with hearing impairment who received LSL-SA (LSL-SA group) versus TSLT (TSLT group), with specific objectives being: (1) to determine if any associations exist between selected study variables (i.e., gender, home language, age at diagnosis of hearing impairment, cause of hearing impairment, duration of amplification, type of hearing amplification device, age at start of EI, duration of EI) within the intervention approaches and learning outcomes; (2) to explore the learning outcomes in the LSL-SA group; (3) to describe the learning outcomes in the TSLT group; (4) to compare the learning outcomes between the two groups; (5) to describe the communication functioning at the onset of EI compared to the communication functioning upon discharge from therapy; (6) to determine the association between communication functioning and learning outcomes; and (7) to identify the promotion to mainstream schooling on completion of the foundation phase as an indicator of academic success.

4.3.1 Study sample and demographics

A total of 64 therapy records and academic reports of children with severe to profound hearing impairment, selected through a non-probability purposive sampling technique, were included in the study, and their demographic data were collected (Table 1). This sample size allowed for detecting medium-large effect sizes ($w = 0.39$) with calculations carried out in G*Power (Faul et al. 2007). The children were enrolled at one of the EI schools in: (1) Johannesburg, Gauteng; (2) Pretoria, Gauteng; (3) Morningside, KwaZulu-Natal; and (4) Cape Town, Western Cape.

4.3.2 Inclusion and exclusion criteria

The records of children: (1) diagnosed with a congenital or early onset, bilateral, severe to profound hearing impairment, (2) enrolled in an EI programme receiving either TSLT or the LSL-SA approach, (3) fitted with hearing aids or cochlear implants, (4) who have completed Grade 3 in the foundation phase of primary schooling, were included in the study. Records of children with hearing impairment who presented with additional comorbidities, such as cognitive impairment, were excluded from the study.

4.3.3 Procedures

Written permission was obtained from all relevant authorities, granting the researcher access to the educational facilities, and to disseminating information to the parents and/or primary caregivers of children with hearing impairment, inviting them to participate in the study. Once access was granted, the researcher compiled a list of potential participants using non-probability purposive sampling. Parents of all the participants signed an informed consent after indicating their willingness to allow the researcher to access their child's therapy files and Grade 3 academic reports.

4.3.4 Data collection tool

A retrospective data collection tool was developed for this study and was pre-tested at each EI school using a therapy file and academic report. The main study did not include records used in the pilot study. The data collection form comprised three sections: Section A, Child Demographics; Section B, Intervention Outcomes; and Section C, Learning Outcomes. The retrospective record review of written and printed records aimed to gather information regarding: (1) the child's hearing impairment; (2) the age at diagnosis of hearing impairment and age at initiation of EI services; (3) the type of amplification device; and (4) speech-language outcomes in comparison to learning outcomes at the end of Grade 3 at the EI school.

4.3.5 Data analysis

The statistical significance of the categorical variables (i.e., gender, home language, cause of hearing impairment) and its association between the LSL-SA and TSLT approach (i.e., marks for each subject in Grade 3 and communication functioning at discharge from therapy) was determined using the X2 test. Fisher's exact test was used for 2×2 tables or where the requirements for the X2 test could not be met. The strength of the associations was measured by Cramer's V and the Phi coefficient, respectively.

The association between the intervention approach and the selected continuous study variables and marks for each subject in Grade 3 and communication functioning at discharge from therapy was determined using the independent samples t-test (or one-way analysis of variance [ANOVA] for more than two groups). Where the data did not meet the assumptions of these tests, the corresponding non-parametric tests were used, that is, the Wilcoxon Rank Sum test and the Kruskal–Wallis test. The strength of the associations was measured by Cohen's d for parametric tests and the r-value for the non-parametric tests. Data were analysed using SAS Software, version 9.4 for Windows, Cary, NC, USA: SAS Institute Inc. (2002-2010) (previously Statistical Analysis System) version 9.4 for Windows (SAS 2002–2010).

4.3.6 Ethical considerations

Ethical clearance to conduct this study was obtained from the University of the Witwatersrand, Human Research Ethics Committee (No. H20/06/03).

4.4 Results

As depicted in Table 1, of the 64 participants, 29 were male, and 35 were female. The medium of instruction at the participating schools is English and Afrikaans. Children are enrolled in English or Afrikaans based on the language used in intervention sessions. The most spoken languages in the participants' households included 4 of the 11 official languages in South Africa. The records of 15 participants indicate that they do not receive EI in their home language. Table 1 presents a further description of the participants' demographic profiles.

Table 4-1: Demographic data of children in the study (N=64)

Gender	
Male	29
Female	35
Home Language	
English	31
Afrikaans	17
Xhosa	14
Sotho	1
English and Afrikaans	1

The association between the categorical variables (i.e., age at diagnosis of hearing impairment, duration of amplification, type of hearing amplification device, age at the start of EI, duration of EI) within the intervention approaches (i.e., LSL-SA or TSLT) and learning outcomes are depicted in Table 2.

The average age of diagnosis of hearing impairment in this study was 2.4 years old. When comparing the age of diagnosis of hearing impairment and age of enrolment in an EI programme between the TSLT and LSL-SA groups, the average age of diagnosis and age of enrolment in an EI programme, respectively, for the LSL-SA group was 2.7 years old and 2.9 years old, and for the TSLT group was 2.0 years old and 2.4 years old. The age at diagnosis of hearing impairment and, consequently, the commencement of EI within the TSLT EI approach is earlier in comparison to the LSL-SA EI approach. The percentage of participants between the two EI groups implanted with cochlear implants to those fitted with hearing aids is comparable. The study found that the mean duration of EI until discharge was significantly longer for those who underwent TSLT (7.3 years; standard deviation [s.d.] 1.2 years) compared to those who underwent LSL-SA (5.9 years; s.d. 1.2 years); $p = 0.011$ (moderate effect size; Cohen's d = 0.75), despite those in the TSLT EI group having a longer duration of amplification.

Table 4- 2: Categorical variables of children included in the study (N=64)

Characteristic	Category	Overall		TSLT		LSL-SA		p-value for between-group comparison
		N	**%**	**N**	**%**	**N**	**%**	
Type of EI		**64**		**23**		**41**		
Age at diagnosis of HI	median (IQR); range	2.4 (1.4-3.6); 0.0-8.0		2.0 (0.8-2.6); 0.1-5.2		2.7 (1.6-4.0); 0.0-8.0		0,098
Type of amplification	Hearing Aid	18	28	7	30	11	27	0,78
	Cochlear Implant	46	72	16	70	30	73	
Duration of amplification (years from earliest amplification to current age)	mean (SD); range	2.4 (3.2); -7.0 to 8.6		3.8 (2.2); -0.3 to 8.6		1.6 (3.4); -7.0 to 7.8		0.0060 (d=0.69)
Age at EI start (years)	median (IQR); range	2.8 (1.6-4.0); 0.2-8.2		2.4 (1.5-3.0); 0.2-5.4		2.9 (1.6-4.7); 0.2-8.2		0,10
Duration of EI (years)	mean (SD); range	6.4 (2.0); 0.6-10.9		7.3 (1.2); 5.3-9.4		5.9 (2.2); 0.6-10.9		0.0061 (d=0.75)

The categorical variable for causes of hearing impairment of the children included in the study is depicted in Table 3. Because of missing data in the children's records, only 38 records could be analysed. Genetic causes were the dominating variable, accounting for 20% of the children with hearing impairment; 6% was attributed to prematurity, 6% to meningitis, 5% to ototoxicity, and 3% each to birth asphyxia, hydrocephalus, and parental substance abuse. Sixteen additional causes were identified, each accounting for 1% of the records analysed.

Table 4-3: Cause of hearing impairment of children in the study (N=38)

Cause of Hearing Impairment		
	N	**%**
Genetic	13	20
Meningitis	4	6
Prematurity	4	6
Ototoxicity	3	5
Birth asphyxia	2	3
Parental substance abuse	2	3
Hydrocephalus	2	3
Brain swelling	1	2
Placentae Abruptio at birth	1	2
NICU	1	2
Chicken Pox	1	2
Recurrent Otitis Media	1	2
Congenital Rubella	1	2
Cleft palate	1	2
Consanguineous	1	2
Cytomegalovirus	1	2
Septicaemia	1	2
Renal failure	1	2
Jaundice requiring transfusion	1	2
MVA	1	2
Maternal German Measles	1	2
Parental alcohol abuse	1	2
Enlarged vestibular aqueducts	1	2
Unknown	27	42

Table 4 depicts the learning outcomes found in this study for the LSL-SA group compared to the TSLT group at the end of the foundation phase (*N)* = 64).

Table 4-4: Learning outcomes between TSLT and LSL-SA at the end of grade 3 (N=64)

Subject Area	**Learning Outcome**	**Overall**		**TSLT**		**LSL-SA**		**p-value for between-group comparison**
		N	**%**	**N**	**%**	**N**	**%**	
		64		**23**		**41**		
Home Language	0-59	23	36	10	43	13	32	0,22
	60-69 Substantial	18	28	8	35	10	24	
	70-100	23	36	5	22	18	44	
Life Skills	0-69	29	45	9	39	20	49	0,28
	70-79 Meritorious	25	39	12	52	13	32	
	80-100 Outstanding	10	16	2	9	8	20	
Mathematics	Subject not taken	1	2	0	0	0	0	
	0-49	11	17	4	18	7	17	0,066
	50-59 Adequate	11	17	7	32	4	10	
	60-69 Substantial	19	30	8	36	11	27	
	70-79 Meritorious	11	17	1	5	10	24	
	80-100 Outstanding	11	17	2	9	9	22	
First Additional Language (FAL)	Subject not taken	1	2	0	0	0	0	
	0-49	19	30	4	18	15	37	0,055
	50-59 Adequate	18	28	10	45	8	20	
	60-69 Substantial	10	16	5	23	5	12	
	70-100	16	25	3	14	13	32	

The records indicate that a higher distribution of learners achieve lower grades (0% – 59%) in the TSLT group. In comparison, a significantly higher percentage of learners who received the LSL-SA EI approach achieved a meritorious to outstanding result (70% – 100%) when compared to those who received the TSLT EI approach. This achievement was translated across all subject areas included in the analysis, as depicted in Table 4. These learning outcomes between-group comparisons for learners who achieved 70% and above for Home Language, Life Skills and Mathematics are depicted in Figure 1.

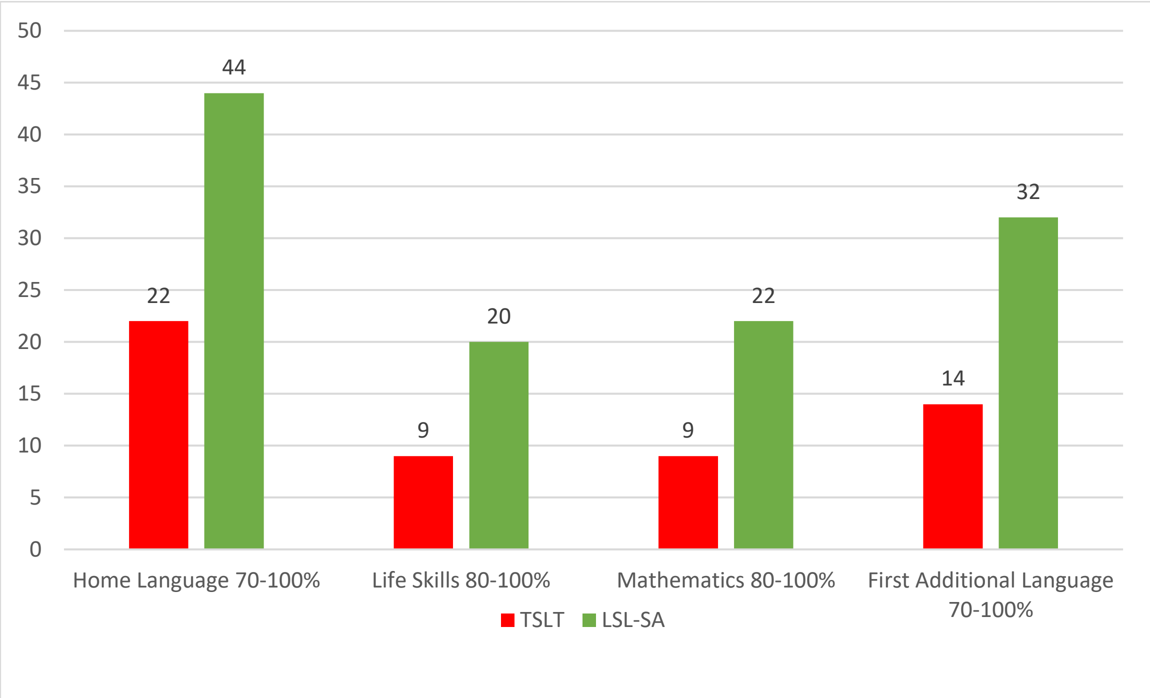

Figure 4-1: Comparative percentage of learners who achieved 70% and above

The communication functioning at the onset of the EI approach, depicted in Table 5, compares the communication functioning upon discharge from therapy, depicted in Table 6 for the LSL-SA group and TSLT group, respectively, at the end of the foundation phase.

As indicated in Table 5, for all participants, communication functioning was delayed at the onset of EI for learners who received LSL-SA and those who received TSLT. The records of participants in this study indicate that a comparable number of learners who received TSLT to those who received LSL-SA achieved age-appropriate scores upon discharge from the EI approach at the end of the foundational phase in the areas of speech, receptive language, and cognitive-linguistics (as shown in Table 6). The results obtained in this study further indicate that in the areas of vocabulary, expressive language and audition, a significantly higher number of learners who underwent the LSL-SA EI approach achieved age-appropriate scores compared to those learners who underwent the TSLT EI approach.

Table4-5: Communication functioning at the onset of the EI approach (N=64)

Communication functioning at the onset of therapy:		**Overall**		**TSLT**		**LSL-SA**		**p-value for between-group comparison**
		N	**%**	**N**	**%**	**N**	**%**	
Speech	Delayed	63	98	23	100	40	98	>0.99
	Age Appropriate	1	2	0	0	1	2	
Vocabulary	Delayed	63	98	23	100	41	100	n/a
	Age Appropriate	0	0	0	0	0	0	
	Unknown	1	2	0	0	0	0	
Receptive Language	Delayed	63	98	23	100	40	98	>0.99
	Age Appropriate	1	2	0	0	1	2	
Expressive Language	Delayed	64	100	23	100	41	100	n/a
	Age Appropriate	0	0	0	0	0	0	
Audition	Delayed	63	98	22	96	41	100	0,36
	Age Appropriate	1	2	1	4	0	0	
Cognitive linguistics	Delayed	61	95	23	100	38	93	0,55
	Age Appropriate	3	5	0	0	3	7	

Table4-6: Communication functioning upon discharge from the EI approach (N=64)

Communication functioning at discharge of therapy:		**Overall**		**TSLT**		**LSL-SA**		**p-value for between-group comparison**
		N	%	**N**	**%**	**N**	**%**	
Speech	Delayed	26	41	10	43	16	39	0,79
	Age Appropriate	38	59	13	57	25	61	
Vocabulary	Delayed	34	53	14	61	20	49	0,44
	Age Appropriate	30	47	9	39	21	51	
Receptive Language	Delayed	34	53	13	57	21	51	0,80
	Age Appropriate	30	47	10	43	20	49	
Expressive Language	Delayed	35	55	14	61	21	51	0,60
	Age Appropriate	29	45	9	39	20	49	
Audition	Delayed	28	44	12	52	16	39	0,43
	Age Appropriate	36	56	11	48	25	61	
Cognitive linguistics	Delayed	22	34	9	39	13	32	0,59
	Age Appropriate	42	66	14	61	28	68	

The following significant associations between language functioning and academic marks as an outcome of EI were found:

- Home Language marks tended to be higher for those with age-appropriate vocabulary upon therapy discharge (p = 0.020; Cramer's V = 0.35; moderate effect size). There was a similar finding for Receptive Language, Expressive Language, and Cognitive linguistics.
- Life Skills marks tended to be higher for those with age-appropriate Receptive Language upon therapy discharge (p = 0.045; Cramer's V = 0.31; moderate effect size). There was a similar finding for Expressive Language.
- Mathematics marks tended to be higher for those with age-appropriate Receptive Language upon therapy discharge (p = 0.034; Cramer's V = 0.40; moderate effect size).
- First Additional Language marks tended to be higher for those with age-appropriate Receptive Language upon therapy discharge (p = 0.024; Cramer's V = 0.39; moderate effect size). There was a similar finding for Expressive Language.

Consideration of promotion to mainstream schooling on completion of the foundation phase, resultant of EHDI, is a marker of academic success. The type of schooling recommended upon completion of the foundation phase is depicted in Table 7.

Table 4-7: Type of School recommended upon completing grade 3 (N=64)

Type of school recommended after EI	***Overall***		***TSLT***		***LSL-SA***		***The p-value for between-group comparison***
	N	**%**	**N**	**%**	**N**	**%**	
Mainstream	40	63	14	61	26	63	>0.99
Remedial	24	37	9	39	15	37	

Comparing TSLT to LSL-SA, there was no statistical difference in the number of learners who progressed to mainstream schooling upon completing Grade 3. This accounts for two-thirds of the participant sample.

4.5 Discussion

A representative sample of 64 records of foundation phase learners with hearing impairment who received LSL-SA or TSLT were used in the analyses of this study. The two EI cohorts were matched for gender and type of amplification device. The typical age of diagnosis of hearing impairment in the study varied between 2.0 and 2.7 years, and the age at the start of EI varied between 2.4– and 2.9 years. The study confirms that the speech-language and learning outcome measures used in the study have validity, as the EI schools in South Africa use the same measures for the assessment of these outcomes.

While attempting to determine if any associations exist between selected study variables (i.e., gender, home language, age at diagnosis of hearing impairment, cause of hearing impairment, duration of amplification, type of hearing amplification device, age at the start of EI, duration of EI) within the intervention approaches (LSL-SA and TSLT) and learning outcomes, current findings indicate that 25% of the participants and their families receive EI in the child's and early enrolment in effective EI programmes (Auditory Verbal UK, 2022b). Although the age of diagnosis of hearing impairment (2.0 years) and age at enrolment in an EI programme (2.4 years) is earlier for the TSLT group, findings of this study indicate that even the adjusted 1-4-8 South African guidelines have not been achieved to date (HPCSA 2018). These findings are consistent with the findings of Kuschke et al. (2020), indicating an average age of diagnosis of hearing impairment at 2.6 years, Chan (2018) at 2.58 years, Butler et al. (2015) at 3.01 years and Khoza-Shangase and Michal (2014) at approximately 2.0 years. These findings highlight the delay within the South African context in meeting stipulated guidelines and raise implications for translating policy into practice.

The causes of hearing impairment identified in this study correlate with causes identified by Smith et al. 2023; the American Speech-Language-Hearing Association (2023), and Korver et al. (2017). Congruent with many studies, a definitive cause was unidentified in 38% of the participants (Korver et al. 2017; Mulwafu, Kuper & Ensink 2015). The findings of this study did not find any statistically significant association between the cause of hearing impairment within the intervention approaches (i.e., LSL-SA and TSLT) and learning outcomes, but raised awareness of understanding the risk profile of infants in an LMIC, depending upon the underlying cause. These findings raise implications in planning EHDI services, particularly preventive audiology initiatives.

Despite these confounding variables, this study's findings indicate that children with hearing impairment enrolled in the LSL-SA intervention approach attend therapy for a shorter duration until discharge. This is a positive finding for this LMIC, given the financial stressors imposed by a hearing impairment on resource-constrained African healthcare systems (Hear-It.org 2019). Although the current study does not provide exact financial figures, these findings support the mathematical modelling study by Baltussen and Smith (2012), stating that when available effective interventions are implemented to remediate hearing impairment in sub-Saharan Africa, substantial health gains of up to $32 million Disability-Adjusted Life Years (DALYs) are achieved. These findings raise implications for managing the burden of disease in LMICs.

When exploring the learning outcomes in the LSL-SA group, findings show a positive contribution of LSL-SA to the grades achieved in Home Language, Life Skills, Mathematics and FAL. The findings of this study are consistent with previous studies indicating that children with hearing impairment receiving AVT achieve average to above-average grades on measures of academic achievement (Auditory Verbal UK, 2022a; Eriks-Brophy et al. 2012; Goldblat & Pinto 2017). These findings highlight the dearth of empirical research on learning outcomes, as only one of these studies compared the learning outcomes of children with hearing impairment who received AVT to those not enrolled in an AVT approach (Goldblat & Pinto 2017). Notably, the study by Goldblat and Pinto (2017) included participants with additional special needs. It additionally did not have information on the EI approach that the control group received, resulting in an inability to compare the learning outcomes based on affiliation to a certain rehabilitation approach (Goldblat & Pinto 2017). This study's findings highlight the paucity of well-controlled research in this field and raise the need for further empirical research comparing EI approaches and their impact on learning outcomes in diverse contexts.

As far as the learning outcomes of foundation phase learners with hearing impairment who received TSLT are concerned, learners are exposed to an adapted curriculum in which grade-appropriate core skills are taught and assessed within a small class setting and with therapeutic intervention. These adaptations support how the content is taught and assessed at a grade-appropriate level equivalent to normal hearing learners. While exploring the TSLT group's learning outcomes, findings indicate that more learners achieve lower grades in Home Language, Life Skills, and Mathematics. The findings are consistent with the literature stating that children with hearing impairment are at higher risk of poorer academic achievement (Su et al. 2020). The findings of this study further highlight the inconsistencies among EI approaches for children with hearing impairment as existing research relating to TSLT varies widely in participant characteristics, laterality and degree of hearing loss, and philosophies of EI approaches (Ganek & Cardy 2021). These findings highlight the need for addressing the academic repercussions of childhood hearing impairment by implementing evidence-based speech and language treatment protocols for children, especially in resource-constrained settings such as South Africa.

When the learning outcomes of foundation phase learners between the two groups were compared, this study's findings correlate with the learning outcomes found in Goldblat and Pinto (2017), the only study that compared the learning outcomes of AVT graduates to the learning outcomes of those not enrolled in an AVT approach. Goldblat and Pinto (2017) suggest that AVT graduates outperformed the control group who were not rehabilitated via the AVT approach. The findings of this study indicate that the LSL-SA EI approach yields superior learning outcomes compared to the TSLT approach. It is noteworthy that contributing factors such as degree of hearing loss, language skills pre-EI, age-range, and school grade were controlled for in the study by Goldblat and Pinto (2017).

When comparing the communication functioning at the onset of EI to the communication functioning upon discharge from the EI approach, this study's findings revealed delayed speech, vocabulary, receptive and expressive language, audition, and cognitive-linguistics development prior to receiving EI, as expected. This is congruent with research data that 'the first 3 years of life are critical for developing spoken language through listening' (Auditory Verbal UK 2020). Upon discharge from EI at the end of the foundation phase, this study's findings demonstrated that children with hearing impairment enrolled in LSL-SA outperformed those enrolled in TSLT by achieving age-equivalent outcomes of vocabulary, expressive language (spoken language) and audition (listening skills). These results are consistent with the findings of research conducted by Auditory Verbal UK, (2022a), Yanbay et al. (2014), Dettman et al. (2013), Motasaddi- Zarandy et al. (2009), Percy-Smith et al. (2017), and Fairgray et al. (2010). Mortazavi and Mortazavi (2017) advocate for the AVT approach as a legitimate communication approach for children with hearing impairment regardless of the type of hearing amplification devices. The findings of this study are congruent with Mortazavi and Mortazavi 2017. as a comparable number of participants enrolled in LSL-SA (70%) and TSLT (73%) are implanted with cochlear implants. These findings highlight the need for Early Interventionists to capitalise on current knowledge and mobilise collective resources to ensure improved developmental outcomes for children with hearing impairment in LMICs.

Many studies agree that possessing competent language forms the basis of reading and literacy (Catts 2003; Tunick & Pennington 2002; Burgess 2002). *When determining the association between communication functioning and learning outcomes,* there was a significant trend linking higher grades to age-appropriate language skills in vocabulary, receptive language, expressive language, and cognitive linguistics across learning outcome measures for languages (i.e., Home Language and FAL) and life skills. Mathematics measures indicate a trend linked to higher marks across all participants of age-appropriate receptive language. This study's results concur with findings that mathematics requires reading comprehension and understanding specific linguistic mathematical terms such as conditionals, comparatives, and inferential statistics (Edwards, Edwards & Langdon 2013; Mukari, Ling & Ghani 2007; Traxler 2000). These trends reflect positive learning outcomes based on enrolment in an EI communication intervention approach, with no differentiation between LSL-SA and TSLT. The findings of this study contrast with a study conducted by Percy-Smith et al. (2017), who researched the impact of (re)habilitation strategies on speech-language outcomes for early cochlear implanted children who received different communication intervention approaches following cochlear implantation, that is, TSLT versus AVT. Children with hearing impairment enrolled in the AVT intervention approach scored age appropriately and outperformed children with hearing impairment enrolled in TSLT on receptive language, expressive language, and productive vocabulary (Percy-Smith et al. 2017).

When identifying the promotion to mainstream schooling on completion of the foundation phase as an indicator of academic success, this study's findings support research data that indicate an EHDI approach (i.e., appropriate hearing amplification, family-centred care and appropriate intervention) will allow children with hearing impairment to achieve linguistic skills at the same level as their hearing peers and contribute to their integration into mainstream schooling (Casoojee et al. 2021; Ching et al. 2017; Fulcher et al. 2015). The findings highlight that EI, in general, is associated with positive language outcomes in children with hearing impairment and while the therapeutic approaches may vary, there is congruence among the strategies suggested to families (Casoojee et al. 2021; Roberts 2019). This study's findings redress the lacuna of research in the South African context, providing results regarding the schooling career of children with hearing impairment upon completion of Grade 3.

Furthermore, this study's findings are noteworthy, as the estimated annual cost of deaf education in a residential school for the deaf in South Africa is $9459.50 per child (Emmet & Francis 2015). A cost analysis conducted by the National Center for Hearing Assessment and Management (NCHAM 2010) indicates that substantial amounts of money would be saved over a child's educational lifetime if, because of early and effective interventions, the most appropriate educational setting for the child is a regular mainstream classroom instead of residential programmes.

4.6 Conclusion

The findings of this study emphasise the importance of EHDI, whether TSLT or LSL-SA, as they conclude that learning outcomes depend on language attainment achieved within both approaches. However, a deeper analysis of the results reveals that children with hearing impairment enrolled in LSL-SA outperform those enrolled in TSLT in achieving age-equivalent language outcomes. Children with hearing impairment enrolled in LSL-SA are enrolled for a shorter duration until discharge than those enrolled in a TSLT approach. This finding is important for LMICs with limited resources, such as South Africa. This finding suggests a possible reduction in the global burden of disease caused by hearing impairment. The results suggest that EI services must be adapted to local contexts. Although a comparable number of children with hearing impairment progressed to mainstream schooling, children with hearing impairment enrolled in LSL-SA achieved meritorious to outstanding learning outcomes. The study suggests that new and updated policies and guidelines in South Africa regarding the current EI approaches for children with hearing impairment are needed. Frameworks are required to achieve proper and effective monitoring and evaluation systems that track progress and improve levels of access to and the quality of EI services for infants and young children as stipulated in government policies. The results obtained in this study, at best, attest to the premise of LSL-SA in maximising linguistic competence and literacy development for infants and young children with hearing impairment and, at the very least, stresses the need for further study.

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Chapter 5: Paper III – Exploration of parental perspectives and involvement in therapeutic communication approaches for deaf and/or hard-of-hearing children at special schools in South Africa

(Reprinted with permission: Appendix N)

5.1 ABSTRACT

Family-centred intervention optimises the development of communication abilities and academic outcomes in children with hearing loss. Cognisance of family values, respect for family differences and adaptations to cultural and linguistic diversity ensure the collaboration of parent-professional relationships. This study investigated the parental involvement and parental perceptions regarding the communication intervention approaches implemented (i.e., traditional speech-language therapy and listening and spoken language-South Africa—adapted Auditory Verbal Therapy) for children with profound hearing loss. The study was conducted at special schools for children with hearing loss across four provinces in South Africa, where grade-level core skills are taught using a mainstream curriculum complemented by specialised instruction. Data were collected through a parental self-administered survey and a retrospective record review. An inductive analysis of transcripts was conducted, and the Fisher's exact test assessed associations between data sets. Findings demonstrated limited informational counselling provided to parents regarding communication intervention options. Following the initiation of the communication intervention process, findings indicate parental buy-in, fuelled by their aspirations for their child with a hearing loss. Although results suggest that parents prefer a listening and spoken language therapeutic communication modality, this approach is hindered by the lack of culturally sensitive and linguistically appropriate care. This is an important finding, particularly in multilingual and multicultural contexts like South Africa. These context-specific outcomes emphasise that communication interventionists must be cognizant of parental-informed decision-making, cultural contexts and linguistic sensitivity for effective parent-professional collaborations.

5.2 BACKGROUND

A congenital hearing loss present at birth or early onset permanent bilateral hearing loss are common defects in neonates and infants. Hearing loss prevents children from receiving adequate access to auditory stimulation, impacting the development of language, cognitive abilities and psycho-social skills (Health Professions Council of South Africa 2018; Black *et al* 2017). The linguistic competence and literacy development for deaf and/or hard-of-hearing (DHH) infants and young children can be maximised by Early Hearing Detection and Intervention (EHDI), that is, newborn hearing screening by 1 month old, diagnosis of hearing loss by 3 months old and the implementation of intervention services by 6 months old (1-3-6 benchmark) (Joint Committee on Infant Hearing 2019a). In South Africa, a low- and middle-income country (LMIC), the Health Professions Council of South Africa (HPCSA) has adjusted the EHDI benchmarks to 1-4-8 based on contextual factors (Casoojee *et al* 2024; Health Professions Council of South Africa 2018). Despite this, there is no established uniform system for newborn hearing screening in the public healthcare sector of South Africa. Hearing screening is currently conducted on a risk basis, which also lacks systematic implementation (Bezuidenhout *et al* 2018).

South Africa grapples with continuous challenges, including social inequality, poverty, unemployment, a high burden of disease, inequitable healthcare service provision and a substantial human resources crisis facing the health sector, a legacy of apartheid which fostered racial segregation (de Villiers 2021; Coovadia *et al* 2009). Despite these formidable pressures, South Africa has affirmed its commitment to upholding children's rights by ratifying policies that endorse unrestricted access to healthcare services and education alongside other fundamental human rights (de Villiers 2021; Balton *et al* 2020). Nevertheless, individuals with disabilities in South Africa face disparities in accessing healthcare, exacerbated by the paucity of disability-specific services, such as aural rehabilitation for hearing loss (Kuper and Haness-Hancock 2020). This situation underscores the ongoing challenges and contradictions within the country's efforts to ensure equitable rights and opportunities for all its citizens, particularly DHH infants and young children.

The prevalence of hearing loss in South Africa is estimated at 17 babies born daily with permanent sensorineural hearing loss (Casoojee *et al* 2021). Given that 22% of the registered speech-language therapists (SLTs) and audiologists work in public healthcare in South Africa, the critical shortage of skilled healthcare professionals in relation to the high prevalence of hearing loss is evident (Casoojee 2024; Pillay *et al* 2020. Deliberations around family-centred intervention (FCI) are thus crucial to the success of EHDI programmes in LMICs. FCI is an approach that emphasises the active involvement of families in the planning, delivery and evaluation of healthcare services, prioritising the family's needs, values and goals to optimise child development outcomes (Moeller *et al* 2013; Holzinger *et al* 2022). Parents of children with hearing loss are the primary individuals involved in the child's daily life, providing a significant cultural and emotional influence on their development compared with SLTs and audiologists, who have a more limited and intermittent engagement with the child (Maluleke *et al* 2021; Mantri-Langeveldt *et al* 2019). FCI can thus be defined as a family-professional partnership, prioritising the child's developmental outcomes within the context of their family (Holzinger *et al* 2022).

To facilitate effective intervention, professionals must strive to collaborate with the parents of infants and young DHH children in the process of gaining the necessary knowledge, information, clarity and experiences that support fully informed decisions (Scarinci *et al* 2018; Moeller *et al* 2013; Joint Committee on Infant Hearing 2019b; Holzinger *et al* 2022; Maluleke and Khoza-Shangase 2023). Elements influencing parental decisions include the DHH child's unique strengths and abilities, the family's values and belief system, social circumstances, cultural influences and personal comfort level in making choices on behalf of the child (Holzinger *et al* 2022). Volterra and Gullberg (2008) suggest that language acquisition, signed or spoken, depends on the hearing family members' responsiveness to their hearing-impaired child's communication needs. Blose and Joseph (2017) found that, given the early auditory and language deprivation, intervention sessions consisting of 1 or 2 hours per week were inadequate to compensate and account for the improved language scores. Thus, empowering parents to become the primary facilitators of their child's speech and language development is a critical therapy component for DHH children learning language (Stacy Crouse 2020; Khoza-Shangase 2022).

Within the first few months after diagnosis, parents often face the heavy burden of deciding on medical and communication options for their DHH children, such as cochlear implants or sign language (DesGeorges 2016). An ongoing debate over communication choices for DHH children persists across political, moral, educational and clinical contexts (DesGeorges 2016; Kanji and Casoojee 2021). The quality and quantity of information required for families to navigate this complex process are derived from various sources while considering the cultural, educational and social implications of their decisions (Ching *et al* 2018; Davids *et al* 2021; DesGeorges 2016). The decision regarding which communication approach to use should be a dynamic, ongoing family-centred exploration with the early interventionist, focusing on the ease and frequent language exchange between the family and DHH child (Gravel and O'Gara 2003; Casoojee *et al* 2021; Prelock 2021). The communication journey of a DHH child and their family is a complex, interwoven process in which the child's use of language or method of communication may change numerous times (Blose and Joseph 2017; Scarinci *et al* 2018). Families may adjust their DHH child's communication method at various stages, influenced by the family's characteristics, strengths, beliefs, access to information and the availability of family-centred services. This necessitates that early interventionists provide ongoing support to families throughout the entirety of the DHH child's communication journey rather than limiting their advice on a communication approach to the initial decision-making phase following a hearing loss diagnosis.

Two intervention practices are implemented in South Africa for DHH children and their families. The (1) traditional speech- language therapy (TSLT) approach includes various communication methods, ranging from visual-gestural approaches like sign language, total communication (i.e., a range of communication methods, such as sign language, speech and listening, lip reading, fingerspelling, facial expressions and gestures, used in combinations tailored to each DHH child's needs) or cued speech (Casoojee *et al* 2021; Kanji and Casoojee 2021) . There is a dyadic therapy interaction during TSLT, that is, also called a remedial sequence where the first part, the therapist requests, in the second part, the client responds and in the third part, the therapist evaluates the client's response with a scaffolding role in the interaction. The (2) listening and spoken language-South Africa (LSL-SA) approach is based on auditory verbal therapy principles. The multiparty interaction during a listening and spoken language (LSL) session allows for a versatile interaction structure, providing conversational teamwork and alliances between the LSL interventionist and the parent (Ronkainen *et al* 2014). The LSL interventionist simultaneously supports the child's spoken language learning while coaching the parent (Ronkainen *et al* 2014). Active parental participation is at the core of an LSL approach (Estabrooks *et al* 2020).

Parental involvement is typically defined as a parent's ability to follow through with intervention recommendations, including attending appointments, having confidence in working with their child and engaging in communication intervention (Cejas *et al* 2021), as facilitated by programmes such as Hi-Hopes within the South African context. Parental involvement in communication interventions is not just effective but is considered as best practice in early language intervention for DHH children (Roberts 2019; Roberts and Kaiser 2011; Stephan and Manning 2017). Parents' communication skills are a significant predictor of positive language and academic development for these children (Calderon 2000). Recent studies continue to highlight the importance of these skills, showing that parents' ability to engage in responsive, supportive communication is linked to better language outcomes and academic achievement for DHH children (Miller *et al* 2024). Moreover, effective communication supports vocabulary development and fosters social-emotional skills, which are essential for academic success (Sultana and Purdy 2024). This underscores the importance of parents being taught to implement specific language support strategies (Roberts and Kaiser 2011). However, it is also important to note that hearing parents with insufficient sign language proficiency may inadvertently cause delayed language acquisition in DHH children (Hall 2017). Recent evidence challenges earlier assumptions that hearing parents must achieve fluency in sign language to support the language growth of their DHH children. Studies suggest that even limited proficiency in sign language can contribute positively to a child's language development, provided that interactions are consistent and meaningful. For instance, Delcenserie *et al* (2024) emphasise that exposure to naturalistic signed communication, regardless of parental fluency, supports language acquisition and cognitive development in DHH children. Similarly, Caselli *et al* (2021) highlight that parental engagement, rather than fluency, is the critical factor for fostering linguistic growth, as it encourages frequent and rich communication exchanges. Pontecorvo *et al* (2023) further argue that focusing on collaborative and interactive communication strategies can mitigate risks of language delay or deprivation, even when parents are not fully fluent in sign language. These findings highlight the importance of emphasising parental involvement and accessible support structures over linguistic perfection in early intervention programmes.

With >90% of DHH children born into hearing families (National Institute on Deafness and Other Communication Disorders 2021), these parents would need support to find a community of peers and role models who use both sign and spoken/written language (Lillo-Martin and Henner 2021). Despite the equal potentiality of acquiring sign language and spoken language, deaf children born to hearing parents do not have this equal potentiality to acquire sign language when their parents do not sign (Lillo-Martin and Henner 2021). Blose and Joseph (2017) found that communication for deaf children using South African Sign Language (SASL) within the South African home is problematic as communication partners are not fluent in SASL. This mismatch in the communication mode in the home context resulted in fewer communication interactions and impoverished SASL with frequent breakdowns, amid the predominance of oral language (Blose and Joseph 2017).

Early interventionists are tasked with providing informational counselling to parents. However, when this information lacks clarity or is delivered in a biased or incomplete manner, it compromises parents' ability to make fully informed choices (Kecman 2019; Moeller *et al* 2013; Porter *et al* 2018; Young *et al* 2005b). Furthermore, early interventionists are to ensure that parents acquire the necessary skills to implement the language support strategies and feel confident applying them in their daily lives (Stephan and Manning 2017). Interventions should thus be focused on helping parents gain the knowledge and skills they need to use to help their DHH child (Dempsey and Dunst 2004). In TSLT, the DHH child is the client, and the provider is hands-on with the DHH child (ie, provider-implemented) (DeVeney *et al* 2017; Ganek and Cardy 2021; Roberts 2019). On the contrary, the LSL approach coaches parents to provide the services required by the DHH child rather than simplistically teaching and focusing only on the child, to the detriment of the family and social milieu (Stacy Crouse 2020). Keeping the parents of a DHH child firmly at the centre of the child's therapy programme is intrinsic to an LSL approach (ie, parent- implemented)

(White and Brennan-Jones 2014).

Socio-familial/cultural background, family communicative patterns and parental hearing sensitivity influence the development of the DHH child's communication abilities and academic outcomes (Sevinc and Senkal 2021; Bush *et al* 2014). The successful outcomes of early intervention programmes depend on more than just the communication approach or technology due to the central role of hearing in a child's development (Butler 2012). Studies have demonstrated that family support as a component of EHDI forms the backbone of the intervention process, providing numerous strengths and opportunities which have a positive impact on speech and language development (Sealy *et al* 2023; Dall *et al* 2022; Akçakaya and Tavşancıl 2016; Lew *et al* 2014; Nelson *et al* 2011). Interventions should thus be implemented in a culturally competent manner, as it would enable the collaboration of a family-professional relationship that is cognisant of family values, goals and aspirations (Naidoo and Khan 2022; Moeller *et al* 2013). Cultural competence refers to the ability of healthcare professionals to provide care to patients with diverse values, beliefs and behaviours, tailoring care to meet patients' social, cultural and linguistic needs (Betancourt *et al* 2002).

South Africa's multicultural and multilingual landscape reflects a global phenomenon where cultural competence is essential in therapeutic interventions. The South African context is uniquely characterised by the incongruence between the racial and linguistic profile of early interventionists and those of the majority of the population. Early interventionists within the South African context need to be cognisant that intervention sessions must incorporate culturally sensitive and responsive practices in their therapeutic modalities (Pinto *et al* 2024; Estabrooks *et al* 2020; Paul and Roth 2011; Pascoe and Norman 2011). The LSL intervention approach and its therapy resources developed by clinicians and researchers in high-income countries are being implemented in South Africa due to the absence of our own contextually relevant resources (Pascoe and Norman 2011). Contextually relevant resources refer to assessment tools, intervention programmes, guidelines and norms developed for use within a specific population and setting (Pascoe and Norman 2011). It is well-established that culturally responsive intervention approaches are more readily embraced (Pascoe and Norman 2011).

Among the most challenging issues interventionists face is linguistic diversity (Estabrooks *et al* 2020; Maluleke *et al* 2022). South Africa's multilingual milieu presents a particularly arduous but surmountable obstacle. Vocabulary, stereotypical concepts, high-frequency words, body language and gestures differ between cultures and languages (Pascoe and Norman 2011). Studies confirm that intervention strategies used in one language may not be applicable when used with another (Greenwood *et al* 2010; Gxilishe 2004). Khoza-Shangase and Mophosho (2021) provide sufficient evidence supporting positive outcomes linked to health interventions that take careful cognisance of patients' language and culture.

Effective FCI transcends therapeutic communication strategies for DHH children (Roberts 2019). It recognises that language development is intrinsically connected to other abilities that are essential for social inclusion and active participation in everyday life (Samuelsson *et al* 2024). Coaching parents in the systematic instruction and implementation of communication strategies is critical to modifying the parent and the DHH child's behaviour (Roberts 2019). The parental coaching and empowerment process within the paediatric rehabilitation milieu reflects a paradigm shift from therapist-as-expert to one of supporting goal achievement and capacity building, exemplifying family-centred practice principles, suggesting positive, long-term outcomes (King *et al* 2024).

FCI frames this study in three ways. First, as far as the *rationale for FCI as the framework* is concerned, the study adopts FCI as a theoretical framework to explore parental involvement, perceptions and decision-making in therapeutic communication interventions for DHH children. This framework aligns with the premise that effective intervention is most achievable when professionals collaborate with families, recognising them as central to the child's developmental progress (Maluleke *et al* 2021; Moeller *et al* 2013). Second, regarding *integration into the methodology,* the FCI framework in this study guided the development of the survey instrument by ensuring that the questions addressed key FCI components, such as parental engagement in therapy sessions, their confidence in implementing strategies and their perceptions of cultural and linguistic appropriateness. Lastly, insofar as *guiding the interpretation of results*, the FCI framework informed the interpretation of findings, highlighting how parental empowerment and culturally sensitive practices influence family-professional collaboration and, subsequently, child outcomes.

5.3 MATERIALS AND METHODS

5.3.1 Ethical approval

Prior to the study being conducted, ethical approval was obtained from the University of the Witwatersrand Ethics Committee (HREC) (protocol number: H20/06/03). Thereafter, all procedures and protocols also adhered to the Helsinki Declaration of 1975, as revised in 2013 (World Medical Association 2013).

5.3.2 Aim

The main aim of this study was to explore the parental perspectives and parental involvement in the communication intervention process of learners with hearing loss who received LSL-SA (LSL-SA group) versus TSLT (TSLT group), with the specific objectives being: (1) to explore the parental involvement in the communication therapy of children with hearing loss, (2) to determine the communication skills of DHH children on discharge from therapy and their academic outcomes at the end of the foundation phase at school in order to assess parental confidence in applying communication therapy techniques at home, (3) to establish parental perceptions about the cultural and linguistic appropriateness of communication therapy techniques implemented and materials used in therapy, (4) to determine perceived facilitators and barriers regarding the communication therapy approach and (5) to identify whether the parents would have preferred a different therapeutic communication approach to be implemented in therapy.

5.3.3 Study design

A descriptive survey design was adopted. Although this study forms part of a larger study titled '*Speech-Language Acquisition and Scholastic Outcomes of Children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study*', the objectives and reported findings discussed here are exclusive to this paper. This study employed a descriptive survey design to explore parental involvement and perceptions regarding communication intervention approaches for DHH children. The design incorporated both quantitative and qualitative methods to capture a comprehensive understanding of parental experiences. Data were collected through a self-administered parental survey and a retrospective review of therapy records. This mixed-methods approach allowed for triangulation of data, enhancing the credibility and depth of the findings. The survey included closed-ended and open-ended questions to examine various aspects of therapy involvement, while the retrospective review provided additional context and validation of the reported information.

5.3.4 Study sample and demographics

The parents of 127 children with profound hearing loss, selected through a purposive sampling technique, were invited to participate in the survey, to which 23 parents agreed. To gain access to the participants, the researchers obtained written permission from special schools for children with hearing loss in (1) Johannesburg, Gauteng; (2) Pretoria, Gauteng; (3) Morningside, KwaZulu Natal; (4) Cape Town, Western Cape and (5) Port Elizabeth Central, Gqeberha. Once access was granted to the special school, the researcher compiled a list of potential participants based on recommendations from school management. This included parents of DHH children who completed grade 3 in the foundation phase of primary schooling between 2008 and 2020. Researchers sought permission from school management to identify potential participants. After obtaining institutional approval, the schools facilitated initial contact by distributing the study information and consent forms to eligible parents. The researchers did not access parents' contact details directly, ensuring compliance with the Protection of Personal Information Act. Interested parents contacted the researchers directly to express their willingness to participate and signed informed consent forms prior to data collection. The parents signed an informed consent form after indicating their willingness to complete a survey and allow the researcher to access their children's therapy files and grade 3 academic reports. This approach safeguarded participants' privacy and adhered to ethical guidelines for handling personal information.

All the special schools identified in this study equally offer DHH children and their families a structured FCI programme, therapeutic services that include speech-language therapy, audiology and social work, a structured preprimary grade and a foundation phase school environment. The teaching approaches at these schools follow an oral, language-enriched programme, incorporating natural gestures, designed to address the language delay needs of DHH children, with the goal of enabling them to continue their education in mainstream schools on completion of grade 3 in the foundation phase. The educational approach (i.e., a mainstream curriculum in which grade-appropriate core skills are taught and assessed within a small class setting, with therapeutic intervention) and the rehabilitation approach (i.e., communication interventions offered at school, with the same measures used across the special schools in this study to assess speech-language and academic outcomes) are congruent. These measures include the Preschool Language Scales-5, Clinical Evaluation of Language Fundamentals, Integrated Scales of Language Development, Functional Listening Index-Paediatric, and the Goldman Fristoe Test of Articulation. The included schools specialise in developing listening, speech, spoken language and communication skills for DHH children. Therefore, none of the schools follow an SASL approach, as they do not identify as schools for the deaf.

The adequacy of the sample size was determined using the formula: $n = \frac{m}{1+\frac{m-1}{N}}$ where $m = \frac{Z^2P(1-P)}{d^2}$ (n = sample size, N = population size - 127 children included in the main study, Z=Z-statistic for the chosen level of confidence (95%), P=expected prevalence or proportion (50% worst case), d=precision of 5%). The sample size of 23 is adequate for the descriptive analysis (Daniel 2013).

5.3.5 Inclusion and exclusion criteria

The parents of children (1) diagnosed with a congenital or early onset, bilateral, profound hearing loss, (2) enrolled in an intervention programme receiving either TSLT or the LSL-SA approach, (3) fitted with hearing aids or cochlear implants, (4) who have completed grade 3 in the foundation phase of primary schooling, were included in the study. The parents of DHH children who presented with additional cognitive impairment were excluded from the study. This exclusion was ascertained from the main study.

5.3.6 Data collection

5.3.6.1 Data collection tool

Data collection was conducted using a questionnaire that was specifically developed for this study and pretested with one parent. The participant in the pilot study was not included in the main study. The questionnaire, available on request from researchers, comprised two sections: section A—parent demographics and section B—therapy information and EI outcomes.

5.3.6.2 Data analysis

Descriptive analysis of the study variables for objectives 1, 2, 3 and 5 was conducted using SAS V.9.4 for Windows (SAS Institute Inc 2010). Fisher's exact test assessed associations between selected study variables for objectives 1 and 3. For objective 4, inductive analysis to identify codes and key themes within the responses to the open-ended questions was used following the framework of thematic analysis suggested by Braun and Clarke (2006): (1) familiarisation of data (data were transcribed, data were read and re-read, ideas were noted down), (2) generating initial codes (interesting features of the data were written down, data relevant to each code were collated), (3) searching for themes (codes were placed into various themes, data relevant to each theme were selected), (4) reviewing themes for validity and reliability (themes were checked, a thematic map was generated), (5) defining and naming themes (ongoing analysis was performed that refined each theme, names for each theme was generated), (6) producing the report (a final analysis was conducted and the scholarly report produced.

5.3.6.3 Validity, reliability, trustworthiness and rigour

This research study employed an integrated, systematic and stringent approach to ensure that both quantitative and qualitative aspects were robust and credible, as outlined below (Stahl and King 2020):

- Pilot study: where content, construct and face validity were assured.
- Internal consistency: the consistency of the results across items within a test was ensured using Cronbach's alpha, which was >0.7.
- Inter-rater reliability: the extent to which the different raters gave consistent estimates of the same observation was measured, and comparable with a kappa statistic of 0.7, indicating substantial agreement (McHugh 2012).
- Credibility: the findings of this study were shared with the research participants to confirm that they accurately reflected the participants' experiences.
- Transferability: a detailed description of the context and participants, enabling others to determine if the findings may apply to their context, was employed in this study (Stahl and King 2020).
- Dependability: the research process is documented logically, allowing others to understand how conclusions were reached and replicate the study if necessary (ATLAS.ti 2023).
- Confirmability: during the inductive analysis phase, the identified themes were refined and analysed through inter-rater agreement to ensure reliability (Gisev *et al* 2013).
- Triangulation: multiple data sources, methods and investigators were used to cross-check data and interpretations.

To mitigate recall bias, the study used multiple data sources, including both caregiver self-reported surveys and retrospective record reviews. Cross-referencing caregiver responses with therapy records provided an additional layer of validation to reduce reliance solely on memory.

5.4 RESULTS

5.4.1 Study sample and demographics

Twenty-three parents of DHH children identified at special schools for children with hearing loss participated in the study. Table 1 depicts the sociodemographic profile of the 23 parents.

Of the 23 participants, 22 mothers and 1 father completed the survey. The participants' ages ranged between 33 and 54 years. The participants represented all four recognised race categories in South Africa (Posel 2001). According to table 1, the educational level of 43% of the participants was equivalent to a National Senior Certificate (high school diploma), and 53% of the participants had either a college diploma, a baccalaureate degree or a postgraduate degree. Seventeen per cent of the participants were unemployed, and 30% were single parents, divorced or separated. Thirty- nine per cent of participants reside in a low socioeconomic residential area in comparison with 4% residing in an upper socioeconomic residential area. The associations of the sociodemographic profile are depicted in the online supplemental table A.

Table 5-1: Demographic data of participants in the study

Table 1 Demographic data of participants included in the study (n=23)

Characteristic	Category	N	%
		23	
Age (years) (n=20)	Mean (SD); range	42 (6); 33-54	
Ethnicity	White	10	43
	Black	5	22
	Coloured	5	22
	Indian	3	13
Gender	Male	1	4
	Female	22	96
Relationship to child	Mother	22	96
	Father	1	4
Marital status	Married	16	70
	Single	3	13
	Divorced	3	13
	Separated	1	4
Highest level of education	Grade 11 (standard 9) or lower	1	4
	Grade 12 (matric)	10	43
	Postmatric diploma	5	22
	Baccalaureate degree(s)	5	22
	Postgraduate degree(s)	2	9
Employment status	Employed	15	65
	Self-employed	4	17
	Unemployed	4	17
Socioeconomic profile of the residential area	Low	9	39
	Low-middle	5	22
	Middle	5	22
	Middle-upper	3	13
	Upper	1	4

The following results are depicted in table 2.

The participants indicated that one of two therapy approaches is being implemented at the schools where their DHH children are enrolled. A large majority of the participants (70%) indicated that LSL-SA was being used, while the remaining minority (30%) indicated the use of TSLT.

Of the total sample, 13% of the participants indicated that they chose the therapy approach by themselves, 35% made a joint decision with the early interventionist and more than half of the participants (52%) reported that the early interventionist independently chose the therapy approach for their child with a hearing loss.

All children were receiving therapy during the data collection period, with therapy provided at school but not necessarily only during school hours, as some sessions were scheduled in the afternoons. When exploring the frequency of therapy sessions received by the child, results range from a maximum of daily therapy attendance (4%) to a minimum of once a month (35%).

Less than half (43%) of the participants indicated that they never attend therapy sessions with their child. Similarly, a congruent number (43%) of participants indicated they always attend therapy with their child.

Online supplemental table B depicts the associations between how the communication approach was chosen and how often the parent attends therapy with the child, which shows no significant associations ($p=0.21$). There was also no significant association between the frequency of therapy that the child with a hearing loss attends and how often the parent attends therapy with the child ($p=0.38$).

Parents whose children received LSL-SA therapy reported higher satisfaction with communication outcomes compared with those in TSLT. This disparity suggests that the parent-coaching model of LSL-SA may better align with family-centred principles.

Table 5-2: Therapy approach and parental involvement

Table 2 Therapy approach and parental involvement (n=23)

Duration of EI (years) (n=23)	Mean (SD); range	6.1 (3.0); 0.9–14.4	
		N	**%**
Type of therapy approach	Listening and spoken language-South Africa	16	70
	Traditional speech-language therapy	7	30
How was the therapy approach chosen	Chosen independently by the interventionist	12	52
	Joint decision between the parent and the interventionist	8	35
	Chosen independently by the parent	3	13
Frequency of therapy received by the child	Daily	1	4
	Once a week	5	22
	More than once a week	2	9
	Once every alternate week	7	30
	Once a month	8	35
Frequency of therapy attended by the parent	Never	10	43
	Every session	10	43
	Every alternate session	1	4
	Once a month	2	9

Determining the communication skills of DHH children on discharge from therapy and their academic outcomes at the end of the foundation phase at school in order to assess parental confidence in applying communication therapy techniques at home

All participants who attended therapy sessions with their child with hearing loss indicated confidence in applying the therapy techniques at home, irrespective of the therapy approach. The communication outcomes and academic outcomes are depicted in online supplemental tables C,D, respectively, as predictors of parental confidence.

Eighty-one per cent of DHH children enrolled in LSL-SA achieved age-appropriate communication outcomes in speech, expressive vocabulary, receptive language, expressive language, audition and cognitive-linguistics. This is in comparison with the 33% of children in TSLT who achieved age-appropriate communication in expressive language, 50% in expressive vocabulary, 67% in speech and receptive language and 83% in audition and cognitive-linguistics.

60%–67% of the DHH children in which an LSL-SA approach was followed achieved 70%–100% in English, Afrikaans, Mathematics and Life Skills subjects at school. This is in comparison with 13% of the DHH children in whom a TSLT approach was followed who achieved 70%–100% in English and Afrikaans, and 0% achieved 70%–100% in Mathematics and Life Skills.

Establishing parental perceptions about the cultural and linguistic appropriateness of communication therapy techniques implemented and materials used in therapy

The parental perceptions of the cultural and linguistic appropriateness of communication therapy techniques (i.e., therapy aims and home programmes) and the materials (i.e., toys and books) used in therapy are depicted in table 3. While 100% of parents found therapy materials linguistically appropriate, fewer than 30% perceived them as culturally appropriate, highlighting the need for more inclusive resources.

There was no significant association between the type of communication therapy approach and the cultural appropriateness of any communication therapy techniques implemented and materials used in therapy.

Table 5-3: The association between communication therapy approaches and cultural and linguistic appropriateness

		Type of communication intervention						
		Overall		TSLT		LSL-SA		
Characteristic	**Category**	**N**	**%**	**N**	**%**	**N**	**%**	**P value**
N		23		6		16		
Toys	Culturally appropriate	6	26	2	33	4	25	>0.99
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Books	Culturally appropriate	5	22	1	17	4	25	>0.99
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Home programme	Culturally appropriate	7	30	2	33	5	31	>0.99
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Therapy aims	Culturally appropriate	4	17	0	0	4	25	0.54
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Other	Culturally appropriate	3	13	0	0	3	19	0.53
	Linguistically appropriate	6	26	2	33	4	25	>0.99

Determining the perceived facilitators and barriers regarding the communication therapy approach

The parental perception of the facilitators and barriers regarding the communication therapy techniques was examined using inductive analysis to identify codes and key themes within the responses to the open-ended questions.

When performing inductive thematic analysis in establishing facilitators and recommendations, the following six themes, as depicted in table 4, emerged, with sample quotes: (1) spoken language surmounts boundaries; (2) fostering an environment of togetherness; (3) benefits of therapy on communication skills development; (4) parental empowerment; (5) academic achievements (depicted in online supplemental table D) as an indicator of positive therapy outcomes and (6) skillful and adept early interventionists.

Theme 1: *Spoken language surmounts boundaries*

Parents consistently highlighted that spoken language offered their children opportunities to integrate better into their social and educational environments. One parent shared, '*Spoken language and not sign language allows interaction with people*', emphasising how LSL-SA (adapted auditory verbal therapy) provided their child with the tools to communicate more broadly. Another noted, "*My daughter is able to interact and converse with people. She has developed somewhat adequate spoken language ability as a result of her therapy sessions"*. These reflections suggest that families perceived spoken language as a means to break down barriers, offering their children greater inclusion in a predominantly oral society. Parents who experienced challenges with other modes of communication expressed a preference for LSL-SA due to its alignment with societal norms and expectations.

Theme 2: *Fostering an environment of togetherness*

Several participants remarked on how therapy facilitated a sense of cohesion within their families. One parent stated, *"LSL is absolutely positive because we talk with her at home all the time",* underscoring the importance of family participation in therapeutic activities. Another parent reflected, *"She is just like her brother and sister now",* indicating that therapy helped normalise their child's interactions within the family unit. Parents frequently mentioned that therapy brought them closer to their children by enabling open communication, thus fostering stronger familial bonds. This sentiment aligns with the principles of FCI, which emphasise collaboration between parents and professionals to support the child's development.

Theme 3: *Benefits of therapy on communication skills development*

Parents overwhelmingly reported improvements in their children's communication skills following therapy. One parent remarked, *"His vocabulary expanded at a good* *pace"*, while another noted, *"It has built her listening skills; her spoken language has increased, and more vocabulary as well".* The development of language and auditory skills was highlighted as a significant outcome of therapy. Participants shared examples of their children following instructions more effectively, engaging in conversations and achieving specific listening goals. These findings demonstrate the tangible benefits of structured, consistent intervention.

Theme 4: *Parental empowerment*

Empowerment emerged as a recurring theme, with parents emphasising the knowledge and skills they gained through therapy. One parent stated, *"They have equipped me to support my child's language development",* reflecting the impact of the coaching model used in LSL-SA. Another parent highlighted how these skills extended beyond their DHH child: "*I have also taken the skills and knowledge I learned through the sessions and applied them to my two other kids who are not hearing impaired".* This illustrates how therapy benefits the child and enhances the overall communicative environment within the family.

Theme 5: *Academic achievements as indicators of positive therapy outcomes*

Participants linked their children's academic success to the outcomes of therapy. One parent shared, "*She would not be where she is without the therapy. She is an A-grade student. She stopped CAPS in grade 7 and moved to the Cambridge syllabus".* This finding highlights the role of communication intervention in supporting educational attainment. Parents attributed their children's ability to excel academically to the foundational language and cognitive skills developed during therapy.

Theme 6: *Skilful and adept early interventionists*

Parents praised the expertise and adaptability of the early interventionists who worked with their children. One participant noted, *"The LSL-SA therapists are the best of the best* *and seriously know what they are doing"*. Another commented, *"The therapist often thought out of the box and tried various techniques to improve my daughter's linguistic development"*. This theme raises the importance of professional competence in delivering effective and responsive therapy, particularly in culturally and linguistically diverse settings.

Table 5-4: Themes and sample quotes

Table 4 Themes and sample quotes (n=23)

Themes	Sample quotes: LSL-SA	Sample quotes: TSLT
1. Spoken language surmounts boundaries	‘Spoken language and not sign language allows interaction with people’. ‘Gives them more confidence to communicate with people’. “Spoken language language works for both of us”.	“My daughter is able to interact and converse with people. She has developed somewhat adequate spoken ability as a result of her therapy sessions”.
2. Fostering an environment of togetherness	“LSL is absolutely positive because we talk with her at home all the time”. “It worked for both of us”. “She is just like her brother and sister now”.	“Being able to communicate gives us a sense of togetherness”.
3. Benefits of therapy on communication skills development	“His vocabulary expanded at a good pace”. “It has built her listening skills; her spoken language has increased, and more vocabulary as well”. “My child can now follow instructions”. “My child learned to listen and speak”. “We achieved listening goals for my little girl”. ‘It provided language enrichment’ ‘Speech and language development is amazing’.	
4. Parent empowerment	“They have equipped me to support my child's language development”. “Through implementing everything learned in therapy in our daily lives, she learned so quickly. I have also taken the skills and knowledge I learned through the sessions and applied them to my two other kids who are not hearing impaired. It helps them to recognise sounds, communicate and learn much quicker”.	
5. Academic achievements as an indicator of positive therapy outcomes (online supplemental table D)	“She would not be where she is without the therapy. She is an A-grade student. She stopped CAPS in grade 7 and moved to the Cambridge syllabus. My child could not talk initially. I am thankful for all the LSL therapy she received”.	“Therapy allows him to learn”.
6. Skilful and adept early interventionists	“We received excellent therapy”. ‘The LSL-SA therapists are the best of the best and seriously know what they are doing’.	“The therapist was open to different approaches and tried more than once to explore and find suitable solutions to improve my daughter’s linguistic development”. “I thought that the speech therapy my daughter received was of a high standard, and I value the efforts that were made to support her development”. “The therapist often thought out of the box and tried various techniques. My daughter preferred to make use of spoken language, although we struggled to understand her at times. She is still very aware that her pronunciations are not always correct, and the therapy she received laid the foundation for her to experience this in a positive light, rather than feeling insecure about it as she was rewarded for trying, not for succeeding”. “Some of the unorthodox approaches the therapist used prompted a deeper understanding and language development, which she enjoyed thoroughly and which I think worked really well”.

When performing inductive thematic analysis in establishing barriers, the following two themes, as depicted in table 5, emerged, with sample quotes: (1) the constraints of English as the language of instruction and (2) perceived barriers to communication skills development.

Theme 1: *The constraints of English as the language of instruction*

A major barrier identified was the predominance of English in therapy sessions, which many parents found limiting. One parent stated, '*It would be nice to add other African languages, such as Sesotho, Tsonga, etc, as a medium to do therapy*'. This reflects the broader challenge of linguistic diversity in South Africa, where therapy resources and professionals often fail to accommodate the multilingual needs of families, a large majority of which do not speak English or Afrikaans—which are languages mostly spoken by professionals. Parents highlighted the need for culturally and linguistically appropriate materials to support effective communication.

Theme 2: *Perceived barriers to communication skills development*

Some parents expressed frustration with certain aspects of therapy, particularly in the TSLT approach. One participant stated, *"I found my daughter struggled with picture exchange communication; it worked well but was frustrating and cumbersome to implement and practice"*.

This theme points to the limitations of certain methods and the need for more adaptable and personalised approaches that cater to the child's unique needs and family context.

Table 5-5: Themes and sample quotes

Table 5 Themes and sample quotes		
	Sample quotes	
Themes	LSL-SA	TSLT
1. The constraints of English as the language of instruction	'It would be nice to add other African languages, such as Sesotho, Tsonga, etc, as a medium to do therapy'. "As English is not my home language, it can be a bit difficult to fully understand what goes on in therapy, but therapists always try to explain in a way I can understand".	
2. Perceived barriers to communication skills development		"He doesn't talk". "I found my daughter struggled with picture exchange communication; it worked well but was frustrating and cumbersome to implement and practice". "I saw a speech therapist after who did not do the LSL-SA approach and I was disappointed. I believe the mission and vision of the approach created great professionals. All therapists need to understand the system and approach. Especially how they encourage parents to get buy-in".

LSL-SA, listening and spoken language-South Africa; TSLT, traditional speech-language therapy.

Identifying whether the parents would have preferred a different therapeutic communication approach to be implemented in therapy None (0%) of the participants whose DHH children received LSL-SA would have preferred a different therapeutic communication approach, whereas 30% of the participants whose DHH children received TSLT would have preferred a listening and spoken language approach as the alternative.

5.5 DISCUSSION

A culturally representative sample of 23 parents of DHH children who received LSL-SA or TSLT was used in the analyses of the current study. The cohorts of DHH children were matched for degree of hearing loss and attendance at special schools for children with hearing loss up to grade 3 (foundation phase).

Childhood hearing loss impacts the family and often leads to elevated stress levels, which may, in turn, negatively impact parent-child interaction and, consequently, the child's development (Blank *et al* 2020; Dall *et al* 2022). When examining the impact of parental education and socioeconomic status on the development of DHH children, it is evident that higher parental education is decisively linked to better outcomes in both communication and academics. Specifically, DHH children with parents who have higher levels of education demonstrate a greater likelihood of achieving age-appropriate communication skills in expressive vocabulary and auditory abilities. Furthermore, higher parental education was associated with improved academic outcomes in subjects such as Social Sciences, Natural Sciences and Technology. These findings corroborate previous research by Cupples *et al* (2018) and Ching *et al* (2018), which highlights the benefits of higher maternal education on the outcomes for DHH children, and the evidence presented under- scores that while higher parental education is beneficial, the comprehensive impact on DHH children's development also hinges on the degree of hearing loss of the child, the hearing technology fitted and language performance remedied through early intervention (Chen and Liu 2021).

The findings of this study suggest that parental employment and marital status were not significantly associated with the frequency of parental involvement in therapy sessions or the reported confidence in applying communication strategies at home. However, it is important to note that this study did not directly assess the language competence or academic outcomes of the DHH children as outcomes. Therefore, any claims regarding the impact of these parental factors on language and academic outcomes are beyond the scope of this research. Further studies that directly investigate these relationships are needed to draw such conclusions. These findings are consistent with research data by Kaipa and Danser (2016) and Binos *et al* (2023). This may imply that families from lower socioeconomic status may still provide sufficient input for their children with hearing loss, as the outcome of language acquisition and academic performance is an interplay between the (1) LSL-driven programme by the early interventionist and (2) carryover of language support strategies by the parents. Therefore, addressing these interconnected factors is crucial for optimising outcomes for DHH children.

Bailey (2001) emphasises parental involvement on two levels: (1) behaviours that range from bringing the child to the intervention centre and attending the therapy sessions and (2) parental confidence in implementing the professionals' recommendations at home. When exploring the parental involvement and confidence in the communication therapy of DHH children, participant demographics in the current study support the finding of Zaidman-Zait *et al* (2018) that mothers were significantly more involved than fathers in the communication intervention process. Research reports that mothers show higher interest and are more actively engaged with professionals in their child's communication intervention (Zaidman-Zait *et al* 2018). These results have direct implications for parental involvement in communication intervention programmes for children with hearing loss. The findings of this study suggest the importance of understanding the cultural dimensions of the involvement of both parents, especially in the South African context, which will equip early interventionists to better support parents and provide family-centred care service delivery (Zaidman-Zait *et al* 2018).

When exploring how the communication approach was chosen, the findings of this study indicate that the early interventionist chose the therapy approach independently in the majority of cases (52%) for the child with hearing loss. These findings concur with the findings of Harris *et al* (2021), which illustrated a dislocation between the practice of informed choice, the notion of unbiased support and debunked claims of neutrality of early interventionists. These findings further concur with studies by Shezi and Joseph (2021), Prendergast *et al* (2002), Young (2002), Beazley and Moore (2013), Eleweke and Rodda (2000), Young (2003), Young *et al* (2005a) that early interventionists filter a substantial amount of information and do not tell parents about more than one communication option, indicating that the informational counselling provided by early interventionists is limited and biased (Shezi and Joseph 2021; American Speech-Language-Hearing Association 2008). Informational counselling practices may have implications that infringe on parental-informed decision-making and affect the collaboration of a family-professional relationship considerate of family values, goals and aspirations. It is, therefore, likely that the participants in this study ultimately internalised the views and opinions of the early interventionists who chose the communication approach on their behalf and then accepted these views as their own (Decker *et al* 2012).

Parental involvement in the intervention process is a well-established predictor of spoken language outcomes, cognition, prereading skills and future educational success in DHH children (Calderon 2000; Cejas *et al* 2021; Moeller 2000). Less than half of the participants (44%) never attend therapy sessions with their child. These findings concur with the Gray Group International Insights (2023), attributing possible challenges to the accessibility of parents attending intervention sessions to geographic factors, financial constraints and limited availability of providers, confounded by single-parent households and the parental employment status of the participants in this study. These context-specific challenges are immense but not insurmountable. The cochlear implant programmes in South Africa typically drive EHDI services, with three of the 12 programmes within the public healthcare sector and four combined within the public and private healthcare sectors (Bhamjee *et al* 2022). These public healthcare sector programmes strive to ensure that EHDI services are available to all families enrolled in these programmes, regardless of location or financial situation. The programmes at the special schools attended by the participants' DHH children offer these parents an initial, compulsory, family support and guidance programme to (1) promote language and brain development, (2) provide counselling and emotional support services to families of DHH children to accept the diagnosis, (3) audiological management of the hearing loss and (4) taking cognisance of the home environment to upskill parents to intensify the progress of the DHH child (Western Cape Government 2022). These programmes may be the reason why, despite parents no longer attending therapy sessions with their children during school-based interventions, they can still play a key role in their children's intervention for hearing loss.

Changes in the delivery and models used for communication programmes have evolved to be more parent-focused and family-focused (Calderon 2000). When determining parental confidence in applying the communication therapy techniques at home, all the participants confirmed their confidence. The findings of this study, regarding age-appropriate communication outcomes and the meritorious academic outcomes of DHH children, align with the literature, which suggests that parental confidence in following communication strategies and guidelines at home, as prescribed by the early interventionist, enhances their child's language acquisition (Ingber and Most 2018). These findings further indicate that parent guidance and effective coaching allow the parent to follow the early interventionist's advice, unrelated to the service setting, irrespective of the therapy approach (i.e., LSL-SA or TSLT) (Kellar-Guenther *et al* 2014).

While establishing parental perceptions about the cultural and linguistic appropriateness of communication therapy techniques implemented and materials used in therapy, the findings of the current study indicate no significant association between the type of communication therapy approach and the cultural appropriateness of any of the communication therapy techniques implemented and materials used in therapy. Current findings indicate linguistic appropriateness but limited culturally sensitive materials across both domains (i.e., therapy techniques and therapy materials), irrespective of the therapy approach (i.e., LSL-SA or TSLT). This concurs with findings by Grandpierre *et al* (2019), Southwood and Van Dulm (2015) and Wieber and Sumner (2015) that materials used during language interventions are not reflective of cultures in diverse contexts. This finding is particularly relevant in the provision of communication intervention services in the South African context, as it acknowledges the challenge of meeting the cultural demands of families and children with hearing loss. These findings highlight that early interventionists remain accountable for acquiring reliable and valid evidence for outcomes and employing resources from a cultural and linguistic perspective (Health Professions Council of South Africa 2019). When interventions are implemented in a culturally proficient manner, a plausible corollary would be an enhanced family-professional relationship (Moeller *et al* 2013). In determining the perceived facilitators and barriers regarding the communication therapy approach, this study indicates the following findings:

Positive findings were expressed by participants, specifically that spoken language surmounts boundaries and fosters an environment of togetherness. These findings concur with the literature that in the LSL-SA approach, parents do not have to learn a new language or communication mode, as this approach can be seen as a reliable solution for DHH children (Rhoades and Duncan 2017; Slentz and Krogh 2017; White and Brennan- Jones 2014). These findings likely strengthen the case for LSL-SA as the approach of choice, as the primary concern of families of infants with hearing loss is how they will develop spoken language (Binos *et al* 2021). South African studies have produced empirical evidence highlighting age-appropriate communication outcomes following an LSL-SA approach (Casoojee *et al* 2024). This implies that professionals providing EHDI services are duty-bound to support parent communication choices, ensuring the child achieves spoken language outcomes (Houston and Stredler-Brown 2012).

Participants expressed that the LSL-SA therapy benefitted their child's communication skills development and benchmarked their child's academic outcomes as an indicator of positive therapy outcomes. This is congruent with findings of various comparative studies demonstrating that DHH children receiving an LSL approach are more likely to outperform those DHH children receiving TSLT, yielding higher odds of performing at age- equivalent measures of speech perception, language outcomes and academic achievements (Casoojee *et al* 2024; Yanbay *et al* 2014; Dettman *et al* 2013; Motasaddi-Zarandy *et al* 2009; Percy-Smith *et al* 2018; Fairgray *et al* 2010).

The participants in this study acknowledge that the early interventionists were skillful and adept and contributed to parent empowerment, regardless of the communication therapy approach. The current study findings concur that early interventionists who enhance the family's understanding of the infant's strengths and needs are more likely to promote the family's ability to advocate for the child with hearing loss (Health Professions Council of South Africa 2018). Hence, families should be equipped and empowered to make informed decisions regarding the communication approach to be adopted for their DHH child (Centers for Disease Control and Prevention 2018).

Participants highlighted perceived barriers. Current study findings indicate the constraints of English as the language of instruction. These findings are twofold. First, the findings are particularly relevant in the provision of the LSL-SA communication approach in the South African context. These results are confirmatory with the findings of a study conducted by Mdladlo *et al* (2016), indicating that the average SLT and audiologist in the South African context is predominantly either an English or Afrikaans-speaking female, with only 5% of SLTs and audiologists speaking an African language as a first language in South Africa (Khoza- Shangase and Mophosho 2018). This highlights the predominance of English in the profession and the ongoing challenge of meeting the demands of families when implementing an LSL-SA approach (Mdladlo *et al* 2016). South Africa's history of apartheid, its multicultural and multilingual nature, as well as its socioeconomic inequalities pose unique challenges to early interventionists providing clinical services to children with hearing loss, often restricting effective service delivery (Fouché-Copley *et al* 2016; Samuels *et al* 2012).

The current study findings concur with studies conducted by Taylor (2016) and

Casoojee *et al* 2024 and confirm that the majority of DHH children receive communication intervention in their second language. LSL-SA is premised on principles that employ developmental patterns of listening, language, speech and cognition to stimulate natural communication and provide support services to facilitate children's educational and social inclusion in mainstream education (Joint Committee on Infant Hearing 2019b). Taylor (2016) confirms that LSL-SA interventionists have highlighted linguistic diversity as a challenge to successfully implementing the approach within the South African context. Consequently, there is a possible lack of family-centred EHDI within these contexts. These findings highlight the importance of family involvement and collaboration between EHDI service providers and parents.

Another finding was perceived barriers to achieving adequate communication skills using the TSLT approach. To date, the research and clinical focus in South Africa has been on adapting international EHDI principles for early identification and detection of hearing loss via screening methods (Khan *et al* 2018; Moodley and Storbeck 2015; Störbeck and Young 2016). The intervention aspect of EHDI in South Africa has been neglected. Consequently, there is limited research identifying patient outcomes based on context-specific intervention methods once hearing loss has been identified (Moodley and Storbeck 2015). The current study findings are consistent with Casoojee *et al* (2024) and Percy-Smith *et al* (2018), demonstrating that DHH children enrolled in LSL-SA outperformed those enrolled in TSLT in achieving age-equivalent language outcomes. The current study findings further support that LSL-SA graduates achieved superior academic outcomes dependent on language attainment, providing contextually relevant evidence supporting the effectiveness of the LSL-SA communication approach in South Africa (Casoojee *et al* 2024).

When identifying whether the participants would have preferred a different therapeutic communication approach to be implemented in therapy, a third of the parents of DHH children enrolled in TSLT would have chosen an LSL approach. This confirms the evidence presented by Auditory Verbal UK (2023) and Li *et al* (2003) that an LSL approach is a more robust, family-centred coaching programme when compared with TSLT. This implies that LSL early interventionists are obligated to equip parents with the tools to support the development of their child's spoken language through listening.

5.6 CONCLUSION

The findings of this study emphasise that early interventionists who work with DHH children should take cognizance of the interplay of many factors beyond the extent of the child's hearing loss to optimise therapeutic outcomes. Specifically, the study reveals significant gaps in the informational counselling provided to parents, which affects their ability to make fully informed decisions about communication options. It is incumbent on early interventionists to adhere to the Joint Committee on Infant Hearing and HPCSA guidelines regarding the provision of aural rehabilitation in LMICs, where healthcare and socioeconomic risk factors are present due to inequitable systems of care. This study further highlights the need for targeted training and capacity building for early interventionists, which emphasise the importance of understanding and integrating parental perspectives and local cultural contexts into their practices. This will improve the quality of interventions and align them more closely with the needs and preferences of families. Fostering collaborative efforts among relevant stakeholders, including policymakers, is crucial. Collaborative initiatives can help address the systemic barriers identified in the study, promote the development of culturally and linguistically appropriate therapy materials and support a more inclusive approach to early intervention. While we recognise the need for thoughtful re-examination of policy to practice, results of this study suggest communication interventions must be cognizant of local contexts, which will ensure more effective and more respectful early interventionists of the diverse needs and preferences of the families they serve.

This study has several limitations that should be considered when interpreting the findings. First, the small sample size of 23 caregivers limits the generalisability of the results, as it may not fully represent the diverse population of caregivers of DHH children in South Africa. Second, the retrospective design, with data collection spanning a time-frame as far back as 2008, introduces the potential for recall bias, as caregivers may have difficulty accurately remembering details of their involvement in therapy over extended periods. To address this, data were cross-validated with retrospective records where available; however, this does not entirely eliminate the risk of bias. Additionally, the study relied on self-reported data, which is inherently susceptible to social desirability bias, potentially influencing caregivers to portray their involvement or perceptions in a more favourable light. Another limitation is the lack of linguistic and cultural diversity in therapy resources, which may have influenced caregivers' perceptions of cultural appropriateness and therapy outcomes. Lastly, the study did not include perspectives from professionals or other family members, which could have provided a more holistic understanding of the FCI process. Despite these limitations, the findings contribute valuable insights into the challenges and facilitators of communication interventions in the context of multilingual and multicultural settings.

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Chapter 6: Paper IV – Communication Outcomes of children with hearing loss: A comparison of two Early Intervention approaches

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6.1 Abstract

Background: Early intervention approaches play a critical role in shaping the communication outcomes of children with hearing loss, influencing their language development and overall learning trajectory. Objectives: The main objective of this study was to compare the communication outcomes of children with hearing loss who received Listening and Spoken Language-South Africa (LSL-SA) with those who received Traditional Speech-Language Therapy (TSLT). Methods: A retrospective record review was conducted to gather data on communication outcomes from participants' speech-language therapy records. Communication outcomes were measured using standardized assessments evaluating speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive–linguistic skills. The data were analyzed using quantitative statistics. Key statistical methods included measures to determine associations, identify statistical significance, determine outcomes, and compare differences between the two groups. Results: The study found that children in the LSL-SA group had statistically significant better communication outcomes, with 63% achieving age-appropriate speech intelligibility compared to 45% in the TSLT group ($p = 0.046$). Similar trends were observed for expressive vocabulary (LSL-SA: 58% vs. TSLT: 39%, $p = 0.048$) and receptive language (LSL-SA: 60% vs. TSLT: 39%, $p = 0.043$). Additionally, 66% of children in the LSL-SA group were recommended for mainstream schooling, compared to 39% in the TSLT group ($p = 0.0023$). These findings highlight the importance of early amplification and structured intervention in improving communication

outcomes. The results also emphasize the importance of Early Hearing Detection and Intervention (EHDI) in decreasing the odds of delay in communication outcomes, irrespective of the type of communication approach, although a higher proportion of children in the LSL-SA approach group achieved age-appropriate communication outcomes than those in the TSLT group. Conclusions: This study highlights that communication intervention approaches aligned with the LSL-SA practice promote better communication development and enhance spoken language outcomes in children with hearing loss, facilitating successful transitions to mainstream schooling. Contribution: This study provides contextually relevant evidence for implementing an LSL-SA intervention approach for children with hearing loss. The implications of these findings for clinical practice and future research are discussed in detail.

6.2 Introduction

Congenital or early-onset hearing loss poses significant challenges in children, impacting the development of communication skills, cognitive abilities, psychosocial skills, and academic outcomes [1–3]. Consequently, the Joint Committee on Infant Hearing in the United States proposed an Early Hearing Detection and Intervention (EHDI) program to maximize the linguistic competence of infants and young children with hearing loss [4]. Similar policies and guidelines exist globally, including the European Consensus Statement on Neonatal Hearing Screening and the World Health Organization’s recommendations for early hearing intervention, highlighting the widespread recognition of EHDI as a public health priority.

Components of an EHDI program include (1) newborn hearing screening that aims to identify infants with hearing loss, ideally by one month of age, (2) audiologic diagnosis to confirm the presence and degree of hearing loss for infants who fail the initial hearing screening by three months of age, and (3) referral to early intervention (EI) services by six months of age

[4]. EI services include audiological management, educational support, family counselling, and communication intervention.

Communication intervention aims to support children with hearing loss and their families during the critical stages of language development, typically from birth to three years of age. During this period, the brain undergoes rapid growth and plasticity, making it particularly receptive to language input [5]. Numerous studies have shown EI to significantly improve communication outcomes in children with hearing loss across domains that include speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive linguistics (cognitive linguistics informs AVT how children with hearing loss process auditory information to support language, attention, memory and conceptual thinking) outcomes [6–12]. The interventions explored in this study, while effective in promoting spoken language outcomes, must be critically examined within the context of systemic inequities that limit access to alternative communication modalities, such as South African Sign Language (SASL). This focus on spoken language risks marginalizing Deaf cultural identity and the right to linguistic diversity, as emphasized by the CRPD. Positive communication outcomes are limited to studies using the 1-3-6 benchmark by which children with hearing loss were diagnosed and received amplification and EI (i.e., 1-3-6 EHDI time-frame benchmark) [13–21]. Whilst this benchmark is recommended, it has not been fully achieved in South Africa due to delays in identification and early intervention [3,22]. Within these proposed timeframes, there are important variables to consider as possible factors contributing to communication outcomes. These variables include the hearing amplification device fitted, the degree of the aided audiogram, the communication intervention approach adopted, and linguistic diversity influences on outcomes [23]. While this study focuses on spoken language approaches, we acknowledge the importance of Deaf cultural identity and the validity of sign language as a primary mode of communication. Future research and interventions should aim to balance linguistic, cultural, and individual preferences to foster inclusivity. South Africa, a low-middle-income country (LMIC), has lagged in implementing EHDI as a standard [3]. Currently, more than 90% of infants with hearing loss are not identified early or provided with intervention, largely due to (1) budgetary constraints affecting health policy, (2) limited access to services, (3) poor-quality Early Childhood Development (ECD) structures, and 4) a lack of comprehensive empirical evidence [3,24,25]. These systemic barriers prevent families from making fully informed choices about communication modalities, which include spoken language, sign language, or bilingual approaches.

Hearing loss is recognized as a disability under the social and rights-based models of disability [26,27]. This perspective acknowledges that barriers to effective communication and language acquisition can lead to social exclusion, educational challenges, and limited future opportunities for individuals with hearing loss. In this study, EI approaches (TSLT and Listening and Spoken Language-South Africa [LSL-SA—based on the LSLS Certified Auditory–Verbal Therapist (LSLS Cert. AVT®) qualification by the AG Bell Academy [24] are analyzed for their potential to support inclusive education and enhance life outcomes for children with hearing loss, aligning with the goals of disability frameworks that emphasize reducing barriers, promoting equity, and enabling full societal participation. This positioning underlines the importance of evidence-based interventions that improve communication skills, thereby fostering access to mainstream schooling and social integration, essential components of inclusive development within disability frameworks.

Studies on communication intervention approaches for children with hearing loss have primarily taken descriptive approaches [28]. Roberts [28] has found that, despite details on the type of intervention approach being included in these studies, these studies either observe convenience samples of children undergoing specific interventions [29,30] or track children participating in EI programs longitudinally [12,18]. There is a scarcity of studies comparing the outcomes under different communication intervention approaches. Results of a study conducted by Percy-Smith et al. [31] indicated that children with hearing loss who enrolled in an LSL approach scored age-appropriately and outperformed children with hearing loss enrolled in a TSLT approach.

In this study, two intervention approaches were compared: Traditional Speech-Language Therapy (TSLT) and Listening and Spoken Language—South Africa (LSL-SA). TSLT is a multimodal approach incorporating auditory training, speech production exercises, and visual supports such as lip-reading and gestures, and is grounded in a general speech-language pathology framework, focusing on enhancing auditory perception, speech production, and language skills, typically involving a mix of auditory and visual supports tailored to the child's needs. The TSLT approach typically incorporates multi-modal communication strategies, including auditory training, speech articulation exercises, and visual cues such as lip-reading and gestures. Therapy sessions are structured to address individualized goals, often with periodic assessments to adapt the intervention plan based on the child's progress. TSLT sessions also include strategies for language expansion through interactive play and storytelling to support vocabulary and sentence structure development. In contrast, LSL-SA follows an AVT model, which is highly parent-centered and focuses on developing auditory skills in everyday contexts. The AVT model emphasizes auditory input over visual cues to develop spoken language, based on the principle that consistent auditory access can maximize language outcomes for children with hearing loss. Intervention involves teaching parents to create rich auditory learning environments at home, promoting the consistent use of hearing devices such as cochlear implants or hearing aids. Sessions are intensive and structured, emphasizing active listening skills, phoneme discrimination, and sentence-level auditory comprehension. Visual cues are minimized to encourage auditory reliance, with therapists' modeling techniques to integrate speech and language goals into routine family interactions. Both approaches aim to develop age-appropriate spoken language skills, though they differ in their theoretical emphasis on auditory vs. multimodal (auditory and visual) support.

These interventions are individualized, considering factors such as the child's degree (mild to profound) and type (sensorineural, conductive, or mixed) of congenital hearing loss, age at diagnosis, and age at intervention. LSL-SA may be more intensive and parent-centered, involving regular family participation to integrate language learning into everyday environments, whereas TSLT may employ a broader range of communication supports. In evaluating outcomes, both approaches assess speech intelligibility, expressive and receptive language, vocabulary, and cognitive–linguistic skills.

However, while this study compares TSLT and LSL-SA, both focus on spoken language development but diverge from Deaf cultural identity and the use of SASL. This comparison highlights a broader debate in communication sciences and disorders: the prioritization of spoken language versus sign language and the implications of these choices for Deaf identity and inclusion within Deaf communities [32]. While the current study primarily focuses on spoken language outcomes, it highlights the need for future research to explore the broader implications of Deaf identity and cultural alignment of intervention approaches, especially in LMIC contexts where family-centered and linguistically congruent options are limited [23,32].

This study also aligns with current debates around Deaf identity and the choice of Sign Language as a primary communication mode, particularly in contexts where LSL approaches may not align with the cultural and linguistic preferences of Deaf communities. SASL offers an equally valid communication option that fosters a strong Deaf cultural identity. However, due to the limited availability of SASL resources, particularly in LMICs, spoken language approaches may be the only accessible intervention option for many families [32]. Future research should consider integrating Deaf cultural perspectives and increasing access to bilingual or bimodal communication options in early intervention to foster more holistic and culturally responsive outcomes.

The National Development Plan (NDP) 2030 for Persons with Disabilities (2015) seeks to address the needs of children with disabilities, including children with hearing loss, who are at risk of being excluded from early childhood investments in South Africa [33]. The NDP aims to roll out a process involving inclusive education and the implementation of continuity of care between EI programs and educational settings, dependent on proper and effective monitoring and evaluation systems that track progress against goals and objectives [33,34]. This roll-out was envisaged to improve the access to and quality of ECD services for infants and young children. However, educational intervention for children with hearing loss is already at risk, given the paucity of resources accessible to these children [3,35]. Of the 43 Schools for the Deaf, only 12 offer education up to the National Senior Certificate level, which is a pre-requisite for entering any institution of higher learning [36–38]. This limited access undermines efforts to build an inclusive society [24]. If left unaddressed, hearing loss can have severe consequences, including delayed communication development, leading to poor academic outcomes and, consequently, fewer employment opportunities, personal–social maladjustments, and emotional difficulties [39]. To counteract these realities, it is imperative that efforts aimed at EHDI are maximized and that strategies facilitating positive outcomes from these processes are investigated. The current study was prompted by findings from a previously conducted exploratory study investigating the learning outcomes of foundation phase learners with hearing loss. Whilst these findings also included speech and language outcomes as part of the learning outcomes and suggested the LSL-SA approach as having maximized linguistic competence and literacy development of children with congenital or early-onset hearing loss, the sample of records was small and limited to EI schools in three provinces in South Africa [24]. The current study proffers additional insight, providing a trajectory into the communication outcomes using a larger, more representative sample of records from EI schools across four provinces in South Africa. While this study focuses on South Africa, similar challenges exist in many LMICs, as well as underserved regions in high-income countries (HICs). Limited access to newborn hearing screening, delays in diagnosis and intervention, and disparities in service provision have been reported in countries such as Brazil, India, and rural parts of the United States. These global challenges highlight the need for contextually relevant early intervention approaches that can be adapted

across diverse healthcare and educational settings.

Therefore, the main aim of this study was to investigate the communication outcomes (i.e., speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, cognitive linguistics) of children with hearing loss who received LSL-SA versus TSLT in South Africa. The specific objectives included (1) describing the communication functioning prior to the commencement of EI and upon discharge from therapy in both the LSL-SA group and TSLT group; (2) describing the communication functioning prior to the commencement of EI and upon discharge from therapy in the LSL-SA and TSTL groups; (3) comparing the communication outcomes between the two groups; (4) determining if any associations exist between selected study variables (i.e., age at identification of hearing loss, age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at start of EI, duration of EI, degree of the aided audiogram, home language vs. language used in therapy) within the communication intervention approaches and communication outcomes; and (5) identifying the type of school recommended after EI, based on communication outcomes.

6.3 Materials and Methods

6.3.1 Study Design

A retrospective record review was conducted to compare communication outcomes in children with hearing loss who received either Listening and Spoken Language-South Africa (LSL-SA) or Traditional Speech-Language Therapy (TSLT). The study used quantitative data analysis to assess associations between intervention type and communication outcomes. As this was a non-randomized study, children were grouped based on the intervention they had received within their educational setting, and no manipulation of intervention assignment was performed. While the children with hearing loss in the study received only one intervention (either LSL-SA or TSTL), the type of therapy was determined by the school and not by the researcher. Thus, the assignment to LSL-SA or TSTL was not controlled but rather a reflection of the services available within each school setting at the time of the child's intervention.

6.3.2 Study Objectives and Corresponding Variables

The study aimed to achieve the following objectives, each linked to the data collected:

1. Describe communication functioning prior to and upon discharge from early intervention (EI) for both the LSL-SA and TSLT groups.
    - *Variables:*
    - Communication Functioning: speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, cognitive–linguistic skills (all ordinal variables: delayed, age-appropriate).
2. Compare communication outcomes between the LSL-SA and TSLT groups.
    - *Variables:*
        - Type of Communication Intervention: TSLT OR LSL-SA (nominal).

        - Outcome Measures: proportion of children with age-appropriate communication skills at discharge (ordinal).

3. Determine associations between selected study variables and communication outcomes within each intervention approach.
    - *Variables:*
        - Age at Identification of Hearing Loss (ratio, years).
        - Age at Diagnosis of Hearing Loss (ratio, years).
        - Age at Amplification (ratio, years).
        - Type of Amplification Device (hearing aid or cochlear implant, nominal).
        - Age at Start of EI (ratio, years).
        - Duration of EI (ratio, years).
        - Degree of Aided Audiogram (ordinal: normal, mild, moderate, severe).
        - Home Language vs. Language Used in Therapy (nominal: matched or not matched).
4. Identify the type of school recommended after EI based on communication outcomes.
    - *Variables:*
        - Type of School Recommended (nominal: mainstream or specialized).

6.3.3 Study Sample and Demographics

This study reviewed records from 126 children with profound congenital or early onset hearing loss attending EI schools across four South African provinces: Western Cape (Cape Town), Gauteng (Johannesburg and Pretoria), KwaZulu Natal (Morningside), and Eastern Cape (Gqeberha). These schools serve diverse linguistic and socioeconomic populations, with participants speaking five of South Africa's official languages. Many families come from low- to middle-income communities with limited access to private healthcare, relying on public sector EI services. Most participants received communication intervention in English, with some receiving intervention in Afrikaans. The study timeframe spanned records collected over a five-year period, allowing a comprehensive assessment of communication outcomes for children allocated to either a TSLT or LSL-SA intervention approach. The EI schools offer both therapy options; however, each child is allocated to only one type of intervention.

6.3.4 Inclusion and Exclusion Criteria

Records of participants who met the following criteria were included: (1) had a diagnosis of congenital or early onset, bilateral, sensorineural, profound hearing loss; (2) were enrolled in an EI program receiving either TSLT or the LSL-SA approach; (3) had cochlear implants or were fitted with hearing aids (as approved by a South African Cochlear Implant Group-endorsed cochlear team); and (4) had finished Grade 3 in the foundation phase of primary schooling. Participants were assessed at discharge from EI, typically between the ages of 6 and 10 years, ensuring comparability between groups. Developmental factors, including age at identification, age at amplification, and duration of intervention, were accounted for in the analysis to minimize underlying variability. The study excluded children with unilateral profound hearing loss or bilateral profound hearing loss who also had other documented co-morbidities, such as cognitive impairment, to ensure a homogenous sample focused on the effects of intervention alone.

6.3.5 Procedures

Ethical approval from the University of the Witwatersrand Ethics Committee (HREC) (protocol number: H20/06/03). Thereafter, permission was sought from all relevant authorities, granting the researcher access to the educational facilities and disseminating information to the parents/primary caregivers of children with hearing loss. Written informed consent was obtained from the parents/primary caregivers of children with hearing loss after indicating their willingness to allow the researcher to access their child's records. Once permission and consent were obtained, records were accessed and reviewed. As this study was retrospective in nature, it was reliant on pre-existing records, which may not uniformly capture all variables of interest. Consequently, the findings are descriptive and associative rather than causative, and the conclusions drawn must be interpreted with caution.

6.3.6 Data Collection Tool

The data collection tool used in the current study was specifically designed for this purpose. It was pre-tested on a therapy file from each EI school before use. None of the records used in the pre-test phase formed part of the main study. The data collection form consisted of two sections. Section A gathered information on child demographics, and Section B gathered information on Intervention Outcomes. The record review aimed to gather information regarding (1) the child's hearing loss, (2) the age at diagnosis of hearing loss and age at initiation of EI services, (3) the type of amplification device fitted and duration of use, (4) the type of communication intervention approach, and (5) speech- language communication functioning at the onset of therapy and communication out- comes at the end of grade three at the EI school and (6) the type of school recommended upon completion of the foundation phase of primary school. This study compares specific approaches but does not negate the relevance of alternative communication methods, including sign language, which may align more closely with the values of Deaf communities.

Communication functioning was measured consistently across all EI schools using standardized assessment tools to evaluate domains including speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive– linguistic skills. These assessments were administered by qualified speech-language therapists at the beginning of therapy and upon discharge, ensuring uniformity in evaluating communication progress. Data were collected retrospectively over a five-year period, providing a longitudinal view of each child's progress. Records were detailed, capturing information on the initial communication functioning at therapy onset, intermediate progress notes, and final outcomes, allowing for a comprehensive analysis of communication development in each intervention group.

6.3.6.1 Standardized Assessment Tools

The communication outcomes measured in this study—including speech intelligibility, expressive and receptive language, vocabulary, audition, and cognitive–linguistic skills—were assessed using validated tools commonly used in South Africa. These included the Preschool Language Scale—Fifth Edition (PLS-5), Clinical Evaluation of Language Fundamentals, Integrated Scales of Language Development, Functional Listening Index-Paediatric, and the Goldman Fristoe Test of Articulation, which have been adapted and used in multilingual South African contexts. Assessments were conducted by qualified speech-language therapists, ensuring standardized administration across all early intervention (EI) sites.

6.3.7 Data Analysis

Each research question was analyzed using the following models:

- Objectives 1 and 2: Comparing Communication Functioning and Outcomes: Descriptive statistics (means, standard deviations, percentages) were used to summarize communication outcomes in both groups. Comparisons were conducted using independent samples t-tests for continuous variables and chi-square tests for categorical variables. For categorical variables with small cell sizes, Fisher's exact test was used instead of the chi-square test.

- Objective 3: Associations Between Study Variables and Communication Outcomes: Logistic regression models were used to assess associations between intervention type (LSL-SA vs. TSLT) and outcome measures (age-appropriate vs. delayed) while controlling for confounding variables (age at amplification, device type, duration of EI). For model transparency, logistic regression outputs after multiple comparisons, significance levels were set at $p < 0.021$.
- Objective 4: School Placement After EI:

  Associations between communication outcomes and the type of school recommended were assessed using Fisher's exact test.

All data were analyzed using SAS version 9.4 for Windows [40]. Blinding in data analysis occurred. To minimize bias, the researchers conducting the data analysis were blinded to the intervention group assignments during statistical processing. Data were de-identified and coded before analysis to ensure that the analysts were unaware of whether participants had received LSL-SA or TSLT. This approach enhanced the objectivity and validity of the findings by preventing any potential influence of preconceived expectations on the interpretation of results.

6.3.8 Ethical Considerations

This study was conducted in accordance with ethical guidelines for research involving human participants. Ethical approval was obtained from the University of the Witwatersrand Human Research Ethics Committee (HREC) (Protocol Number: H20/06/03) before data collection commenced. Permission was also granted by relevant educational authorities and school administrators to access speech-language therapy and audiology records. As this was a retrospective record review, informed consent was obtained from the parents or primary caregivers of all children whose records were included in the study. To ensure confidentiality and data protection, all records were anonymized, with unique identification codes assigned to participants instead of personal identifiers. Data were stored in a password-protected database accessible only to authorized research personnel. The study adhered to the principles outlined in the Declaration of Helsinki, ensuring respect for participant privacy, non-maleficence, and responsible data handling. Findings were reported objectively and without bias, with appropriate caution taken to acknowledge study limitations related to its retrospective and non-randomized design.

6.3.9 Validity and Reliability

To ensure validity and reliability, this study employed standardized data collection methods and used validated assessment tools to measure communication outcomes across all EI sites. Content validity was maintained by aligning outcome measures—such as speech intelligibility, expressive and receptive language, and auditory skills—with established early intervention frameworks. Reliability was enhanced through consistent administration of assessments by qualified speech-language therapists and audiologists, minimizing inter-rater variability. Additionally, statistical controls were applied to account for potential confounders, such as age at amplification and duration of intervention, strengthening the internal validity of findings. External validity was considered by including a diverse sample from multiple provinces, making the findings more generalizable to similar contexts within South Africa and other LMICs. Data accuracy and consistency were ensured through rigorous double-checking procedures during data entry and statistical analysis. These methodological safeguards support the trustworthiness and reproducibility of the study's results.

6.3.10 Data Management

Data management involved collecting, storing, and securing participant records to ensure the integrity and confidentiality of sensitive information. Data were sourced from retrospective records at EI schools, and each record was anonymized by assigning unique identification codes to participants to protect their identities. The data were transferred to a secure, password-protected database accessible only to authorized research team members. Variables collected included demographic information, communication outcomes, intervention details, and audiological data, which were carefully entered and checked for accuracy and completeness. Regular data-cleaning addressed inconsistencies or missing information. All data handling complied with ethical guidelines, ensuring that participants' privacy and data security were maintained throughout the study. After analysis, data were securely archived for future reference while retaining confidentiality standards.

6.4 Results

6.4.1 Demographic Profile of Participants

As depicted in Table 1, of the 126 participants, 64 were enrolled in TSLT, and 62 were enrolled in the LSL-SA group. Both groups had more females than males, with ages ranging between 6.0 and 10.1 years old. Participants spoke five of South Africa's 12 official languages and represented all four recognized race groups [41]. In the TSLT group, 41 participants wore cochlear implants, compared to 48 participants in the LSL-SA group, with 22 participants in the TSLT group and 29 in the LSL-SA group using bilateral cochlear implants.

Genetic causes of hearing loss accounted for 14% of participants, prenatal infections for 17%, and postnatal infections for 18%. The cause of hearing loss remained unknown in

51% of participants due to missing data.

Table 6-1: Demographic data of children included in the study (N=126)

Characteristic	Category	Overall		TSLT		LSL-SA		*p*-Value for Between-Group Comparison
		n	**%**	**N**	**%**	**N**	**%**	
N		**126**		**64**		**62**		
Age	Median (IQR); range	8.3 (6.0–10.1); 1.7–16.7		8.7 (6.5–10.2); 1.7–16.7		6.8 (5.6–10.0); 1.7–11.7		0.092
Gender	Male	54	43	29	45	25	40	0.59
	Female	72	57	35	55	37	60	
Race Group	Colored	53	42	29	45	23	37	0.61
	White	41	33	19	30	22	35	
	Black	23	18	13	20	10	16	
	Indian	7	6	2	3	5	8	
	Other	3	2	1	2	2	3	
Home Language	English	58	46	27	42	31	50	0.84
	Afrikaans	39	31	21	33	18	29	
	Xhosa	17	13	4	6	10	16	
	English and Afrikaans	5	4	10	16	7	11	
	Zulu	4	3	2	3	3	5	
	Southern Sotho	1	1	0	0	1	2	
	Other	2	2	1	2	1	2	
Type of Amplification	Hearing Aid	37	29	23	36	14	23	0.12
	Cochlear Implant	89	71	41	64	48	77	
Number of Cochlear Implants	0	36	29	22	34	14	23	0.26
	1	39	31	20	31	19	31	
	2	51	40	22	34	29	47	

6.4.2 Communication Functioning Prior to the Commencement of EI and upon Discharge from Therapy in the TSLT and LSL-SA Groups

The Description of Communication Functioning Prior to the Commencement of EI to the Communication Outcomes upon Discharge from Therapy in the TSLT Group (n = 64) is Depicted in Table 2

At the onset of therapy, 98% (n = 63) of children in the TSLT group exhibited delayed communication skills across all domains, including speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive linguistics. Of these, 36% (n = 23) were fitted with hearing aids, and 64% (n = 41) had cochlear implants. Upon discharge from therapy, 39% to 48% of participants showed improvements, achieving age-appropriate communication skills across all the domains.

Table 6-2: Comparison of Communication Functioning prior to the commencement of EI and upon discharge from EI

Table 2. Comparison of Communication Functioning prior to the commencement of EI and upon discharge from EI.

Communication Domains	TSLT						LSL-SA					
	Communication Functioning at the Onset of Therapy			Communication Functioning at Discharge of Therapy			Communication Functioning at the Onset of Therapy			Communication Functioning at Discharge of Therapy		
	% Delayed	% Age Appropriate	% Unknown	% Delayed n	% Age Appropriate	% Unknown	% Delayed	% Age Appropriate	% Unknown	% Delayed	% Age Appropriate	% Unknown
Speech intelligibility	97% (n = 62)	2% (n = 1)	1% (n = 1)	55% (n = 35)	45% (n = 29)	1% (n = 1)	97% (n = 60)	3% (n = 2)		32% (n = 20)	66% (n = 41)	
Vocabulary	98% (n = 63)	2% (n = 1)		61% (n = 39)	39% (n = 25)		97% (n = 60)	3% (n = 2)		39% (n = 24)	61% (n = 38)	
Receptive Language	98% (n = 63)	2% (n = 1)		61% (n = 39)	39% (n = 25)		97% (n = 60)	3% (n = 2)		37% (n = 23)	61% (n = 38)	
Expressive Language	98% (n = 63)	2% (n = 1)		61% (n = 39)	39% (n = 25)		97% (n = 60)	3% (n = 2)		44% (n = 27)	56% (n = 35)	
Audition	98% (n = 63)	2% (n = 1)		56% (n = 36)	44% (n = 28)		98% (n = 63)	2% (n = 1)		32% (n = 20)	68% (n = 42)	
Cognitive Linguistics	98% (n = 63)	2% (n = 1)		52% (n = 33)	48% (n = 31)		90% (n = 56)	8% n = 5)	1% (n = 1)	27% (n = 17)	73% (n = 45)	

6.4.3 The Description of Communication Functioning Prior to the Commencement of EI to the Communication Outcomes upon Discharge from Therapy in the LSL-SA Group (n= 62) is depicted in Table 2

Results indicate delayed communication skills in speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive–linguistic skills ranging from 90% to 98%. Of the participants in the LSL-SA group, 23% (n = 14) were fitted with hearing aids, and 77% (n = 48) had cochlear implants. Upon discharge from therapy, significant improvements were observed in achieving age-appropriate communication skills ranging from 56% to 73% across all the communication domains.

6.5 Comparing the Communication Outcomes Between the Two Groups

Comparing the communication outcomes between the two groups (i.e., TSLT and LSL-SA), as depicted in Table 3, the categories for “age-appropriate—delayed” and “age-appropriate—age-appropriate” were very small and were grouped into categories “delayed—delayed” and “delayed—age-appropriate”, respectively.

A comparison of outcomes between TSLT and LSL-SA was conducted and adjusted for significant differences in characteristics between the two groups, namely age at identification and age at amplification. The analysis also accounted for usual development, which reflects the natural progression of children over time, by considering the duration of early intervention (EI), as children typically develop and change during this period. Although the duration of EI did not differ significantly between the groups, it was included in the analysis as a post-hoc measure to assess its impact on communication outcomes. The results from this post-hoc analysis indicated that longer durations of EI were associated with reduced delays in communication development.

Findings further indicate statistically significantly decreased odds of remaining or becoming delayed in speech intelligibility and expressive vocabulary for the LSL-SA group (compared to the TSLT group). There were statistically significant decreased odds of remaining or becoming delayed in receptive language, audition, and cognitive–linguistics, both unadjusted and adjusted for the earliest age of amplification for the LSL-SA group (compared to the TSLT group). Findings further indicate that children with hearing loss who underwent LSL-SA were characterized by a higher proportion of participants who attained age-appropriate speech intelligibility, expressive vocabulary, receptive language, audition, and cognitive–linguistics upon discharge from therapy compared to those in TSLT.

Table 6-3: Comparison of communication outcomes between TSLT and LSL-SA groups (N=126)

N		**126**		**64**		**62**			
		Overall		**TSLT**		**LSL-SA**		**Unadjusted**	**Adjusted**
Communication outcomes trajectory (onset to discharge):		N	%	n	%	n	%	**Odds Ratio (OR) for LSL vs TSLT (95% CI)**	
Speech	Delayed – Delayed	54	43	34	53	20	32	0.42 (0.20-0.86)	0.46 (0.21-1.02)
	Delayed - Age-Appropriate	67	53	28	44	39	63	reference	
	Age Appropriate - Age Appropriate	3	2	1	2	2	3		
	Unknown	2	2						
Vocabulary	Delayed – Delayed	62	49	38	59	24	39	0.41 (0.20-0.83)	0.48 (0.21-1.07)
	Age Appropriate – Delayed	1	1	1	2				
	Delayed - Age-Appropriate	61	48	25	39	36	58	reference	
	Age Appropriate - Age Appropriate	2	2			2	3		
Receptive Language	Delayed – Delayed	61	48	38	59	23	37	0.38 (0.18-0.78)	0.43 (0.19-0.99)
	Age Appropriate – Delayed	1	1	1	2				
	Delayed - Age-Appropriate	62	49	25	39	37	60	reference	
	Age Appropriate - Age Appropriate	2	2			2	3		
Expressive Language	Delayed – Delayed	65	52	38	59	27	44	0.50 (0.24-1.01)	0.61 (0.28-1.33)
	Age Appropriate – Delayed	1	1	1	2				
	Delayed - Age-Appropriate	58	46	25	39	33	53	reference	
	Age Appropriate - Age Appropriate	2	2			2	3		
Audition	Delayed – Delayed	55	44	35	55	20	32	0.37 (0.18-0.77)	0.42 (0.19-0.92)
	Age Appropriate – Delayed	1	1	1	2				
	Delayed - Age-Appropriate	69	55	28	44	41	66	reference	
	Age Appropriate - Age Appropriate	1	1			1	2		
Cognitive Linguistics	Delayed – Delayed	49	39	33	52	16	26	0.33 (0.16-0.71)	0.39 (0.17-0.88)
	Delayed - Age-Appropriate	70	56	30	47	40	65	reference	
	Age Appropriate - Age Appropriate	6	5	1	2	5	8		
	Unknown	1	1						

6.6 Determining If Any Associations Exist Between Selected Study Variables and Communication Outcomes Within Each Communication Intervention Approach

Findings on the *selected study variables of participants (*i.e., *age at identification of hearing loss, age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at start of EI, duration of EI, degree of aided audiogram, home language vs. language used in therapy) within the intervention approaches*, are depicted in Table 4.

Table 6-4: Categorical variables of participants within each intervention approach (N=126)

Characteristic	Category	Overall		TSLT		LSL-SA		p-value for between-group comparison
		N	%	n	%	n	%	
N		**126**		**64**		**62**		
Identification and Diagnosis of Hearing Loss								
Age of identification of hearing loss (years)	median (IQR); range	1.5 (0.5-2.5); 0.0-8.1		1.7 (0.7-2.5); 0.0-7.7		1.0 (0.3-2.3); 0.0-8.1		0,047
Duration from identification to diagnosis (months)	median (IQR); range	0.0 (0.0-7.0); 0.0-58.0		0.0 (0.0-6.5); 0.0-37.0		0.5 (0.0-7.0); 0.0-58.0		0,19
Age at diagnosis of hearing loss (years)	median (IQR); range	1.8 (0.8-3.0); 0.0-8.1		2.1 (1.2-3.0); 0.1-7.7		1.5 (0.5-3.0); 0.0-8.1		0,095
Hearing Amplification								
Duration from diagnosis to amplification (months)	median (IQR); range	1.0 (0.0-3.0); 0.0-61.0		1.0 (0.0-4.0); 0.0-61.0		0.0 (0.0-2.0); 0.0-13.9		0,075
Earliest age of amplification (years)	median (IQR); range	2.1 (1.0-3.1); 0.1-8.2		2.3 (1.7-3.3); 0.1-8.2		1.8 (0.6-3.0); 0.2-8.2		0,037
Age of amplification with CI (years)	(n) median (IQR); range	(n=90) 3.1 (1.9-4.9); 0.2-11.8		(n=42) 3.5 (2.3-5.0); 0.2-11.8		(n=48) 2.7 (1.8-4.9); 0.5-8.7		0,16
Age at the start of Communication Intervention (years)	median (IQR); range	2.5 (1.5-3.6); 0.2-8.3		2.5 (1.6-3.5); 0.3-8.3		2.5 (1.4-3.9); 0.2-8.2		0,86
Type of hearing amplification device	Hearing Aid	37	29	23	36	14	23	0,12
	Cochlear Implant	89	71	41	64	48	77	
Communication Intervention								
Duration from diagnosis to Communication Intervention (months)	median (IQR); range	2.7 (1.0-7.0); 0.0-67.2		2.7 (0.7-6.3); 0.0-53.6		2.9 (1.2-11.9); 0.0-67.2		0,40
Duration of Communication Intervention (years)	median (IQR); range	4.6 (3.0-6.8); 0.5-13.6		5.5 (3.4-7.3); 0.5-13.6		4.2 (2.9-6.3); 1.0-10.9		0,071
Hearing Age until discharge from Communication Intervention	median (IQR); range	4.1 (2.6-6.0); 0.1-24.0		4.4 (2.4-6.5); 0.7-24.0		4.0 (2.7-5.4); 0.1-10.7		0,61
Language of Communication Intervention								
The language used in sessions	English	89	71	43	67	46	74	0,44
	Afrikaans	37	29	21	33	16	26	
Language used during communication intervention sessions	Same	100	79	50	78	50	81	0,83
	Different	26	21	14	22	12	19	

When examining the age of identification, diagnosis, and fitting of amplification de- vices for children with hearing loss between the LSL-SA (n = 62) and TSLT (n = 64) groups, findings revealed that participants in the LSL-SA group were identified and diagnosed with hearing loss at younger ages and fitted with hearing amplification devices at a younger age compared to those in the TSLT group. These findings show that participants in the LSL-SA group have earlier access to EHDI (identification = 1.0 years old, diagnosis = 1.5 years old, amplification = 2.3 years old) services, leading to earlier intervention for children with hearing loss than those in the TSLT group.

There is no statistically significant time difference between the LSL-SA and the TSLT groups when comparing the time taken from diagnosis of hearing loss to the start of communication intervention. The study also examined the average duration of communication intervention sessions attended by participants, averaging 4.6 years; notably, participants in the LSL-SA group (n = 62) attended therapy for an average of 4.2 years, significantly less than those in the TSLT group (n = 64), who attended for an average of 5.5 years. In both the TSLT and LSL-SA groups, the majority of participants received communication intervention in English. A subset of participants, 33% (n = 21) in TSLT and 26% (n = 16) in LSL-SA received intervention in Afrikaans. Of these, 78% (n = 50) in TSLT and 81% in LSL-SA received intervention in their home language. The minority, 22% (n = 14) in TSLT and 19% (n = 12) in LSL-SA, received intervention in a language other than their home language.

Table 5 depicts the aided audiogram results between the TSLT group (n = 44) and the LSL-SA group (n = 22). The audiological assessment measures were conducted by registered audiologists (i.e., Health Professions Council of South Africa [HPCSA]) using calibrated equipment (i.e., SANS 10182:2006) in a calibrated soundproof booth that complies with standards and regulations (i.e., S EN ISO 8253-1: 2010) [42,43]. Participants who failed to achieve normal aided thresholds across all frequencies had aided audiograms within the mild hearing loss category in both groups.

Table 6-5: Aided Audiogram Results

Characteristic		**Overall**		**TSLT**		**LSL-SA**		**p-value for between-group comparisons**
		n	%	N	%	n	%	
Aided Audiogram Results Available	No	60	48	20	31	40	65	0,0003
	Yes	66	52	44	69	22	35	
% fail (25dB cutoff): Ear R	250Hz (n=54)		28		29		26	>0.99
	500 Hz (n=58)		40		40		40	>0.99
	1000 Hz (n=58)		43		42		45	>0.99
	2000 Hz (n=56)		55		58		50	0,77
	4000 Hz (n=49)		63		71		43	0,10
	8000 Hz (n=7)							
	Low frequencies (250-1000 Hz) (n=58)		48		45		55	0,58
	High frequencies (2000-4000 Hz) (n=56)		68		74		56	0,23
% fail (25dB cutoff): Ear L	250Hz (n=54)		30		31		28	>0.99
	500 Hz (n=56)		43		46		37	0,58
	1000 Hz (n=56)		41		38		47	0,57
	2000 Hz (n=55)		45		49		39	0,57
	4000 Hz (n=49)		49		56		33	0,22
	8000 Hz (n=5)							
	Low frequencies (250-1000 Hz) (n=56)		50		51		47	>0.99
	High frequencies (2000-4000 Hz) (n=55)		60		65		50	0,38

Table 6 depicts the associations that exist *between the selected study variables (i.e., age at identification of hearing loss, age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at start of EI, duration of EI, degree of aided audiogram, home language vs. language used in therapy) and the communication outcomes (controlling for the communication intervention approach and hearing amplification device)*. No statistically significant association was found between the communication intervention approach and study variables, except that those who received LSL-SA had a lower median age of identification and a lower median earliest age of amplification. These factors were adjusted when comparing outcomes between TSLT and LSL-SA, as the other variables were most likely not prognostic for outcomes or were themselves outcomes. Since age of identification and earliest age of amplification were strongly correlated (r = 0.816; $p < 0.0001$), only the earliest age of amplification was used.

Table 6-6: Association between the categorical variables and communication outcomes

Table 6. Association between the categorical variables and communication outcomes.

Odds Ratios are for Delay vs. Age Appropriate		Speech			Vocabulary			Receptive Language			Expressive Language			Audition			Cognitive Linguistics		
		Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)
Duration from ID to diagnosis (m)	median (IQR)	0.0 (0.0–11.0)	0.0 (0.0–3.0)	1.04 (1.01–1.08)	0.0 (0.0–9.0)	0.0 (0.0–3.0)	1.03 (0.99–1.07)	0.0 (0.0–9.0)	0.0 (0.0–3.0)	1.04 (0.99–1.08)	0.0 (0.0–8.0)	0.0 (0.0–3.0)	1.03 (0.99–1.07)	0.0 (0.0–8.0)	0.0 (0.0–6.0)	1.01 (0.98–1.05)	0.0 (0.0–8.0)	0.0 (0.0–6.0)	1.01 (0.98–1.05)
Duration from ID to EI (m)	median (IQR)	8.2 (2.6–22.7)	6.0 (2.6–19.2)	1.02 (0.99–1.04)	7.4 (2.7–18.3)	6.9 (2.5–26.3)	1.00 (0.98–1.03)	7.2 (2.7–16.9)	7.2 (2.5–26.9)	1.00 (0.97–1.02)	7.8 (2.8–18.3)	6.5 (2.4–23.8)	1.00 (0.98–1.03)	6.9 (2.6–14.4)	7.5 (2.6–27.6)	0.99 (0.96–1.02)	7.8 (2.6–18.3)	6.6 (2.7–23.8)	1.00 (0.97–1.03)
Duration from identification to amplification (m)	median (IQR); range	6.0 (1.0–15.0)	2.0 (0.0–8.5)	1.03 (0.99–1.07)	6.0 (1.0–18.0)	2.0 (0.0–8.0)	1.04 (0.99–1.07)	6.0 (1.0–18.0)	2.0 (0.0–7.6)	1.04 (0.99–1.07)	6.0 (1.0–15.0)	2.0 (0.0–8.3)	1.03 (0.98–1.07)	6.0 (1.1–12.5)	2.0 (0.0–9.0)	1.01 (0.98–1.05)	6.0 (1.1–12.0)	3.0 (0.0–9.0)	1.01 (0.98–1.05)
Duration of Amplification (y)	median (IQR); range	3.4 (1.8–5.4)	4.9 (3.5–6.4)	0.73 (0.59–0.89)	3.9 (2.3–5.7)	4.7 (3.4–6.3)	0.86 (0.72–1.01)	3.9 (2.3–5.7)	4.7 (3.3–6.2)	0.88 (0.74–1.04)	3.9 (2.3–5.7)	4.8 (3.4–6.3)	0.86 (0.72–1.02)	3.8 (2.3–5.5)	4.7 (3.2–6.3)	0.85 (0.71–1.02)	3.4 (1.8–5.4)	4.8 (3.4–6.3)	0.76 (0.62–0.93)
Audiogram (% fail)	Ear A—low frequencies (n = 58)	63	38	3.03 (0.96–9.53)	63	38	3.10 (0.96–10.0)	61	40	2.79 (0.84–9.22)	63	38	3.10 (0.96–10.0)	60	42	2.50 (0.71–8.85)	72	38	6.14 (1.48–25.4)
	Ear A—high frequencies (n = 56)	83	58	2.67 (0.71–10.1)	87	55	4.11 (0.97–17.5)	86	56	3.49 (0.81–15.1)	87	55	4.11 (0.97–17.5)	90	56	5.08 (0.95–27.1)	94	[illegible]	10.3 (1.19–89)
	Ear B—low frequencies (n = 56)	67	38	3.31 (1.06–10.4)	67	38	3.49 (1.05–11.6)	65	39	3.08 (0.90–10.5)	67	38	3.49 (1.05–11.6)	63	43	2.52 (0.68–9.38)	71	41	3.83 (1.01–14.6)
	Ear B—high frequencies (n = 56)	75	48	2.69 (0.78–9.32)	78	47	2.57 (0.69–9.52)	77	48	2.07 (0.54–7.92)	78	47	2.57 (0.69–9.52)	79	50	2.09 (0.50–8.71)	88	[illegible]	6.22 (1.16–33)
Number of cochlear implants (column %)	0	34	23	reference	41	16	reference	42	16	reference	41	15	reference	46	14	reference	46	17	reference
	1	31	31	0.73 (0.28–1.92)	37	25	0.58 (0.22–1.58)	35	27	0.53 (0.20–1.42)	35	27	0.50 (0.19–1.36)	36	27	0.43 (0.16–1.14)	42	24	0.71 (0.27–1.45)
	2	34	47	0.14 (0.05–0.38)	22	59	0.16 (0.06–0.41)	23	58	0.16 (0.06–0.42)	24	58	0.16 (0.06–0.42)	18	59	0.10 (0.04–0.28)	12	59	0.37 (0.16–0.86)
Age at start of EI (y)	median (IQR); range	3.0 (2.1–4.3)	2.3 (1.0–3.3)	1.49 (1.15–1.92)	2.9 (2.1–4.2)	2.1 (0.9–3.1)	1.52 (1.16–1.99)	2.9 (2.1–4.2)	2.2 (0.9–3.1)	1.52 (1.16–1.99)	2.8 (2.1–4.1)	2.1 (0.9–3.2)	1.47 (1.13–1.90)	2.9 (1.9–4.3)	2.3 (1.0–3.3)	1.38 (1.07–1.78)	3.0 (2.1–4.5)	2.3 (1.0–3.2)	1.50 (1.16–1.96)

Earliest age of amplification (y)	median (IQR); range	2.8 (1.8–4.0)	1.8 (0.6–2.6)	1.65 (1.24–2.21)	2.8 (2.0–4.0)	1.4 (0.4–2.4)	2.07 (1.47–2.92)	2.8 (2.0–4.0)	1.4 (0.5–2.4)	2.18 (1.53–3.11)	2.6 (1.8–4.0)	1.5 (0.4–2.5)	1.88 (1.35–2.60)	2.8 (2.0–4.0)	1.6 (0.6–2.6)	1.75 (1.27–2.39)	2.9 (2.0–4.2)	1.8 (0.6–2.6)	1.74 (1.28–2.37)
Earliest age of amplification with CI (y) (n = 90)	median (IQR); range	4.0 (3.0–5.7)	2.5 (1.6–4.2)	1.34 (1.07–1.68)	3.6 (2.5–5.2)	2.7 (1.6–4.3)	1.19 (0.97–1.46)	3.6 (2.5–5.1)	2.8 (1.6–4.5)	1.17 (0.95–1.43)	3.6 (2.3–5.2)	2.8 (1.6–4.5)	1.15 (0.95–1.40)	3.6 (2.5–5.3)	2.8 (1.7–4.7)	1.15 (0.94–1.41)	4.3 (3.0–5.3)	2.7 (1.7–4.3)	1.23 (0.99–1.52)
Earliest age of ampli fication vs. Age at start of EI (cutoffs 2.1y and 2.5y respectively	Early / Early	36	59	reference	41	57	reference	42	56	reference	42	57	reference	41	56	reference	36	58	reference
	Early / Late	5	16	0.83 (0.20–3.47)	3	19	0.33 (0.07–1.70)	2	20	0.16 (0.03–1.2)	5	18	0.46 (0.11–1.90)	2	19	0.20 (0.02–1.75)	4	16	0.68 (0.13–3.59)
	Late / Late	58	26	3.38 (1.49–7.66)	56	24	2.97 (1.30–6.75)	56	23	2.97 (1.30–6.78)	53	25	2.55 (1.13–5.78)	57	26	2.75 (1.20–6.62)	60	26	3.42 (1.48–7.94)
Duration of EI (y)	median (IQR); range	4.1 (2.4–6.8)	5.4 (3.8–7.3)	0.81 (0.68–0.95)	4.1 (2.9–6.8)	5.4 (3.6–7.4)	0.80 (0.68–0.94)	4.2 (2.9–6.8)	5.4 (3.6–7.3)	0.81 (0.68–0.95)	4.1 (2.9–6.6)	5.5 (3.8–7.4)	0.79 (0.67–0.93)	4.1 (2.8–6.7)	5.4 (3.7–7.3)	0.77 (0.65–0.91)	3.7 (2.8–6.1)	5.5 (3.8–7.3)	0.72 (0.60–0.87)
SLT Language match to home language	Same	67	89	reference	67	92	reference	66	92	reference	67	93	reference	61	94	reference	62	91	reference
	Different	33	11	3.55 (1.34–9.41)	33	8	5.69 (1.88–17.2)	34	8	6.06 (1.98–18.5)	33	7	6.74 (2.08–21.9)	39	6	12.3 (3.57–42.6)	38	9	6.28 (2.20–17.9)

Figure 1 below depicts the association between the selected variables and communication outcome (controlling for TSLT or LSL-SA and hearing amplification device). It presents the statistically significant associations that result in increased or decreased odds of delay across the six communication domains, after correction for multiple comparisons.

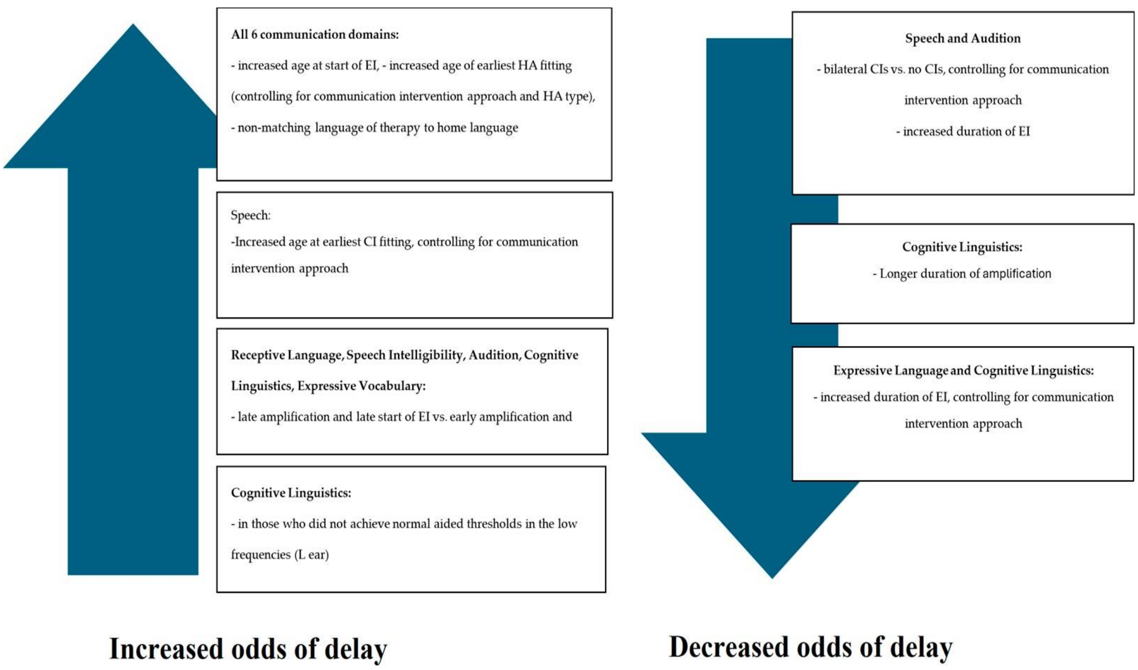

Figure 6-1: Statistically significant associations between variables result in increased or decreased odds of delay

6.7 Identifying the Type of School Recommended After EI Based on Communication Outcomes

When examining *the type of school recommended after EI based on communication out- comes*, as depicted in Figure 2, the participants who received LSL-SA (n = 25) had a higher proportion of being recommended for mainstream schooling in comparison to the participants who received TSLT (n = 39) (*p*-value for between-group comparison = 0.0023), who were recommended for specialized schooling.

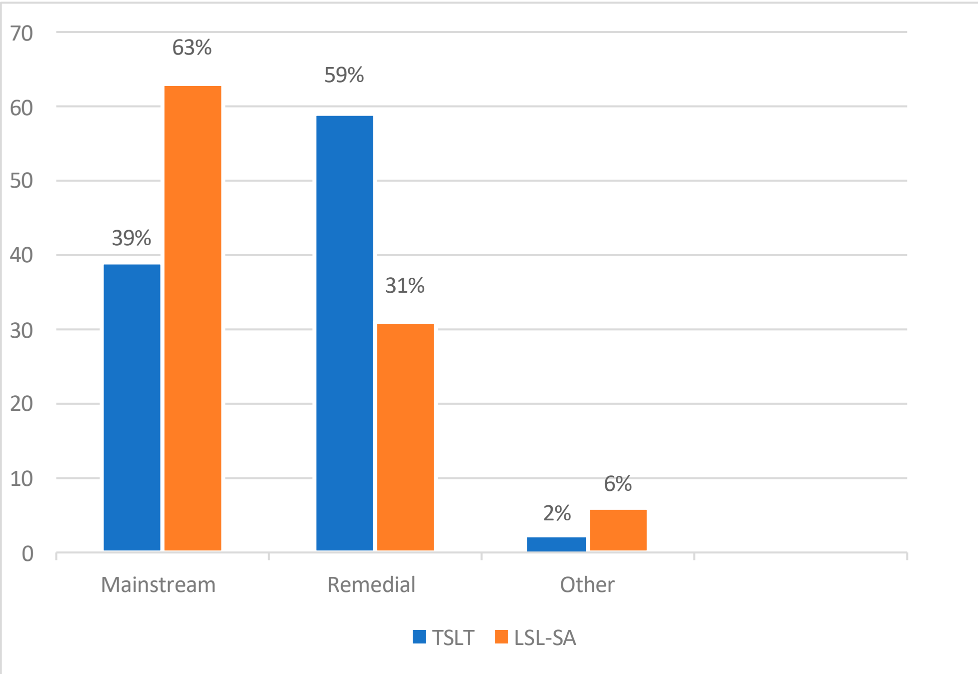

Figure 6-2: Type of school recommended upon discharge from communication intervention

6.8 Discussion

The sample comprised the speech-language therapy records of 126 children with hearing loss enrolled at one of four participating EI schools in South Africa. All the children were discharged from communication intervention therapy at the end of their foundation phase of schooling. The study affirms the validity of the speech-language outcomes measures, as consistent communication assessment tools were used across the EI schools to evaluate these outcomes. Given the retrospective nature of the study, which relied on existing records, slight variations in record-keeping and assessment practices were considered. Although standardized assessment tools were used, the potential impact of these variations on the consistency and validity of the outcomes was taken into account in the analysis.

Research confirms multiple advantages to hearing with two cochlear implants [44,45]. Despite the provision of free hearing aids to children under six and a national CI platform, rehabilitative interventions compete with life-threatening conditions within an over-stressed and under-resourced health budget and are poorly prioritized [3,46]. In 2019, only 23 children received government-funded CIs despite 17 babies born daily with permanent sensorineural hearing loss in South Africa [46,47]. If hearing amplification de- vices are available and used optimally (i.e., appropriate pre-fitting counselling, device management skills, and post-fitting support), it would ensure better health and developmental outcomes for children with hearing loss in South Africa.

Findings regarding the aetiology of hearing loss identified in this study correlate with research conducted by Shearer et al. [48], Korver et al. [49] and Mulwafu et al. [50]. In accordance with the exploratory study [51], the risk profile of infants in an LMIC has been highlighted, raising implications in the planning of EHDI in the South African context.

When describing the communication functioning prior to the commencement of EI to the communication functioning upon discharge from therapy in the TSLT group, findings indicate that 98% of participants had delayed communication skills, consistent with the literature which suggests auditory deprivation during the first three years of life is linked to less favorable outcomes in speech intelligibility, language, developmental, educational, and cognitive outcomes in children [52–55]. Upon discharge from therapy, only 48% of participants achieved age-appropriate communication skills. This is consistent with the findings of Lederberg et al. [56] that the majority of children with profound hearing loss in communication interventions, such as sign language and sign-supported approaches, do not achieve age-appropriate grammar, language-related areas of development (i.e., theory of mind) and literacy development, compared to their normal hearing peers, despite early identification. The current study's findings also concur with the study by Harris et al. [57], comparing the language and literacy of two cohorts of children with profound hearing loss enrolled in TSLT, recruited ten years apart. Harris et al. [57] reported that, while the second cohort had a higher vocabulary score, this was not matched by commensurate phonological awareness or reading ability improvements. These results suggest that, despite EHDI, most children with profound hearing loss in TSLT do not achieve age-appropriate language and literacy levels.

When describing *the communication functioning prior to the commencement of EI to the communication functioning upon discharge from therapy in the LSL-SA group*, the data indicate that at least two-thirds of participants achieved age-appropriate communication skills. These findings are consistent with findings by Yanbay et al. [58], who observed variability in outcomes in areas of speech and language, with some children achieving below-average scores and others achieving above-average scores. Yanbay et al. [58] also noted that family involvement in the intervention process was a key factor in significantly improving language outcomes. While the LSL-SA intervention approach emphasizes a family-based approach, which may contribute to improved outcomes, it is important to recognize that several factors, such as the intensity and consistency of the intervention, the level of family support, and individual child characteristics, also play crucial roles in influencing results. Therefore, while the data suggests that children with hearing loss enrolled in an LSL intervention approach have higher odds of performing at age-appropriate speech and language levels, the extent to which it produces better outcomes compared to other interventions must be considered within a broader context of these unaccounted variables. This highlights the need for further investigation into how these multiple factors interact and contribute to communication outcomes in children with hearing loss.

Upon *comparing the communication outcomes between the two groups (i.e., TSLT and LSL-SA)*, the findings reveal that the LSL-SA group are more likely to achieve age-appropriate communication skills. This confirms findings from the exploratory study [51] and aligns with Percy-Smith et al. [31], who found that children with hearing loss in an LSL approach outperformed those in TSLT on speech intelligibility, expressive vocabulary, and receptive language. Percy-Smith et al. [31] adjusted the effect of the intervention approach (i.e., LSL versus TSLT) with other covariates and found that LSL participants had higher odds of reaching age-appropriate speech and language levels. The current study reinforces the effectiveness of the LSL-SA approach in achieving optimal communication outcomes. Although the LSL-SA approach demonstrates favourable outcomes, this study recognizes that the focus on spoken language interventions may inadvertently perpetuate systemic barriers to inclusive practices. The lack of resources for SASL and bilingual approaches reflects broader inequities that constrain family choices and limit the alignment of interventions with cultural and linguistic rights. The specifics of both intervention approaches, including their theoretical underpinnings, implementation processes, and individualized strategies, are critical to understanding their impact on communication outcomes. Future research should provide more granular descriptions of intervention protocols to enhance clarity and reproducibility. These results may enable policymakers, especially in LMICs, to allocate resources for and plan strategically to promote and enhance access to this early intervention approach, alleviating the deleterious consequences of hearing loss. It is, therefore, likely that the costs of hearing loss (i.e., health sector, hearing devices, educational support, loss of productivity, societal costs) on the global economy, currently at US$ 980 billion annually, may be reduced [59]. The effectiveness of the LSL-SA approach, as shown by its better outcomes when compared to TSLT in terms of achieving age-appropriate communication skills, suggests that policymakers should consider promoting and enhancing access to LSL-SA to improve communication outcomes for children with hearing loss in South Africa. It is important to acknowledge and underscore that the prioritization of spoken language interventions raises critical questions about inclusivity and equity in the context of Deaf education. Incorporating sign language and fostering bilingualism might better address these concerns, supporting a broader range of outcomes that align with the preferences of Deaf communities. These findings align with international research demonstrating that auditory-based early interventions, when accessible and appropriately implemented, can significantly improve communication outcomes. Countries with established LSL programs, such as Australia and the United States, have reported similar benefits, suggesting that structured, parent-centered interventions could be beneficial beyond the South African context. However, variations in healthcare infrastructure, cultural attitudes toward Deaf identity, and language policies must be considered when adapting such approaches to different regions.

When examining the *selected study variables (i.e., age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at the start of EI, duration of EI, degree of the aided audiogram, home language vs. language used in therapy) within the intervention approaches*, despite findings of this study showing the children enrolled in the LSL-SA cohort is characterized by a lower median age of identification of hearing loss (1.0 years old), lower median age of diagnosis of hearing loss (1.5 years old) and a lower median earliest age of amplification (1.8 years old), it highlights the incongruence between transferring the theory of the adjusted 1-4-8 South African guidelines into practice. These findings exemplify what [3,24] claim regarding the incongruence of disability in relation to the number and distribution of speech-language and hearing professionals in the South African context. These findings advocate for the training of additional therapists to address the capacity-demand ratio so that more children with hearing loss will have access to evidence-based EI services.

The age of diagnosis of hearing loss determines the age of amplification and, subsequently, the age of enrolment in a communication intervention program [3,60]. Findings of this study reveal that, despite the average age of earliest hearing aid amplification (1.8 years old) and cochlear implantation (2.7 years old) being earlier for the LSL-SA group, the age of enrolment in a communication intervention program (2.5 years old) was the same for both cohorts. This finding highlights that international and national EHDI guidelines may not be transferable to clinical practice in South Africa due to contextual constraints. Studies by [3] and Meyer et al. [61] highlight delays in amplification in South Africa. The current study's findings advocate for the timely provision of early amplification and/or cochlear implantation and confirm that auditory input is key to communication outcomes in children with hearing loss [13,20]. These findings further motivate an increase in budget allocation to meet the demands for hearing amplification devices and may contribute toward initiatives for affordable and accessible service delivery in LMICs. As far as timing of intervention and communication outcomes, current findings highlight that early identification, diagnosis, and amplification are crucial for achieving age-appropriate communication skills. The study emphasizes the need for timely intervention to mitigate the negative impact of delayed communication skills on speech intelligibility, language development, educational outcomes, and cognitive development. Furthermore, the incongruence between guidelines and practice demonstrated by current findings shows that despite guidelines like the 1-4-8 EHDI in South Africa, there are challenges in translating these guidelines into practice, leading to delays in access to intervention services. Addressing these incongruences requires additional training for therapists and improving the capacity of healthcare systems to deliver timely interventions.

The degree of improved hearing provided by amplification devices is associated with better speech and language development in children with hearing loss [16]. However, the issue of successful amplification is multifaceted and must be carefully considered. While the current study's findings show that the duration of hearing amplification is associated with decreased odds of delay in speech and cognitive linguistics, it is important to recognize that the mere provision of amplification does not guarantee positive outcomes. Successful amplification depends on several factors, including the appropriateness of the device, proper fitting, consistent use, and ongoing maintenance. This concurs with the findings by Tomblin et al. [16]. Additionally, access to high-quality hearing devices and the ability to maintain their use is a significant challenge in resource-constrained settings. These findings support the early provision of well-fitted hearing aids and/or cochlear implants, but they also highlight the need for a comprehensive approach to amplification. Ensuring the availability of affordable, well-fitted hearing devices, as well as providing families with the necessary support for consistent device use, is crucial for improving speech and language outcomes. Adequate budget allocation and initiatives for increasing affordability and accessibility of hearing devices are crucial for achieving optimal outcomes in this context.

Findings of the current study indicate that children in the LSL-SA approach attend therapy for a significantly shorter duration than those in TSLT. These findings concur with the exploratory study [51] and with reports indicating substantial health gains within the Disability-Adjusted Life Years (DALYs) [62]. These findings directly influence the financial, human and infrastructure resource constraints and raise implications for managing the burden of disease in South Africa.

The findings of this study show that human resource constraints in providing communication intervention services foment a linguistic mismatch between speech-language therapists and/or audiologists and the population they serve within the South African context. This concurs with the findings of numerous studies [3,24,63]. The findings of this study thus raise implications of implementing an adapted first-world intervention approach that requires contextually relevant and linguistically responsive evidence. Early communication interventionists remain accountable for acquiring reliable and valid evidence in communication approaches and need to consider resources from a cultural and linguistic perspective, as it is key to effective clinical service provision in South Africa (Health

Professions Council of South Africa [64]. This study's retrospective design limits its ability to establish causality or definitively attribute outcomes to specific interventions. A well-designed prospective study incorporating randomized controlled methods would be essential to confirm these findings and draw more robust conclusions about the comparative efficacy of LSL-SA and TSLT approaches.

Results examining whether associations exist *between the selected study variables (i.e., age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at the start of EI, duration of EI, degree of the aided audiogram, home language vs. language used in therapy) and the communication outcomes (controlling for the communication intervention approach and type of hearing amplification device)*, reveal that children with hearing loss who have access to EI (which includes the diagnosis of hearing loss, fitting of hearing amplification devices, and adopting a linguistically appropriate communication approach, i.e., communication methods, resources or interventions that are tailored to the language needs and cultural background of the child) at the earliest opportunity increase their chances of achieving age-appropriate communication outcomes. This is despite the participant sample not adhering to the South African 1-4-8 EHDI guidelines. These results concur with the literature that children with earlier diagnosed hearing loss and amplification that quickly follow demonstrate more advanced language outcomes than those diagnosed and fitted with hearing amplification devices later [13,16,65]. Results further indicate that communication outcomes are hindered when the communication intervention approach does not incorporate linguistically appropriate care. This finding concurs with outcomes described in the exploratory study [51] and is particularly relevant in the South African context.

When examining *the type of school recommended after EI based on communication outcomes* as a predictor of success, results show that children with hearing loss enrolled in an LSL communication approach outperformed children with hearing loss enrolled in a TSLT communication approach. These findings again confirm those of [51] and Goldblatt and Pinto [66], who state that significant associations exist between language function and academic progress as an outcome of EI. Spoken language is often seen as a gateway to inclusive education and social competence [67, 68]. However, it is important to note that this study's focus on only two intervention approaches—TSLT and LSL-SA excludes other options, such as SASL or bilingual approaches, which may better align with Deaf culture and identity and offer a more inclusive range of communication options for families. The findings, therefore, are limited in their generalizability, particularly for families who prefer or have access to alternative communication strategies. While the LSL-SA approach may support academic progress in some contexts, future research should consider the broader perspectives of the Deaf community and explore how different approaches, including sign language, can contribute to more culturally responsive, inclusive educational outcomes.

6.9 Conclusions

This study highlights the critical role of EHDI in improving communication outcomes for children with hearing loss. The findings highlight the importance of timely amplification, structured intervention approaches, and family-centered therapies in promoting age-appropriate language development. Moreover, the study emphasizes the need for context-specific solutions in LMICS, where resource constraints pose challenges to implementing optimal EHDI programs. These insights can inform policymakers and clinicians working toward improved access and inclusivity in early intervention services globally. Results from this study emphasize the importance of adapting EI communication approaches to local contexts, ensuring cultural sensitivity, linguistic responsiveness and continuity of care. To promote truly inclusive education and societal participation, there is an urgent need to integrate spoken language approaches with robust support for sign language and bilingual communication. This requires addressing systemic inequities and fostering interventions that uphold the linguistic and cultural rights of all children with hearing loss. The LSL-SA approach emphasizes family involvement, with parents playing an active role in reinforcing language learning in everyday contexts. This family-centered approach is shown to increase the odds of achieving age-appropriate communication out- comes for infants and young children with hearing loss in South Africa. However, despite its effectiveness, the LSL-SA approach faces significant barriers in South Africa. There are only 51 LSL-SA therapists and 7 LSLS Cert.AVT® therapists nationwide, which limits the availability and accessibility of this intervention. The capacity–demand ratio is further compounded by the disparities between the public-private healthcare sectors, with 82.6% of the population relying on an overburdened public healthcare system, while only 17.4% have access to private healthcare [69]. Thus, the imperative of developing updated policies and guidelines for children with hearing loss in South Africa is emphasized. These policies, as well as practices, should align with inclusive frameworks that integrate diverse communication options.

Although this study was conducted in South Africa, its findings offer valuable insights for other LMICs and underserved populations globally. The evidence supporting earlier amplification, structured early intervention, and linguistic considerations can guide policymakers in designing sustainable, contextually appropriate hearing healthcare frameworks. Future research should explore how these findings translate into diverse settings, ensuring equitable access to effective communication interventions worldwide.

6.10 Limitations of the Study

When interpreting the findings of this study, several limitations must be considered. Given that this study adopted a retrospective design, randomization was not feasible. The children were grouped based on the interventions they had already received. Consequently, the assignment to one of the intervention groups was not randomized but rather reflective of the services offered by each school at the time the child's intervention took place. This lack of randomization introduces the potential for selection bias, as factors such as the availability of resources and institutional preferences may have influenced the assignment to one of the intervention groups. To mitigate this bias, the researchers cross-validated the intervention groups with retrospective records, ensuring that children had received the intervention assigned by their school. Furthermore, the two intervention groups were matched for gender and type of amplification device, which helped reduce potential bias. However, some limitations may remain due to the non-random assignment. Despite these limitations, the findings provide valuable context-specific evidence on communication outcomes for children with hearing loss.

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CHAPTER 7: Paper V - COMMUNICATION INTERVENTION IN SOUTH AFRICA: ADVOCATING FOR THE LISTENING AND SPOKEN LANGUAGE APPROACH

(Reprinted with permission: Appendix P)

Adhering to Early Hearing Detection and Intervention (EHDI) guidelines is critical for the timely identification and management of infants with hearing impairment. Early intervention specifically focusses on family-centred communication interventions, of which the Listening and Spoken Language–South Africa (LSL-SA) approach is available for children with hearing impairment in South Africa. Studies have evidenced significant benefits for children with hearing impairment enrolled in LSL-SA compared to those enrolled in Traditional Speech-Language Therapy (TSLT), that is, age-equivalent communication outcomes, shorter duration of therapy until discharge, meritorious academic performance and integration into a hearing society. Despite these positive outcomes related to the LSL-SA approach, significant contextual barriers hinder effective implementation nationwide.

7.1 Contribution

The successful implementation of EHDI guidelines in South Africa hinges on overcoming barriers through tailored healthcare strategies and contextualised delivery. Adapting frameworks such as LSL-SA to fit the local context is crucial for advancing equitable access to EHDI services, positively impacting children with hearing impairment and their families. This article highlights the systemic challenges in South Africa in optimising resources by adopting linguistically appropriate and culturally responsive early intervention approaches to champion hearing healthcare initiatives. Effective collaboration among diverse stakeholders is essential for enhancing the uptake of EHDI guidelines and translating policy into impactful communication interventions. Implementing the core principles of the LSL-SA approach will not only ensure access to this specialised service for suitable candidates but may also alleviate specific barriers to EHDI implementation within TSLT approaches.

7.2 Introduction

In South Africa, a low-middle-income country (LMIC), children with hearing impairment face unique challenges in accessing health services crucial for their development and societal integration (Bush et al., 2017; World Health Organization [WHO], 2016). The Health Professions Council of South Africa's (HPCSA) Professional Board for Speech, Language, and Hearing Professions, in alignment with the Joint Committee on Infant Hearing's (JCIH) 2007 position statement, drafted an Early Hearing Detection and Intervention (EHDI) guideline (HPCSA, 2018). This guideline proposes to identify, diagnose and provide intervention for children with hearing impairment at the earliest stages of infancy, enabling effective communication and promoting their full developmental potential (HPCSA, 2018). According to the HPCSA, South African speech-language therapists (SLTs) and audiologists play a crucial role in achieving developmental goals by offering fair, accessible and equitable early childhood development services that account for contextual realities. They are also responsible for providing specialised rehabilitation services to children with hearing impairment and their families, as outlined in the HPCSA EHDI Guideline (HPCSA, 2018; Khoza-Shangase, 2021b; Pascoe & Singh, 2023; Pillay et al., 2020). The choice of communication intervention approach plays a pivotal role in determining speech-language acquisition and overall educational outcomes of children with hearing impairment (Casoojee et al., 2024; Casoojee & Khoza-Shangase, 2022; Maluleke et al., 2021a). The current landscape of early communication interventions in South Africa for children with hearing impairment and their families employs one of the following two approaches:

1. Traditional Speech-Language Therapy (TSLT) is a more cost-effective intervention approach, given the challenges within South Africa (Casoojee et al., 2021). It encompasses a range of communication methods, from visual-gestural approaches such as sign language, total communication and cued speech to auditory methods involving natural gestures, speechreading and visual cues combined with amplification (Casoojee et al., 2021). Sign language acquisition follows a developmental trajectory analogous to spoken language, provided children with hearing impairment receive consistent input from fluent signers from birth (Lillo-Martin & Henner, 2021). However, the acquisition context varies significantly: while deaf children with deaf signing parents have an optimal linguistic environment for sign language acquisition, more than 90% of deaf children are born to hearing, non-signing families (NIH, 2015). In these cases, a lack of exposure to spoken language because of hearing impairment and insufficient proficiency in sign language among parents result in delayed language acquisition (Hall et al., 2017).
2. Listening and Spoken Language-South Africa (LSL-SA) is a postgraduate diploma offered through the University of Stellenbosch, which serves as an additional licensing course following an undergraduate qualification. It is based on the LSLS Certified Auditory-Verbal Therapist (LSLS Cert. AVT®) qualification by the AG Bell Academy. The LSL-SA emphasises auditory-verbal techniques aimed at maximising a child's ability to listen, understand spoken language and speak (Estabrooks, 2020). Seven of the 10 LSL principles involve parents training their children to integrate listening skills

into communication and social development. Blose and Joseph (2018) found that one or two hours of weekly intervention were insufficient to address early auditory and language deprivation in children with hearing impairment, which highlights the importance of empowering South African parents to become primary facilitators of their child's speech and language development (Casoojee et al., 2024a; Khoza-Shangase, 2022). The LSL principles further advocate for early diagnosis of hearing impairment and prompt audiological management, utilising advanced hearing technology for maximum auditory stimulation benefits. These principles bind LSL interventionists (AG Bell Academy, 2018), leveraging natural developmental listening, language, speech and cognition patterns to promote effective communication. An LSL approach aims to facilitate the educational and social integration of children with hearing impairment into mainstream schools (AG Bell Academy, 2018).

A global body of evidence supports the effectiveness of the LSL approach (Auditory Verbal UK, 2023). Emphasising natural language development and cognitive growth through structured therapy activities, the LSL approach involves parents as partners in fostering listening and language skills during daily routines and play (Chowdhry, 2010). Research demonstrates that children with hearing impairment in LSL programmes attain spoken language commensurate with their normal hearing peers, irrespective of hearing technology, and make similar progress in listening skills, reading, mathematics and self-esteem (Cupples et al., 2017; First Voice, 2023; Fulcher et al., 2012; Hitchins & Hogan, 2018; Mortazavi & Mortazavi, 2017; Noel et al., 2023; Percy-Smith et al., 2017). Research further indicates that children with hearing impairment enrolled in LSL programmes achieve comparable academic progress, societal interaction and social role fulfilment as their normal hearing peers, promoting better social integration within a predominantly hearing society (Constantinescu-Sharpe et al., 2017).

The rationale for advocating the broader adoption and integration of the LSL approach within the South African context is justified by empirical evidence, its adaptability to local challenges and the potential to improve access and equity in services for children with hearing impairment. This article further explores how the LSL approach can be practically applied amid contextual challenges such as access to services, service delivery issues, continuity of care, language and cultural barriers, and socio-economic disparities (Khoza-Shangase, 2021b).

7.3 Overcoming barriers and enhancing LSL-SA implementation for improved outcomes

Effective healthcare must integrate contextual considerations to optimise intervention outcomes, ensure intervention relevance and address sustainability challenges to achieve widespread impact (Coles et al., 2020). Adapting approaches such as LSL-SA to meet the specific needs of children with hearing impairment is crucial. This involves fostering collaboration among early interventionists, SLTs, audiologists, parents, educators and government stakeholders. By integrating contextualised healthcare practices within communication interventions such as the LSL approach, South Africa can significantly enhance the quality of care, support holistic development and promote societal integration for children with hearing impairment (Hlayisi et al., 2024; Khoza-Shangase & Mophosho, 2018). Leveraging effective, collaborative strategies is key to overcoming the challenges presented by the high prevalence of child hearing impairment in South Africa and achieving successful implementation of the LSL-SA approach.

In 2021, South Africa recorded nearly 1 million births (Stats SA, 2021), with an estimated 3 to 6 out of every 1000 babies born with hearing impairment (Khoza-Shangase, 2021a). Congenital hearing impairment is particularly prevalent in the public healthcare sector (Khoza-Shangase, 2021b), which serves 82.6% of the population (Stats SA, 2016).

This sector faces significant strain, exacerbated by a shortage of skilled health professionals, including SLTs and audiologists (Matthews & Van Wyk, 2018). Only 22.0% of SLTs and audiologists are employed in public healthcare, highlighting a critical shortfall of 2800 professionals and the need for a 300.0% growth rate by 2030 to meet healthcare demands (Pillay et al., 2020). In addition, South Africa grapples with the limited availability of LSL-SA interventionists, with only

51 LSL-SA therapists and six qualified LSLS Cert.AVT® therapists nationwide, predominantly concentrated in the private healthcare sector located in urban areas (Casoojee et al., 2024b; South African Cochlear Implant Group, 2022). This disparity underscores challenges in public–private healthcare sectors and urban–rural service provision in meeting the needs of children with hearing impairment. Addressing these disparities necessitates a concerted effort to

(1) increase the number of trained LSL-SA and LSLS Cert. AVT® qualified therapists across South Africa, (2) acquire funding to support the development and delivery of LSL-SA programmes and investment in research, (3) coordinated management, (4) community and stakeholder engagement, (5) infrastructure development (access to facilities and technology integration), and (6) evaluation and feedback mechanisms.

The HPCSA EHDI Guidelines (2018) emphasise the roles of SLTs and audiologists in promptly selecting, fitting and monitoring amplification devices. The guidelines recommend that SLTs and audiologists with expertise in cochlear implants participate in assessing candidacy for such devices (HPCSA, 2018). The LSL-SA approach rests heavily on a child's access to the acoustic features of speech provided by hearing aids and cochlear implantation (Casoojee et al., 2021; Dettman et al., 2016). Addressing the accessibility and cost issues associated with these devices (Casoojee et al., 2021; Khoza-Shangase, 2021b) is crucial to making LSL-SA a viable option within the South African public healthcare sector. Solutions could include increasing the availability of hearing aids and cochlear implants through public healthcare programmes, subsidising costs to make them more affordable and advocating government funding and support. By improving access to these amplification devices, South Africa can enhance the implementation of the LSL-SA approach, ensuring children with hearing impairment benefit from its proven effectiveness.

Children with disabilities in South Africa face significant barriers to healthcare and education because of limited access to appropriate interventions, which diminishes their potential for success (Kuper & Hancock, 2020). Despite efforts by the South African Department of Basic Education to create an inclusive education system, progress remains slow (Khumalo & Hodgson, 2017). Research by Casoojee et al. (2024) shows that children with hearing impairment enrolled in LSL-SA achieve age-equivalent language outcomes and are more likely to qualify for mainstream schooling compared to those in TSLT. The study, which matched learners by age and classification of hearing impairment, excluded those with unilateral profound hearing impairment or bilateral profound hearing impairment with significant comorbidities, highlights that 64% of the TSLT cohort and 77% of the LSL-SA cohort wore cochlear implants, while 36% of the TSLT cohort and 23% of the LSL-SA cohort used hearing aids. These findings underscore the need to address accessibility to LSL-SA and cost issues related to hearing devices to enhance the viability of LSL-SA. Supporting LSL-SA aligns with the National Development Plan 2030's goals for early intervention, inclusive education, and continuity of care (Casoojee et al., 2024b).

Children with hearing impairment enrolled in LSL-SA were enrolled in therapy for a shorter duration until discharge than those enrolled in TSLT. This is a significant finding, particularly in LMICs, offering a possible reduction in the global burden of disease caused by hearing impairment in this context (Casoojee et al., 2024). In a country with limited resources, constrained socio-economic support by the state, as well as capacity versus demand of SLTs and audiologists and workforce challenges (Khoza-Shangase, 2022; Khoza- Shangase et al., 2021; Pillay et al., 2020), these positive outcomes of LSL-SA are financially, and quality of life justified to be pursued. Research attests that implementing an LSL-SA intervention approach is key to improving communication outcomes for children with hearing impairment (Casoojee et al., 2024. By reducing therapy duration and improving communication outcomes, LSL-SA addresses both cost and quality-of-life concerns effectively. Leveraging the benefits of LSL-SA, includes (1) advocating for increased funding and support for LSL-SA programmes,

(2) expanding training opportunities for SLTs and audiologists, and (3) ensuring that LSL-SA is integrated into public healthcare policies. By focusing on these areas, South Africa can enhance the implementation of LSL-SA, making it a viable and impactful solution for improving the lives of children with hearing impairment.

Despite the above-stated positive findings associated with the LSL-SA approach, a study by Casoojee et al. (2024a) reveals that its effectiveness is compromised by a lack of culturally sensitive and linguistically appropriate resources. This is particularly important in South Africa, where linguistic and cultural diversity is critical to effective clinical service provision (HPCSA, 2019; Khoza-Shangase & Mophosho, 2021; Maluleke & Khoza-Shangase, 2022; Mophosho et al., 2022). Therefore, LSL-SA interventionists must prioritise the development and implementation of resources that are both culturally and linguistically responsive to meet the needs of diverse communities (Taylor, 2016). In the South African context, providing LSL- SA intervention in a language disparate from the home language of children with hearing impairment and their families does not respond to their needs, resulting in poorer communication outcomes (Al Shamsi et al., 2020; Khoza- Shangase & Kalenga, 2023).

A significant barrier to effective communication arises when healthcare providers, especially SLTs and audiologists, do not share a first language with the population they serve (Khoza-Shangase & Kanji, 2021; Khoza-Shangase & Mophosho, 2018; Pillay & Kathard, 2015). In South Africa's multilingual context, isiZulu is the most spoken language, followed by isiXhosa, Afrikaans and English (Dauncey, 2023). Only 5% of SLTs and audiologists in South Africa speak an African language as their mother tongue, highlighting workforce demographic incongruities (Khoza-Shangase & Mophosho, 2018). English is the Lingua Franca in South Africa, posing challenges in meeting diverse family needs, particularly in implementing the LSL-SA approach. Furthermore, the population group of SLTs and audiologists in South Africa are classified as white (59.7%), followed by Indian (15.4%), black (15.2%), mixed race (4.7%) and an unidentified population group of these professionals of 4.7% (Pillay et al., 2020). Conversely, risk profile studies of childhood hearing impairment in South Africa indicate that the most prevalent languages and cultures are first-language speakers of an African language as opposed to English and Afrikaans (35%) (Ehlert & Coetzer, 2020; Kuschke et al., 2020; Louw et al., 2018; Swanepoel et al., 2013). To address these disparities and enhance the effectiveness of the LSL-SA approach, several culturally sensitive modifications are required, including (1) the development of multilingual resources to bridge the communication gap and ensure interventions are accessible and relevant to diverse families, (2) cultural sensitivity training of SLTs and audiologists to effectively connect with the families of children with hearing impairment, (3) involving parents as partners to ensure the intervention is more readily accepted and implemented, (4) training of LSL-SA interventionists from diverse linguistic backgrounds (Casoojee et al. 2024a). By integrating these modifications, the LSL-SA approach can become more effective and inclusive, mitigating these challenges significantly (Casoojee et al., 2024b; Maluleke et al., 2021b; Maluleke, 2024; Matthews & Van Wyk, 2018).

To improve access to the LSL-SA communication intervention approach in South Africa, it is imperative that SLTs and audiologists address the diverse needs of children with hearing impairment and their families, employing pragmatic, linguistically appropriate, and culturally sensitive resources and skills. Implementing LSL-SA resources that are both linguistically and culturally congruent can foster strong partnerships with parents and caregivers, significantly improving therapy outcomes (Casoojee et al., 2024a; Khoza-Shangase, 2019; Maluleke, 2024; Maluleke et al., 2023). The Patients' Rights Charter in South Africa advocates the importance of equitable healthcare access and effective communication between providers and patients to achieve optimal health outcomes (HPCSA, 2016; Jardien-Baboo et al., 2019; Khan et al., 2023). By integrating these approaches, the LSL-SA method can be more responsive to the South African context, ultimately enhancing the quality of care for children with hearing impairment.

7.4 Conclusion

This article advocates for access to the LSL-SA intervention approach, underscoring its significant benefits for children with hearing impairment who meet the candidacy criteria. By leveraging the contextual research evidence (Casoojee et al. 2024a, 2024b; Casoojee et al., 2024; Taylor, 2016), it emphasises the urgent need for equitable and effective interventions in South Africa. The LSL-SA approach is particularly compelling, as it addresses the unique needs of children with hearing impairment and their families achieving age-appropriate communication outcomes, academic achievements and societal inclusion (Mirzoev & Kane, 2017; Weiner, 2021). Notably, children with hearing impairment enrolled in LSL-SA were recommended for mainstream schooling based on their communication outcomes after early intervention, suggesting a positive step towards an inclusive society and potentially reducing the cost of hearing impairment within a resource-constrained LMIC milieu (Casoojee et al., 2024).

Despite the challenges posed by limited resources and workforce constraints, the potential benefits of LSL-SA transcend these obstacles. This article calls for the engagement of various stakeholders – academic institutions, healthcare providers, SLTs, audiologists, government officials and professional bodies – to champion policies supporting LSL-SA implementation. Key actions include securing funding, reframing training programmes, capacity building among SLTs, audiologists and educators, and launching public awareness campaigns to ensure the widespread adoption of LSL-SA and its benefits for suitable candidates among children with hearing impairment and their families in South Africa.

Adapting LSL-SA to fit the South African context is crucial to establishing contextually relevant care that meets the unique needs of children with hearing impairment and their families. By upholding patient rights to timely and effective communication intervention (WHO, 2024), South Africa has the opportunity to set a precedent for inclusive and responsive healthcare practices in LMICs. This proactive stance not only addresses immediate needs but also paves the way for a more equitable, empowered and inclusive society.

7.5 References

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CHAPTER 8

SYNTHESIS OF FINDINGS

8.1 Introduction

This chapter synthesises the findings from Chapters 3 to 7, consolidating the insights from the individual studies presented. A key focus of this synthesis is to demonstrate the comparative impact of Listening and Spoken Language-South Africa (LSL-SA) and Traditional Speech-Language Therapy (TSLT) on both speech-language acquisition and scholastic outcomes for children with hearing impairment. The chapter provides a contextualised analysis of early intervention (EI) in South Africa, discussing not only the clinical and theoretical implications but also the real-world challenges in translating policy into practice. Additionally, it evaluates the role of family involvement, resource availability, and language accessibility, which have emerged as critical determinants in optimising intervention effectiveness in diverse settings. It aims to connect these contributions to the broader body of knowledge in audiology, with a particular focus on EI and communication therapy within the South African context. The chapter discusses the implications of the findings for theory, clinical practice, policy development, and future research, providing a comprehensive overview that guides the interpretation of the results. Additionally, it highlights key areas for further exploration to advance the field of contextually relevant communication interventions for children with hearing impairment.

8.2 Aim of the Study

The speech-language acquisition and scholastic outcomes of children with hearing impairment following EI in South Africa remain an underexplored area, compounded by varying therapeutic communication approaches in practice. This study sought to bridge critical gaps in research by providing a comparative evaluation of LSL-SA and TSLT; two intervention approaches widely used in South Africa. By systematically analysing both linguistic and academic trajectories, this study contributes to a nuanced understanding of how EI strategies shape long-term developmental outcomes. The findings not only offer empirical evidence for policymakers and practitioners but also advocate for context-sensitive models that align with South Africa's multilingual and resource-constrained environment.

EI is critical for supporting children with hearing impairment; however, the effectiveness of different intervention approaches, such as LSL-SA and TSLT, is not well-documented, especially in South Africa. While previous studies have demonstrated positive outcomes for speech-language development in children with hearing impairment, the comparative effectiveness of these specific intervention approaches in the South African context is yet to be comprehensively examined. The lack of controlled studies and research specific to South Africa's socio-cultural environment calls for a deeper investigation into how these interventions function in multilingual and multicultural settings. Therefore, the current study aimed to investigate and compare the speech-language acquisition and scholastic outcomes of children with hearing impairment who received EI in South Africa.

The primary focus was to evaluate the effectiveness of different therapeutic communication approaches used in special schools for children with hearing impairment, specifically the LSL-SA and TSLT approaches. To study reviewed the literature and set out several specific objectives to describe the therapeutic communication approaches to EI implemented at special schools in South Africa, to determine the speech-language acquisition and scholastic outcomes for children receiving LSL-SA, and to determine similar outcomes for those receiving TSLT. Furthermore, the outcomes of children receiving LSL-SA with those receiving TSLT were compared. Finally, the strengths and barriers of these communication approaches, particularly in relation to the needs and goals of the families of children with hearing impairment, were identified.

8.3 Main Findings

In all the studies incorporated into this thesis, the research methodologies were designed to address various dimensions of communication intervention and the challenges specific to South African healthcare contexts. A systematic review, exploratory research design, and comparative analyses facilitated a comprehensive examination of early communication intervention approaches and their outcomes in special educational settings. The comparative analysis across studies revealed that children receiving LSL-SA intervention demonstrated statistically significant improvements in speech intelligibility, expressive and receptive vocabulary, and academic placement outcomes compared to those who received TSLT. Key findings include:

- Children in the LSL-SA group achieved age-appropriate speech and language skills more frequently than those in the TSLT group.
- LSL-SA was associated with shorter therapy durations and higher rates of mainstream school placement, suggesting an advantage in both intervention efficiency and long-term scholastic success.
- Parental involvement played a crucial role in optimising outcomes, particularly in the LSL-SA model, where family-centred strategies enabled better speech development and confidence in therapy continuation at home.

- Despite its benefits, LSL-SA faced challenges related to resource constraints, the availability of trained therapists, and linguistic barriers, limiting its widespread implementation.
- TSLT, while providing a more accessible approach in some settings, showed slower gains in speech-language acquisition and academic readiness, emphasising the need for individualised therapy planning

Below is a detailed account of these key findings.

Systematic Review

The systematic review examined current trends and evidence on therapeutic communication interventions for congenital or early-onset childhood hearing impairment, focusing on their impact on speech, language, and academic development. AVT and LSL-SA were among the approaches analysed, highlighting their varying effects across different outcomes.

The systematic review, conducted in 2021, synthesised 12 studies that met the inclusion criteria, focusing on speech, language, and scholastic outcomes of children with hearing impairment related to communication intervention approaches. The review confirmed that AVT is internationally recognised as the preferred communication approach for children with hearing impairment, with all studies reporting positive language outcomes from its use as an EI strategy. Successful outcomes in AVT are linked to early identification of hearing impairment, the use of advanced hearing devices, early and intensive rehabilitation, and active family involvement.

However, despite the widespread adoption of AVT, the review revealed a critical gap: the lack of randomised or quasi-randomized controlled trials. Additionally, the reviewed studies predominantly focused on HICs, limiting the applicability of these findings to South

Africa’s diverse context. This review highlighted a significant need for controlled studies to evaluate the effectiveness of AVT for children with hearing impairment in South Africa's unique socio-cultural environment. Furthermore, the review suggested that further research is essential to compare the adapted AVT approach (LSL-SA) with other widely used habilitation methods, such as TSLT, in South Africa. A critical observation from the review is the limited body of evidence specific to the South African context, highlighting the absence of controlled studies on therapeutic communication interventions. This gap has significant implications for children with hearing impairment, as it affects all domains of their development, including future vocational, social, and life outcomes. It underscores the urgent need for comparative studies to evaluate the effectiveness of these strategies in diverse settings.

Comparative Analysis of early communication intervention approaches in children with hearing impairment in a South African context

Building on existing literature that emphasises the importance of EI for children with hearing impairment, this study aimed to compare the effectiveness of two therapeutic approaches—LSL-SA and TSLT. The study reviewed records from 126 children with profound congenital or early-onset hearing loss attending EI schools across four South African provinces, serving diverse linguistic and socioeconomic populations. The study timeframe spanned records collected over five years. The research highlighted how the type, timing, and duration of EI contribute to the development of communication skills in children with hearing impairment. Using a retrospective record review, children were grouped based on the intervention received at their schools, with assignment determined by available services rather than randomisation. While the study provides valuable context-specific insights, the retrospective design introduced potential selection bias, as children were not randomly assigned to intervention groups. To mitigate this, the groups were cross-validated with retrospective records and matched for gender and amplification device type.

The study assessed various communication domains, including speech intelligibility, expressive vocabulary, receptive and expressive language, audition, and cognitive-linguistic skills, prior to the onset and upon discharge from therapy. The findings indicate statistically significant improvements in communication outcomes for children enrolled in LSL-SA, with a higher proportion achieving age-appropriate speech and language skills compared to those in the TSLT group. Specifically, children in the LSL-SA group showed improvements in achieving age-appropriate communication skills, with the proportion of children reaching these milestones in speech intelligibility, expressive vocabulary, receptive language, audition, and cognitive-linguistic skills ranging from 56% to 73%. In contrast, the TSLT group showed a range of 39% to 48%. Furthermore, the study found that children receiving the LSL-SA intervention attended therapy for a shorter duration, a positive outcome for resource-constrained healthcare systems. This suggests that LSL-SA was more effective in promoting faster and more substantial progress in communication development, especially when intervention was initiated earlier. This finding corroborates with research that effective interventions can lead to substantial health gains and reduce the burden of disease in LMICs.

Logistic regression models were used to assess associations between intervention type (LSL-SA vs. TSLT) and communication outcomes (age-appropriate vs. delayed), controlling for variables such as age at amplification, device type, and duration of EI. After correcting for multiple comparisons (significance levels were set at $p < 0.021$), the findings revealed several significant associations: later age at the start of EI, later fitting of hearing aids or cochlear implants, and a mismatch between the language of therapy and the home language were linked to higher odds of delay across all communication domains. In contrast, earlier amplification, an earlier start to EI, and longer durations of EI were associated with decreased odds of delay, particularly in speech, audition, and cognitive-linguistics. Additionally, the use of bilateral cochlear implants was linked to improved outcomes in speech and audition, while longer durations of amplification and EI were associated with reduced delays in expressive language and cognitive-linguistics. These findings underscore the importance of timely intervention and appropriate amplification in achieving better communication outcomes for children with hearing loss.

The study further examined the association between these communication outcomes and the type of school recommended post-EI. The results demonstrated that children in the LSL-SA were more likely to be recommended for mainstream schooling, indicating that early spoken language interventions not only improved language skills but also had a positive impact on educational placement. This outcome emphasises the importance of targeted EI programmes in shaping future educational opportunities for children with hearing loss.

Corroborating with Percy-Smith et al (2017) who compared the language outcomes of children enrolled in different intervention programmes, this study suggests the potential benefits of LSL-SA in promoting age-appropriate communication skills and more inclusive educational placements for children with hearing impairment, which can inform educational and clinical practices in South Africa and similar LMICs.

Comparative Analysis of scholastic outcomes in children with hearing impairment

This study, in the thesis, shifted the focus to educational outcomes and how hearing impairment impacts foundational learning, specifically within the context of South African EI programmes. This study primarily explored the educational trajectory of children with hearing impairment, examining the role of communication intervention strategies in optimising their academic achievement in the foundation phase. This chapter presents an investigation into the foundation phase learning outcomes of children with severe to profound hearing impairment who received LSL-SA versus TSLT. This comparison between the two intervention approaches—LSL-SA and TSLT—provides critical insights into how different therapeutic communication approaches influence children's scholastic success in South Africa.

The study's objectives were multifaceted, aiming to explore not only the associations between various demographic and intervention-related factors (such as age at diagnosis, age at initiation of intervention, and type of amplification device) but also to assess the learning outcomes of foundation phase learners (Grade 3). By examining these outcomes through a retrospective analysis of therapy records and academic reports, this study investigates how EI approaches contribute to learners' performance in key subject areas such as Home Language, First Additional Language, Life Skills, and Mathematics. The results indicate that children receiving LSL-SA achieved superior learning outcomes compared to those receiving TSLT, with more learners progressing to mainstream schooling in a shorter duration. Moreover, the study sought to evaluate whether communication functioning, both prior to and upon discharge from therapy, plays a significant role in the academic success of these learners.

A quantitative, cross-sectional research methodology was employed to capture and analyse data, with a sample of 64 therapy records and academic reports of learners across four provinces in South Africa. The use of purposive sampling and a retrospective data collection tool allowed for a comprehensive review of various factors impacting the children's academic performance. The study was particularly attentive to the diversity of the South African context, including differences in home language and the socio-economic factors that influence access to services. The statistical analyses revealed key differences in the academic outcomes of the children in the LSL-SA and TSLT groups, with children in the LSL-SA group achieving significantly higher academic performance across multiple subjects. This result aligns with the broader research on the efficacy of early language interventions but adds a South African perspective to the discourse.

One of the most notable findings of this study was the association between communication functioning at discharge of therapy and academic achievement. Children with age-appropriate language skills—specifically receptive and expressive language—demonstrated higher marks across the board, suggesting that language acquisition plays a crucial role in academic success. This highlights the importance of EI in improving not just communication skills but also foundational learning outcomes, which, in turn, could influence long-term educational and social integration outcomes. In line with Ekstrom et al. (2023), the study underscores the critical role communication plays in academic performance and the broader social and emotional aspects of a child's development. However, the study also emphasises the need for further research into how these EI outcomes impact children's transitions to mainstream schooling and their continued academic success beyond the foundation phase.

Strengths and Barriers of Communication Intervention Approaches Based on the Needs and Goals of Families of Children with Hearing Impairment

Given the principles of family-centred care, which emphasise the importance of involving families in the intervention process to enhance outcomes for children, this part of the study aimed to explore the critical role of parental involvement in EI, with a focus on the knowledge, participation, and perceptions regarding the therapeutic communication interventions for children with hearing impairment. The chapter examines the ways in which parents are engaged in the therapeutic process, their understanding of the interventions, and the challenges they face in applying communication strategies at home. This focus on parental involvement aligns with research by Erbasi et al. (2018), who strongly encourage the active participation of parents in interventions for children, highlighting its critical role in improving therapeutic outcomes. The study specifically sought to address key aspects related to parental involvement in therapy, including their confidence in applying therapeutic techniques at home, their perceptions of the two communication modalities (LSL-SA and TSLT), and the barriers they faced in supporting their child's therapy. It also highlights the lack of sufficient informational counselling provided to parents, which is crucial for effective family-centred intervention. Furthermore, the study aimed to explore whether the materials and techniques were culturally and linguistically appropriate for the families that facilitated or hindered the success of therapy. In line with the findings from Erbasi et al. (2018), this study highlights a gap in understanding how parental involvement is operationalised in therapeutic interventions, as existing literature provides limited descriptions of actual parental participation. The findings suggest that while parents express a preference for the LSL-SA approach, challenges persist in its implementation, particularly regarding the cultural and linguistic suitability of the therapy materials and methods.

The study's design integrated both quantitative and qualitative approaches. Data were gathered through a self-administered parental survey and a retrospective review of therapy records. This comprehensive methodology enabled triangulation, enhancing the findings' depth and credibility. The survey explored various aspects of parental involvement, while the retrospective review provided valuable context by linking the survey responses to actual therapy outcomes. The sample consisted of 23 parents whose children were enrolled in special schools for the deaf, with a balanced representation from different regions of South Africa. This diverse sample allowed for an in-depth understanding of the parental experience across varied linguistic and socio-economic contexts.

One of the study's most significant findings was that parental involvement and confidence in applying therapy techniques at home were higher in the LSL-SA group. The coaching model used in LSL-SA, which actively involves parents in the therapy process, seemed to contribute positively to both the communication skills and academic outcomes of the children. In contrast, parents whose children were in the TSLT group expressed a preference for a different approach, often indicating that they would have preferred a listening and spoken language approach. This disparity points to the importance of the therapeutic approach's alignment with both the parents' expectations and the child's needs. Moreover, parental involvement, particularly in LSL-SA, was linked to increased satisfaction with communication outcomes, highlighting the importance of family-centred therapy models.

Parents also expressed a range of perceptions regarding the cultural and linguistic appropriateness of the therapy materials and techniques used in their children's treatment. While most parents found the therapy materials linguistically appropriate, less than 30% perceived them as culturally appropriate, indicating a need for more inclusive resources. The study's thematic analysis revealed that several factors facilitated successful therapy, including the use of spoken language for broader social integration, the development of a supportive family environment, and the empowerment of parents to apply therapeutic techniques at home. However, barriers to success included the constraints of English as the primary language of therapy and challenges in implementing some of the techniques used in TSLT. These findings suggest that there is a need for more tailored approaches to therapy that are sensitive to the linguistic and cultural diversity of families, ensuring that all children receive effective and inclusive interventions.

This study provides valuable insights into the complexities of parental involvement in communication therapy for children with hearing impairment in South Africa. It emphasises the role of culturally and linguistically appropriate therapy materials and the importance of a collaborative, family-centred therapeutic approach. The findings advocate for a more inclusive and supportive approach to parental involvement, which could help overcome implementation challenges and improve the outcomes of communication therapy for children with hearing impairment in South Africa. The study contributes to the broader discourse on improving communication and scholastic outcomes for children with hearing impairment by strengthening parental involvement and ensuring that therapies are effective and culturally sensitive.

Enhancing access to LSL-SA for children with hearing impairment

In addition to the role of family-centred approaches, the study highlights the significant benefits of the LSL-SA intervention approach, which directly addresses the unique needs of children with hearing impairment and their families. As the research indicates, LSL-SA promotes age-appropriate communication outcomes, academic success, and societal inclusion, supporting children's integration into mainstream schooling. This emphasises the importance of providing access to LSL-SA for those who meet the candidacy criteria, particularly in a resource-constrained context like South Africa. This study also explored the implementation of EHDI in South Africa, discussing the barriers to service delivery, such as policy gaps and resource constraints. The findings suggest that LSL-SA offers a promising solution to overcome the challenges posed by limited resources and workforce shortages, advocating for greater collaboration among academic institutions, healthcare providers, SLTs, audiologists, and government officials. This collective effort is essential to advocate for policies that support the implementation of LSL-SA**,** secure funding, and address the critical need for training, capacity building, and public awareness campaigns.

Furthermore, adapting LSL-SA to the South African context is crucial to providing contextually relevant care, ensuring that the therapy meets the unique needs of children with hearing impairment and their families. Addressing these contextual needs also requires a strategic approach to healthcare delivery, with tailored strategies that optimise access to LSL-SA and improve outcomes for children with hearing impairment. By prioritising patient rights to timely and effective communication interventions, as outlined by the World Health Organization (2024), South Africa has the opportunity to set a precedent for inclusive and responsive healthcare practices in LMICs. This proactive approach not only meets the immediate healthcare needs but also lays the foundation for a more inclusive and equitable healthcare system, ultimately benefiting all children with hearing impairment and promoting sustained improvements in their communication abilities and societal integration.

8.4 Theoretical and Practical contribution of the study

This PhD study provides significant theoretical contributions to the field of audiology, particularly in the context of EI for children with hearing impairment in South Africa. The study is one of the first to compare the LSL-SA and TSLT intervention approaches in the South African context, making it a pioneering investigation in this area. By drawing on Fitzpatrick's International Hearing Framework (Fitzpatrick, 2010) and Vygotsky's Zone of Proximal Development (ZPD) (Vygotsky, 1978), this research expands the understanding of how contextually relevant, family-centred communication interventions can influence the speech, language, and scholastic outcomes for children with hearing impairment.

From a theoretical standpoint, the study contributes to the body of knowledge by applying Fitzpatrick's IHF to a low-resource, multicultural context, offering new insights into the importance of early identification, family involvement, and timely intervention. While the IHF has been widely applied in various settings, the current study provides novel evidence on how these elements work together to improve outcomes for children in South Africa's diverse socio-cultural and linguistic environment. The research supports the IHF’s emphasis on contextually appropriate intervention strategies, demonstrating that the LSL-SA approach, with its focus on spoken language and active family participation, aligns with the framework’s key principles, particularly in LMICs.

The study also extends Vygotsky’s ZPD by illustrating how EI models can effectively scaffold the development of children with hearing impairment. It underscores the importance of family involvement and individualised support within the child’s ZPD to accelerate communication development. The findings demonstrate that LSL-SA, with its structured family engagement, provided children with the necessary support to achieve age-appropriate language skills more quickly than children in the TSLT group. This highlights the value of scaffolding in early communication interventions, particularly when working with children who face significant developmental challenges due to hearing impairment.

On a practical level, this study makes important contributions to clinical practice and policy development in South Africa and similar LMICs. The comparison of LSL-SA and TSLT revealed that LSL-SA was more effective in promoting speech intelligibility, expressive vocabulary, and cognitive-linguistic skills and that these improvements occurred more quickly than with TSLT. This finding has direct implications for the clinical management of children with hearing impairment in resource-constrained environments, where the efficiency and timeliness of intervention are paramount. LSL-SA, with its focus on spoken language and shorter intervention durations, could offer a more resource-efficient alternative to other therapeutic approaches.

In addition, the study highlighted the scholastic outcomes associated with early language intervention. Children who received LSL-SA were more likely to be recommended for mainstream schooling, suggesting that early spoken language interventions can significantly improve educational placement opportunities for children with hearing impairment. These findings advocate for the integration of EI approaches like LSL-SA into educational policies, particularly to ensure that children with hearing impairment have access to the best possible educational opportunities, as early language skills are strongly correlated with future academic success.

Furthermore, the study emphasises the importance of parental involvement in EI. The LSL-SA approach's emphasis on family-centred care and parental coaching led to higher levels of parental satisfaction and confidence in applying therapeutic techniques at home. This is a critical practical contribution, as it reinforces the need for interventions that actively engage parents as partners in their child's development. Parental involvement, especially in the LSL-SA approach, was linked to improved language and academic outcomes, highlighting the collaborative nature of effective communication interventions. The study also emphasised the importance of providing culturally and linguistically appropriate therapy materials to ensure that all children, regardless of their cultural background, benefit from the intervention.

This research also advocates for the adoption of context-sensitive therapeutic models that address the diverse needs of families in South Africa's multilingual context. The study found that while many parents felt that therapy materials were linguistically appropriate, there were concerns about their cultural relevance. These findings point to the need for more inclusive and culturally sensitive resources to better serve the diverse populations in South Africa. Tailoring therapeutic approaches to align with both linguistic and cultural needs can greatly enhance the efficacy of intervention programmes, ensuring that therapy not only improves communication skills but also respects and incorporates the cultural values and practices of the families involved.

In conclusion, this study makes both theoretical and practical contributions to the field of EI for children with hearing impairment. The application of Fitzpatrick's IHF and Vygotsky's ZPD frameworks provides a deeper understanding of how early, family-centred interventions can support the communication and scholastic outcomes of children with hearing impairment. The data highlights that LSL-SA, when fully implemented, aligns with IHF principles by emphasising early detection, parental coaching, and access to advanced hearing technology. However, the unequal distribution of resources and linguistic mismatches in therapy delivery raise concerns about equitable access. This suggests that policy efforts should focus on integrating multilingual therapy resources and scaling up training programmes for LSL-SA therapists to ensure broader adoption in both urban and rural settings. From a practical perspective, the study offers valuable insights into the effectiveness of LSL-SA in the South African context, particularly in resource-constrained settings. These findings have implications for clinical practice, policy development, and future research, particularly in LMICs where EI and family involvement are critical to the long-term success of children with hearing impairment.

8.5 Limitations of the study

While this study offers valuable contributions to the body of knowledge and highlights important implications for training, practice, resource distribution, and policy formation regarding communication intervention approaches for children with hearing impairment in South Africa, several limitations should be considered when interpreting the findings. These limitations are discussed in each study from Chapter 3 to Chapter 7, with this section focusing on the main limitations of the study.

Firstly, the communication outcomes study utilised a retrospective design, which introduced potential biases due to the non-random assignment of children to different intervention groups. The groups were formed based on the interventions children had already received, reflecting the services available at the time. Although efforts were made to cross-validate the groups and match them based on gender and type of amplification device, the lack of randomisation remains a limitation. Despite these limitations, the study provides valuable context-specific insights into communication outcomes for children with hearing loss in South Africa.

Secondly, the learner outcomes study stresses the need for further investigation, as the results provide initial evidence of the potential benefits of LSL-SA in improving linguistic competence and literacy development for children with hearing impairment. However, the study's findings highlight the importance of continued research to explore the long-term impacts of LSL-SA on communication and academic outcomes.

Lastly, several limitations were identified in the parental perspectives study, the most notable being the small sample size, which limits the generalizability of the findings. This sample may not fully represent the diverse caregiver population of children with hearing impairment in South Africa. Additionally, the retrospective design, with data collected from as far back as 2008, introduces the potential for recall bias, as caregivers may have struggled to remember their involvement in therapy over extended periods accurately. Although the data were cross-validated with retrospective records where possible, the risk of recall bias remains. The reliance on self-reported data also presents a limitation, as it is subject to social desirability bias, where caregivers may overstate their involvement or portray their experiences in a more favourable light. The absence of perspectives from professionals or other family members also limits the comprehensiveness of the findings, which would have benefited from a more holistic understanding of the family-centred intervention process.

Overall, an additional limitation of this study is the potential linguistic and cultural bias inherent in the intervention models evaluated. The LSL-SA approach relies heavily on spoken English as the primary language of therapy, which may not align with the linguistic backgrounds of many South African children. Given that the majority of speech-language therapy resources are developed in English or Afrikaans, children from non-English-speaking households may face language mismatches that impact intervention effectiveness. Future studies should explore how multilingual therapy approaches can be incorporated into existing models to ensure equitable access for linguistically diverse populations.

While this study provides strong comparative evidence on the effectiveness of LSL-SA, further research is needed to examine its long-term impact beyond early schooling. Future studies should track academic and social outcomes into adolescence and adulthood, offering a more complete picture of intervention efficacy in real-world settings. Assessment of the long-term academic, social, and vocational progress of children with hearing impairment beyond early schooling is crucial since current findings are limited to short- to medium-term scholastic achievements, and it remains unclear how speech-language acquisition influences later educational attainment and workforce integration. Future studies should incorporate longitudinal follow-ups to track participants over a more extended period, offering a more holistic perspective on intervention efficacy.

This study specifically compared the LSL-SA and TSLT approaches, excluding alternative communication strategies such as South African Sign Language (SASL) or bilingual-bicultural approaches that may be preferred by certain families. The exclusion of sign-based communication methods means that the findings are not generalisable to children who might benefit from a multimodal or bilingual approach. Future research should expand comparative analyses to include additional communication modalities, particularly SASL-based interventions, to provide a more inclusive representation of intervention outcomes.

Another limitation is the potential variability in therapist training, experience, and adherence to intervention protocols. The effectiveness of LSL-SA and TSLT may be influenced by individual therapist skills, access to professional development, and institutional support. Given the shortage of trained therapists in South Africa, disparities in intervention quality could have affected outcomes. It is likely that different clinicians provided the two intervention types, and no control was applied to standardise or match therapist delivery across groups. This variability in therapist-related factors introduces a potential confounding variable, where differences in outcomes may be influenced not only by the intervention model but also by the provider. Furthermore, as this study employed a retrospective design, the researcher did not assess any participants directly but relied on previously recorded clinical data. While all sites used standardised assessment tools, variability may still exist in the completeness, detail, or structure of clinical records, which could have influenced data extraction and interpretation. Although efforts were made to mitigate these limitations through data cross-validation and matching of participant characteristics, these methodological constraints should be considered when interpreting the findings. Future research should consider standardising therapist training and controlling for provider-related variables to ensure that differences in outcomes are attributed solely to the intervention itself.

The study was conducted in select schools and clinical settings, where access to hearing technology, professional expertise, and parental support services varied. Children from low-resource environments may experience delayed access to hearing aids, cochlear implants, or specialised therapy, impacting intervention outcomes. Future research should assess how systemic inequities in healthcare and education influence EI success and propose strategies for scaling interventions in under-resourced settings.

While the studies contribute to understanding the therapeutic approaches and outcomes for children with hearing impairment in South Africa, future research should address these limitations by employing more rigorous research designs, larger and more diverse samples, and a more comprehensive approach that includes multiple perspectives. Future research should focus on:

- Expanding longitudinal studies to track children beyond early schooling and assess long-term academic and social integration.
- Conducting randomised controlled trials to establish causality in intervention effectiveness, particularly in multilingual environments.
- Exploring hybrid models that combine elements of LSL-SA and TSLT, ensuring that children with diverse linguistic and cultural backgrounds benefit from personalised approaches.
- Investigating alternative intervention strategies that integrate sign language and auditory-based approaches to accommodate children with varied needs.

8.6 Conclusion

This thesis compared the effectiveness of two communication intervention approaches (LSL-SA and TSLT) for children with hearing impairment in South Africa, focusing on communication and scholastic outcomes. As the first study to compare LSL-SA to TSLT in South Africa, the findings reveal the following:

➢ Family-centred approaches, when integrated with culturally relevant and linguistically appropriate therapy, are crucial for fostering positive communication outcomes for children with hearing impairment, ensuring equitable access to resources while respecting cultural beliefs.

➢ The LSL-SA intervention demonstrates substantial potential in enhancing communication outcomes, academic achievement, and societal inclusion for children who meet the candidacy criteria. It is a key strategy to address the unique needs of children with hearing impairment in South Africa.

➢ Access to LSL-SA in a resource-constrained environment is vital to ensure children with hearing impairment benefit from effective interventions. EI through LSL-SA has the potential to contribute to inclusive mainstream schooling while also reducing the long-term societal costs associated with hearing impairment in low-resource settings.

➢ Despite challenges posed by limited resources, the potential benefits of LSL-SA can be maximised through collaboration among stakeholders, including healthcare providers, educators, audiologists, and government bodies. Key actions should include securing funding, revising training programmes, and launching public awareness campaigns to support the widespread adoption of LSL-SA.

➢ Adapting LSL-SA to South Africa's context is critical for ensuring relevant and effective interventions. Upholding patient rights to timely and effective communication interventions offers an opportunity for South Africa to set a precedent for inclusive healthcare practices in LMICs.

➢ The right to inclusive education and equal access to essential services is fundamental for children with hearing impairment. By addressing barriers such as the lack of integrated audiological care within South Africa's public healthcare system, the country can foster a more equitable, inclusive society.

By demonstrating the comparative benefits of LSL-SA, particularly in accelerating speech-language development and mainstream school placement, this study highlights the urgent need for policy reform in EI services. The findings advocate for:

- Scaling up LSL-SA training programmes to increase therapist availability, particularly in public healthcare and school-based settings.
- Developing culturally and linguistically responsive therapy materials to improve intervention accessibility for diverse South African populations.
- Strengthening EHDI implementation to ensure earlier identification and intervention, reducing the risk of delayed language acquisition.
- Integrating parental coaching programmes into state-funded EI services to enhance family engagement and improve therapy outcomes.
- Encouraging multi-stakeholder collaboration among healthcare providers, educators, policymakers, and advocacy groups to translate research findings into actionable policy changes.

Ultimately, the findings of this thesis provide a strong empirical foundation for optimizing EI frameworks in South Africa, ensuring that children with hearing impairment receive the highest quality support for both linguistic and academic success.

In conclusion, the findings of this study contribute valuable insights into the landscape of communication interventions for children with hearing impairment in South Africa.

Addressing identified limitations and fostering cross-sector collaboration will improve communication outcomes and ensure the full societal inclusion of children with hearing impairment, ultimately benefiting their long-term integration into education and society.

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SUPPLEMENTAL TABLES

Supplemental Table A: Association of participant socio-demographic profile (N=23)

		Overall		Relationship status: Single/Div/Sep		Relationship status: Married		p-value	Highest Level of Education: Matric or less		Highest Level of Education: Higher Education		p-value	Employment status: Unemployed		Employment status: (Self) employed		p-value
		n	%	n	%	n	%		n	%	n	%		n	%	n	%	
		23		7		16			11		12			4		19		
Speech	Delayed	6	26	1	14	5	31	0,62	3	27	3	25	>0.99	1	25	5	26	>0.99
	Age-appropriate	17	74	6	86	11	69		8	73	9	75		3	75	14	74	
Vocabulary	Delayed	7	30	3	43	4	25	0,63	6	55	1	8	0,027	1	25	6	32	>0.99
	Age-appropriate	16	70	4	57	12	75		5	45	11	92		3	75	13	68	
Receptive language	Delayed	6	26	2	29	4	25	>0.99	5	45	1	8	0,069	0	0	6	32	0,54
	Age-appropriate	17	74	5	71	12	75		6	55	11	92		4	100	13	68	
Expressive language	Delayed	8	35	3	43	5	31	0,66	6	55	2	17	0,089	1	25	7	37	>0.99
	Age-appropriate	15	65	4	57	11	69		5	45	10	83		3	75	12	63	
Audition	Delayed	4	17	1	14	3	19	>0.99	4	36	0	0	0,037	0	0	4	21	>0.99
	Age-appropriate	19	83	6	86	13	81		7	64	12	100		4	100	15	79	
Cognitive linguistics	Delayed	5	22	1	14	4	25	>0.99	4	36	1	8	0,16	0	0	5	26	0,54
	Age-appropriate	18	78	6	86	12	75		7	64	11	92		4	100	14	74	

Supplemental Table B: Associations between therapy sessions and parent attendance

		Overall		Frequency of sessions: Once a week or more often		Frequency of sessions: Less than once a week		p-value	How the therapy approach was chosen: By therapist		How the therapy approach was chosen: Joint decision / by parent		p-value
Characteristic	**Category**	**n**	**%**	**n**	**%**	**n**	**%**		**n**	**%**	**n**	**%**	
N		**23**		**8**		**15**			**12**		**11**		
How often parent attends therapy	never	10	43	2	25	8	53	0,38	7	58	3	27	0,21
	every session / every 2nd session / once a month	13	57	6	75	7	47		5	42	8	73	

Supplemental Table C: Communication outcomes of the child with hearing loss (N=23)

				Type of Communication Intervention Approach				
		Overall		**TSLT**		**LSL-SA**		p-value
Characteristic	**Category**	**n**	**%**	**n**	**%**	**n**	**%**	
Speech	Delayed	6	26	2	33	3	19	0,58
	Age-appropriate	17	74	4	67	13	81	
Vocabulary	Delayed	7	30	3	50	3	19	0,28
	Age-appropriate	16	70	3	50	13	81	
Receptive language	Delayed	6	26	2	33	3	19	0,58
	Age-appropriate	17	74	4	67	13	81	
Expressive language	Delayed	8	35	4	67	3	19	0,054
	Age-appropriate	15	65	2	33	13	81	
Audition	Delayed	4	17	1	17	3	19	>0.99
	Age-appropriate	19	83	5	83	13	81	
Cognitive linguistics	Delayed	5	22	1	17	3	19	>0.99
	Age-appropriate	18	78	5	83	13	81	

Supplemental Table D: Academic Outcomes of the child with hearing loss (N=23)

				Type of Communication Intervention Approach				
		Overall		TSLT		LSL-SA		p-value
English	0-49	3	13	1	17	2	13	0,12
	50-69	9	39	4	67	4	25	
	70-100	11	48	1	17	10	63	
Afrikaans	0-49	8	35	5	83	3	19	0,031
	50-69	4	17	0	0	4	25	
	70-100	10	43	1	17	9	56	
Mathematics	0-49	6	26	3	50	3	19	0,035
	50-69	7	30	3	50	4	25	
	70-100	9	39	0	0	9	56	
Life Skills / Life Orientation (n=21)	0-49	3	13	1	17	2	13	0,0027
	50-69	7	30	5	83	2	13	
	70-100	10	43	0	0	10	63	
Social Sciences (n=21)	0-49	5	22	2	33	3	19	0,088
	50-69	5	22	3	50	2	13	
	70-100	10	43	1	17	9	56	
Natural Sciences (n=19)	0-49	5	22	2	33	3	19	0,34
	50-69	4	17	2	33	2	13	
	70-100	9	39	1	17	8	50	
Technology (n=19)	0-49	5	22	2	33	3	19	0,34
	50-69	4	17	2	33	2	13	
	70-100	9	39	1	17	8	50	

APPENDICES

Appendix A

Principles of Certified LSLS Auditory-Verbal Therapists (LSLS Cert. AVT)

1. Promote early diagnosis of hearing loss in newborns, infants, toddlers, and young children, followed by immediate audiologic management and auditory-verbal therapy.

2. Recommend immediate assessment and use of appropriate, state-of-the-art hearing technology to obtain maximum benefits of auditory stimulation.

3. Guide and coach parents to help their child use hearing as the primary sensory modality in developing listening and spoken language.

4. Guide and coach parents to become the primary facilitators of their child's listening and spoken language development through active consistent participation in individualized auditory-verbal therapy.

5. Guide and coach parents to create environments that support listening for the acquisition of spoken language throughout the child's daily activities.

6. Guide and coach parents to help their child integrate listening and spoken language into all aspects of the child's life.

7. Guide and coach parents to use natural developmental patterns of audition, speech, language, cognition, and communication.

8. Guide and coach parents to help their child self-monitor spoken language through listening.

9. Administer ongoing formal and informal diagnostic assessments to develop individualized auditory-verbal treatment plans, to monitor progress and to evaluate the effectiveness of the plans for the child and family.

10. Promote education in regular schools with peers who have typical hearing and with appropriate services from early childhood onwards.

**An Auditory-Verbal Practice requires all 10 principles.*

The term "parents" also includes grandparents, relatives, guardians, and any caregivers who interact with the child. **(A.G. Bell Academy, 2020)**

Appendix B

(please print on organisational letterhead)

Permission Letter from ____

Title of Project: **"Speech-Language Acquisition and Scholastic Outcomes of children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study"**

Name of Researcher: **Aisha Casoojee**

I, __________, in my capacity as Principal of __________, hereby grant Aisha Casoojee permission to visit our institution and conduct the following for a period of 2 weeks to 2 months:

The researcher will commence with a pilot study, to refine the techniques to be employed in the main study.

- The researcher will analyse school records of children with hearing impairment who were enrolled in the special school programme between the period 2008 to 2019 to determine eligibility for inclusion in the study.
- The researcher will collect and collate data from the files of the above-identified children with hearing impairment to identify their speech and language outcomes following early intervention
- The researcher will additionally collect data from the school reports of the eligible children who have since graduated from the special school programme to establish scholastic outcomes
- The researcher will contact potential parent participants
- The researcher will circulate questionnaires to the parents/caregivers of the above-identified children with hearing impairment, to gain insight and foster a greater understanding of caregiver perceptions of reported therapeutic outcomes

Name: ________________

Signature: ________________

Date: ________________

Appendix C

PARTICIPANTS NEEDED

for a study investigating

Speech-Language Acquisition and Scholastic Outcomes of children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study

A researcher from the University of the Witwatersrand is looking for **PARENTS** of children with hearing impairment to help with a study focusing on comparing outcomes following either traditional speech therapy vs. LSL-SA.

Parents will be required to complete a questionnaire and allow the researcher access to your child's school records and academic report.

Contact for more information:

Aisha Casoojee – 0713592575, Aisha.Casoojee@wits.ac.za

Appendix D

Draft Email to Participants

Subject: Invitation for parents to participate in a study investigating the Speech-Language Acquisition and Scholastic Outcomes of Children with Hearing Impairment following Early Intervention in South Africa

Dear Parent/Caregiver

My name is Aisha Casoojee and I am currently registered for my PhD in the Department of Audiology at the University of the Witwatersrand. I am conducting a study that will be comparing the Outcomes of Children with Hearing Impairment following Speech Therapy &/ LSL-SA.

I am looking for parents of children with hearing impairment to help with this study by completing a questionnaire and allowing the researcher access to your child's school records and academic report.

Please refer to the attached document explaining the purpose of the study, including your rights as a participant.

Contact for more information:

Telephone - 0713592575
Email - Aisha.Casoojee@wits.ac.za

I appreciate and value your assistance

Aisha Casoojee

Appendix E

Consent form for participants

<u>**Consent form**</u>

Title of Project: **"Speech-Language Acquisition and Scholastic Outcomes of children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study"**

Name of Researcher: **Aisha Casoojee**

I, _______________________________ parent / caregiver of __________________________

agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below).

I agree to complete a questionnaire for the purposes of this study.	YES	NO
I agree that my child's school records and academic reports may be accessed for the purposes of this study.	YES	NO
I agree that my participation will remain anonymous	YES	NO
I agree that the researcher may use anonymous quotes in her research report	YES	NO
I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	YES	NO

Name of Participant: _________________________

Signature: _________________________

Date: _________________________

Appendix F

Caregiver Questionnaire

Date:

Title of Project: “Speech-Language Acquisition and Scholastic Outcomes of children with Hearing Impairment following Early Intervention* in South Africa: A Comparative Study”

Name of Researcher: **Aisha Casoojee**

SECTION A: Caregiver demographic information

This section refers to your background information and your family’s demographic information.

1. Ethnicity

Black	White	Coloured	Indian	Asian	Other

2. Age

____

3. Gender

Male	Female

4. Marital status

Single	Married	Separated	Divorced	Widowed

5. Your highest education qualification

Grade 11 or lower (Std 9)	Grade 12 (Matric)	Post-Matric Diploma or	Baccalaureate Degree(s)	Postgraduate Degree(s)

6. Employment

Student	Unemployed	Self-employed	Employed

7. Specify your relationship to your child/ward with hearing impairment (e.g. mother, aunt, grandfather, etc.)

____

8. Where do you live? (Area)

____

SECTION B: Therapy Information and Outcomes

This section refers to your perception of your child /ward therapy outcomes

9. Date enrolled within the Early Intervention (therapy) approach

				-			-		

10. Date discharged from Early Intervention (therapy) approach

				-			-		

11. How often does your child/ward receive therapy?

Daily	More than once a week but not daily	Once every alternate week	Once a month

12. Do you attend therapy with your child/ward?

Yes	**No**

13. How often do you attend therapy with your child/ward?

Every Session	Once weekly	Once every alternate week	Once a month

14. Type of communication approach that your child/ward is receiving during Speech-Language Therapy

Traditional Speech-Language Therapy	Listening and Spoken Language – South Africa (LSLSA)	Sign language	Total Communication	Cued Speech	Other

15. How was the communication approach chosen?

Chosen by the Therapist	
Joint Decision between myself and the Therapist	
Chosen by myself	
Other, please specify	

16. Are you confident in applying the intervention techniques with your child/ward at home?

Yes	**No**

17. Do you think the following intervention techniques used during therapy sessions with your child/ward are appropriate?

	Culturally Appropriate		**Linguistically Appropriate (i.e. language, vocabulary, dialect)**	
	Yes	**No**	**Yes**	**No**
Toys				
Books				
Home Programme				
Therapy Aims				
Other, please specify				

18. Indicate your perceptions of your child's/ward's communication functioning at the time of

	Onset of Therapy			**Discharge from Therapy**		
	Delayed	**Age Appropriate**	**Age Equivalent (Years, Months)**	**Delayed**	**Age Appropriate**	**Age Equivalent (Years, Months)**
Speech						
Vocabulary						
Receptive Language						
Expressive Language						
Audition						
Cognitive Linguistics						

19. Indicate your perceptions of your child's / ward's scholastic outcomes

	Struggling	**Partially Achieved**	**Achieved**	**Outstanding Progress**
English				
Afrikaans				
Life Skills / Life Orientation				
Numeracy				
Social Science				
Other				

20. What are the strengths of the communication approach being implemented in therapy with your child/ward?

____

____

21. What are the barriers to the communication approach being implemented in therapy with your child/ward?

____

____

22. Would you have preferred to choose a different communication approach to be implemented with your child/ward?

Yes	No

23. Could you provide recommendations/suggestions on how to improve the Speech- Language Therapy that your child/ward is attending

____

____

Thank you for your cooperation in completing this questionnaire.

* Early Intervention is the term used to describe the services and supports that are available to babies and young children with developmental delays and disabilities and their families (CDC, 2019)

Appendix G

Data Collection Sheet of Scholastic Performance

Date:

Title of Project: "Speech-Language Acquisition and Scholastic Outcomes of children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study"
Name of Researcher: **Aisha Casoojee**

Section A: Child Demographic Information

This section of the data collection tool refers to the child's biographical information and school information

1. Participant Number

____

2. Name of School

____

3. Date enrolled at School

				-			-		

4. Type of School

Mainstream	Remedial Schooling	Home Schooling	Other

5. Current Grade

Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Gr 7	Gr 8	Gr 9	Gr 10

6. Was child enrolled at another school previously?

Yes	No

7. If yes to Q6, indicate type of school previously attended

Mainstream	Remedial Schooling	Home Schooling	Other

8. Date enrolled at previous School

				-			-		

9. Date left previous school

				-			-		

10. Scholastic Outcomes

	1	**2**	**3**	**4**	**5**	**6**	**7**
	0 - 29 F	**30 -39 Elementary**	**40 -49 Moderate**	**50 -59 Adequate**	**60 -69 Substantial**	**70 -79 Meritorious**	**80 – 100 Outstanding**
English							
Afrikaans							
Life Skills / Life Orientation							
Numeracy							
Social Science							
Other							

Appendix H

Retrospective Data Collection Sheet

Date:

Title of Project: “Speech-Language Acquisition and Scholastic Outcomes of children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study”

Name of Researcher: **Aisha Casoojee**

Section A: Child Demographic Information

This section of the data collection tool refers to the child’s background or biographical information and hearing impairment.

1. Participant Number

____

2. Name of EI Preschool

____

3. Date enrolled at EI preschool

				-			-		

4. Date graduated from EI preschool

				-			-		

5. Gender

Female	Male

6. Child’s age (years, months)

____

7. Date of birth (CCYY-MM-DD)

				-			-		

8. Child's Ethnicity

Black	White	Coloured	Indian	Asian	Other

9. Child's home language

____

10. Age at identification of hearing impairment (years, months)

____

11. Age at diagnosis of hearing impairment (years, months)

____

12. Cause of hearing impairment (if unknown, please state unknown)

____

____

13. Type of hearing impairment

Congenital	Early Onset

14. Ear with hearing impairment

Left	Right	Bilateral

15. Degree of hearing impairment – Left Ear

Mild	Moderate	Severe	Profound

16. Degree of hearing impairment – Right Ear

Mild	Moderate	Severe	Profound

17. Age at amplification

____

18. Type of hearing amplification device

Hearing Aids	Cochlear Implant	FM System	Other

19. Ear on which amplification device is fitted

Left	Right	Bilateral

20. Hearing Age (years, months)

____

21. Attends the following therapies:

Speech - Language Therapy	Occupational Therapy	Physiotherapy	Aural Rehabilitation	Play Therapy	Other, specify

22. Language the child receives Speech-Language Therapy in

English	Afrikaans	isiZulu	Sesotho	Tswana	Sign Language	Other

23. Communication Approach implemented during Speech-Language Therapy:

Traditional Speech-Language Therapy	Listening and Spoken Language – South Africa (LSLSA)	Sign language	Total Communication	Cued Speech	Other

24. Age at which child began intervention services (years, months)

____

25. Where does the child receive audiological services?

____

26. Type of audiological service

Mapping	Aural Rehabilitation	Other

Section B: Intervention Outcomes

This section of the data collection tool refers to the child's Speech-Language intervention outcomes

27. Date enrolled within EI approach

				-			-		

28. Date discharged from EI approach

				-			-		

29. Communication functioning

	Onset of Therapy			**Discharge from Therapy**		
	Delayed	**Age Appropriate**	**Age Equivalent (Years, Months)**	**Delayed**	**Age Appropriate**	**Age Equivalent (Years, Months)**
Speech						
Vocabulary						
Receptive Language						
Expressive Language						
Audition						
Cognitive Linguistics						

30. School readiness assessment conducted nearing discharge of intervention and graduation from EI preschool programme

Yes	No

31. Results of school readiness assessment nearing discharge of intervention and graduation from EI preschool programme

Not Ready	Ready

32. Type of school recommended upon discharge of intervention and graduation from the special school programme

Mainstream	Remedial Schooling	Home Schooling	Other

33. Specify further details of the school mentioned in question 32, including the name of the school

____

34. Recommendations made upon discharge of intervention and graduation from the special school programme

Traditional Speech- Language Therapy	Listening and Spoken Language – South Africa (LSLSA)	Physiotherapy	Occupational Therapy	Play Therapy	Mapping	Other

Appendix I

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Casoojee

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H20/06/03**
PROJECT TITLE	Speech-Language Acquisition and Scholastic Outcomes of Children with Hearing Impairment following Early Intervention within Gauteng, South Africa: A Comparative Study
INVESTIGATOR(S)	Ms A Casoojee
SCHOOL/DEPARTMENT	Human and Community Development/
DATE CONSIDERED	19 June 2020
DECISION OF THE COMMITTEE	Approved Permission letters required before data collection can commence Risk Level: Low
EXPIRY DATE	06 August 2023

DATE 07 August 2020 **CHAIRPERSON** J Knight
(Professor J Knight)

cc: Supervisor : Prof K Khoza-Shangase and Prof A Kanji

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature **Date** 19 / 06 / 2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix J

Participant Information Letter to Schools

Date:

Dear Sir / Madam,

My name is Aisha Casoojee, and I am currently registered for my PhD in the Department of Audiology at the University of the Witwatersrand. In fulfilment of my degree, I am conducting a study titled: **"Speech-Language Acquisition and Scholastic Outcomes of Children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study"**

My study seeks to contribute to the growing body of evidence and knowledge in the field of Early Intervention pertaining to Audiology as practised within a South African context. My study aims to gather contextually and culturally relevant information regarding different therapeutic approaches in Early Intervention. With a better understanding of therapeutic outcomes, the results of the study will contribute to the advocacy of earlier and appropriate intervention for children with hearing impairment. It is envisaged that the gathered information will establish a benchmark of greater professional understanding and insight, ultimately updating government policies and guidelines for Early Intervention for children with hearing impairment.

The researcher requests that your institution disseminate information to the parents/caregivers of learners regarding the purpose of the study to obtain their consent to share their contact details with the researcher should they be willing to participate. This information will be disseminated by displaying a poster on the school premises that the researcher has developed. Additionally, an email (drafted by the researcher) is to be sent by the school to the parents/caregivers.

Once consent has been received by the parents/caregivers, the researcher requests permission to visit your institution and conduct the following for a period of 2 weeks to 2 months, which will entail the following:

The researcher will commence with a pilot study to refine the techniques to be employed in the main study and the subsequent main research study at our facility

The researcher will contact potential parent participants and collect relevant data from the files.
The researcher will analyse school records of children with hearing impairment who were enrolled in your preschool programme between the period 2008 to 2019 to determine eligibility for inclusion in the study.
The researcher will collect and collate data from the files of the above-identified children with hearing impairment to identify their speech and language outcomes following early intervention
The researcher will additionally collect data from the school reports of the eligible children who have since graduated from the EI preschool programme to establish scholastic outcomes
The researcher will circulate questionnaires to the caregivers of the above-identified children with hearing impairment to gain insight and foster a greater understanding of caregiver perceptions of reported therapeutic outcomes

Should you provide permission to the researcher, all identifying information gathered from your institution will be kept in a locked cupboard in a locked office or stored electronically in a secure environment and will not be available to others and will be kept confidential to the extent possible by law. All future users of the stored data are required to apply for further Research Ethics Committee review and approval for secondary use of the stored data.

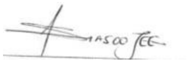
Participation is voluntary, and you are not being forced to take part in this study. The choice of whether to participate or not is yours alone. If you choose not to participate, you will not be affected in any way whatsoever. If you agree to participate, you may stop participating in the research at any time and tell me that you don’t want to continue. No penalties will be incurred should you decide to withdraw.

The researcher will not record the name of your institution anywhere, and no one will be able to connect you to the information obtained. The information obtained will be linked to a code number, and the researcher will refer to you in this way in the data, any publication, report or other research output. All information gathered will be stored electronically in a secure environment and used for research or academic purposes now or later in ways that will not reveal who you are. All future users of the stored data are required to apply for further Research Ethics Committee review and approval for secondary use of the stored data.

There will be no personal costs to you if you participate in this research project. At the present time, the researcher does not see any risk of harm from your participation. The risks associated with participation in this study are no greater than those encountered in daily life. There are no direct benefits to you from participating in this research. However, this study will be extremely helpful to us in that we hope we will promote understanding of the speech-language acquisition and scholastic outcomes of hearing-impaired children following early intervention.

If you have any questions during or afterwards about this research, feel free to contact me or my supervisors using the details listed below. The results of this study will be written as published articles and/or a thesis. It may be accessed through the University of the Witwatersrand library website. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical) by telephone at +27(0) 11 717 1408, or email hrecnon-medical@wits.ac.za

Sincerely,



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Appendix K

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Participant Information Sheet

Date: April 2021

Dear Caregiver / Parent,

My name is Aisha Casoojee, and I am currently registered for my PhD in the Department of Audiology at the University of the Witwatersrand. In fulfilment of my degree, I am conducting a study titled: **"Speech-Language Acquisition and Scholastic Outcomes of Children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study"**

My study seeks to contribute to the growing body of evidence and knowledge in the field of Early Intervention pertaining to Audiology as practised within a South African context. My study aims to gather contextually and culturally relevant information regarding different therapeutic approaches in Early Intervention. With a better understanding of therapeutic outcomes, the results of the study will contribute to the advocacy of earlier and appropriate intervention for children with hearing impairment. It is envisaged that the gathered information will establish a benchmark of greater professional understanding and insight, ultimately updating government policies and guidelines for Early Intervention for children with hearing impairment.

I hereby:

1. Invite you to participate in this study, which will involve you completing a questionnaire that will take approximately 30 minutes of your time to complete. This will allow me to gain insight and a greater understanding of your perceptions of reported therapeutic outcomes
2. Seek your consent by granting me access to your child's school records and academic reports to collect and collate information pertaining to their speech-language acquisition and scholastic outcomes

Should you agree to participate in the study by completing the self-administered questionnaire and provide consent to the researcher to access data from your child's school records and academic report, all information gathered will be kept in a locked cupboard in a locked office or stored electronically in a secure environment. The information you share with me will not be available to others and will be kept confidential to the extent possible by law. All future users of the stored data are required to apply for further Research Ethics Committee review and approval for secondary use of the stored data.

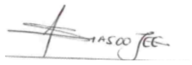
Participation is voluntary, and you are not being forced to take part in this study. The choice of whether to participate or not is yours alone. If you choose to not participate, you will not be affected in any way whatsoever. If you agree to participate, you may stop participating in the research at any time and tell me that you don't want to continue. No penalties will be incurred should you decide to withdraw.

The researcher will not record your name anywhere and no one will be able to connect you to the information obtained. The information obtained will be linked to a code number, and the researcher will refer to you in this way in the data, any publication, report or other research output.

There will be no personal costs to you if you participate in this research project. At the present time, the researcher does not see any risk of harm from your participation. The risks associated with participation in this study are no greater than those encountered in daily life. There are no direct benefits to you from participating in this research. However, this study will be extremely helpful to us in that we hope we will promote understanding of the speech-language acquisition and scholastic outcomes of hearing-impaired children following early intervention.

If you have any questions during or afterwards about this research, feel free to contact me or my supervisors using the details listed below. The results of this study will be written as published articles and/or a thesis. It may be accessed through the University of the Witwatersrand library website. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical) by telephone at +27(0) 11 717 1408, email at hrecnon-medical@wits.ac.za

Sincerely,



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Appendix L

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Therapeutic approaches to early intervention in audiology: A systematic review

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ABSTRACT

Babies born with a congenital sensorineural hearing impairment or acquire early-onset permanent bilateral hearing impairment are at risk for delayed speech and language development and poor scholastic outcomes. Auditory Verbal Therapy (AVT) has become the primary intervention approach for developing spoken language in children with hearing impairment, and South Africa also has adopted this approach. The outcomes of AVT within the South African context have not been thoroughly investigated. As part of a larger study, the objective of this systematic review was to describe the speech, language and scholastic outcomes of hearing-impaired children enrolled in AVT as a therapeutic approach to early intervention. This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Electronic databases searched included Google Scholar, Science Direct and PubMed. Selected studies were published in English and focused on the outcomes of early intervention for children with hearing impairment. The selected date range of the included articles ensured that the latest research was reviewed. Due to the limited evidence base, the review cannot conclude definitively that AVT yields positive speech, language, and scholastic outcomes in children with hearing impairment. Of the reviewed articles, only one study compares the outcomes of therapeutic intervention approaches, an important consideration, particularly in Low- and Middle-Income countries (LMICs). Current findings provide a strong rationale for the larger study by highlighting that further research comparing AVT to standard speech-language habilitation is required. Research in contexts with linguistic and cultural diversity in countries such as South Africa is required.

1. Introduction

The incidence of congenital permanent sensorineural hearing impairment is estimated at five infants for every 1000 live births in high-income countries [1]. Statistics for the developing world are higher due to constrained economic and health resources [2]. This common congenital disability impedes speech and language skills development with consequent scholastic, social and vocational challenges [3]. The early identification of hearing impairment minimizes its lifelong impact, leading to the advent of and advocacy for Universal Newborn Hearing Screening (UNHS), facilitating Early Hearing Detection and Intervention (EHDI) programs globally [4].

There are three components to EHDI: newborn hearing screening, reducing the age of diagnosis of the hearing impairment, and enrolling the infant in an early intervention (EI) program [5]. The Joint Committee on Infant Hearing (JCIH) [6] and Health Professions Council of South Africa (HPCSA) [5] assert that EHDI maximizes linguistic competence, literacy development and scholastic outcomes in children with hearing impairment. Evidence of the continuous excellent outcomes in infants in whom hearing impairment is identified early and intervention initiated early is seen in their rate of language development akin to their hearing peers [4,7–9].

All therapeutic approaches to EI strive to encompass the three components of EHDI. EHDI is a public health initiative in high-income countries, whilst this is the case in 11% of LMICs (ten of 91 LMICs) [10,11]. Olusanya's [10] review of the status of newborn hearing screening programs in LMICs indicates neonatal hearing screening services were constrained by several factors: failure in recognizing infant hearing impairment as a critical health condition, insufficient financial resources for neonatal hearing screening services, absence of appropriate risk-based selective screening, unsuitable environment and conditions for hearing tests. South Africa has an inadequately resourced and funded public healthcare system, functioning alongside a well-developed private healthcare system. Khoza-Shangase [12] lists the

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following reasons for the current status of EI in South Africa: lack of a government mandate for UNHS, significant resource constraints, a high burden of disease with which EHDI has to compete, and significantly poor social determinants of health. Khoza-Shangase, Kanji and Ismail [13] highlight resource allocations and availability and limited contextually responsive strategic planning as gaps in the public and private healthcare sector. These gaps are compounded by the failure to implement knowledge, policies, and guidelines into practice [13]. These lacunae require attention by the South African audiology community for measurable progress to be made in EI [13].

Of the 900 000 children born in South Africa annually, 17 babies are born daily with permanent sensorineural hearing impairment [14]. South Africa, an LMIC, has been unsuccessful in implementing UNHS or systematic and uniform targeted neonatal hearing screening [15]. South African Speech-Language Therapists and/or Audiologists are trained to provide timely fitting and monitoring of hearing amplification devices, educate and counsel families of hearing-impaired children, and provide therapeutic interventions to these children and their families [6,16]. The implementation of EI services should be achievable. EI enjoys scant priority, and consequently, more than 90% of hearing-impaired babies born in South Africa annually do not have the prospect of early identification and intervention [12,17]. Budgetary constraints impede health policy development, exacerbated by a lacuna of research evidence. Small scale studies fail to embody the South African context, failing to support the prioritization of EHDI [17,18]. Research evidence should corroborate South Africa's healthcare priorities and aim toward evidence-based intervention practices that ensure optimal speech, language, and scholastic development of children with hearing impairment [19].

In South Africa, various intervention approaches are being implemented by Early Interventionists (i.e., Speech-Language Therapists and/or Audiologists and Teachers of the Deaf) within the public and private healthcare sector. These include auditory approaches such as auditory–verbal therapy (AVT) incorporating listening and spoken language (LSL) principles; the oral-aural approach (the use of amplification and speechreading/natural gestures/visual cues), and cued speech (a system of manual gestures which accompany speech production in real-time). It also includes more visual approaches such as total communication (a variety of communication methods, including sign, speech and listening, lip reading, fingerspelling, facial expression and gesture, in a combination that is best suited for a particular child), or sign language (a visual, gestural approach) [20]. The chosen mode(s) of communication extends beyond the therapy session, based on the educational placement of children with hearing impairment or those who are cochlear implant candidates [20]. Evidence remains limited regarding the outcomes of intervention approaches that do not specify the early fitting and monitoring of amplification devices, especially in Sub-Saharan Africa [14]. Despite this lack of local research in intervention outcomes, two intervention practices are implemented for children with hearing impairment and their families within contextual constraints [20].

Amidst the number of family-centered intervention approaches aiming to improve the speech, language, and scholastic outcomes of children with hearing impairment, AVT, a first-world technique, has been adapted to South Africa. This intervention approach is delivered by Early Interventionists who have undergone post-graduate training to become LSL Specialists [21]. Members of the South African Cochlear Implant Group (SACIG) with Auditory Verbal-UK (AVUK) adapted the AVT approach and implemented training in recent years. The principles of AVT were modified for LSL-South Africa (LSL-SA) in 2005 [22]. A limited number of LSL trained therapists (i.e., 51) provide EI to children with hearing impairment, resulting in incomplete penetration in South Africa [23]. AVT is a parent-coaching program aimed at stimulating auditory brain development, encompassing listening and spoken conversations. It facilitates the utilization of hearing amplification devices, teaching children with hearing impairment to use their residual hearing optimally [24,25]. Traditional Speech-Language Therapy is the more cost-effective intervention approach, given the cultural diversity and challenges within South Africa [20].

South Africa is seeking cost-effective solutions within an already overburdened health care system. Late identified hearing impairment places financial stress on the health system and country at large [12,17]. It is estimated that a severe to profound hearing loss cost-to-society is approximately $300,000 over the lifetime per individual [24]. This cost is especially high in a resource-constrained context like South Africa, where economic inequalities exist [22]. It is vital to establish which therapeutic interventions are cost-effective and efficacious, hence the current review–forming part of a larger study investigating the speech, language and scholastic outcomes of children with hearing impairment following early intervention in South Africa.

Furthermore, there is an incongruence of disability in relation to the number and distribution of professionals in South Africa [26]. Statistics indicate a total of 1589 Speech-Language Therapists and Audiologists and 642 Audiologists registered with the HPCSA [5]. Not all children with hearing impairment may be enrolled in an AVT program, let alone receive standard habilitation. The advocacy for the training of additional therapists to address the capacity-demand challenge is thus justified. This systematic review highlights current research and outcomes on the two therapeutic approaches in early intervention.

2. Methods

2.1. Search strategy

A systematic review of published literature related to intervention approaches and language outcomes for children with hearing impairment was conducted, in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) [27]. The following online databases were searched: Google Scholar, Science Direct and PubMed. Additionally, a manual review of scientific publications identified from presentations at the World Congress of Audiology in October 2018 was included. The following key terms were used: auditory verbal therapy, early intervention, hearing impairment, language outcomes, speech therapy. To be included, articles had to be peer-reviewed scientific papers published in English between 2015 and 2021. The selected date range ensured current research was included, reflecting the latest intervention approaches and best practices [28,29]. Furthermore, it corresponds to the introduction of LSL-SA (2015) in South Africa [22]. Articles needed to report speech, language or scholastic outcomes of hearing-impaired children following AVT or traditional habilitation. Two independent reviewers identified articles for inclusion, enhancing reliability.

2.2. Inclusion and exclusion criteria

Published articles with no stated design, evaluation methods and no clearly stated therapeutic approach were excluded. Articles selected for inclusion were original pieces of scientific work or reports published in peer-reviewed scientific journals. The methodological design criteria of the articles were outcomes-research (comparative clinical), providing evidence regarding the benefits, risks, and results of therapeutic approaches for children with hearing impairment. All the articles were published in English. Furthermore, grey literature (i.e., literature published informally or non-commercially, or unpublished due to a lack of peer-review) was excluded [30]. An initial search was conducted in February 2019 and repeated on 12 January 2021 to include updated developments.

The Newcastle-Ottawa scale (NOS) was used as an evaluation tool to assess the methodological rigor of the non-randomized studies included in this review. The NOS categorized studies as strong (7–9), satisfactory (4–6), or unsatisfactory (0–3) based on the inclusion of the following quality indicators: selection of study group, comparability of groups (variables) and ascertainment of exposure/outcomes (potential bias and blinding) [31]. Only studies that attained ratings of strong were included.

2.3. Data extraction and synthesis

Fourteen thousand nine hundred and ninety-four articles were retrieved. Of these, 105 articles were identified for possible inclusion. One hundred and two articles were identified from the databases, and three were identified from manual reviews of scientific publications at the World Congress of Audiology in October 2018. Eight records were excluded due to duplication. Fifty-two records were excluded post title and abstract review. Thirty-three full-text articles were screened for eligibility.

Eventually, twelve peer-reviewed research studies were included. These included three longitudinal comparative studies, two survey cohorts, one descriptive-analytical research design, one multiple baseline across subjects cohort, one outcomes-based study, one collective case design, two prospective research designs, one retrospective research design study. First, articles to be selected for inclusion were independently identified by all investigators using pre-defined abstraction. Disagreements on papers selected for inclusion were resolved through discussion and consensus. Where consensus was not reached, the lead author made the final decision. Second, the authors provided a narrative synthesis of the findings from studies that met the inclusion criteria. The synthesis included the location of the study, sample size, results, conclusions, and recommendations.

The PRISMA flow diagram, showing the process of selecting studies for inclusion in this review, is included (Fig. 1).

3. Results and discussion

Study findings of the 12 articles reviewed are tabulated in Table 1. A descriptive analysis approach was employed in analyzing qualitative data [32]. Despite the widespread use of AVT, this systematic review found no single- or quasi-randomized controlled trials. Furthermore, some studies did not specifically evaluate AVT but focused on other factors such as the age of fitting of hearing aids or cochlear implants. Evident from the published literature, internationally, AVT is considered the therapeutic approach of choice for children with hearing impairment [4,7–9,33–39]. All the articles revealed positive language outcomes from AVT as an EI approach [4,7–9,33–40].

One of the reviewed studies indicated that approximately 80% of children with hearing impairment receiving amplification before one year old demonstrate normal receptive vocabulary by school entry [8]. Another study indicated that positive language outcomes are solely attributed to the early fitting of cochlear implants before 12 months of age and are not related to the implementation of AVT techniques [34]. On the contrary, Mortazavi and Mortazavi [39] advocate that AVT is a legitimate communication approach for children with hearing impairment regardless of the type of hearing amplification devices. Evident from the above, it can be argued that the successful outcomes of EI programs are dependent on the communication approach and technology, due to the central role of hearing in a child's development.

Data indicates early exposure to AVT incorporates a) early

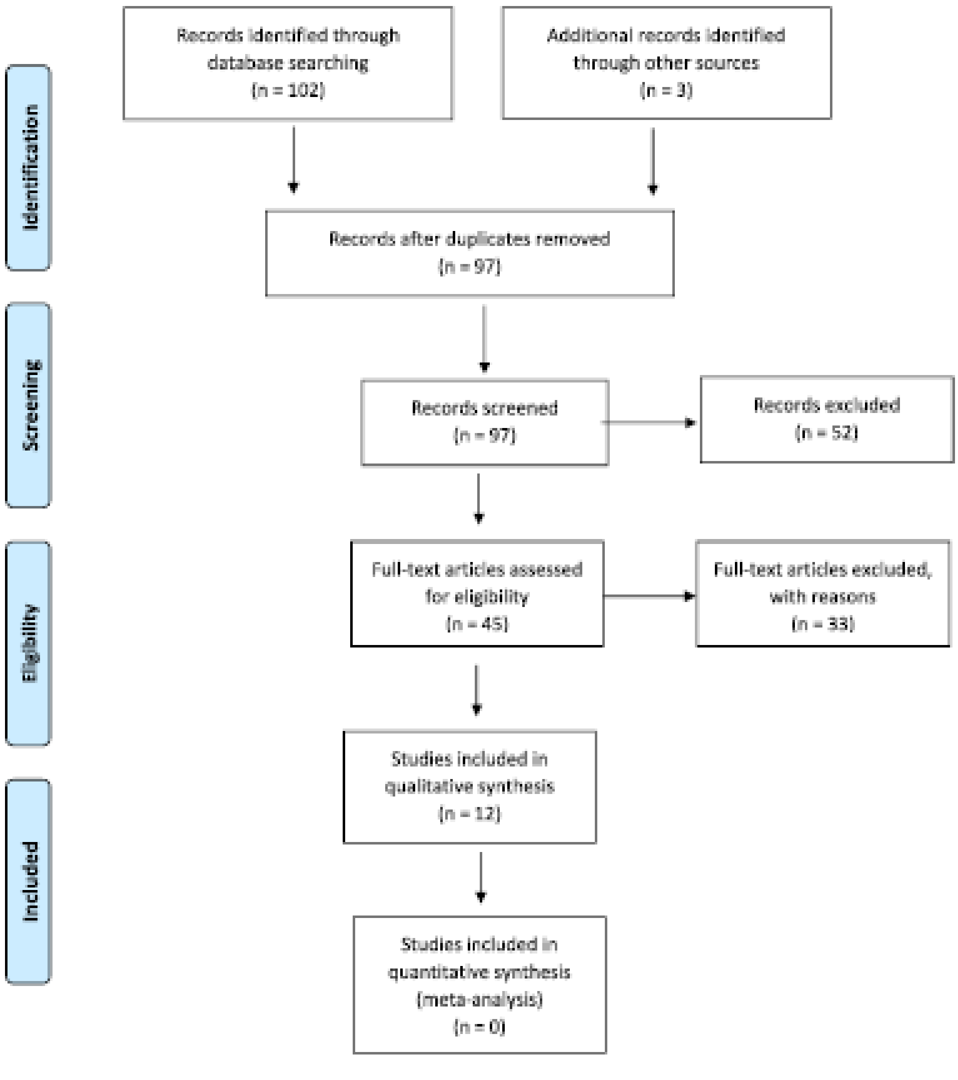

Fig. 1. The PRISMA 2009 flow diagram for included studies.

Table 1
Findings of reviewed articles.

Reference	Location	Sample Size	Therapeutic Approach	Results and Conclusions	Recommendations
[4] Lew, J., Purcell, A.A., Doble, M. and Lim, L.H. (2014). Hear here: Children with hearing loss learn words by listening. *International Journal of Pediatric Otorhinolaryngology*. 78. 1716–1725.	Singapore	N = 3	• AVT	• The early use of hearing devices and family participation in AVT has been associated with gains made in speech perception skills, vocabulary, and speech development. • Therapy directed at listening alone, without incorporating additional goals into a therapy program showed a positive impact on speech and vocabulary development	• A larger study is necessary for more conclusive findings
[7] Fulcher, A.N., Purcell, A., Baker, E. and Munro, N. (2015). Factors influencing speech and language outcomes of children with early identified severe/profound hearing loss: Clinician-identified facilitators and barriers. *International Journal of Speech-Language Pathology*. 17(3). 325–333.	Australia	N = 6	• AVT	• Results indicate early identification of children with severe/profound hearing impairment, early amplification and commencing AVT under 6 months facilitates child progress	• An EHDI approach (including AVT) will empower clinicians to facilitate optimal speech and language outcomes for children with hearing-impairment.
[8] Akçakaya, H., and Tavşancıl, E. (2016). Teacher opinions about auditory verbal therapy. *Journal of Qualitative Research in Education*. 4(2), 1–25. https://doi.org/10.14689/issn.2148-2624.1.4c2s1m	Turkey	N = 10	• AVT	• Results indicate working with the child's family (a premise of AVT) has a positive impact on speech perception, language development and speech production.	The researchers advocate that: • AVT training should occur during the undergraduate education of Therapists and Educators of Hard of Hearing • AVT should be widespread as it is useful for children with hearing impairment and their families.
[9] Ching, T.Y.C., Dillon, H., Button, L., Seeto, M., Van Buynder, P., Marnane, V, Cupples, L. and Leigh, G. (2017). Age at Intervention for Permanent Hearing Loss and 5-Year Language Outcomes. Pediatrics. 140(3). E20164274.	Australia	N = 350	• AVT	• EI improves language outcomes of children with Permanent Childhood Hearing Loss	• Research that focuses on post-diagnostic intervention, capitalizing on the opportunity offered by UNHS to improve language development. • Research monitoring early outcomes with amplification so that children at risk for language delays can receive intervention at the earliest age possible
[33] Hitchins, A.R.C. and Hogan, C. (2018). Outcomes of early intervention for deaf children with additional needs following an Auditory Verbal Approach to communication. *International Journal of Pediatric Otorhinolaryngology*. 115. 125–132. https://doi.org/10.1016/j.ijporl.2018.09.025	UK	N = 129	• AVT	• Families who have access to EI increases the chances of achieving age-appropriate language when a: - suitable communication approach is adopted at the earliest opportunity - child with additional needs will acquire listening and spoken language at a rate commensurate with their full potential • Results of hearing-impaired children on the AVT program: - 79% achieved age-appropriate spoken language scores - 1 in 2 with additional disabilities (N = 52) reached age-appropriate spoken language scores after being in the program for two years - The mean Rate of Language Development (N = 52) indicated a significant increase	Comparisons across studies from different centers around the world are required and may be achieved by categorizing children's additional needs
[34] Dettman, S.J., Dowell, R.C., Choo, D., Arnott, W., Abrahams, Y., Davis, A., Dornan, D., Leigh, J., Constantinescu, G., Cowan, R. and Briggs, R.J. (2016). Long-term Communication Outcomes for Children Receiving Cochlear Implants Younger Than 12 Months: A Multicenter Study. *Otology & Neurotology*. 37: e82-e95.	Australia	N = 403	• AVT • Oral-Aural • Sign-Bilingual	• The fitting of cochlear implants before 12 months old: - facilitated speech production accuracy and language acquisition comparable to hearing peers - 80% of children demonstrated receptive vocabulary knowledge within the normal range by school entry	• Further research is currently underway in examining literacy development and academic outcomes due to the importance of vocabulary and oral language in the development of literacy skills
[35] Cupples, L., Ching, T.Y.C., Button, L., Seeto, M., Zhang, V., Whitfield, J., Gunnourie, M., Martin, L. and	Australia	N = 339	• AVT • Combined sign/mixed	• The use of an oral communication mode in EI is associated with better receptive language performance.	• Research considering confounding variables influencing outcome measures.

(continued on next page)

Table 1 (*continued*)

Reference	Location	Sample Size	Therapeutic Approach	Results and Conclusions	Recommendations
Marnane, V. (2018). Spoken language and everyday functioning in 5-year--old children using hearing aids or cochlear implants. International Journal of Audiology. 57(2). S55-S69. https://doi.org/10.1080/14992027.2017.1370140.				• Earlier amplification, higher non-verbal cognition, lesser degrees of hearing loss and higher maternal education were associated with better language outcomes	
[36] Percy-Smith, L., Tonning, T.L., Josvassen, J.L., Mikkelsen, J.H., Nissen, L., Dieleman, E., Hallstrom, M. and Caye-Thomasen, P. (2018). Auditory verbal habilitation is associated with improved outcome for children with cochlear implant. *Cochlear Implants International. An Interdisciplinary Journal.* 19(1). 38–45. https://doi.org/10.1080/14670100.2017.1389020.	Denmark	N = 130	• AVT • Traditional Speech Language Therapy	Children with hearing impairment enrolled in AVT scored age-appropriately and outperformed children with hearing impairment enrolled in traditional speech-language therapy.	• All children with hearing impairment should be offered AVT. • National boards of Health and Social Affairs should recommend basing habilitation principles on AVT
[37] Percy-Smith, L., Hallstrom, M., Josvassen, J.L., Mikkelsen, J.H., Nissen, L., Dieleman, E. and Caye-Thomasen, P. (2018). Differences and similarities in early vocabulary development between children with hearing aids and children with cochlear implant enrolled in 3-year auditory verbal intervention. *International Journal of Pediatric Otorhinolaryngology.* 108. 67–72. https://doi.org/10.1016/j.ijporl.2018.02.030.	Denmark	N = 55	• AVT	• Equal progress in both cohorts of an AVT program, i.e., cochlear implants and hearing aids, were noted	• AVT is recommended as a relevant EI practice
[38] Moeller, M.P. and Tomblin, B. (2016). An Introduction to the Outcomes of Children with Hearing Loss Study. Ear Hear. 36(01). 4s–13s. https://doi.org/10.1097/AUD.0000000000000210.	USA	N = 434	Cumulative Linguistic Experience – encompassing all therapeutic approaches that maximize audibility through amplification and family involvement	Results indicate that children with hearing impairment experience limitations in access to linguistic input, leading to a decrease in uptake of language exposure and an overall reduction in linguistic experience.	Intervention approaches should: • Maximize audibility with hearing amplification. • Coach families to provide high-quality conversational interactions. • Provide high-quality early intervention
[39] Mortazavi, Z. and Mortazavi, S. (2016). Auditory-Verbal Therapy (AVT) and Evidence-Based Practice (EBP). BMJ Open. 7(0). A1-A78. https://doi.org/10.1136/bmjopen.2016.015415.26.	Iran	N = 20	• AVT	This study employed the following hypothesis to conduct an evidence-based AVT program evaluation: 1. Evidence-Based research 2. Clinical skills 3. Stakeholder perspectives, including families. Results indicated: • 80% of children with hearing impairment reached a language development level comparable with normal hearing children. • Considerable receptive language development was seen within the first six months of attending the AVT program. • Considerable expressive language development was seen within the second six months of attending the AVT program	The researchers advocate that the AVT approach is a legitimate communication approach for children with hearing impairment, regardless of hearing amplification devices.
[40] Ching, T.Y.C., Dillon, H., Leigh, G. and Cupples, L. (2017). Learning from the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study: summary of 5-year findings and implications. *International Journal of Audiology.* 57 (sup2):1–7. https://doi.org/10.1080/14992027.2017.1385865	Australia	N = 470	• AVT	Better language outcomes are associated with: • The use of spoken language for communication • Less severe hearing loss • Higher non-verbal cognitive ability • Higher maternal education Absence of additional disabilities	To achieve parity of outcomes with normal hearing peers further research should address: • How spoken language is best learnt in the presence of hearing impairment. Effective ways for parents to promote communication

identification of hearing impairment, b) the use of high-tech amplification to enhance access to the speech signal, c) providing early intense (re)habilitation whilst presenting auditory stimuli as the primary sensory input, and d) family involvement as critical aspects of success with AVT [4,7,32–34,36,38,41]. South Africa has, since 1995, recommended the implementation of EHDI; however, the focus to date has been on screening programs, to the detriment of intervention. A small number of studies exist focusing on the age of identification of hearing impairment in South Africa; with the mean age of identification ranging from 1 year 3 months to 2 years 3 months, and a mean age of initiation of EI services at 2 years 5 months old [42,43]. Various reasons for this have been proffered.

AVT emphasizes fitting children with state-of-the-art hearing technologies, teaching them to use their residual hearing optimally. One reviewed study indicated that children receiving cochlear implants younger than 12 months presented with language outcomes within the normal range compared to their typically developing hearing peers [34]. Other reviewed studies indicate that early use of hearing amplification devices is associated with age-appropriate verbal communication outcomes for children with hearing impairment [4,9]. Furthermore, Cupples et al. [35] discuss the extent to which hearing aids improved the speech production and language outcomes of children. The results indicated significant improvements in their speech and language outcomes, suggestive of the clear benefit of amplification [7,35]. It suggests the benefits of early intervention persist into school age, postulating that future studies of the same cohort of children will provide robust predictors of outcomes at school age [35].

Conversely, Percy-Smith et al. [37] report that the language outcomes achieved within their study were regardless of hearing technology. In South Africa, state-of-the-art hearing technologies, such as cochlear implantation, are not widely available within the public healthcare sector. Hearing aid technology has progressed; unfortunately, the costs remain prohibitive. The delayed age of identification of hearing impairment, coupled with the sub-optimal provision of amplification devices further delays the age of initiation of EI services [42]. These factors conspire to delay definitive intervention, with no particular emphasis on AVT [44].

Only one study compared the language outcomes of children enrolled in different intervention programs. Percy-Smith et al. [36] studied two cohorts who received either standard habilitation (i.e., traditional speech-language therapy) or AVT. Results indicated that children in the AVT program outperformed those in the standard habilitation program, yielding higher odds at performing at age-equivalent speech and language levels [36]. EI, in general, is associated with positive language outcomes in children with hearing impairment [45]. Whilst the therapeutic approaches may vary, there is congruence among the strategies suggested to families [45]. A comparative study is essential between the adapted AVT approach (LSLS-SA) to the standard habilitation approach that is mostly implemented.

Studies reviewed were limited by the lack of control or comparison groups and failure to compare therapeutic intervention approaches. Most of the studies reviewed were conducted in high-income countries, raising serious implications for extrapolating findings to South Africa. The linguistic and cultural diversity further poses a challenge to the family-centered approach. Unbiased research regarding the effectiveness of AVT for hearing-impaired children must be conducted.

4. Conclusion and recommendations

Findings indicated only one study that directly compared language outcomes between or among different programmes. Due to the limited evidence base, the review cannot conclude definitively that AVT yields positive speech, language, and scholastic outcomes in children with hearing impairment but supports the hypothesis that early provision of AVT yields positive outcomes for hearing-impaired children. Further, this benefit appears dependent upon family-centered care and appropriate hearing amplification, factors that impact the success of an EI programme and vary widely across countries. There is a need for rigorous country-specific research comparing family-based intervention approaches for hearing-impaired children. A determination of the most effective approach to EI can be made only by examining different approaches with consideration for economic, cultural, and/or linguistic differences across regions or countries. This review highlights the need to investigate the speech-language acquisition and scholastic outcomes of children receiving AVT (LSL), particularly within South Africa. The dearth of research into AVT highlights the need for controlled studies and raises important implications for policy development.

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Declaration of competing interest

None.

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Appendix M

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AOSIS

Page 1 of 11 Original Research

A comparative study of learning outcomes for hearing-impaired foundation phase learners

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Background: Two intervention approaches are implemented in South Africa to alleviate the deleterious consequences of congenital or early onset hearing impairment on language acquisition and subsequent poor learning outcomes.

Aim: This study investigated the learning outcomes of foundation phase learners with severe to profound hearing impairment who received Listening and Spoken Language – South Africa (LSL-SA) (adapted Auditory Verbal Therapy) therapy compared to those who received Traditional Speech-Language Therapy (TSLT).

Setting: The study was conducted at four early intervention (EI) schools for children with hearing impairment across three provinces in South Africa.

Methods: Data were collected through record reviews of their Speech-Language Therapy Outcomes and South African National Department of Basic Education academic report cards. Data were analysed using quantitative statistics.

Results: Findings demonstrated that children with hearing impairment enrolled in LSL-SA outperformed those enrolled in TSLT in achieving age-equivalent language outcomes. A higher percentage of learners enrolled in LSL-SA achieved meritorious to outstanding learning outcomes. While a comparable number of learners progressed to mainstream schooling, children with hearing impairment enrolled in LSL-SA are enrolled for a shorter duration until discharge than those enrolled in TSLT. This is an important finding, particularly in low-middle income countries (LMICs).

Conclusion: Listening and Spoken Language – South Africa graduates achieved superior learning outcomes dependent on language attainment, providing contextually relevant evidence supporting the effectiveness of the LSL-SA EI approach.

Contribution: These context-specific outcomes stress the obligation to upscale and fast-track EI services. Implications for investment in LSL-SA are proposed through collaboration between families, educators, and early interventionists.

Keywords: academic achievement; auditory-verbal therapy; early hearing detection and intervention; early intervention; hearing impairment; listening and spoken language – South Africa; learning outcomes; schooling.

Introduction

The pathways for future academic success are often shaped during early childhood. 'Early childhood is defined as the period from prenatal development to 8 years of age' (World Health Organization [WHO], 2007), as young children learn essential skills that serve as the foundation for the development of later academic skills (Gertler et al. 2014; Hanover Research 2016; Woodhead et al. 2014). Evidence indicates that a hearing impairment denies children access to appropriate stimulation, impacting the development of cognitive abilities, language, and psychosocial skills needed for classroom learning (Black et al. 2017; Feder et al. 2017; Lang-Roth 2014).

Language is the foundation of all communication and influences how we express ourselves, analyse, process, decode, and understand information (Sherred 2021). Language abilities are among several important factors contributing to academic success (Antia et al. 2020; Goldblat & Pinto 2017; Mahmud 2014; Moeller et al. 2007). Auditory input is critical to language development. Consequently, early identification of a child's hearing impairment is important for implementing early amplification and intervention (Korver et al. 2010).

South Africa, it continues to be delivered primarily by the private healthcare sector and often at a significant financial cost to the patient and their family (Maluleke 2022; White & Brennan-Jones 2014). Knowledge of the economic costs associated with a hearing impairment is a powerful tool for policymakers in planning the best use of their healthcare budgets, especially in LMICs (World Health Organization [WHO] 2017).

Children with better oral communication skills perform better academically (Sherred 2021). Fairgray et al. (2010) investigated the effects of AVT on school-aged children with hearing impairment, and their findings support the notion that AVT techniques improve outcomes of children aged 5–17 years old with hearing impairment in receptive language, phonological development, articulation, and listening in noise. In a study examining the effects of the frequency of EI on spoken language and literacy outcomes, Geers et al. (2019) concluded that greater availability of EI services (0–36 months old) yielded higher spoken language and literacy scores at the foundation phase. Furthermore, studies consistently show that children with hearing impairment enrolled in an LSL EI programme attain significantly higher levels of language and learning outcomes relative to age-matched peers than children without EI (Davidson, Osman & Geers 2021). Positive outcomes prevail across auditory verbal centres; however, these data are based on limited empirical evidence (Rhoades 2010). Additionally, all the positive reviews and documented outcomes of AVT globally have emanated from studies conducted in high-income countries (HICs).

The education of learners with hearing impairment is controversial, particularly regarding the type of school placement and, relatedly, the intervention approach adopted (Marschark et al. 2015). There is a dearth of evidence regarding the learning outcomes of children with hearing impairment enrolled in TSLT programmes compared to LSL approaches. In a systematic review by Erbasi, Hickson and Scarinci (2017), findings indicated that communication outcomes in children with hearing impairment were highly variable and evidence regarding the impact of the different EI approaches on learning outcomes was inconclusive. This scarcity of evidence is further influenced by the lack of control and/or comparison groups and the failure in available studies to compare therapeutic intervention approaches (Casoojee, Kanji & Khoza-Shangase 2021; Goldblat & Pinto 2017; White & Brennan-Jones 2014). There is a necessity for research surrounding the use and effectiveness of these different intervention approaches for children with hearing impairment in sub-Saharan Africa (Khoza-Shangase 2019).

This study aimed to contribute towards filling this identified lacuna in the context of research on the effectiveness of an LSL approach for children with hearing impairment, specifically extrapolating the findings to South Africa, a LMIC.

Methods

A quantitative, cross-sectional research approach was adopted to address the study's objectives. This study forms part of a larger study titled 'Speech-language acquisition and learning outcomes of children with hearing impairment following EI in South Africa: A comparative study'. The main aim was to investigate the learning outcomes of foundation phase learners (Grade 3) with hearing impairment who received LSL-SA (LSL-SA group) versus TSLT (TSLT group), with specific objectives being: (1) to determine if any associations exist between selected study variables (i.e., gender, home language, age at diagnosis of hearing impairment, cause of hearing impairment, duration of amplification, type of hearing amplification device, age at start of EI, duration of EI) within the intervention approaches and learning outcomes; (2) to explore the learning outcomes in the LSL-SA group; (3) to describe the learning outcomes in the TSLT group; (4) to compare the learning outcomes between the two groups; (5) to describe the communication functioning at the onset of EI compared to the communication functioning upon discharge from therapy; (6) to determine the association between communication functioning and learning outcomes; and (7) to identify the promotion to mainstream schooling on completion of the foundation phase as an indicator of academic success.

Study sample and demographics

A total of 64 therapy records and academic reports of children with severe to profound hearing impairment, selected through a non-probability purposive sampling technique, were included in the study, and their demographic data were collected (Table 1). This sample size allowed for detecting medium-large effect sizes ($w = 0.39$) with calculations carried out in G*Power (Faul et al. 2007). The children were enrolled at one of the EI schools in: (1) Johannesburg, Gauteng; (2) Pretoria, Gauteng; (3) Morningside, KwaZulu-Natal; and (4) Cape Town, Western Cape.

Inclusion and exclusion criteria

The records of children: (1) diagnosed with a congenital or early onset, bilateral, severe to profound hearing impairment, (2) enrolled in an EI programme receiving either TSLT or the LSL-SA approach, (3) fitted with hearing aids or cochlear implants, (4) who have completed Grade 3 in the foundation phase of primary schooling, were included in the study. Records of children with hearing impairment who presented with additional comorbidities, such as cognitive impairment, were excluded from the study.

Procedures

Written permission was obtained from all relevant authorities, granting the researcher access to the educational facilities, and to disseminating information to the parents and/or primary caregivers of children with hearing impairment, inviting them to participate in the study. Once access was granted, the researcher compiled a list of potential participants using non-probability purposive sampling. Parents of all the participants signed an informed consent after indicating their willingness to allow the researcher to access their child's therapy files and Grade 3 academic reports.

Data collection tool

A retrospective data collection tool was developed for this study and was pre-tested at each EI school using a therapy file and academic report. The main study did not include records used in the pilot study. The data collection form comprised three sections: Section A, Child Demographics; Section B, Intervention Outcomes; and Section C, Learning Outcomes. The retrospective record review of written and printed records aimed to gather information regarding: (1) the child's hearing impairment; (2) the age at diagnosis of hearing impairment and age at initiation of EI services; (3) the type of amplification device; and (4) speech-language outcomes in comparison to learning outcomes at the end of Grade 3 at the EI school.

Data analysis

The statistical significance of the categorical variables (i.e., gender, home language, cause of hearing impairment) and its association between the LSL-SA and TSLT approach (i.e., marks for each subject in Grade 3 and communication functioning at discharge from therapy) was determined using the X^2 test. Fisher's exact test was used for 2 × 2 tables or where the requirements for the X^2 test could not be met. The strength of the associations was measured by Cramer's V and the Phi coefficient, respectively.

The association between the intervention approach and the selected continuous study variables and marks for each subject in Grade 3 and communication functioning at discharge from therapy was determined using the independent samples t-test (or one-way analysis of variance [ANOVA] for more than two groups). Where the data did not meet the assumptions of these tests, the corresponding non-parametric tests were used, that is, the Wilcoxon Rank Sum test and the Kruskal–Wallis test. The strength of the associations was measured by Cohen's d for parametric tests and the r-value for the non-parametric tests. Data were analysed using SAS Software, version 9.4 for Windows, Cary, NC, USA: SAS Institute Inc. (2002-2010) (previously Statistical Analysis System) version 9.4 for Windows (SAS 2002–2010).

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of the Witwatersrand, Human Research Ethics Committee (No. H20/06/03).

Results

As depicted in Table 1, of the 64 participants, 29 were male, and 35 were female. The medium of instruction at the participating schools is English and Afrikaans. Children are enrolled in English or Afrikaans based on the language used in intervention sessions. The most spoken languages in the participants' households included 4 of the 11 official languages in South Africa. The records of 15 participants indicate that they do not receive EI in their home language. Table 1 presents a further description of the participants' demographic profiles.

The association between the categorical variables (i.e., age at diagnosis of hearing impairment, duration of amplification, type of hearing amplification device, age at the start of EI, duration of EI) within the intervention approaches (i.e., LSL-SA or TSLT) and learning outcomes are depicted in Table 2.

The average age of diagnosis of hearing impairment in this study was 2.4 years old. When comparing the age of diagnosis of hearing impairment and age of enrolment in an EI programme between the TSLT and LSL-SA groups, the average age of diagnosis and age of enrolment in an EI programme, respectively, for the LSL-SA group was 2.7 years old and 2.9 years old, and for the TSLT group was 2.0 years old and 2.4 years old. The age at diagnosis of hearing impairment and, consequently, the commencement of EI within the TSLT EI approach is earlier in comparison to the LSL-SA EI approach. The percentage of participants between the two EI groups implanted with cochlear implants to those fitted with hearing aids is comparable. The study found that the mean duration of EI until discharge was significantly longer for those who underwent TSLT (7.3 years; standard deviation [s.d.] 1.2 years) compared to those who underwent LSL-SA (5.9 years; s.d. 1.2 years); $p = 0.011$ (moderate effect size; Cohen's d = 0.75), despite those in the TSLT EI group having a longer duration of amplification.

The categorical variable for causes of hearing impairment of the children included in the study is depicted in Table 3. Because of missing data in the children's records, only 38 records could be analysed. Genetic causes were the dominating variable, accounting for 20% of the children with hearing impairment; 6% was attributed to prematurity, 6% to meningitis, 5% to ototoxicity, and 3% each to birth asphyxia, hydrocephalus, and parental substance abuse. Sixteen additional causes were identified, each accounting for 1% of the records analysed.

TABLE 1: Demographic data of children included in the study (N = 64).

Demographic profile	n
Gender	
Male	29
Female	35
Home language	
English	31
Afrikaans	17
Xhosa	14
Sotho	1
English and Afrikaans	1

TABLE 2: Categorical variables of children included in the study (N = 64).

Characteristic	Overall							TSLT							LSL-SA							p value for between-group comparison
	n	%	Median	IQR	Mean	s.d.	Range	n	%	Median	IQR	Mean	s.d.	Range	n	%	Median	IQR	Mean	s.d.	Range	
Type of EI	64	-	-	-	-	-	-	23	-	-	-	-	-	-	41	-	-	-	-	-	-	-
Age at diagnosis of hearing impairment	-	-	2.4	1.4–3.6	-	-	0.0–8.0	-	-	2.0	0.8–2.6	-	-	0.1–6.2	-	-	2.7	1.6–4.0	-	-	0.0–8.0	0.098
Type of amplification																						0.78
Hearing Aid	18	28	-	-	-	-	-	7	30	-	-	-	-	-	11	27	-	-	-	-	-	
Cochlear Implant	46	72	-	-	-	-	-	16	70	-	-	-	-	-	30	73	-	-	-	-	-	
Duration of amplification (years from earliest amplification to current age)	-	-	-	-	2.4	3.2	-7.0–8.6	-	-	-	-	3.8	2.2	-0.3–8.6	-	-	-	-	1.6	3.4	-7.0–7.8	0.0060 (d = 0.69)
Age at EI start (years)	-	-	2.8	1.6–4.0	-	-	0.2–8.2	-	-	2.4	1.5–3.0	-	-	0.2–5.4	-	-	2.9	1.6–4.7	-	-	0.2–8.2	0.10
Duration of EI (years)	-	-	-	-	6.4	2.0	0.6–10.9	-	-	-	-	7.3	1.2	5.3–9.4	-	-	-	-	5.9	2.2	0.6–10.9	0.0061 (d = 0.78)

EI, early intervention; IQR, interquartile range; s.d., standard deviation; TSLT, traditional speech-language therapy; LSL-SA, listening and spoken language – South Africa.

Table 4 depicts the learning outcomes found in this study for the LSL-SA group compared to the TSLT group at the end of the foundation phase (N) = 64).

The records indicate that a higher distribution of learners achieve lower grades (0% – 59%) in the TSLT group. In comparison, a significantly higher percentage of learners who received the LSL-SA EI approach achieved a meritorious to outstanding result (70% – 100%) when compared to those who received the TSLT EI approach. This achievement was translated across all subject areas included in the analysis, as depicted in Table 4. These learning outcomes between-group comparisons for learners who achieved 70% and above for Home Language, Life Skills and Mathematics are depicted in Figure 1.

The communication functioning at the onset of the EI approach, depicted in Table 5, compares the communication functioning upon discharge from therapy, depicted in Table 6 for the LSL-SA group and TSLT group, respectively, at the end of the foundation phase.

As indicated in Table 5, for all participants, communication functioning was delayed at the onset of EI for learners who received LSL-SA and those who received TSLT. The records of participants in this study indicate that a comparable number of learners who received TSLT to those who received LSL-SA achieved age-appropriate scores upon discharge from the EI approach at the end of the foundational phase in the areas of speech, receptive language, and cognitive-linguistics (as shown in Table 6). The results obtained in this study further indicate that in the areas of vocabulary, expressive language and audition, a

TABLE 3: Cause of hearing impairment of children included in the study (N = 38).

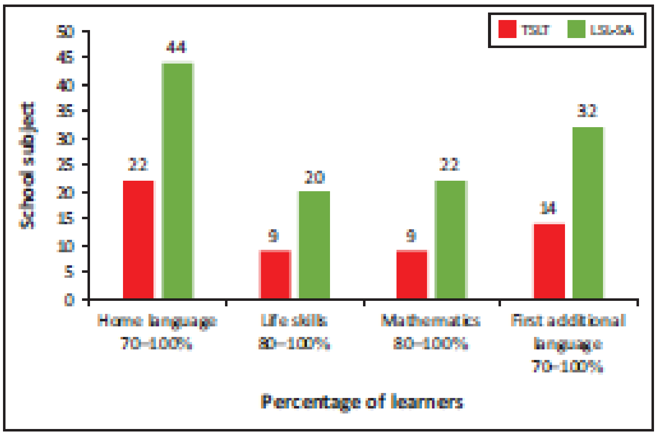
Cause of hearing impairment	n	Percentage (%)
Genetic	13	20
Meningitis	4	6
Prematurity	4	6
Ototoxicity	3	5
Birth asphyxia	2	3
Parental substance abuse	2	3
Hydrocephalus	2	3
Brain swelling	1	2
Placentae Abruptio at birth	1	2
NICU	1	2
Chicken Pox	1	2
Recurrent Otitis Media	1	2
Congenital Rubella	1	2
Cleft palate	1	2
Consanguineous	1	2
Cytomegalovirus	1	2
Septicaemia	1	2
Renal failure	1	2
Jaundice requiring transfusion	1	2
Trauma	1	2
Maternal German Measles	1	2
Parental alcohol abuse	1	2
Enlarged vestibular aqueducts	1	2
Unknown	27	42

NICU, neonatal intensive care unit.

TABLE 4: Learning outcomes between traditional speech-language therapy and listening and spoken language – South Africa at the end of Grade 3 (*N* = 64).

Subject area	Learning outcome	Overall (*N* = 64)		TSLT (*N* = 23)		LSL-SA (*N* = 41)		*p*-value for between-group comparison
		n	%	*n*	%	*n*	%	
Home language	0–59	23	36	10	43	13	32	0.22
	60–69 Substantial	18	28	8	35	10	24	-
	70–100	23	36	5	22	18	44	-
Life skills	0–69	29	45	9	39	20	49	0.28
	70–79 Meritorious	25	39	12	52	13	32	-
	80–100 Outstanding	10	16	2	9	8	20	-
Mathematics	Subject not taken	1	2	0	0	0	0	0.066
	0–49	11	17	4	18	7	17	-
	50–59 Adequate	11	17	7	32	4	10	-
	60–69 Substantial	19	30	8	36	11	27	-
	70–79 Meritorious	11	17	1	5	10	24	-
	80–100 Outstanding	11	17	2	9	9	22	-
First Additional Language (FAL)	Subject not taken	1	2	0	0	0	0	0.055
	0–49	19	30	4	18	15	37	-
	50–59 Adequate	18	28	10	45	8	20	-
	60–69 Substantial	10	16	5	23	5	12	-
	70–100	16	25	3	14	13	32	-

TSLT, traditional speech-language therapy; LSL-SA, listening and spoken language – South Africa.



TSLT, traditional speech-language therapy; LSL-SA, listening and spoken language – South Africa.

FIGURE 1: Comparative percentage of learners who achieved 70% and above.

significantly higher number of learners who underwent the LSL-SA EI approach achieved age-appropriate scores compared to those learners who underwent the TSLT EI approach.

The following significant associations between language functioning and academic marks as an outcome of EI were found:

- Home Language marks tended to be higher for those with age-appropriate vocabulary upon therapy discharge (p = 0.020; Cramer's V = 0.35; moderate effect size). There was a similar finding for Receptive Language, Expressive Language, and Cognitive linguistics.
- Life Skills marks tended to be higher for those with age-appropriate Receptive Language upon therapy discharge (p = 0.045; Cramer's V = 0.31; moderate effect size). There was a similar finding for Expressive Language.
- Mathematics marks tended to be higher for those with age-appropriate Receptive Language upon therapy discharge (p = 0.034; Cramer's V = 0.40; moderate effect size).
- First Additional Language marks tended to be higher for those with age-appropriate Receptive Language upon therapy discharge (p = 0.024; Cramer's V = 0.39; moderate effect size). There was a similar finding for Expressive Language.

Consideration of promotion to mainstream schooling on completion of the foundation phase, resultant of EHDI, is a marker of academic success. The type of schooling recommended upon completion of the foundation phase is depicted in Table 7.

Comparing TSLT to LSL-SA, there was no statistical difference in the number of learners who progressed to mainstream schooling upon completing Grade 3. This accounts for two-thirds of the participant sample.

Discussion

A representative sample of 64 records of foundation phase learners with hearing impairment who received LSL-SA or TSLT were used in the analyses of this study. The two EI cohorts were matched for gender and type of amplification device. The typical age of diagnosis of hearing impairment in the study varied between 2.0 and 2.7 years, and the age at the start of EI varied between 2.4– and 2.9 years. The study confirms that the speech-language and learning outcome measures used in the study have validity, as the EI schools in South Africa use the same measures for the assessment of these outcomes.

While attempting to determine if any associations exist between selected study variables (i.e., gender, home language, age at diagnosis of hearing impairment, cause of hearing impairment, duration of amplification, type of hearing amplification device, age at the start of EI, duration of EI) within the intervention approaches (LSL-SA and TSLT) and learning outcomes, current findings indicate that 25% of the participants and their families receive EI in the child's

TABLE 5: Communication functioning at the onset of the early intervention approach (N = 64).

Communication functioning at the onset of therapy	Overall		TSLT		LSL-SA		p-value for between-group comparison
	n	%	n	%	n	%	
Speech							
Delayed	63	98	23	100	40	98	> 0.99
Age appropriate	1	2	0	0	1	2	-
Vocabulary							
Delayed	63	98	23	100	41	100	NA
Age appropriate	0	0	0	0	0	0	-
Unknown	1	2	0	0	0	0	-
Receptive language							
Delayed	63	98	23	100	40	98	> 0.99
Age appropriate	1	2	0	0	1	2	-
Expressive language							
Delayed	64	100	23	100	41	100	NA
Age appropriate	0	0	0	0	0	0	-
Audition							
Delayed	63	98	22	96	41	100	0.36
Age appropriate	1	2	1	4	0	0	-
Cognitive linguistics							
Delayed	61	95	23	100	38	93	0.55
Age appropriate	3	5	0	0	3	7	-

TSLT, traditional speech-language therapy; LSL-SA, listening and spoken language – South Africa.

TABLE 6: Communication functioning upon discharge from the early intervention approach (N = 64).

Communication functioning at discharge of therapy:	Overall		TSLT		LSL-SA		p-value for between-group comparison
	n	%	n	%	n	%	
Speech							
Delayed	26	41	10	43	16	39	0.79
Age appropriate	38	59	13	57	25	61	-
Vocabulary							
Delayed	34	53	14	61	20	49	0.44
Age appropriate	30	47	9	39	21	51	-
Receptive language							
Delayed	34	53	13	57	21	51	0.80
Age appropriate	30	47	10	43	20	49	-
Expressive language							
Delayed	35	55	14	61	21	51	0.60
Age appropriate	29	45	9	39	20	49	-
Audition							
Delayed	28	44	12	52	16	39	0.43
Age appropriate	36	56	11	48	25	61	-
Cognitive linguistics							
Delayed	22	34	9	39	13	32	0.59
Age appropriate	42	66	14	61	28	68	-

TSLT, traditional speech-language therapy; LSL-SA, listening and spoken language – South Africa.

TABLE 7: Type of school recommended upon completing Grade 3 (N = 64).

Type of school recommended after EI	Overall		TSLT		LSL-SA		The p-value for between-group comparison
	n	%	n	%	n	%	
Mainstream	40	63	14	61	26	63	> 0.99
Remedial	24	37	9	39	15	37	-

TSLT, traditional speech-language therapy; LSL-SA, listening and spoken language – South Africa.

second language because of a lack of another common language between the Early Interventionist and the child.

These findings are consistent with gaps identified within the South African context, evidencing a significant linguistic and cultural mismatch between Speech-Language Therapists and/or Audiologists and the population they serve (Gxilishe 2011; Khoza-Shangase & Mophosho 2018, 2021; Mdladlo et al. 2016).

In a systematic review by Larson et al. (2020), various studies confirmed that the language of intervention played a role in intervention effectiveness. The findings of this study highlight that LSL-SA interventionists face immense challenges in providing equitable services based on linguistic diversity. This may influence the successful implementation of communication intervention approaches in South Africa. These findings raise implications that breach AVT (and LSLS-SA) principles in providing support services to families of children with hearing impairment, failing to facilitate educational and social inclusion, and creating a challenge in meeting the demands of all families.

Optimal communication and learning outcomes for children with hearing impairment are associated with early diagnosis and early enrolment in effective EI programmes (Auditory Verbal UK, 2022b). Although the age of diagnosis of hearing impairment (2.0 years) and age at enrolment in an EI programme (2.4 years) is earlier for the TSLT group, findings of this study indicate that even the adjusted 1-4-8 South African guidelines have not been achieved to date (HPCSA 2018). These findings are consistent with the findings of Kuschke et al. (2020), indicating an average age of diagnosis of hearing impairment at 2.6 years, Chan (2018) at 2.58 years, Butler et al. (2015) at 3.01 years and Khoza-Shangase and Michal (2014) at approximately 2.0 years. These findings highlight the delay within the South African context in meeting stipulated guidelines and raise implications for translating policy into practice.

The causes of hearing impairment identified in this study correlate with causes identified by Smith et al. 2023; the American Speech-Language-Hearing Association (2023), and Korver et al. (2017). Congruent with many studies, a definitive cause was unidentified in 38% of the participants (Korver et al. 2017; Mulwafu, Kuper & Ensink 2015). The findings of this study did not find any statistically significant association between the cause of hearing impairment within the intervention approaches (i.e., LSL-SA and TSLT) and learning outcomes, but raised awareness of understanding the risk profile of infants in an LMIC, depending upon the underlying cause. These findings raise implications in planning EHDI services, particularly preventive audiology initiatives.

Despite these confounding variables, this study's findings indicate that children with hearing impairment enrolled in the LSL-SA intervention approach attend therapy for a shorter duration until discharge. This is a positive finding for this LMIC, given the financial stressors imposed by a hearing impairment on resource-constrained African healthcare systems (Hear-It.org 2019). Although the current study does not provide exact financial figures, these findings support the mathematical modelling study by Baltussen and Smith (2012), stating that when available effective interventions are implemented to remediate hearing impairment in sub-Saharan Africa, substantial health gains of up to $32 million Disability-Adjusted Life Years (DALYs) are achieved. These findings raise implications for managing the burden of disease in LMICs.

When exploring the learning outcomes in the LSL-SA group, findings show a positive contribution of LSL-SA to the grades achieved in Home Language, Life Skills, Mathematics and FAL. The findings of this study are consistent with previous studies indicating that children with hearing impairment receiving AVT achieve average to above-average grades on measures of academic achievement (Auditory Verbal UK, 2022a; Eriks-Brophy et al. 2012; Goldblat & Pinto 2017). These findings highlight the dearth of empirical research on learning outcomes, as only one of these studies compared the learning outcomes of children with hearing impairment who received AVT to those not enrolled in an AVT approach (Goldblat & Pinto 2017). Notably, the study by Goldblat and Pinto (2017) included participants with additional special needs. It additionally did not have information on the EI approach that the control group received, resulting in an inability to compare the learning outcomes based on affiliation to a certain rehabilitation approach (Goldblat & Pinto 2017). This study's findings highlight the paucity of well-controlled research in this field and raise the need for further empirical research comparing EI approaches and their impact on learning outcomes in diverse contexts.

As far as the learning outcomes of foundation phase learners with hearing impairment who received TSLT are concerned, learners are exposed to an adapted curriculum in which grade-appropriate core skills are taught and assessed within a small class setting and with therapeutic intervention. These adaptations support how the content is taught and assessed at a grade-appropriate level equivalent to normal hearing learners. While exploring the TSLT group's learning outcomes, findings indicate that more learners achieve lower grades in Home Language, Life Skills, and Mathematics. The findings are consistent with the literature stating that children with hearing impairment are at higher risk of poorer academic achievement (Su et al. 2020). The findings of this study further highlight the inconsistencies among EI approaches for children with hearing impairment as existing research relating to TSLT varies widely in participant characteristics, laterality and degree of hearing loss, and philosophies of EI approaches (Ganek & Cardy 2021). These findings highlight the need for addressing the academic repercussions of childhood hearing impairment by implementing evidence-based speech and language treatment protocols for children, especially in resource-constrained settings such as South Africa.

When the learning outcomes of foundation phase learners between the two groups were compared, this study's findings correlate with the learning outcomes found in Goldblat and Pinto (2017), the only study that compared the learning outcomes of AVT graduates to the learning outcomes of those not enrolled in an AVT approach. Goldblat and Pinto (2017) suggest that AVT graduates outperformed the control group who were not rehabilitated via the AVT approach. The findings of this study indicate that the LSL-SA EI approach yields superior learning outcomes compared to the TSLT approach. It is noteworthy that contributing factors such as degree of hearing loss, language skills pre-EI, age-range, and school grade were controlled for in the study by Goldblat and Pinto (2017).

When comparing the communication functioning at the onset of EI to the communication functioning upon discharge from the EI approach, this study's findings revealed delayed speech, vocabulary, receptive and expressive language, audition, and cognitive-linguistics development prior to receiving EI, as expected. This is congruent with research data that 'the first 3 years of life are critical for developing spoken language through listening' (Auditory Verbal UK 2020). Upon discharge from EI at the end of the foundation phase, this study's findings demonstrated that children with hearing impairment enrolled in LSL-SA outperformed those enrolled in TSLT by achieving age-equivalent outcomes of vocabulary, expressive language (spoken language) and audition (listening skills). These results are consistent with the findings of research conducted by Auditory Verbal UK, (2022a), Yanbay et al. (2014), Dettman et al. (2013), Motasaddi-Zarandy et al. (2009), Percy-Smith et al. (2017), and Fairgray et al. (2010). Mortazavi and Mortazavi (2017) advocate for the AVT approach as a legitimate communication approach for children with hearing impairment regardless of the type of hearing amplification devices. The findings of this study are congruent with Mortazavi and Mortazavi 2017. as a comparable number of participants enrolled in LSL-SA (70%) and TSLT (73%) are implanted with cochlear implants. These findings highlight the need for Early Interventionists to capitalise on current knowledge and mobilise collective resources to ensure improved developmental outcomes for children with hearing impairment in LMICs.

Many studies agree that possessing competent language forms the basis of reading and literacy (Catts 2003; Tunick & Pennington 2002; Burgess 2002). *When determining the association between communication functioning and learning outcomes*, there was a significant trend linking higher grades to age-appropriate language skills in vocabulary, receptive language, expressive language, and cognitive linguistics across learning outcome measures for languages (i.e., Home Language and FAL) and life skills. Mathematics measures indicate a trend linked to higher marks across all participants of age-appropriate receptive language. This study's results concur with findings that mathematics requires reading comprehension and understanding specific linguistic mathematical terms such as conditionals, comparatives, and inferential statistics (Edwards, Edwards & Langdon 2013; Mukari, Ling & Ghani 2007; Traxler 2000). These trends reflect positive learning outcomes based on enrolment in an EI communication intervention approach, with no differentiation between LSL-SA and TSLT. The findings of this study contrast with a study conducted by Percy-Smith et al. (2017), who researched the impact of (re)habilitation strategies on speech-language outcomes for early cochlear implanted children who received different communication intervention approaches following cochlear implantation, that is, TSLT versus AVT. Children with hearing impairment enrolled in the AVT intervention approach scored age appropriately and outperformed children with hearing impairment enrolled in TSLT on receptive language, expressive language, and productive vocabulary (Percy-Smith et al. 2017).

When identifying the promotion to mainstream schooling on completion of the foundation phase as an indicator of academic success, this study's findings support research data that indicate an EHDI approach (i.e., appropriate hearing amplification, family-centred care and appropriate intervention) will allow children with hearing impairment to achieve linguistic skills at the same level as their hearing peers and contribute to their integration into mainstream schooling (Casoojee et al. 2021; Ching et al. 2017; Fulcher et al. 2015). The findings highlight that EI, in general, is associated with positive language outcomes in children with hearing impairment and while the therapeutic approaches may vary, there is congruence among the strategies suggested to families (Casoojee et al. 2021; Roberts 2019). This study's findings redress the lacuna of research in the South African context, providing results regarding the schooling career of children with hearing impairment upon completion of Grade 3.

Furthermore, this study's findings are noteworthy, as the estimated annual cost of deaf education in a residential school for the deaf in South Africa is $9459.50 per child (Emmet & Francis 2015). A cost analysis conducted by the National Center for Hearing Assessment and Management (NCHAM 2010) indicates that substantial amounts of money would be saved over a child's educational lifetime if, because of early and effective interventions, the most appropriate educational setting for the child is a regular mainstream classroom instead of residential programmes.

Conclusion

The findings of this study emphasise the importance of EHDI, whether TSLT or LSL-SA, as they conclude that learning outcomes depend on language attainment achieved within both approaches. However, a deeper analysis of the results reveals that children with hearing impairment enrolled in LSL-SA outperform those enrolled in TSLT in achieving age-equivalent language outcomes. Children with hearing impairment enrolled in LSL-SA are enrolled for a shorter duration until discharge than those enrolled in a TSLT approach. This finding is important for LMICs with limited resources, such as South Africa. This finding suggests a possible reduction in the global burden of disease caused by hearing impairment. The results suggest that EI services must be adapted to local contexts. Although a comparable number of children with hearing impairment progressed to mainstream schooling, children with hearing impairment enrolled in LSL-SA achieved meritorious to outstanding learning outcomes. The study suggests that new and updated policies and guidelines in South Africa regarding the current EI approaches for children with hearing impairment are needed. Frameworks are required to achieve proper and effective monitoring and evaluation systems that track progress and improve levels of access to and the quality of EI services for infants and young children as stipulated in government policies. The results obtained in this study, at best, attest to the premise of LSL-SA in maximising linguistic competence and literacy development for infants and young children with hearing impairment and, at the very least, stresses the need for further study.

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Competing interests

The authors have declared that no competing interest exists.

Authors' contributions

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Data availability

The data that support the findings of this study are available from the corresponding author, A.C., upon reasonable request.

Disclaimer

The views and opinions expressed in this article are those of the authors and are the product of professional research. It does not necessarily reflect the official policy or position of any affiliated institution, funder, agency, or that of the publisher. The authors are responsible for this article's results, findings, and content.

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Appendix N

OPEN ACCESS

Exploration of parental perspectives and involvement in therapeutic communication approaches for deaf and/or hard-of-hearing children at special schools in South Africa

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ABSTRACT
Family-centred intervention optimises the development of communication abilities and academic outcomes in children with hearing loss. Cognisance of family values, respect for family differences and adaptations to cultural and linguistic diversity ensure the collaboration of parent-professional relationships. This study investigated the parental involvement and parental perceptions regarding the communication intervention approaches implemented (i.e., traditional speech-language therapy and listening and spoken language-South Africa—adapted Auditory Verbal Therapy) for children with profound hearing loss. The study was conducted at special schools for children with hearing loss across four provinces in South Africa, where grade-level core skills are taught using a mainstream curriculum complemented by specialised instruction. Data were collected through a parental self-administered survey and a retrospective record review. An inductive analysis of transcripts was conducted, and the Fisher's exact test assessed associations between data sets. Findings demonstrated limited informational counselling provided to parents regarding communication intervention options. Following the initiation of the communication intervention process, findings indicate parental buy-in, fuelled by their aspirations for their child with a hearing loss. Although results suggest that parents prefer a listening and spoken language therapeutic communication modality, this approach is hindered by the lack of culturally sensitive and linguistically appropriate care. This is an important finding, particularly in multilingual and multicultural contexts like South Africa. These context-specific outcomes emphasise that communication interventionists must be cognizant of parental-informed decision-making, cultural contexts and linguistic sensitivity for effective parent-professional collaborations.

BACKGROUND
A congenital hearing loss present at birth or early onset permanent bilateral hearing loss are common defects in neonates and infants. Hearing loss prevents children from receiving adequate access to auditory stimulation, impacting the development of language, cognitive abilities and psychosocial skills (Health Professions Council of South Africa 2018; Black *et al* 2017). The linguistic competence and literacy development for deaf and/or hard-of-hearing (DHH) infants and young children can be maximised by Early Hearing Detection and Intervention (EHDI), that is, newborn hearing screening by 1 month old, diagnosis of hearing loss by 3 months old and the implementation of intervention services by 6 months old (1-3-6 benchmark) (Joint Committee on Infant Hearing 2019a). In South Africa, a low- and middle-income country (LMIC), the Health Professions Council of South Africa (HPCSA) has adjusted the EHDI benchmarks to 1-4-8 based on contextual factors (Casoojee *et al* 2024; Health Professions Council of South Africa 2018). Despite this, there is no established uniform system for newborn hearing screening in the public healthcare sector of South Africa. Hearing screening is currently conducted on a risk basis, which also lacks systematic implementation (Bezuidenhout *et al* 2018).

South Africa grapples with continuous challenges, including social inequality, poverty, unemployment, a high burden of disease, inequitable healthcare service provision and a substantial human resources crisis facing the health sector, a legacy of apartheid which fostered racial segregation (de Villiers 2021; Coovadia *et al* 2009). Despite these formidable pressures, South Africa has affirmed its commitment to upholding children's rights by ratifying policies that endorse unrestricted access to healthcare services and education alongside other fundamental human rights (de Villiers 2021; Balton *et al* 2020). Nevertheless, individuals with disabilities in South Africa face disparities in accessing healthcare, exacerbated by the paucity of disability-specific services, such as aural rehabilitation for hearing loss (Kuper and Hanass-Hancock 2020). This situation underscores the ongoing challenges and contradictions within the country's efforts to ensure equitable rights and opportunities for all its citizens, particularly DHH infants and young children.

The prevalence of hearing loss in South Africa is estimated at 17 babies born daily with permanent sensorineural hearing loss (Casoojee *et al* 2021). Given that 22% of the registered speech-language therapists (SLTs) and audiologists work in public healthcare in South Africa, the critical shortage of skilled healthcare professionals in relation to the high prevalence of hearing loss is evident (Casoojee 2024; Pillay *et al* 2020. Deliberations around family-centred intervention (FCI) are thus crucial to the success of EHDI programmes in LMICs. FCI is an approach that emphasises the active involvement of families in the planning, delivery and evaluation of healthcare services, prioritising the family's needs, values and goals to optimise child development outcomes (Moeller *et al* 2013; Holzinger *et al* 2022). Parents of children with hearing loss are the primary individuals involved in the child's daily life, providing a significant cultural and emotional influence on their development compared with SLTs and audiologists, who have a more limited and intermittent engagement with the child (Maluleke *et al* 2021; Mantri-Langeveldt *et al* 2019). FCI can thus be defined as a family-professional partnership, prioritising the child's developmental outcomes within the context of their family (Holzinger *et al* 2022).

To facilitate effective intervention, professionals must strive to collaborate with the parents of infants and young DHH children in the process of gaining the necessary knowledge, information, clarity and experiences that support fully informed decisions (Scarinci *et al* 2018; Moeller *et al* 2013; Joint Committee on Infant Hearing 2019b; Holzinger *et al* 2022; Maluleke and Khoza-Shangase 2023). Elements influencing parental decisions include the DHH child's unique strengths and abilities, the family's values and belief system, social circumstances, cultural influences and personal comfort level in making choices on behalf of the child (Holzinger *et al* 2022). Volterra and Gullberg (2008) suggest that language acquisition, signed or spoken, depends on the hearing family members' responsiveness to their hearing-impaired child's communication needs. Blose and Joseph (2017) found that, given the early auditory and language deprivation, intervention sessions consisting of 1 or 2 hours per week were inadequate to compensate and account for the improved language scores. Thus, empowering parents to become the primary facilitators of their child's speech and language development is a critical therapy component for DHH children learning language (Stacy Crouse 2020; Khoza-Shangase 2022).

Within the first few months after diagnosis, parents often face the heavy burden of deciding on medical and communication options for their DHH children, such as cochlear implants or sign language (DesGeorges 2016). An ongoing debate over communication choices for DHH children persists across political, moral, educational and clinical contexts (DesGeorges 2016; Kanji and Casoojee 2021). The quality and quantity of information required for families to navigate this complex process are derived from various sources while considering the cultural, educational and social implications of their decisions (Ching *et al* 2018; Davids *et al* 2021; DesGeorges 2016). The decision regarding which communication approach to use should be a dynamic, ongoing family-centred exploration with the early interventionist, focusing on the ease and frequent language exchange between the family and DHH child (Gravel and O'Gara 2003; Casoojee *et al* 2021; Prelock 2021). The communication journey of a DHH child and their family is a complex, interwoven process in which the child's use of language or method of communication may change numerous times (Blose and Joseph 2017; Scarinci *et al* 2018). Families may adjust their DHH child's communication method at various stages, influenced by the family's characteristics, strengths, beliefs, access to information and the availability of family-centred services. This necessitates that early interventionists provide ongoing support to families throughout the entirety of the DHH child's communication journey rather than limiting their advice on a communication approach to the initial decision-making phase following a hearing loss diagnosis.

Two intervention practices are implemented in South Africa for DHH children and their families. The (1) traditional speech-language therapy (TSLT) approach includes various communication methods, ranging from visual-gestural approaches like sign language, total communication (i.e., a range of communication methods, such as sign language, speech and listening, lip reading, fingerspelling, facial expressions and gestures, used in combinations tailored to each DHH child's needs) or cued speech (Casoojee *et al* 2021; Kanji and Casoojee 2021) . There is a dyadic therapy interaction during TSLT, that is, also called a remedial sequence where the first part, the therapist requests, in the second part, the client responds and in the third part, the therapist evaluates the client's response with a scaffolding role in the interaction. The (2) listening and spoken language-South Africa (LSL-SA) approach is based on auditory verbal therapy principles. The multiparty interaction during a listening and spoken language (LSL) session allows for a versatile interaction structure, providing conversational teamwork and alliances between the LSL interventionist and the parent (Ronkainen *et al* 2014). The LSL interventionist simultaneously supports the child's spoken language learning while coaching the parent (Ronkainen *et al* 2014). Active parental participation is at the core of an LSL approach (Estabrooks *et al* 2020).

Parental involvement is typically defined as a parent's ability to follow through with intervention recommendations, including attending appointments, having confidence in working with their child and engaging in communication intervention (Cejas *et al* 2021), as facilitated by programmes such as Hi-Hopes within the South African context. Parental involvement in communication interventions is not just effective but is considered as best practice in early language intervention for DHH children (Roberts 2019; Roberts and Kaiser 2011; Stephan and Manning 2017). Parents' communication skills are a significant predictor of positive language and academic development for these children (Calderon 2000). Recent studies continue to highlight the importance of these skills, showing that parents' ability to engage in responsive, supportive communication is linked to better language outcomes and academic achievement for DHH children (Miller *et al* 2024). Moreover, effective communication supports vocabulary development and fosters social-emotional skills, which are essential for academic success (Sultana and Purdy 2024). This underscores the importance of parents being taught to implement specific language support strategies (Roberts and Kaiser 2011). However, it is also important to note that hearing parents with insufficient sign language proficiency may inadvertently cause delayed language acquisition in DHH children (Hall 2017). Recent evidence challenges earlier assumptions that hearing parents must achieve fluency in sign language to support the language growth of their DHH children. Studies suggest that even limited proficiency in sign language can contribute positively to a child's language development, provided that interactions are consistent and meaningful. For instance, Delcenserie *et al* (2024) emphasise that exposure to naturalistic signed communication, regardless of parental fluency, supports language acquisition and cognitive development in DHH children. Similarly, Caselli *et al* (2021) highlight that parental engagement, rather than fluency, is the critical factor for fostering linguistic growth, as it encourages frequent and rich communication exchanges. Pontecorvo *et al* (2023) further argue that focusing on collaborative and interactive communication strategies can mitigate risks of language delay or deprivation, even when parents are not fully fluent in sign language. These findings highlight the importance of emphasising parental involvement and accessible support structures over linguistic perfection in early intervention programmes.

With >90% of DHH children born into hearing families (National Institute on Deafness and Other Communication Disorders 2021), these parents would need support to find a community of peers and role models who use both sign and spoken/written language (Lillo-Martin and Henner 2021). Despite the equal potentiality of acquiring sign language and spoken language, deaf children born to hearing parents do not have this equal potentiality to acquire sign language when their parents do not sign (Lillo-Martin and Henner 2021). Blose and Joseph (2017) found that communication for deaf children using South African Sign Language (SASL) within the South African home is problematic as communication partners are not fluent in SASL. This mismatch in the communication mode in the home context resulted in fewer communication interactions and impoverished SASL with frequent breakdowns, amid the predominance of oral language (Blose and Joseph 2017).

Early interventionists are tasked with providing informational counselling to parents. However, when this information lacks clarity or is delivered in a biased or incomplete manner, it compromises parents' ability to make fully informed choices (Kecman 2019; Moeller *et al* 2013; Porter *et al* 2018; Young *et al* 2005b). Furthermore, early interventionists are to ensure that parents acquire the necessary skills to implement the language support strategies and feel confident applying them in their daily lives (Stephan and Manning 2017). Interventions should thus be focused on helping parents gain the knowledge and skills they need to use to help their DHH child (Dempsey and Dunst 2004). In TSLT, the DHH child is the client, and the provider is hands-on with the DHH child (ie, provider-implemented) (DeVeney *et al* 2017; Ganek and Cardy 2021; Roberts 2019). On the contrary, the LSL approach coaches parents to provide the services required by the DHH child rather than simplistically teaching and focusing only on the child, to the detriment of the family and social milieu (Stacy Crouse 2020). Keeping the parents of a DHH child firmly at the centre of the child's therapy programme is intrinsic to an LSL approach (ie, parent-implemented) (White and Brennan-Jones 2014).

Socio-familial/cultural background, family communicative patterns and parental hearing sensitivity influence the development of the DHH child's communication abilities and academic outcomes (Sevinc and Senkal 2021; Bush *et al* 2014). The successful outcomes of early intervention programmes depend on more than just the communication approach or technology due to the central role of hearing in a child's development (Butler 2012). Studies have demonstrated that family support as a component of EHDI forms the backbone of the intervention process, providing numerous strengths and opportunities which have a positive impact on speech and language development (Sealy *et al* 2023; Dall *et al* 2022; Akçakaya and Tavşancıl 2016; Lew *et al* 2014; Nelson *et al* 2011). Interventions should thus be implemented in a culturally competent manner, as it would enable the collaboration of a family-professional relationship that is cognisant of family values, goals and aspirations (Naidoo and Khan 2022; Moeller *et al* 2013). Cultural competence refers to the ability of healthcare professionals to provide care to patients with diverse values, beliefs and behaviours, tailoring care to meet patients' social, cultural and linguistic needs (Betancourt *et al* 2002).

South Africa's multicultural and multilingual landscape reflects a global phenomenon where cultural competence is essential in therapeutic interventions. The South African context is uniquely characterised by the incongruence between the racial and linguistic profile of early interventionists and those of the majority of the population. Early interventionists within the South African context need to be cognisant that intervention sessions must incorporate culturally sensitive and responsive practices in their therapeutic modalities (Pinto *et al* 2024; Estabrooks *et al* 2020; Paul and Roth 2011; Pascoe and Norman 2011). The LSL intervention approach and its therapy resources developed by clinicians and researchers in high-income countries are being implemented in South Africa due to the absence of our own contextually relevant resources (Pascoe and Norman 2011). Contextually relevant resources refer to assessment tools, intervention programmes, guidelines and norms developed for use within a specific population and setting (Pascoe and Norman 2011). It is well-established that culturally responsive intervention approaches are more readily embraced (Pascoe and Norman 2011).

Among the most challenging issues interventionists face is linguistic diversity (Estabrooks *et al* 2020; Maluleke *et al* 2022). South Africa's multilingual milieu presents a particularly arduous but surmountable obstacle. Vocabulary, stereotypical concepts, high-frequency words, body language and gestures differ between cultures and languages (Pascoe and Norman 2011). Studies confirm that intervention strategies used in one language may not be applicable when used with another (Greenwood *et al* 2010; Gxilishe 2004). Khoza-Shangase and Mophosho (2021) provide sufficient evidence supporting positive outcomes linked to health interventions that take careful cognisance of patients' language and culture.

Effective FCI transcends therapeutic communication strategies for DHH children (Roberts 2019). It recognises that language development is intrinsically connected to other abilities that are essential for social inclusion and active participation in everyday life (Samuelsson *et al* 2024). Coaching parents in the systematic instruction and implementation of communication strategies is critical to modifying the parent and the DHH child's behaviour (Roberts 2019). The parental coaching and empowerment process within the paediatric rehabilitation milieu reflects a paradigm shift from therapist-as-expert to one of supporting goal achievement and capacity building, exemplifying family-centred practice principles, suggesting positive, long-term outcomes (King *et al* 2024).

FCI frames this study in three ways. First, as far as the *rationale for FCI as the framework* is concerned, the study adopts FCI as a theoretical framework to explore parental involvement, perceptions and decision-making in therapeutic communication interventions for DHH children. This framework aligns with the premise that effective intervention is most achievable when professionals collaborate with families, recognising them as central to the child's developmental progress (Maluleke *et al* 2021; Moeller *et al* 2013). Second, regarding *integration into the methodology*, the FCI framework in this study guided the development of the survey instrument by ensuring that the questions addressed key FCI components, such as parental engagement in therapy sessions, their confidence in implementing strategies and their perceptions of cultural and linguistic appropriateness. Lastly, insofar as *guiding the interpretation of results*, the FCI framework informed the interpretation of findings, highlighting how parental empowerment and culturally sensitive practices influence family-professional collaboration and, subsequently, child outcomes.

MATERIALS AND METHODS

Ethical approval

Prior to the study being conducted, ethical approval was obtained from the University of the Witwatersrand Ethics Committee (HREC) (protocol number: H20/06/03). Thereafter, all procedures and protocols also adhered to the Helsinki Declaration of 1975, as revised in 2013 (World Medical Association 2013).

Table 1 Demographic data of participants included in the study (n=23)

Characteristic	Category	N	%
		23	
Age (years) (n=20)	Mean (SD); range	42 (6); 33-54	
Ethnicity	White	10	43
	Black	5	22
	Coloured	5	22
	Indian	3	13
Gender	Male	1	4
	Female	22	96
Relationship to child	Mother	22	96
	Father	1	4
Marital status	Married	16	70
	Single	3	13
	Divorced	3	13
	Separated	1	4
Highest level of education	Grade 11 (standard 9) or lower	1	4
	Grade 12 (matric)	10	43
	Postmatric diploma	5	22
	Baccalaureate degree(s)	5	22
	Postgraduate degree(s)	2	9
Employment status	Employed	15	65
	Self-employed	4	17
	Unemployed	4	17
Socioeconomic profile of the residential area	Low	9	39
	Low-middle	5	22
	Middle	5	22
	Middle-upper	3	13
	Upper	1	4

Aim

The main aim of this study was to explore the parental perspectives and parental involvement in the communication intervention process of learners with hearing loss who received LSL-SA (LSL-SA group) versus TSLT (TSLT group), with the specific objectives being: (1) to explore the parental involvement in the communication therapy of children with hearing loss, (2) to determine the communication skills of DHH children on discharge from therapy and their academic outcomes at the end of the foundation phase at school in order to assess parental confidence in applying communication therapy techniques at home, (3) to establish parental perceptions about the cultural and linguistic appropriateness of communication therapy techniques implemented and materials used in therapy, (4) to determine perceived facilitators and barriers regarding the communication therapy approach and (5) to identify whether the parents would have preferred a different therapeutic communication approach to be implemented in therapy.

Study design

A descriptive survey design was adopted. Although this study forms part of a larger study titled '*Speech-Language Acquisition and Scholastic Outcomes of Children with Hearing Impairment following Early Intervention in South Africa: A Comparative Study*', the objectives and reported findings discussed here are exclusive to this paper. This study employed a descriptive survey design to explore parental involvement and perceptions regarding communication intervention approaches for DHH children. The design incorporated both quantitative and qualitative methods to capture a comprehensive understanding of parental experiences. Data were collected through a self-administered parental survey and a retrospective review of therapy records. This mixed-methods approach allowed for triangulation of data, enhancing the credibility and depth of the findings. The survey included closed-ended and open-ended questions to examine various aspects of therapy involvement, while the retrospective review provided additional context and validation of the reported information.

Study sample and demographics

The parents of 127 children with profound hearing loss, selected through a purposive sampling technique, were invited to participate in the survey, to which 23 parents agreed. To gain access to the participants, the researchers obtained written permission from special schools for children with hearing loss in (1) Johannesburg, Gauteng; (2) Pretoria, Gauteng; (3) Morningside, KwaZulu Natal; (4) Cape Town, Western Cape and (5) Port Elizabeth Central, Gqeberha. Once access was granted to the special school, the researcher compiled a list of potential participants based on recommendations from school management. This included parents of DHH children who completed grade 3 in the foundation phase of primary schooling between 2008 and 2020. Researchers sought permission from school management to identify potential participants. After obtaining institutional approval, the schools facilitated initial contact by distributing the study information and consent forms to eligible parents. The researchers did not access parents' contact details directly, ensuring compliance with the Protection of Personal Information Act. Interested parents contacted the researchers directly to express their willingness to participate and signed informed consent forms prior to data collection. The parents signed an informed consent form after indicating their willingness to complete a survey and allow the researcher to access their children's therapy files and grade 3 academic reports. This approach safeguarded participants' privacy and adhered to ethical guidelines for handling personal information.

All the special schools identified in this study equally offer DHH children and their families a structured FCI programme, therapeutic services that include speech-language therapy,

Table 2 Therapy approach and parental involvement (n=23)

Duration of EI (years) (n=23)	Mean (SD); range	6.1 (3.0); 0.9–14.4	
		N	%
Type of therapy approach	Listening and spoken language-South Africa	16	70
	Traditional speech-language therapy	7	30
How was the therapy approach chosen	Chosen independently by the interventionist	12	52
	Joint decision between the parent and the interventionist	8	35
	Chosen independently by the parent	3	13
Frequency of therapy received by the child	Daily	1	4
	Once a week	5	22
	More than once a week	2	9
	Once every alternate week	7	30
	Once a month	8	35
Frequency of therapy attended by the parent	Never	10	43
	Every session	10	43
	Every alternate session	1	4
	Once a month	2	9

audiology and social work, a structured preprimary grade and a foundation phase school environment. The teaching approaches at these schools follow an oral, language-enriched programme, incorporating natural gestures, designed to address the language delay needs of DHH children, with the goal of enabling them to continue their education in mainstream schools on completion of grade 3 in the foundation phase. The educational approach (i.e., a mainstream curriculum in which grade-appropriate core skills are taught and assessed within a small class setting, with therapeutic intervention) and the rehabilitation approach (i.e., communication interventions offered at school, with the same measures used across the special schools in this study to assess speech-language and academic outcomes) are congruent. These measures include the Preschool Language Scales-5, Clinical Evaluation of Language Fundamentals, Integrated Scales of Language Development, Functional Listening Index-Paediatric, and the Goldman Fristoe Test of Articulation. The included schools specialise in developing listening, speech, spoken language and communication skills for DHH children. Therefore, none of the schools follow an SASL approach, as they do not identify as schools for the deaf.

The adequacy of the sample size was determined using the formula: $n = \frac{m}{1+\frac{m-1}{N}}$,

where $m = \frac{Z^2P(1-P)}{d^2}$ (n=sample size, N=population size—127 children included in the main study, Z=Z-statistic for the chosen level of confidence (95%), P=expected prevalence or proportion (50% worst case), d=precision of 5%). The sample size of 23 is adequate for the descriptive analysis (Daniel 2013).

Inclusion and exclusion criteria

The parents of children (1) diagnosed with a congenital or early onset, bilateral, profound hearing loss, (2) enrolled in an intervention programme receiving either TSLT or the LSL-SA approach, (3) fitted with hearing aids or cochlear implants, (4) who have completed grade 3 in the foundation phase of primary schooling, were included in the study. The parents of DHH children who presented with additional cognitive impairment were excluded from the study. This exclusion was ascertained from the main study.

Data collection

Data collection tool

Data collection was conducted using a questionnaire that was specifically developed for this study and pretested with one parent. The participant in the pilot study was not included in the main study. The questionnaire, available on request from researchers, comprised two sections: section A—parent demographics and section B—therapy information and EI outcomes.

Data analysis

Descriptive analysis of the study variables for objectives 1, 2, 3 and 5 was conducted using SAS V.9.4 for Windows (SAS Institute Inc 2010). Fisher's exact test assessed associations between selected study variables for objectives 1 and 3. For objective 4, inductive analysis to identify codes and key themes within the responses to the open-ended questions was used following the framework of thematic analysis suggested by Braun and Clarke (2006): (1) familiarisation of data (data were transcribed, data were read and re-read, ideas were noted down), (2) generating initial codes (interesting features of the data were written down, data relevant to each code were collated), (3) searching for themes (codes were placed into various themes, data relevant to each theme were selected), (4) reviewing themes for validity and reliability (themes were checked, a thematic map was generated), (5) defining and naming themes (ongoing analysis was performed that refined each theme, names for each theme was generated), (6) producing the report (a final analysis was conducted and the scholarly report produced.

Validity, reliability, trustworthiness and rigour

This research study employed an integrated, systematic and stringent approach to ensure that both quantitative and qualitative aspects were robust and credible, as outlined below (Stahl and King 2020):

- Pilot study: where content, construct and face validity were assured.
- Internal consistency: the consistency of the results across items within a test was ensured using Cronbach's alpha, which was >0.7.
- Inter-rater reliability: the extent to which the different raters gave consistent estimates of the same observation was measured, and comparable with a kappa statistic of 0.7, indicating substantial agreement (McHugh 2012).
- Credibility: the findings of this study were shared with the research participants to confirm that they accurately reflected the participants' experiences.
- Transferability: a detailed description of the context and participants, enabling others to determine if the findings may apply to their context, was employed in this study (Stahl and King 2020).
- Dependability: the research process is documented logically, allowing others to understand how conclusions were reached and replicate the study if necessary (ATLAS.ti 2023).
- Confirmability: during the inductive analysis phase, the identified themes were refined and analysed through inter-rater agreement to ensure reliability (Gisev *et al* 2013).
- Triangulation: multiple data sources, methods and investigators were used to cross-check data and interpretations.

To mitigate recall bias, the study used multiple data sources, including both caregiver self-reported surveys and retrospective record reviews. Cross-referencing caregiver responses with therapy records provided an additional layer of validation to reduce reliance solely on memory.

RESULTS

Study sample and demographics

Twenty-three parents of DHH children identified at special schools for children with hearing loss participated in the study. Table 1 depicts the sociodemographic profile of the 23 parents.

Of the 23 participants, 22 mothers and 1 father completed the survey. The participants' ages ranged between 33 and 54 years. The participants represented all four recognised race categories in South Africa (Posel 2001). According to table 1, the educational level of 43% of the participants was equivalent to a National Senior Certificate (high school diploma), and 53% of the participants had either a college diploma, a baccalaureate degree or a postgraduate degree. Seventeen per cent of the participants were unemployed, and 30% were single parents, divorced or separated. Thirty-nine per cent of participants reside in a low socioeconomic residential area in comparison with 4% residing in an upper socioeconomic residential area. The associations of the sociodemographic profile are depicted in the online supplemental table A.

Exploring the parental involvement in the communication therapy of children with hearing loss

The following results are depicted in table 2.

The participants indicated that one of two therapy approaches is being implemented at the schools where their DHH children are enrolled. A large majority of the participants (70%) indicated that LSL-SA was being used, while the remaining minority (30%) indicated the use of TSLT.

Of the total sample, 13% of the participants indicated that they chose the therapy approach by themselves, 35% made a joint decision with the early interventionist and more than half of the participants (52%) reported that the early interventionist independently chose the therapy approach for their child with a hearing loss.

All children were receiving therapy during the data collection period, with therapy provided at school but not necessarily only during school hours, as some sessions were scheduled in the afternoons. When exploring the frequency of therapy sessions received by the child, results range from a maximum of daily therapy attendance (4%) to a minimum of once a month (35%).

Less than half (43%) of the participants indicated that they never attend therapy sessions with their child. Similarly, a congruent number (43%) of participants indicated they always attend therapy with their child.

Online supplemental table B depicts the associations between how the communication approach was chosen and how often the parent attends therapy with the child, which shows no significant associations (p=0.21). There was also no significant association between the frequency of therapy that the child with a hearing loss attends and how often the parent attends therapy with the child (p=0.38).

Parents whose children received LSL-SA therapy reported higher satisfaction with communication outcomes compared with those in TSLT. This disparity suggests that the parent-coaching model of LSL-SA may better align with family-centred principles.

Determining the communication skills of DHH children on discharge from therapy and their academic outcomes at the end of the foundation phase at school in order to assess parental confidence in applying communication therapy techniques at home

All participants who attended therapy sessions with their child with hearing loss indicated confidence in applying the therapy techniques at home, irrespective of the therapy approach. The communication outcomes and academic outcomes are depicted in online supplemental tables C,D, respectively, as predictors of parental confidence.

Eighty-one per cent of DHH children enrolled in LSL-SA achieved age-appropriate communication outcomes in speech, expressive vocabulary, receptive language, expressive language, audition and cognitive-linguistics. This is in comparison with the 33% of children in TSLT who achieved age-appropriate communication in expressive language, 50% in expressive vocabulary, 67% in speech and receptive language and 83% in audition and cognitive-linguistics.

60%–67% of the DHH children in which an LSL-SA approach was followed achieved 70%–100% in English, Afrikaans, Mathematics and Life Skills subjects at school. This is in comparison with 13% of the DHH children in whom a TSLT approach was followed who achieved 70%–100% in English and Afrikaans, and 0% achieved 70%–100% in Mathematics and Life Skills.

Establishing parental perceptions about the cultural and linguistic appropriateness of communication therapy techniques implemented and materials used in therapy

The parental perceptions of the cultural and linguistic appropriateness of communication therapy techniques (i.e., therapy aims and home programmes) and the materials (i.e., toys and books) used in therapy are depicted in table 3. While 100% of parents found therapy materials linguistically appropriate, fewer than 30% perceived them as culturally appropriate, highlighting the need for more inclusive resources.

There was no significant association between the type of communication therapy approach and the cultural appropriateness of any communication therapy techniques implemented and materials used in therapy.

Determining the perceived facilitators and barriers regarding the communication therapy approach

The parental perception of the facilitators and barriers regarding the communication therapy techniques was examined using inductive analysis to identify codes and key themes within the responses to the open-ended questions.

When performing inductive thematic analysis in establishing facilitators and recommendations, the following six themes, as

Table 3 The association between communication therapy approaches and cultural and linguistic appropriateness (n=23)

				Type of communication intervention				
		Overall		TSLT		LSL-SA		
Characteristic	Category	N	%	N	%	N	%	P value
N		23		6		16		
Toys	Culturally appropriate	6	26	2	33	4	25	>0.99
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Books	Culturally appropriate	5	22	1	17	4	25	>0.99
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Home programme	Culturally appropriate	7	30	2	33	5	31	>0.99
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Therapy aims	Culturally appropriate	4	17	0	0	4	25	0.54
	Linguistically appropriate	23	100	6	100	16	100	>0.99
Other	Culturally appropriate	3	13	0	0	3	19	0.53
	Linguistically appropriate	6	26	2	33	4	25	>0.99

LSL-SA, listening and spoken language-South Africa; TSLT, traditional speech-language therapy.

Table 4 Themes and sample quotes (n=23)

Themes	Sample quotes: LSL-SA	Sample quotes: TSLT
1. Spoken language surmounts boundaries	'Spoken language and not sign language allows interaction with people'. 'Gives them more confidence to communicate with people'. "Spoken language works for both of us".	"My daughter is able to interact and converse with people. She has developed somewhat adequate spoken language ability as a result of her therapy sessions".
2. Fostering an environment of togetherness	"LSL is absolutely positive because we talk with her at home all the time". "It worked for both of us". "She is just like her brother and sister now".	"Being able to communicate gives us a sense of togetherness".
3. Benefits of therapy on communication skills development	"His vocabulary expanded at a good pace". "It has built her listening skills; her spoken language has increased, and more vocabulary as well". "My child can now follow instructions". "My child learned to listen and speak". "We achieved listening goals for my little girl". 'It provided language enrichment' 'Speech and language development is amazing'.	
4. Parent empowerment	"They have equipped me to support my child's language development". "Through implementing everything learned in therapy in our daily lives, she learned so quickly. I have also taken the skills and knowledge I learned through the sessions and applied them to my two other kids who are not hearing impaired. It helps them to recognise sounds, communicate and learn much quicker".	
5. Academic achievements as an indicator of positive therapy outcomes (online supplemental table D)	"She would not be where she is without the therapy. She is an A-grade student. She stopped CAPS in grade 7 and moved to the Cambridge syllabus. My child could not talk initially. I am thankful for all the LSL therapy she received".	"Therapy allows him to learn".
6. Skilful and adept early interventionists	"We received excellent therapy". 'The LSL-SA therapists are the best of the best and seriously know what they are doing'.	"The therapist was open to different approaches and tried more than once to explore and find suitable solutions to improve my daughter's linguistic development". "I thought that the speech therapy my daughter received was of a high standard, and I value the efforts that were made to support her development". "The therapist often thought out of the box and tried various techniques. My daughter preferred to make use of spoken language, although we struggled to understand her at times. She is still very aware that her pronunciations are not always correct, and the therapy she received laid the foundation for her to experience this in a positive light, rather than feeling insecure about it as she was rewarded for trying, not for succeeding". "Some of the unorthodox approaches the therapist used prompted a deeper understanding and language development, which she enjoyed thoroughly and which I think worked really well".

LSL-SA, listening and spoken language-South Africa; TSLT, traditional speech-language therapy.

depicted in table 4, emerged, with sample quotes: (1) spoken language surmounts boundaries; (2) fostering an environment of togetherness; (3) benefits of therapy on communication skills development; (4) parental empowerment; (5) academic achievements (depicted in online supplemental table D) as an indicator of positive therapy outcomes and (6) skilful and adept early interventionists.

Theme 1: Spoken language surmounts boundaries

Parents consistently highlighted that spoken language offered their children opportunities to integrate better into their social and educational environments. One parent shared, *'Spoken language and not sign language allows interaction with people'*, emphasising how LSL-SA (adapted auditory verbal therapy) provided their child with the tools to communicate more broadly. Another noted, *"My daughter is able to interact and converse with people. She has developed somewhat adequate spoken language ability as a result of her therapy sessions"*. These reflections suggest that families perceived spoken language as a means to break down barriers, offering their children greater inclusion in a predominantly oral society. Parents who experienced challenges with other modes of communication expressed a preference for LSL-SA due to its alignment with societal norms and expectations.

Theme 2: Fostering an environment of togetherness

Several participants remarked on how therapy facilitated a sense of cohesion within their families. One parent stated, *"LSL is absolutely positive because we talk with her at home all the time"*, underscoring the importance of family participation in therapeutic activities. Another parent reflected, *"She is just like her brother and sister now"*, indicating that therapy helped normalise their child's interactions within the family unit. Parents frequently mentioned that therapy brought them closer to their children by enabling open communication, thus fostering stronger familial bonds. This sentiment aligns with the principles of FCI, which emphasise collaboration between parents and professionals to support the child's development.

Theme 3: Benefits of therapy on communication skills development

Parents overwhelmingly reported improvements in their children's communication skills following therapy. One parent remarked, *"His vocabulary expanded at a good pace"*, while another noted, *"It has built her listening skills; her spoken language has increased, and more vocabulary as well"*. The development of language and auditory skills was highlighted as a significant outcome of therapy. Participants shared examples of their children following instructions more effectively, engaging in conversations and achieving specific listening goals. These findings demonstrate the tangible benefits of structured, consistent intervention.

Theme 4: Parental empowerment

Empowerment emerged as a recurring theme, with parents emphasising the knowledge and skills they gained through therapy. One parent stated, *"They have equipped me to support my child's language development"*, reflecting the impact of the coaching model used in LSL-SA. Another parent highlighted how these skills extended beyond their DHH child: *"I have also taken the skills and knowledge I learned through the sessions and applied them to my two other kids who are not hearing impaired"*. This illustrates how therapy benefits the child and enhances the overall communicative environment within the family.

Theme 5: Academic achievements as indicators of positive therapy outcomes

Participants linked their children's academic success to the outcomes of therapy. One parent shared, *"She would not be where she is without the therapy. She is an A-grade student. She stopped CAPS in grade 7 and moved to the Cambridge syllabus"*. This finding highlights the role of communication intervention in supporting educational attainment. Parents attributed their children's ability to excel academically to the foundational language and cognitive skills developed during therapy.

Theme 6: Skilful and adept early interventionists

Parents praised the expertise and adaptability of the early interventionists who worked with their children. One participant noted, *"The LSL-SA therapists are the best of the best and seriously know what they are doing"*. Another commented, *"The therapist often thought out of the box and tried various techniques to improve my daughter's linguistic development"*. This theme raises the importance of professional competence in delivering effective and responsive therapy, particularly in culturally and linguistically diverse settings.

When performing inductive thematic analysis in establishing barriers, the following two themes, as depicted in table 5, emerged, with sample quotes: (1) the constraints of English as the language of instruction and (2) perceived barriers to communication skills development.

Theme 1: The constraints of English as the language of instruction

A major barrier identified was the predominance of English in therapy sessions, which many parents found limiting. One parent stated, *'It would be nice to add other African languages, such as Sesotho, Tsonga, etc, as a medium to do therapy'*. This reflects the broader challenge of linguistic diversity in South Africa, where therapy resources and professionals often fail to accommodate the multilingual needs of families, a large majority of which do not speak English or Afrikaans—which are languages mostly spoken by professionals. Parents highlighted the need for culturally and linguistically appropriate materials to support effective communication.

Theme 2: Perceived barriers to communication skills development

Some parents expressed frustration with certain aspects of therapy, particularly in the TSLT approach. One participant stated, *"I found my daughter struggled with picture exchange communication; it worked well but was frustrating and cumbersome to implement and practice"*.

This theme points to the limitations of certain methods and the need for more adaptable and personalised approaches that cater to the child's unique needs and family context.

Identifying whether the parents would have preferred a different therapeutic communication approach to be implemented in therapy

None (0%) of the participants whose DHH children received LSL-SA would have preferred a different therapeutic communication approach, whereas 30% of the participants whose DHH children received TSLT would have preferred a listening and spoken language approach as the alternative.

DISCUSSION

A culturally representative sample of 23 parents of DHH children who received LSL-SA or TSLT was used in the analyses of the current study. The cohorts of DHH children were matched for degree of hearing loss and attendance at special schools for children with hearing loss up to grade 3 (foundation phase).

Childhood hearing loss impacts the family and often leads to elevated stress levels, which may, in turn, negatively impact parent-child interaction and, consequently, the child's development (Blank *et al* 2020; Dall *et al* 2022). When examining the impact of parental education and socioeconomic status on the development of DHH children, it is evident that higher parental education is decisively linked to better outcomes in both communication and academics. Specifically, DHH children with parents who have higher levels of education demonstrate a greater likelihood of achieving age-appropriate communication skills in expressive vocabulary and auditory abilities. Furthermore, higher parental education was associated with improved academic outcomes in subjects such as Social Sciences, Natural Sciences and Technology. These findings corroborate previous research by Cupples *et al* (2018) and Ching *et al* (2018), which

Table 5 Themes and sample quotes

Themes	Sample quotes: LSL-SA	Sample quotes: TSLT
1. The constraints of English as the language of instruction	'It would be nice to add other African languages, such as Sesotho, Tsonga, etc, as a medium to do therapy'. "As English is not my home language, it can be a bit difficult to fully understand what goes on in therapy, but therapists always try to explain in a way I can understand".	
2. Perceived barriers to communication skills development		"He doesn't talk". "I found my daughter struggled with picture exchange communication; it worked well but was frustrating and cumbersome to implement and practice". "I saw a speech therapist after who did not do the LSL-SA approach and I was disappointed. I believe the mission and vision of the approach created great professionals. All therapists need to understand the system and approach. Especially how they encourage parents to get buy-in".

LSL-SA, listening and spoken language-South Africa; TSLT, traditional speech-language therapy.

highlights the benefits of higher maternal education on the outcomes for DHH children, and the evidence presented underscores that while higher parental education is beneficial, the comprehensive impact on DHH children's development also hinges on the degree of hearing loss of the child, the hearing technology fitted and language performance remedied through early intervention (Chen and Liu 2021).

The findings of this study suggest that parental employment and marital status were not significantly associated with the frequency of parental involvement in therapy sessions or the reported confidence in applying communication strategies at home. However, it is important to note that this study did not directly assess the language competence or academic outcomes of the DHH children as outcomes. Therefore, any claims regarding the impact of these parental factors on language and academic outcomes are beyond the scope of this research. Further studies that directly investigate these relationships are needed to draw such conclusions. These findings are consistent with research data by Kaipa and Danser (2016) and Binos *et al* (2023). This may imply that families from lower socioeconomic status may still provide sufficient input for their children with hearing loss, as the outcome of language acquisition and academic performance is an interplay between the (1) LSL-driven programme by the early interventionist and (2) carryover of language support strategies by the parents. Therefore, addressing these interconnected factors is crucial for optimising outcomes for DHH children.

Bailey (2001) emphasises parental involvement on two levels: (1) behaviours that range from bringing the child to the intervention centre and attending the therapy sessions and (2) parental confidence in implementing the professionals' recommendations at home. When exploring the parental involvement and confidence in the communication therapy of DHH children, participant demographics in the current study support the finding of Zaidman-Zait *et al* (2018) that mothers were significantly more involved than fathers in the communication intervention process. Research reports that mothers show higher interest and are more actively engaged with professionals in their child's communication intervention (Zaidman-Zait *et al* 2018). These results have direct implications for parental involvement in communication intervention programmes for children with hearing loss. The findings of this study suggest the importance of understanding the cultural dimensions of the involvement of both parents, especially in the South African context, which will equip early interventionists to better support parents and provide family-centred care service delivery (Zaidman-Zait *et al* 2018).

When exploring how the communication approach was chosen, the findings of this study indicate that the early interventionist chose the therapy approach independently in the majority of cases (52%) for the child with hearing loss. These findings concur with the findings of Harris *et al* (2021), which illustrated a dislocation between the practice of informed choice, the notion of unbiased support and debunked claims of neutrality of early interventionists. These findings further concur with studies by Shezi and Joseph (2021), Prendergast *et al* (2002), Young (2002), Beazley and Moore (2013), Eleweke and Rodda (2000), Young (2003), Young *et al* (2005a) that early interventionists filter a substantial amount of information and do not tell parents about more than one communication option, indicating that the informational counselling provided by early interventionists is limited and biased (Shezi and Joseph 2021; American Speech-Language-Hearing Association 2008). Informational counselling practices may have implications that infringe on parental-informed decision-making and affect the collaboration of a family-professional relationship considerate of family values, goals and aspirations. It is, therefore, likely that the participants in this study ultimately internalised the views and opinions of the early interventionists who chose the communication approach on their behalf and then accepted these views as their own (Decker *et al* 2012).

Parental involvement in the intervention process is a well-established predictor of spoken language outcomes, cognition, prereading skills and future educational success in DHH children (Calderon 2000; Cejas *et al* 2021; Moeller 2000). Less than half of the participants (44%) never attend therapy sessions with their child. These findings concur with the Gray Group International Insights (2023), attributing possible challenges to the accessibility of parents attending intervention sessions to geographic factors, financial constraints and limited availability of providers, confounded by single-parent households and the parental employment status of the participants in this study. These context-specific challenges are immense but not insurmountable. The cochlear implant programmes in South Africa typically drive EHDI services, with three of the 12 programmes within the public healthcare sector and four combined within the public and private healthcare sectors (Bhamjee *et al* 2022). These public healthcare sector programmes strive to ensure that EHDI services are available to all families enrolled in these programmes, regardless of location or financial situation. The programmes at the special schools attended by the participants' DHH children offer these parents an initial, compulsory, family support and guidance programme to (1) promote language and brain development, (2) provide counselling and emotional support services to families of DHH children to accept the diagnosis, (3) audiological management of the hearing loss and (4) taking cognisance of the home environment to upskill parents to intensify the progress of the DHH child (Western Cape Government 2022). These programmes may be the reason why, despite parents no longer attending therapy sessions with their children during school-based interventionse, they can still play a key role in their children's intervention for hearing loss.

Changes in the delivery and models used for communication programmes have evolved to be more parent-focused and family-focused (Calderon 2000). When determining parental confidence in applying the communication therapy techniques at home, all the participants confirmed their confidence. The findings of this study, regarding age-appropriate communication outcomes and the meritorious academic outcomes of DHH children, align with the literature, which suggests that parental confidence in following communication strategies and guidelines at home, as prescribed by the early interventionist, enhances their child's language acquisition (Ingber and Most 2018). These findings further indicate that parent guidance and effective coaching allow the parent to follow the early interventionist's advice, unrelated to the service setting, irrespective of the therapy approach (i.e., LSL-SA or TSLT) (Kellar-Guenther *et al* 2014).

While establishing parental perceptions about the cultural and linguistic appropriateness of communication therapy techniques implemented and materials used in therapy, the findings of the current study indicate no significant association between the type of communication therapy approach and the cultural appropriateness of any of the communication therapy techniques implemented and materials used in therapy. Current findings indicate linguistic appropriateness but limited culturally sensitive materials across both domains (i.e., therapy techniques and therapy materials), irrespective of the therapy approach (i.e., LSL-SA or TSLT). This concurs with findings by Grandpierre *et al* (2019), Southwood and Van Dulm (2015) and Wieber and Sumner (2015) that materials used during language interventions are not reflective of cultures in diverse contexts. This finding is particularly relevant in the provision of communication intervention services in the South African context, as it acknowledges the challenge of meeting the cultural demands of families and children with hearing loss. These findings highlight that early interventionists remain accountable for acquiring reliable and valid evidence for outcomes and employing resources from a cultural and linguistic perspective (Health Professions Council of South Africa 2019). When interventions are implemented in a culturally proficient manner, a plausible corollary would be an enhanced family-professional relationship (Moeller *et al* 2013).

In determining the perceived facilitators and barriers regarding the communication therapy approach, this study indicates the following findings:

Positive findings were expressed by participants, specifically that spoken language surmounts boundaries and fosters an environment of togetherness. These findings concur with the literature that in the LSL-SA approach, parents do not have to learn a new language or communication mode, as this approach can be seen as a reliable solution for DHH children (Rhoades and Duncan 2017; Slentz and Krogh 2017; White and Brennan-Jones 2014). These findings likely strengthen the case for LSL-SA as the approach of choice, as the primary concern of families of infants with hearing loss is how they will develop spoken language (Binos *et al* 2021). South African studies have produced empirical evidence highlighting age-appropriate communication outcomes following an LSL-SA approach (Casoojee *et al* 2024). This implies that professionals providing EHDI services are duty-bound to support parent communication choices, ensuring the child achieves spoken language outcomes (Houston and Stredler-Brown 2012).

Participants expressed that the LSL-SA therapy benefitted their child's communication skills development and benchmarked their child's academic outcomes as an indicator of positive therapy outcomes. This is congruent with findings of various comparative studies demonstrating that DHH children receiving an LSL approach are more likely to outperform those DHH children receiving TSLT, yielding higher odds of performing at age-equivalent measures of speech perception, language outcomes and academic achievements (Casoojee *et al* 2024; Yanbay *et al* 2014; Dettman *et al* 2013; Motasaddi-Zarandy *et al* 2009; Percy-Smith *et al* 2018; Fairgray *et al* 2010).

The participants in this study acknowledge that the early interventionists were skilful and adept and contributed to parent empowerment, regardless of the communication therapy approach. The current study findings concur that early interventionists who enhance the family's understanding of the infant's strengths and needs are more likely to promote the family's ability to advocate for the child with hearing loss (Health Professions Council of South Africa 2018). Hence, families should be equipped and empowered to make informed decisions regarding the communication approach to be adopted for their DHH child (Centers for Disease Control and Prevention 2018).

Participants highlighted perceived barriers. Current study findings indicate the constraints of English as the language of instruction. These findings are twofold. First, the findings are particularly relevant in the provision of the LSL-SA communication approach in the South African context. These results are confirmatory with the findings of a study conducted by Mdladlo *et al* (2016), indicating that the average SLT and audiologist in the South African context is predominantly either an English or Afrikaans-speaking female, with only 5% of SLTs and audiologists speaking an African language as a first language in South Africa (Khoza-Shangase and Mophosho 2018). This highlights the predominance of English in the profession and the ongoing challenge of meeting the demands of families when implementing an LSL-SA approach (Mdladlo *et al* 2016). South Africa's history of apartheid, its multicultural and multilingual nature, as well as its socioeconomic inequalities pose unique challenges to early interventionists providing clinical services to children with hearing loss, often restricting effective service delivery (Fouché-Copley *et al* 2016; Samuels *et al* 2012).

The current study findings concur with studies conducted by Taylor (2016) and Casoojee *et al* 2024 and confirm that the majority of DHH children receive communication intervention in their second language. LSL-SA is premised on principles that employ developmental patterns of listening, language, speech and cognition to stimulate natural communication and provide support services to facilitate children's educational and social inclusion in mainstream education (Joint Committee on Infant Hearing 2019b). Taylor (2016) confirms that LSL-SA interventionists have highlighted linguistic diversity as a challenge to successfully implementing the approach within the South African context. Consequently, there is a possible lack of family-centred EHDI within these contexts. These findings highlight the importance of family involvement and collaboration between EHDI service providers and parents.

Another finding was perceived barriers to achieving adequate communication skills using the TSLT approach. To date, the research and clinical focus in South Africa has been on adapting international EHDI principles for early identification and detection of hearing loss via screening methods (Khan *et al* 2018; Moodley and Storbeck 2015; Störbeck and Young 2016). The intervention aspect of EHDI in South Africa has been neglected. Consequently, there is limited research identifying patient outcomes based on context-specific intervention methods once hearing loss has been identified (Moodley and Storbeck 2015). The current study findings are consistent with Casoojee *et al* (2024) and Percy-Smith *et al* (2018), demonstrating that DHH children enrolled in LSL-SA outperformed those enrolled in TSLT in achieving age-equivalent language outcomes. The current study findings further support that LSL-SA graduates achieved superior academic outcomes dependent on language attainment, providing contextually relevant evidence supporting the effectiveness of the LSL-SA communication approach in South Africa (Casoojee *et al* 2024).

When identifying whether the participants would have preferred a different therapeutic communication approach to be implemented in therapy, a third of the parents of DHH children enrolled in TSLT would have chosen an LSL approach. This confirms the evidence presented by Auditory Verbal UK (2023) and Li *et al* (2003) that an LSL approach is a more robust, family-centred coaching programme when compared with TSLT. This implies that LSL early interventionists are obligated to equip parents with the tools to support the development of their child's spoken language through listening.

CONCLUSION

The findings of this study emphasise that early interventionists who work with DHH children should take cognizance of the interplay of many factors beyond the extent of the child's hearing loss to optimise therapeutic outcomes. Specifically, the study reveals significant gaps in the informational counselling provided to parents, which affects their ability to make fully informed decisions about communication options. It is incumbent on early interventionists to adhere to the Joint Committee on Infant Hearing and HPCSA guidelines regarding the provision of aural rehabilitation in LMICs, where healthcare and socioeconomic risk factors are present due to inequitable systems of care. This study further highlights the need for targeted training and capacity building for early interventionists, which emphasise the importance of understanding and integrating parental perspectives and local cultural contexts into their practices. This will improve the quality of interventions and align them more closely with the needs and preferences of families. Fostering collaborative efforts among relevant stakeholders, including policymakers, is crucial. Collaborative initiatives can help address the systemic barriers identified in the study, promote the development of culturally and linguistically appropriate therapy materials and support a more inclusive approach to early intervention. While we recognise the need for thoughtful re-examination of policy to practice, results of this study suggest communication interventions must be cognizant of local contexts, which will ensure more effective and more respectful early interventionists of the diverse needs and preferences of the families they serve.

This study has several limitations that should be considered when interpreting the findings. First, the small sample size of 23 caregivers limits the generalisability of the results, as it may not fully represent the diverse population of caregivers of DHH children in South Africa. Second, the retrospective design, with data collection spanning a timeframe as far back as 2008, introduces the potential for recall bias, as caregivers may have difficulty accurately remembering details of their involvement in therapy over extended periods. To address this, data were cross-validated with retrospective records where available; however, this does not entirely eliminate the risk of bias. Additionally, the study relied on self-reported data, which is inherently susceptible to social desirability bias, potentially influencing caregivers to portray their involvement or perceptions in a more favourable light. Another limitation is the lack of linguistic and cultural diversity in therapy resources, which may have influenced caregivers' perceptions of cultural appropriateness and therapy outcomes. Lastly, the study did not include perspectives from professionals or other family members, which could have provided a more holistic understanding of the FCI process. Despite these limitations, the findings contribute valuable insights into the challenges and facilitators of communication interventions in the context of multilingual and multicultural settings.

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Appendix O

audiology research

MDPI

Article

Communication Outcomes of Children with Hearing Loss: A Comparison of Two Early Intervention Approaches

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Abstract: Background: Early intervention approaches play a critical role in shaping the communication outcomes of children with hearing loss, influencing their language development and overall learning trajectory. Objectives: The main objective of this study was to compare the communication outcomes of children with hearing loss who received Listening and Spoken Language-South Africa (LSL-SA) with those who received Traditional Speech-Language Therapy (TSLT). Methods: A retrospective record review was conducted to gather data on communication outcomes from participants' speech-language therapy records. Communication outcomes were measured using standardized assessments evaluating speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive–linguistic skills. The data were analyzed using quantitative statistics. Key statistical methods included measures to determine associations, identify statistical significance, determine outcomes, and compare differences between the two groups. Results: The study found that children in the LSL-SA group had statistically significant better communication outcomes, with 63% achieving age-appropriate speech intelligibility compared to 45% in the TSLT group (p = 0.046). Similar trends were observed for expressive vocabulary (LSL-SA: 58% vs. TSLT: 39%, p = 0.048) and receptive language (LSL-SA: 60% vs. TSLT: 39%, p = 0.043). Additionally, 66% of children in the LSL-SA group were recommended for mainstream schooling, compared to 39% in the TSLT group (p = 0.0023). These findings highlight the importance of early amplification and structured intervention in improving communication outcomes. The results also emphasize the importance of Early Hearing Detection and Intervention (EHDI) in decreasing the odds of delay in communication outcomes, irrespective of the type of communication approach, although a higher proportion of children in the LSL-SA approach group achieved age-appropriate communication outcomes than those in the TSLT group. Conclusions: This study highlights that communication intervention approaches aligned with the LSL-SA practice promote better communication development and enhance spoken language outcomes in children with hearing loss, facilitating successful transitions to mainstream schooling. Contribution: This study provides contextually relevant evidence for implementing an LSL-SA intervention approach for children with hearing loss. The implications of these findings for clinical practice and future research are discussed in detail.

Keywords: auditory–verbal therapy; early hearing detection and intervention; hearing loss; listening and spoken language; South Africa; communication outcomes; speech-language therapy; inclusive education

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1. Introduction

Congenital or early-onset hearing loss poses significant challenges in children, impacting the development of communication skills, cognitive abilities, psychosocial skills, and academic outcomes [1–3]. Consequently, the Joint Committee on Infant Hearing in the United States proposed an Early Hearing Detection and Intervention (EHDI) program to maximize the linguistic competence of infants and young children with hearing loss [4]. Similar policies and guidelines exist globally, including the European Consensus Statement on Neonatal Hearing Screening and the World Health Organization's recommendations for early hearing intervention, highlighting the widespread recognition of EHDI as a public health priority.

Components of an EHDI program include (1) newborn hearing screening that aims to identify infants with hearing loss, ideally by one month of age, (2) audiologic diagnosis to confirm the presence and degree of hearing loss for infants who fail the initial hearing screening by three months of age, and (3) referral to early intervention (EI) services by six months of age [4]. EI services include audiological management, educational support, family counselling, and communication intervention.

Communication intervention aims to support children with hearing loss and their families during the critical stages of language development, typically from birth to three years of age. During this period, the brain undergoes rapid growth and plasticity, making it particularly receptive to language input [5]. Numerous studies have shown EI to significantly improve communication outcomes in children with hearing loss across domains that include speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive linguistics (cognitive linguistics informs AVT how children with hearing loss process auditory information to support language, attention, memory and conceptual thinking) outcomes [6–12]. The interventions explored in this study, while effective in promoting spoken language outcomes, must be critically examined within the context of systemic inequities that limit access to alternative communication modalities, such as South African Sign Language (SASL). This focus on spoken language risks marginalizing Deaf cultural identity and the right to linguistic diversity, as emphasized by the CRPD. Positive communication outcomes are limited to studies using the 1-3-6 benchmark by which children with hearing loss were diagnosed and received amplification and EI (i.e., 1-3-6 EHDI time-frame benchmark) [13–21]. Whilst this benchmark is recommended, it has not been fully achieved in South Africa due to delays in identification and early intervention [3,22]. Within these proposed timeframes, there are important variables to consider as possible factors contributing to communication outcomes. These variables include the hearing amplification device fitted, the degree of the aided audiogram, the communication intervention approach adopted, and linguistic diversity influences on outcomes [23]. While this study focuses on spoken language approaches, we acknowledge the importance of Deaf cultural identity and the validity of sign language as a primary mode of communication. Future research and interventions should aim to balance linguistic, cultural, and individual preferences to foster inclusivity.

South Africa, a low-middle-income country (LMIC), has lagged in implementing EHDI as a standard [3]. Currently, more than 90% of infants with hearing loss are not identified early or provided with intervention, largely due to (1) budgetary constraints affecting health policy, (2) limited access to services, (3) poor-quality Early Childhood Development (ECD) structures, and 4) a lack of comprehensive empirical evidence [3,24,25]. These systemic barriers prevent families from making fully informed choices about communication modalities, which include spoken language, sign language, or bilingual approaches.

Hearing loss is recognized as a disability under the social and rights-based models of disability [26,27]. This perspective acknowledges that barriers to effective communication and language acquisition can lead to social exclusion, educational challenges, and limited future opportunities for individuals with hearing loss. In this study, EI approaches (TSLT and Listening and Spoken Language-South Africa [LSL-SA—based on the LSLS Certified Auditory–Verbal Therapist (LSLS Cert. AVT®) qualification by the AG Bell Academy [24] are analyzed for their potential to support inclusive education and enhance life outcomes for children with hearing loss, aligning with the goals of disability frameworks that emphasize reducing barriers, promoting equity, and enabling full societal participation. This positioning underlines the importance of evidence-based interventions that improve communication skills, thereby fostering access to mainstream schooling and social integration, essential components of inclusive development within disability frameworks.

Studies on communication intervention approaches for children with hearing loss have primarily taken descriptive approaches [28]. Roberts [28] has found that, despite details on the type of intervention approach being included in these studies, these studies either observe convenience samples of children undergoing specific interventions [29,30] or track children participating in EI programs longitudinally [12,18]. There is a scarcity of studies comparing the outcomes under different communication intervention approaches. Results of a study conducted by Percy-Smith et al. [31] indicated that children with hearing loss who enrolled in an LSL approach scored age-appropriately and outperformed children with hearing loss enrolled in a TSLT approach.

In this study, two intervention approaches were compared: Traditional Speech-Language Therapy (TSLT) and Listening and Spoken Language—South Africa (LSL-SA). TSLT is a multimodal approach incorporating auditory training, speech production exercises, and visual supports such as lip-reading and gestures, and is grounded in a general speech-language pathology framework, focusing on enhancing auditory perception, speech production, and language skills, typically involving a mix of auditory and visual supports tailored to the child's needs. The TSLT approach typically incorporates multimodal communication strategies, including auditory training, speech articulation exercises, and visual cues such as lip-reading and gestures. Therapy sessions are structured to address individualized goals, often with periodic assessments to adapt the intervention plan based on the child's progress. TSLT sessions also include strategies for language expansion through interactive play and storytelling to support vocabulary and sentence structure development. In contrast, LSL-SA follows an AVT model, which is highly parent-centered and focuses on developing auditory skills in everyday contexts. The AVT model emphasizes auditory input over visual cues to develop spoken language, based on the principle that consistent auditory access can maximize language outcomes for children with hearing loss. Intervention involves teaching parents to create rich auditory learning environments at home, promoting the consistent use of hearing devices such as cochlear implants or hearing aids. Sessions are intensive and structured, emphasizing active listening skills, phoneme discrimination, and sentence-level auditory comprehension. Visual cues are minimized to encourage auditory reliance, with therapists' modeling techniques to integrate speech and language goals into routine family interactions. Both approaches aim to develop age-appropriate spoken language skills, though they differ in their theoretical emphasis on auditory vs. multimodal (auditory and visual) support.

These interventions are individualized, considering factors such as the child's degree (mild to profound) and type (sensorineural, conductive, or mixed) of congenital hearing loss, age at diagnosis, and age at intervention. LSL-SA may be more intensive and parent-centered, involving regular family participation to integrate language learning into everyday environments, whereas TSLT may employ a broader range of communication supports. In evaluating outcomes, both approaches assess speech intelligibility, expressive and receptive language, vocabulary, and cognitive–linguistic skills.

However, while this study compares TSLT and LSL-SA, both focus on spoken language development but diverge from Deaf cultural identity and the use of SASL. This comparison highlights a broader debate in communication sciences and disorders: the prioritization of spoken language versus sign language and the implications of these choices for Deaf identity and inclusion within Deaf communities [32]. While the current study primarily focuses on spoken language outcomes, it highlights the need for future research to explore the broader implications of Deaf identity and cultural alignment of intervention approaches, especially in LMIC contexts where family-centered and linguistically congruent options are limited [23,32].

This study also aligns with current debates around Deaf identity and the choice of Sign Language as a primary communication mode, particularly in contexts where LSL approaches may not align with the cultural and linguistic preferences of Deaf communities. SASL offers an equally valid communication option that fosters a strong Deaf cultural identity. However, due to the limited availability of SASL resources, particularly in LMICs, spoken language approaches may be the only accessible intervention option for many families [32]. Future research should consider integrating Deaf cultural perspectives and increasing access to bilingual or bimodal communication options in early intervention to foster more holistic and culturally responsive outcomes.

The National Development Plan (NDP) 2030 for Persons with Disabilities (2015) seeks to address the needs of children with disabilities, including children with hearing loss, who are at risk of being excluded from early childhood investments in South Africa [33]. The NDP aims to roll out a process involving inclusive education and the implementation of continuity of care between EI programs and educational settings, dependent on proper and effective monitoring and evaluation systems that track progress against goals and objectives [33,34]. This roll-out was envisaged to improve the access to and quality of ECD services for infants and young children. However, educational intervention for children with hearing loss is already at risk, given the paucity of resources accessible to these children [3,35]. Of the 43 Schools for the Deaf, only 12 offer education up to the National Senior Certificate level, which is a pre-requisite for entering any institution of higher learning [36–38]. This limited access undermines efforts to build an inclusive society [24].

If left unaddressed, hearing loss can have severe consequences, including delayed communication development, leading to poor academic outcomes and, consequently, fewer employment opportunities, personal–social maladjustments, and emotional difficulties [39]. To counteract these realities, it is imperative that efforts aimed at EHDI are maximized and that strategies facilitating positive outcomes from these processes are investigated. The current study was prompted by findings from a previously conducted exploratory study investigating the learning outcomes of foundation phase learners with hearing loss. Whilst these findings also included speech and language outcomes as part of the learning outcomes and suggested the LSL-SA approach as having maximized linguistic competence and literacy development of children with congenital or early-onset hearing loss, the sample of records was small and limited to EI schools in three provinces in South Africa [24]. The current study proffers additional insight, providing a trajectory into the communication outcomes using a larger, more representative sample of records from EI schools across four provinces in South Africa. While this study focuses on South Africa, similar challenges exist in many LMICs, as well as underserved regions in high-income countries (HICs). Limited access to newborn hearing screening, delays in diagnosis and intervention, and disparities in service provision have been reported in countries such as Brazil, India, and rural parts of the United States. These global challenges highlight the need for contextually relevant early intervention approaches that can be adapted across diverse healthcare and educational settings.

Therefore, the main aim of this study was to investigate the communication outcomes (i.e., speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, cognitive linguistics) of children with hearing loss who received LSL-SA versus TSLT in South Africa. The specific objectives included (1) describing the communication functioning prior to the commencement of EI and upon discharge from therapy in both the LSL-SA group and TSLT group; (2) describing the communication functioning prior to the commencement of EI and upon discharge from therapy in the LSL-SA and TSTL groups; (3) comparing the communication outcomes between the two groups; (4) determining if any associations exist between selected study variables (i.e., age at identification of hearing loss, age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at start of EI, duration of EI, degree of the aided audiogram, home language vs. language used in therapy) within the communication intervention approaches and communication outcomes; and (5) identifying the type of school recommended after EI, based on communication outcomes.

2. Materials and Methods

2.1. Study Design

A retrospective record review was conducted to compare communication outcomes in children with hearing loss who received either Listening and Spoken Language-South Africa (LSL-SA) or Traditional Speech-Language Therapy (TSLT). The study used quantitative data analysis to assess associations between intervention type and communication outcomes. As this was a non-randomized study, children were grouped based on the intervention they had received within their educational setting, and no manipulation of intervention assignment was performed. While the children with hearing loss in the study received only one intervention (either LSL-SA or TSTL), the type of therapy was determined by the school and not by the researcher. Thus, the assignment to LSL-SA or TSTL was not controlled but rather a reflection of the services available within each school setting at the time of the child's intervention.

2.2. Study Objectives and Corresponding Variables

The study aimed to achieve the following objectives, with each linked to the data collected:

1. Describe communication functioning prior to and upon discharge from early intervention (EI) for both the LSL-SA and TSLT groups.
    - *Variables:*
        - Communication Functioning: speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, cognitive–linguistic skills (all ordinal variables: delayed, age-appropriate).
2. Compare communication outcomes between the LSL-SA and TSLT groups.
    - *Variables:*
        - Type of Communication Intervention: TSLT OR LSL-SA (nominal).
        - Outcome Measures: proportion of children with age-appropriate communication skills at discharge (ordinal).
3. Determine associations between selected study variables and communication outcomes within each intervention approach.
    - *Variables:*
        - Age at Identification of Hearing Loss (ratio, years).
        - Age at Diagnosis of Hearing Loss (ratio, years).
        - Age at Amplification (ratio, years).

- Type of Amplification Device (hearing aid or cochlear implant, nominal).
- Age at Start of EI (ratio, years).
- Duration of EI (ratio, years).
- Degree of Aided Audiogram (ordinal: normal, mild, moderate, severe).
- Home Language vs. Language Used in Therapy (nominal: matched or not matched).

4. Identify the type of school recommended after EI based on communication outcomes.
    - *Variables:*
        - Type of School Recommended (nominal: mainstream or specialized).

2.3. Study Sample and Demographics

This study reviewed records from 126 children with profound congenital or early onset hearing loss attending EI schools across four South African provinces: Western Cape (Cape Town), Gauteng (Johannesburg and Pretoria), KwaZulu Natal (Morningside), and Eastern Cape (Gqeberha). These schools serve diverse linguistic and socioeconomic populations, with participants speaking five of South Africa's official languages. Many families come from low- to middle-income communities with limited access to private healthcare, relying on public sector EI services. Most participants received communication intervention in English, with some receiving intervention in Afrikaans. The study timeframe spanned records collected over a five-year period, allowing a comprehensive assessment of communication outcomes for children allocated to either a TSLT or LSL-SA intervention approach. The EI schools offer both therapy options; however, each child is allocated to only one type of intervention.

2.4. Inclusion and Exclusion Criteria

Records of participants who met the following criteria were included: (1) had a diagnosis of congenital or early onset, bilateral, sensorineural, profound hearing loss; (2) were enrolled in an EI program receiving either TSLT or the LSL-SA approach; (3) had cochlear implants or were fitted with hearing aids (as approved by a South African Cochlear Implant Group-endorsed cochlear team); and (4) had finished Grade 3 in the foundation phase of primary schooling. Participants were assessed at discharge from EI, typically between the ages of 6 and 10 years, ensuring comparability between groups. Developmental factors, including age at identification, age at amplification, and duration of intervention, were accounted for in the analysis to minimize underlying variability. The study excluded children with unilateral profound hearing loss or bilateral profound hearing loss who also had other documented co-morbidities, such as cognitive impairment, to ensure a homogenous sample focused on the effects of intervention alone.

2.5. Procedures

Ethical approval from the University of the Witwatersrand Ethics Committee (HREC) (protocol number: H20/06/03). Thereafter, permission was sought from all relevant authorities, granting the researcher access to the educational facilities and disseminating information to the parents/primary caregivers of children with hearing loss. Written informed consent was obtained from the parents/primary caregivers of children with hearing loss after indicating their willingness to allow the researcher to access their child's records. Once permission and consent were obtained, records were accessed and reviewed. As this study was retrospective in nature, it was reliant on pre-existing records, which may not uniformly capture all variables of interest. Consequently, the findings are descriptive and associative rather than causative, and the conclusions drawn must be interpreted with caution.

2.6. Data Collection Tool

The data collection tool used in the current study was specifically designed for this purpose. It was pre-tested on a therapy file from each EI school before use. None of the records used in the pre-test phase formed part of the main study. The data collection form consisted of two sections. Section A gathered information on child demographics, and Section B gathered information on Intervention Outcomes. The record review aimed to gather information regarding (1) the child's hearing loss, (2) the age at diagnosis of hearing loss and age at initiation of EI services, (3) the type of amplification device fitted and duration of use, (4) the type of communication intervention approach, and (5) speech-language communication functioning at the onset of therapy and communication outcomes at the end of grade three at the EI school and (6) the type of school recommended upon completion of the foundation phase of primary school. This study compares specific approaches but does not negate the relevance of alternative communication methods, including sign language, which may align more closely with the values of Deaf communities.

Communication functioning was measured consistently across all EI schools using standardized assessment tools to evaluate domains including speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive–linguistic skills. These assessments were administered by qualified speech-language therapists at the beginning of therapy and upon discharge, ensuring uniformity in evaluating communication progress. Data were collected retrospectively over a five-year period, providing a longitudinal view of each child's progress. Records were detailed, capturing information on the initial communication functioning at therapy onset, intermediate progress notes, and final outcomes, allowing for a comprehensive analysis of communication development in each intervention group.

2.7. Standardized Assessment Tools

The communication outcomes measured in this study—including speech intelligibility, expressive and receptive language, vocabulary, audition, and cognitive–linguistic skills—were assessed using validated tools commonly used in South Africa. These included the Preschool Language Scale—Fifth Edition (PLS-5), Clinical Evaluation of Language Fundamentals, Integrated Scales of Language Development, Functional Listening Index-Paediatric, and the Goldman Fristoe Test of Articulation, which have been adapted and used in multilingual South African contexts. Assessments were conducted by qualified speech-language therapists, ensuring standardized administration across all early intervention (EI) sites.

2.8. Data Analysis

Each research question was analyzed using the following models:

- Objectives 1 and 2: Comparing Communication Functioning and Outcomes:

Descriptive statistics (means, standard deviations, percentages) were used to summarize communication outcomes in both groups. Comparisons were conducted using independent samples t-tests for continuous variables and chi-square tests for categorical variables. For categorical variables with small cell sizes, Fisher's exact test was used instead of the chi-square test.

- Objective 3: Associations Between Study Variables and Communication Outcomes:

Logistic regression models were used to assess associations between intervention type (LSL-SA vs. TSLT) and outcome measures (age-appropriate vs. delayed) while controlling for confounding variables (age at amplification, device type, duration of EI). For model transparency, logistic regression outputs after multiple comparisons, significance levels were set at $p < 0.021$.

- Objective 4: School Placement After EI:

Associations between communication outcomes and the type of school recommended were assessed using Fisher's exact test.

All data were analyzed using SAS version 9.4 for Windows [40]. Blinding in data analysis occurred. To minimize bias, the researchers conducting the data analysis were blinded to the intervention group assignments during statistical processing. Data were de-identified and coded before analysis to ensure that the analysts were unaware of whether participants had received LSL-SA or TSLT. This approach enhanced the objectivity and validity of the findings by preventing any potential influence of preconceived expectations on the interpretation of results.

2.9. Ethical Considerations

This study was conducted in accordance with ethical guidelines for research involving human participants. Ethical approval was obtained from the University of the Witwatersrand Human Research Ethics Committee (HREC) (Protocol Number: H20/06/03) before data collection commenced. Permission was also granted by relevant educational authorities and school administrators to access speech-language therapy and audiology records. As this was a retrospective record review, informed consent was obtained from the parents or primary caregivers of all children whose records were included in the study. To ensure confidentiality and data protection, all records were anonymized, with unique identification codes assigned to participants instead of personal identifiers. Data were stored in a password-protected database accessible only to authorized research personnel. The study adhered to the principles outlined in the Declaration of Helsinki, ensuring respect for participant privacy, non-maleficence, and responsible data handling. Findings were reported objectively and without bias, with appropriate caution taken to acknowledge study limitations related to its retrospective and non-randomized design.

2.10. Validity and Reliability

To ensure validity and reliability, this study employed standardized data collection methods and used validated assessment tools to measure communication outcomes across all EI sites. Content validity was maintained by aligning outcome measures—such as speech intelligibility, expressive and receptive language, and auditory skills—with established early intervention frameworks. Reliability was enhanced through consistent administration of assessments by qualified speech-language therapists and audiologists, minimizing inter-rater variability. Additionally, statistical controls were applied to account for potential confounders, such as age at amplification and duration of intervention, strengthening the internal validity of findings. External validity was considered by including a diverse sample from multiple provinces, making the findings more generalizable to similar contexts within South Africa and other LMICs. Data accuracy and consistency were ensured through rigorous double-checking procedures during data entry and statistical analysis. These methodological safeguards support the trustworthiness and reproducibility of the study's results.

2.11. Data Management

Data management involved collecting, storing, and securing participant records to ensure the integrity and confidentiality of sensitive information. Data were sourced from retrospective records at EI schools, and each record was anonymized by assigning unique identification codes to participants to protect their identities. The data were transferred to a secure, password-protected database accessible only to authorized research team members. Variables collected included demographic information, communication outcomes, intervention details, and audiological data, which were carefully entered and checked for accuracy and completeness. Regular data-cleaning addressed inconsistencies or missing information. All data handling complied with ethical guidelines, ensuring that participants' privacy and data security were maintained throughout the study. After analysis, data were securely archived for future reference while retaining confidentiality standards.

3. Results

3.1. *Demographic Profile of Participants*

As depicted in Table 1, of the 126 participants, 64 were enrolled in TSLT, and 62 were enrolled in the LSL-SA group. Both groups had more females than males, with ages ranging between 6.0 and 10.1 years old. Participants spoke five of South Africa's 12 official languages and represented all four recognized race groups [41]. In the TSLT group, 41 participants wore cochlear implants, compared to 48 participants in the LSL-SA group, with 22 participants in the TSLT group and 29 in the LSL-SA group using bilateral cochlear implants.

Genetic causes of hearing loss accounted for 14% of participants, prenatal infections for 17%, and postnatal infections for 18%. The cause of hearing loss remained unknown in 51% of participants due to missing data.

Table 1. Demographic data of children included in the study (N = 126).

Characteristic	Category	Overall		TSLT		LSL-SA		p-Value for Between-Group Comparison
		n	%	N	%	N	%	
N		126		64		62		
Age	Median (IQR); range	8.3 (6.0–10.1); 1.7–16.7		8.7 (6.5–10.2); 1.7–16.7		6.8 (5.6–10.0); 1.7–11.7		0.092
Gender	Male	54	43	29	45	25	40	0.59
	Female	72	57	35	55	37	60	
Race Group	Colored	53	42	29	45	23	37	0.61
	White	41	33	19	30	22	35	
	Black	23	18	13	20	10	16	
	Indian	7	6	2	3	5	8	
	Other	3	2	1	2	2	3	
Home Language	English	58	46	27	42	31	50	0.84
	Afrikaans	39	31	21	33	18	29	
	Xhosa	17	13	4	6	10	16	
	English and Afrikaans	5	4	10	16	7	11	
	Zulu	4	3	2	3	3	5	
	Southern Sotho	1	1	0	0	1	2	
	Other	2	2	1	2	1	2	
Type of Amplification	Hearing Aid	37	29	23	36	14	23	0.12
	Cochlear Implant	89	71	41	64	48	77	
Number of Cochlear Implants	0	36	29	22	34	14	23	0.26
	1	39	31	20	31	19	31	
	2	51	40	22	34	29	47	

3.2. *Communication Functioning Prior to the Commencement of EI and upon Discharge from Therapy in the TSLT and LSL-SA Groups*

3.2.1. The Description of Communication Functioning Prior to the Commencement of EI to the Communication Outcomes upon Discharge from Therapy in the TSLT Group (n = 64) is Depicted in Table 2

At the onset of therapy, 98% (n = 63) of children in the TSLT group exhibited delayed communication skills across all domains, including speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive linguistics. Of these, 36% (n = 23) were fitted with hearing aids, and 64% (n = 41) had cochlear implants. Upon discharge from therapy, 39% to 48% of participants showed improvements, achieving age-appropriate communication skills across all the domains.

Table 2. Comparison of Communication Functioning prior to the commencement of EI and upon discharge from EI.

Communication Domains	TSLT						LSL-SA					
	Communication Functioning at the Onset of Therapy			Communication Functioning at Discharge of Therapy			Communication Functioning at the Onset of Therapy			Communication Functioning at Discharge of Therapy		
	% Delayed	% Age Appropriate	% Unknown	% Delayed n	% Age Appropriate	% Unknown	% Delayed	% Age Appropriate	% Unknown	% Delayed	% Age Appropriate	% Unknown
Speech intelligibility	97% (n = 62)	2% (n = 1)	1% (n = 1)	55% (n = 35)	45% (n = 29)	1% (n = 1)	97% (n = 60)	3% (n = 2)		32% (n = 20)	66% (n = 41)	
Vocabulary	98% (n = 63)	2% (n = 1)		61% (n = 39)	39% (n = 25)		97% (n = 60)	3% (n = 2)		39% (n = 24)	61% (n = 38)	
Receptive Language	98% (n = 63)	2% (n = 1)		61% (n = 39)	39% (n = 25)		97% (n = 60)	3% (n = 2)		37% (n = 23)	61% (n = 38)	
Expressive Language	98% (n = 63)	2% (n = 1)		61% (n = 39)	39% (n = 25)		97% (n = 60)	3% (n = 2)		44% (n = 27)	56% (n = 35)	
Audition	98% (n = 63)	2% (n = 1)		56% (n = 36)	44% (n = 28)		98% (n = 63)	2% (n = 1)		32% (n = 20)	68% (n = 42)	
Cognitive Linguistics	98% (n = 63)	2% (n = 1)		52% (n = 33)	48% (n = 31)		90% (n = 56)	8% n = 5)	1% (n = 1)	27% (n = 17)	73% (n = 45)	

3.2.2. The Description of Communication Functioning Prior to the Commencement of EI to the Communication Outcomes upon Discharge from Therapy in the LSL-SA Group (n = 62) is depicted in Table 2

Results indicate delayed communication skills in speech intelligibility, expressive vocabulary, receptive language, expressive language, audition, and cognitive–linguistic skills ranging from 90% to 98%. Of the participants in the LSL-SA group, 23% (n = 14) were fitted with hearing aids, and 77% (n = 48) had cochlear implants. Upon discharge from therapy, significant improvements were observed in achieving age-appropriate communication skills ranging from 56% to 73% across all the communication domains.

3.3. *Comparing the Communication Outcomes Between the Two Groups*

Comparing the communication outcomes between the two groups (i.e., TSLT and LSL-SA), as depicted in Table 3, the categories for "age-appropriate—delayed" and "age-appropriate—age-appropriate" were very small and were grouped into categories "delayed—delayed" and "delayed—age-appropriate", respectively.

A comparison of outcomes between TSLT and LSL-SA was conducted and adjusted for significant differences in characteristics between the two groups, namely age at identification and age at amplification. The analysis also accounted for usual development, which reflects the natural progression of children over time, by considering the duration of early intervention (EI), as children typically develop and change during this period. Although the duration of EI did not differ significantly between the groups, it was included in the analysis as a post-hoc measure to assess its impact on communication outcomes. The results from this post-hoc analysis indicated that longer durations of EI were associated with reduced delays in communication development.

Findings further indicate statistically significantly decreased odds of remaining or becoming delayed in speech intelligibility and expressive vocabulary for the LSL-SA group (compared to the TSLT group). There were statistically significant decreased odds of remaining or becoming delayed in receptive language, audition, and cognitive–linguistics, both unadjusted and adjusted for the earliest age of amplification for the LSL-SA group (compared to the TSLT group). Findings further indicate that children with hearing loss who underwent LSL-SA were characterized by a higher proportion of participants who attained age-appropriate speech intelligibility, expressive vocabulary, receptive language, audition, and cognitive–linguistics upon discharge from therapy compared to those in TSLT.

Table 3. Comparison of communication outcomes between the TSLT and LSL-SA groups (N = 126).

N		**126**		**64**		**62**			
		Overall		**TSLT**		**LSL-SA**		**Unadjusted**	**Adjusted**
Communication Outcomes Trajectory (Onset to Discharge):		**N**	**%**	**n**	**%**	**n**	**%**	**Odds Ratio (OR) for LSL vs. TSLT (95% CI)**	
Speech	Delayed—Delayed	54	43	34	53	20	32	0.42 (0.20–0.86)	0.46 (0.21–1.02)
	Delayed—Age-Appropriate	67	53	28	44	39	63	reference	
	Age Appropriate—Age Appropriate	3	2	1	2	2	3		
	Unknown	2	2						
Vocabulary	Delayed—Delayed	62	49	38	59	24	39	0.41 (0.20–0.83)	0.48 (0.21–1.07)
	Age Appropriate—Delayed	1	1	1	2				

	Delayed—Age-Appropriate	61	48	25	39	36	58	reference	
	Age Appropriate—Age Appropriate	2	2			2	3		
Receptive Language	Delayed—Delayed	61	48	38	59	23	37	0.38 (0.18–0.78)	0.43 (0.19–0.99)
	Age Appropriate—Delayed	1	1	1	2				
	Delayed—Age-Appropriate	62	49	25	39	37	60	reference	
	Age Appropriate—Age Appropriate	2	2			2	3		
Expressive Language	Delayed—Delayed	65	52	38	59	27	44	0.50 (0.24–1.01)	0.61 (0.28–1.33)
	Age Appropriate—Delayed	1	1	1	2				
	Delayed—Age-Appropriate	58	46	25	39	33	53	reference	
	Age Appropriate—Age Appropriate	2	2			2	3		
Audition	Delayed—Delayed	55	44	35	55	20	32	0.37 (0.18–0.77)	0.42 (0.19–0.92)
	Age Appropriate—Delayed	1	1	1	2				
	Delayed—Age-Appropriate	69	55	28	44	41	66	reference	
	Age Appropriate—Age Appropriate	1	1			1	2		
Cognitive Linguistics	Delayed—Delayed	49	39	33	52	16	26	0.33 (0.16–0.71)	0.39 (0.17–0.88)
	Delayed—Age-Appropriate	70	56	30	47	40	65	reference	
	Age Appropriate—Age Appropriate	6	5	1	2	5	8		
	Unknown	1	1						

3.4. *Determining If Any Associations Exist Between Selected Study Variables and Communication Outcomes Within Each Communication Intervention Approach*

Findings on the *selected study variables of participants (i.e., age at identification of hearing loss, age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at start of EI, duration of EI, degree of aided audiogram, home language vs. language used in therapy) within the intervention approaches,* are depicted in Table 4.

Table 4. Categorical variables of participants within each intervention approach (N = 126).

Characteristic	Category	Overall		TSLT		LSL-SA		p-Value for Between-Group Comparison
		N	%	n	%	n	%	
N		**126**		**64**		**62**		
Identification and Diagnosis of Hearing Loss								
Age of identification of hearing loss (years)	median (IQR); range	1.5 (0.5–2.5); 0.0–8.1		1.7 (0.7–2.5); 0.0–7.7		1.0 (0.3–2.3); 0.0–8.1		0.047
Duration from identification to diagnosis (months)	median (IQR); range	0.0 (0.0–7.0); 0.0–58.0		0.0 (0.0–6.5); 0.0–37.0		0.5 (0.0–7.0); 0.0–58.0		0.19
Age at diagnosis of hearing loss (years)	median (IQR); range	1.8 (0.8–3.0); 0.0–8.1		2.1 (1.2–3.0); 0.1–7.7		1.5 (0.5–3.0); 0.0–8.1		0.095
Hearing Amplification								
Duration from diagnosis to amplification (months)	median (IQR); range	1.0 (0.0–3.0); 0.0–61.0		1.0 (0.0–4.0); 0.0–61.0		0.0 (0.0–2.0); 0.0–13.9		0.075
Earliest age of amplification (years)	median (IQR); range	2.1 (1.0–3.1); 0.1–8.2		2.3 (1.7–3.3); 0.1–8.2		1.8 (0.6–3.0); 0.2–8.2		0.037

Age of amplification with CI (years)	(n) median (IQR); range	(n = 90) 3.1 (1.9–4.9); 0.2–11.8		(n = 42) 3.5 (2.3–5.0); 0.2–11.8		(n = 48) 2.7 (1.8–4.9); 0.5–8.7		0.16
Age at the start of Communication Intervention (years)	median (IQR); range	2.5 (1.5–3.6); 0.2–8.3		2.5 (1.6–3.5); 0.3–8.3		2.5 (1.4–3.9); 0.2–8.2		0.86
Type of hearing amplification device	Hearing Aid	37	29	23	36	14	23	0.12
	Cochlear Implant	89	71	41	64	48	77	
Communication Intervention								
Duration from diagnosis to Communication Intervention (months)	median (IQR); range	2.7 (1.0–7.0); 0.0–67.2		2.7 (0.7–6.3); 0.0–53.6		2.9 (1.2–11.9); 0.0–67.2		0.40
Duration of Communication Intervention (years)	median (IQR); range	4.6 (3.0–6.8); 0.5–13.6		5.5 (3.4–7.3); 0.5–13.6		4.2 (2.9–6.3); 1.0–10.9		0.071
Hearing Age until discharge from Communication Intervention	median (IQR); range	4.1 (2.6–6.0); 0.1–24.0		4.4 (2.4–6.5); 0.7–24.0		4.0 (2.7–5.4); 0.1–10.7		0.61
Language of Communication Intervention								
The language used in sessions	English	89	71	43	67	46	74	0.44
	Afrikaans	37	29	21	33	16	26	
Language used during communication intervention sessions	Same	100	79	50	78	50	81	0.83
	Different	26	21	14	22	12	19	

When examining the age of identification, diagnosis, and fitting of amplification devices for children with hearing loss between the LSL-SA (n = 62) and TSLT (n = 64) groups, findings revealed that participants in the LSL-SA group were identified and diagnosed with hearing loss at younger ages and fitted with hearing amplification devices at a younger age compared to those in the TSLT group. These findings show that participants in the LSL-SA group have earlier access to EHDI (identification = 1.0 years old, diagnosis = 1.5 years old, amplification = 2.3 years old) services, leading to earlier intervention for children with hearing loss than those in the TSLT group.

There is no statistically significant time difference between the LSL-SA and the TSLT groups when comparing the time taken from diagnosis of hearing loss to the start of communication intervention. The study also examined the average duration of communication intervention sessions attended by participants, averaging 4.6 years; notably, participants in the LSL-SA group (n = 62) attended therapy for an average of 4.2 years, significantly less than those in the TSLT group (n = 64), who attended for an average of 5.5 years.

In both the TSLT and LSL-SA groups, the majority of participants received communication intervention in English. A subset of participants, 33% (n = 21) in TSLT and 26% (n = 16) in LSL-SA received intervention in Afrikaans. Of these, 78% (n = 50) in TSLT and 81% in LSL-SA received intervention in their home language. The minority, 22% (n = 14) in TSLT and 19% (n = 12) in LSL-SA, received intervention in a language other than their home language.

Table 5 depicts the aided audiogram results between the TSLT group (n = 44) and the LSL-SA group (n = 22). The audiological assessment measures were conducted by registered audiologists (i.e., Health Professions Council of South Africa [HPCSA]) using calibrated equipment (i.e., SANS 10182:2006) in a calibrated soundproof booth that complies with standards and regulations (i.e., S EN ISO 8253-1: 2010) [42,43]. Participants who failed to achieve normal aided thresholds across all frequencies had aided audiograms within the mild hearing loss category in both groups.

Table 5. Aided Audiogram Results.

Characteristic		Overall		TSLT		LSL-SA		p-Value for Between-Group Comparisons
		n	%	N	%	n	%	
Aided Audiogram Results Available	No	60	48	20	31	40	65	0.0003
	Yes	66	52	44	69	22	35	
% fail (25dB cutoff): Ear R	250 Hz (n = 54)		28		29		26	>0.99
	500 Hz (n = 58)		40		40		40	>0.99
	1000 Hz (n = 58)		43		42		45	>0.99
	2000 Hz (n = 56)		55		58		50	0.77
	4000 Hz (n = 49)		63		71		43	0.10
	8000 Hz (n = 7)							
	Low frequencies (250–1000 Hz) (n = 58)		48		45		55	0.58
	High frequencies (2000–4000 Hz) (n = 56)		68		74		56	0.23
% fail (25dB cutoff): Ear L	250 Hz (n = 54)		30		31		28	>0.99
	500 Hz (n = 56)		43		46		37	0.58
	1000 Hz (n = 56)		41		38		47	0.57
	2000 Hz (n = 55)		45		49		39	0.57
	4000 Hz (n = 49)		49		56		33	0.22
	8000 Hz (n = 5)							
	Low frequencies (250–1000 Hz) (n = 56)		50		51		47	>0.99
	High frequencies (2000–4000 Hz) (n = 55)		60		65		50	0.38

Table 6 depicts the associations that exist *between the selected study variables (i.e., age at identification of hearing loss, age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at start of EI, duration of EI, degree of aided audiogram, home language vs. language used in therapy) and the communication outcomes (controlling for the communication intervention approach and hearing amplification device)*. No statistically significant association was found between the communication intervention approach and study variables, except that those who received LSL-SA had a lower median age of identification and a lower median earliest age of amplification. These factors were adjusted when comparing outcomes between TSLT and LSL-SA, as the other variables were most likely not prognostic for outcomes or were themselves outcomes. Since age of identification and earliest age of amplification were strongly correlated ($r = 0.816$; $p < 0.0001$), only the earliest age of amplification was used.

Table 6. Association between the categorical variables and communication outcomes.

Odds Ratios are for Delay vs. Age Appropriate		Speech			Vocabulary			Receptive Language			Expressive Language			Audition			Cognitive Linguistics		
		Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)	Delayed	Age Appropriate	OR (95% CI)
Duration from ID to diagnosis (m)	median (IQR)	0.0 (0.0–11.0)	0.0 (0.0–3.0)	1.04 (1.01–1.08)	0.0 (0.0–9.0)	0.0 (0.0–3.0)	1.03 (0.99–1.07)	0.0 (0.0–9.0)	0.0 (0.0–3.0)	1.04 (0.99–1.08)	0.0 (0.0–8.0)	0.0 (0.0–3.0)	1.03 (0.99–1.07)	0.0 (0.0–8.0)	0.0 (0.0–6.0)	1.01 (0.98–1.05)	0.0 (0.0–8.0)	0.0 (0.0–6.0)	1.01 (0.98–1.05)
Duration from ID to EI (m)	median (IQR)	8.2 (2.6–22.7)	6.0 (2.6–19.2)	1.02 (0.99–1.04)	7.4 (2.7–18.3)	6.9 (2.5–26.3)	1.00 (0.98–1.03)	7.2 (2.7–16.9)	7.2 (2.5–26.9)	1.00 (0.97–1.02)	7.8 (2.8–18.3)	6.5 (2.4–23.8)	1.00 (0.98–1.03)	6.9 (2.6–14.4)	7.5 (2.6–27.6)	0.99 (0.96–1.02)	7.8 (2.6–18.3)	6.6 (2.7–23.8)	1.00 (0.97–1.03)
Duration from identification to amplification (m)	median (IQR); range	6.0 (1.0–15.0)	2.0 (0.0–8.5)	1.03 (0.99–1.07)	6.0 (1.0–18.0)	2.0 (0.0–8.0)	1.04 (0.99–1.07)	6.0 (1.0–18.0)	2.0 (0.0–7.6)	1.04 (0.99–1.07)	6.0 (1.0–15.0)	2.0 (0.0–8.3)	1.03 (0.98–1.07)	6.0 (1.1–12.5)	2.0 (0.0–9.0)	1.01 (0.98–1.05)	6.0 (1.1–12.0)	3.0 (0.0–9.0)	1.01 (0.98–1.05)
Duration of Amplification (y)	median (IQR); range	3.4 (1.8–5.4)	4.9 (3.5–6.4)	0.73 (0.59–0.89)	3.9 (2.3–5.7)	4.7 (3.4–6.3)	0.86 (0.72–1.01)	3.9 (2.3–5.7)	4.7 (3.3–6.2)	0.88 (0.74–1.04)	3.9 (2.3–5.7)	4.8 (3.4–6.3)	0.86 (0.72–1.02)	3.8 (2.3–5.5)	4.7 (3.2–6.3)	0.85 (0.71–1.02)	3.4 (1.8–5.4)	4.8 (3.4–6.3)	0.76 (0.62–0.93)
Audiogram (% fail)	Ear A—low frequencies (n = 58)	63	38	3.03 (0.96–9.53)	63	38	3.10 (0.96–10.0)	61	40	2.79 (0.84–9.22)	63	38	3.10 (0.96–10.0)	60	42	2.50 (0.71–8.85)	72	38	6.14 (1.48–25.4)
	Ear A—high frequencies (n = 56)	83	58	2.67 (0.71–10.1)	87	55	4.11 (0.97–17.5)	86	56	3.49 (0.81–15.1)	87	55	4.11 (0.97–17.5)	90	56	5.08 (0.95–27.1)	94	55	10.3 (1.19–89)
	Ear B—low frequencies (n = 56)	67	38	3.31 (1.06–10.4)	67	38	3.49 (1.05–11.6)	65	39	3.08 (0.90–10.5)	67	38	3.49 (1.05–11.6)	63	43	2.52 (0.68–9.38)	71	41	3.83 (1.01–14.6)
	Ear B—high frequencies (n = 56)	75	48	2.69 (0.78–9.32)	78	47	2.57 (0.69–9.52)	77	48	2.07 (0.54–7.92)	78	47	2.57 (0.69–9.52)	79	50	2.09 (0.50–8.71)	88	47	6.22 (1.16–33)
Number of cochlear implants (column %)	0	34	23	reference	41	16	reference	42	16	reference	41	15	reference	46	14	reference	46	17	reference
	1	31	31	0.73 (0.28–1.92)	37	25	0.58 (0.22–1.58)	35	27	0.53 (0.20–1.42)	35	27	0.50 (0.19–1.36)	36	27	0.43 (0.16–1.14)	42	24	0.71 (0.27–1.45)
	2	34	47	0.14 (0.05–0.38)	22	59	0.16 (0.06–0.41)	23	58	0.16 (0.06–0.42)	24	58	0.16 (0.06–0.42)	18	59	0.10 (0.04–0.28)	12	59	0.37 (0.16–0.86)
Age at start of EI (y)	median (IQR); range	3.0 (2.1–4.3)	2.3 (1.0–3.3)	1.49 (1.15–1.92)	2.9 (2.1–4.2)	2.1 (0.9–3.1)	1.52 (1.16–1.99)	2.9 (2.1–4.2)	2.2 (0.9–3.1)	1.52 (1.16–1.99)	2.8 (2.1–4.1)	2.1 (0.9–3.2)	1.47 (1.13–1.90)	2.9 (1.9–4.3)	2.3 (1.0–3.3)	1.38 (1.07–1.78)	3.0 (2.1–4.5)	2.3 (1.0–3.2)	1.50 (1.16–1.96)

Earliest age of amplification (y)	median (IQR); range	2.8 (1.8–4.0)	1.8 (0.6–2.6)	1.65 (1.24–2.21)	2.8 (2.0–4.0)	1.4 (0.4–2.4)	2.07 (1.47–2.92)	2.8 (2.0–4.0)	1.4 (0.5–2.4)	2.18 (1.53–3.11)	2.6 (1.8–4.0)	1.5 (0.4–2.5)	1.88 (1.35–2.60)	2.8 (2.0–4.0)	1.6 (0.6–2.6)	1.75 (1.27–2.39)	2.9 (2.0–4.2)	1.8 (0.6–2.6)	1.74 (1.28–2.37)
Earliest age of amplification with CI (y) (n = 90)	median (IQR); range	4.0 (3.0–5.7)	2.5 (1.6–4.2)	1.34 (1.07–1.68)	3.6 (2.5–5.2)	2.7 (1.6–4.3)	1.19 (0.97–1.46)	3.6 (2.5–5.1)	2.8 (1.6–4.5)	1.17 (0.95–1.43)	3.6 (2.3–5.2)	2.8 (1.6–4.5)	1.15 (0.95–1.40)	3.6 (2.5–5.3)	2.8 (1.7–4.7)	1.15 (0.94–1.41)	4.3 (3.0–5.3)	2.7 (1.7–4.3)	1.23 (0.99–1.52)
Earliest age of amplification vs. Age at start of EI (cutoffs 2.1y and 2.5y respectively	Early / Early	36	59	reference	41	57	reference	42	56	reference	42	57	reference	41	56	reference	36	58	reference
	Early / Late	5	16	0.83 (0.20–3.47)	3	19	0.33 (0.07–1.70)	2	20	0.16 (0.02–1.3)	5	18	0.46 (0.11–1.90)	2	19	0.20 (0.02–1.75)	4	16	0.68 (0.13–3.59)
	Late / Late	58	26	3.38 (1.49–7.66)	56	24	2.97 (1.30–6.75)	56	23	2.97 (1.30–6.78)	53	25	2.55 (1.13–5.78)	57	26	2.75 (1.20–6.62)	60	26	3.42 (1.48–7.94)
Duration of EI (y)	median (IQR); range	4.1 (2.4–6.8)	5.4 (3.8–7.3)	0.81 (0.68–0.95)	4.1 (2.9–6.8)	5.4 (3.6–7.4)	0.80 (0.68–0.94)	4.2 (2.9–6.8)	5.4 (3.6–7.3)	0.81 (0.68–0.95)	4.1 (2.9–6.6)	5.5 (3.8–7.4)	0.79 (0.67–0.93)	4.1 (2.8–6.7)	5.4 (3.7–7.3)	0.77 (0.65–0.91)	3.7 (2.8–6.1)	5.5 (3.8–7.3)	0.72 (0.60–0.87)
SLT Language match to home language	Same	67	89	reference	67	92	reference	66	92	reference	67	93	reference	61	94	reference	62	91	reference
	Different	33	11	3.55 (1.34–9.41)	33	8	5.69 (1.88–17.2)	34	8	6.06 (1.98–18.5)	33	7	6.74 (2.08–21.9)	39	6	12.3 (3.57–42.6)	38	9	6.28 (2.20–17.9)

Figure 1 below depicts the association between the selected variables and communication outcome (controlling for TSLT or LSL-SA and hearing amplification device). It presents the statistically significant associations that result in increased or decreased odds of delay across the six communication domains, after correction for multiple comparisons.

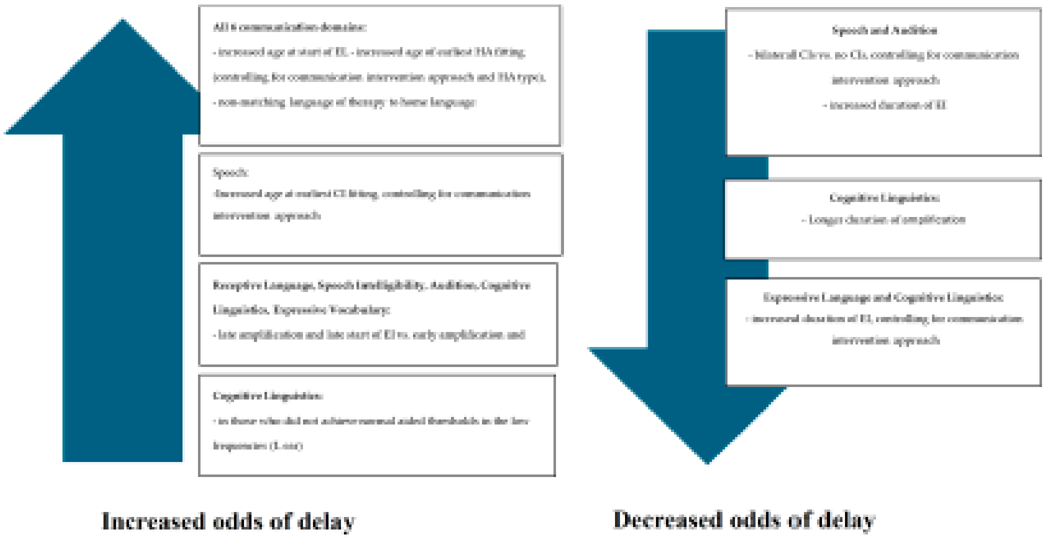

Figure 1. Statistically significant associations between variables result in increased or decreased odds of delay.

3.5. *Identifying the Type of School Recommended After EI Based on Communication Outcomes*

When examining *the type of school recommended after EI based on communication outcomes*, as depicted in Figure 2, the participants who received LSL-SA (n = 25) had a higher proportion of being recommended for mainstream schooling in comparison to the participants who received TSLT (n = 39) (p-value for between-group comparison = 0.0023), who were recommended for specialized schooling.

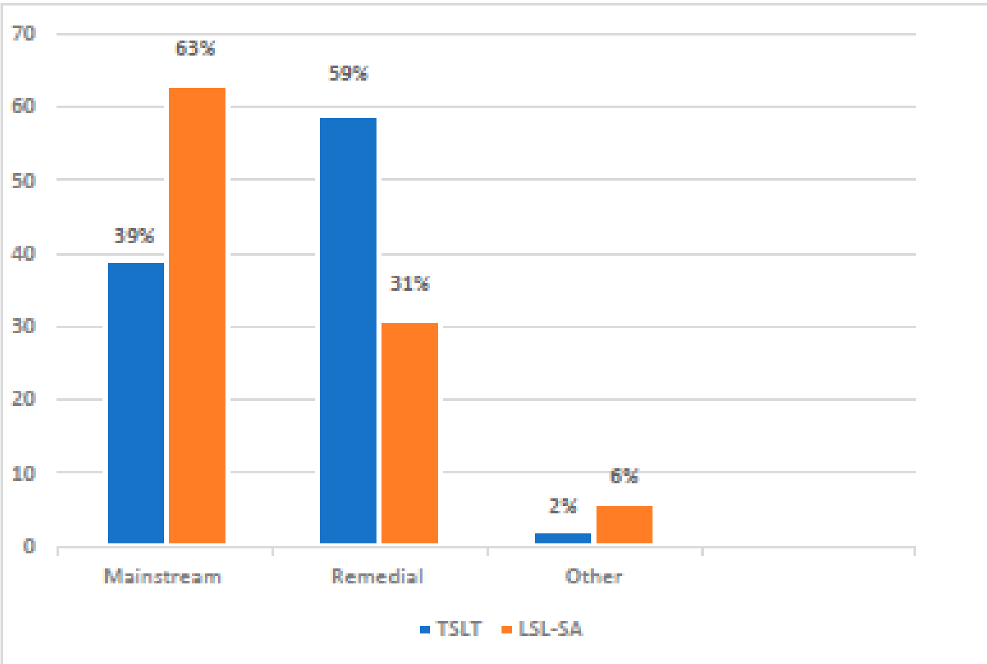

Figure 2. Type of school recommended upon discharge from communication intervention.

4. Discussion

The sample comprised the speech-language therapy records of 126 children with hearing loss enrolled at one of four participating EI schools in South Africa. All the children were discharged from communication intervention therapy at the end of their foundation phase of schooling. The study affirms the validity of the speech-language outcomes measures, as consistent communication assessment tools were used across the EI schools to evaluate these outcomes. Given the retrospective nature of the study, which relied on existing records, slight variations in record-keeping and assessment practices were considered. Although standardized assessment tools were used, the potential impact of these variations on the consistency and validity of the outcomes was taken into account in the analysis.

Research confirms multiple advantages to hearing with two cochlear implants [44,45]. Despite the provision of free hearing aids to children under six and a national CI platform, rehabilitative interventions compete with life-threatening conditions within an over-stressed and under-resourced health budget and are poorly prioritized [3,46]. In 2019, only 23 children received government-funded CIs despite 17 babies born daily with permanent sensorineural hearing loss in South Africa [46,47]. If hearing amplification devices are available and used optimally (i.e., appropriate pre-fitting counselling, device management skills, and post-fitting support), it would ensure better health and developmental outcomes for children with hearing loss in South Africa.

Findings regarding the aetiology of hearing loss identified in this study correlate with research conducted by Shearer et al. [48], Korver et al. [49] and Mulwafu et al. [50]. In accordance with the exploratory study [51], the risk profile of infants in an LMIC has been highlighted, raising implications in the planning of EHDI in the South African context.

When describing the communication functioning prior to the commencement of EI to the communication functioning upon discharge from therapy in the TSLT group, findings indicate that 98% of participants had delayed communication skills, consistent with the literature which suggests auditory deprivation during the first three years of life is linked to less favorable outcomes in speech intelligibility, language, developmental, educational, and cognitive outcomes in children [52–55]. Upon discharge from therapy, only 48% of participants achieved age-appropriate communication skills. This is consistent with the findings of Lederberg et al. [56] that the majority of children with profound hearing loss in communication interventions, such as sign language and sign-supported approaches, do not achieve age-appropriate grammar, language-related areas of development (i.e., theory of mind) and literacy development, compared to their normal hearing peers, despite early identification. The current study's findings also concur with the study by Harris et al. [57], comparing the language and literacy of two cohorts of children with profound hearing loss enrolled in TSLT, recruited ten years apart. Harris et al. [57] reported that, while the second cohort had a higher vocabulary score, this was not matched by commensurate phonological awareness or reading ability improvements. These results suggest that, despite EHDI, most children with profound hearing loss in TSLT do not achieve age-appropriate language and literacy levels.

When describing *the communication functioning prior to the commencement of EI to the communication functioning upon discharge from therapy in the LSL-SA group*, the data indicate that at least two-thirds of participants achieved age-appropriate communication skills. These findings are consistent with findings by Yanbay et al. [58], who observed variability in outcomes in areas of speech and language, with some children achieving below-average scores and others achieving above-average scores. Yanbay et al. [58] also noted that family involvement in the intervention process was a key factor in significantly improving language outcomes. While the LSL-SA intervention approach emphasizes a family-based approach, which may contribute to improved outcomes, it is important to recognize that several factors, such as the intensity and consistency of the intervention, the level of family support, and individual child characteristics, also play crucial roles in influencing results. Therefore, while the data suggests that children with hearing loss enrolled in an LSL intervention approach have higher odds of performing at age-appropriate speech and language levels, the extent to which it produces better outcomes compared to other interventions must be considered within a broader context of these unaccounted variables. This highlights the need for further investigation into how these multiple factors interact and contribute to communication outcomes in children with hearing loss.

Upon *comparing the communication outcomes between the two groups (i.e., TSLT and LSL-SA)*, the findings reveal that the LSL-SA group are more likely to achieve age-appropriate communication skills. This confirms findings from the exploratory study [51] and aligns with Percy-Smith et al. [31], who found that children with hearing loss in an LSL approach outperformed those in TSLT on speech intelligibility, expressive vocabulary, and receptive language. Percy-Smith et al. [31] adjusted the effect of the intervention approach (i.e., LSL versus TSLT) with other covariates and found that LSL participants had higher odds of reaching age-appropriate speech and language levels. The current study reinforces the effectiveness of the LSL-SA approach in achieving optimal communication outcomes. Although the LSL-SA approach demonstrates favourable outcomes, this study recognizes that the focus on spoken language interventions may inadvertently perpetuate systemic barriers to inclusive practices. The lack of resources for SASL and bilingual approaches reflects broader inequities that constrain family choices and limit the alignment of interventions with cultural and linguistic rights. The specifics of both intervention approaches, including their theoretical underpinnings, implementation processes, and individualized strategies, are critical to understanding their impact on communication outcomes. Future research should provide more granular descriptions of intervention protocols to enhance clarity and reproducibility. These results may enable policymakers, especially in LMICs, to allocate resources for and plan strategically to promote and enhance access to this early intervention approach, alleviating the deleterious consequences of hearing loss. It is, therefore, likely that the costs of hearing loss (i.e., health sector, hearing devices, educational support, loss of productivity, societal costs) on the global economy, currently at US$ 980 billion annually, may be reduced [59]. The effectiveness of the LSL-SA approach, as shown by its better outcomes when compared to TSLT in terms of achieving age-appropriate communication skills, suggests that policymakers should consider promoting and enhancing access to LSL-SA to improve communication outcomes for children with hearing loss in South Africa. It is important to acknowledge and underscore that the prioritization of spoken language interventions raises critical questions about inclusivity and equity in the context of Deaf education. Incorporating sign language and fostering bilingualism might better address these concerns, supporting a broader range of outcomes that align with the preferences of Deaf communities. These findings align with international research demonstrating that auditory-based early interventions, when accessible and appropriately implemented, can significantly improve communication outcomes. Countries with established LSL programs, such as Australia and the United States, have reported similar benefits, suggesting that structured, parent-centered interventions could be beneficial beyond the South African context. However, variations in healthcare infrastructure, cultural attitudes toward Deaf identity, and language policies must be considered when adapting such approaches to different regions.

When examining the *selected study variables (i.e., age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at the start of EI, duration of EI, degree of the aided audiogram, home language vs. language used in therapy) within the intervention approaches,* despite findings of this study showing the children enrolled in the LSL-SA cohort is characterized by a lower median age of identification of hearing loss (1.0

years old), lower median age of diagnosis of hearing loss (1.5 years old) and a lower median earliest age of amplification (1.8 years old), it highlights the incongruence between transferring the theory of the adjusted 1-4-8 South African guidelines into practice. These findings exemplify what [3,24] claim regarding the incongruence of disability in relation to the number and distribution of speech-language and hearing professionals in the South African context. These findings advocate for the training of additional therapists to address the capacity-demand ratio so that more children with hearing loss will have access to evidence-based EI services.

The age of diagnosis of hearing loss determines the age of amplification and, subsequently, the age of enrolment in a communication intervention program [3,60]. Findings of this study reveal that, despite the average age of earliest hearing aid amplification (1.8 years old) and cochlear implantation (2.7 years old) being earlier for the LSL-SA group, the age of enrolment in a communication intervention program (2.5 years old) was the same for both cohorts. This finding highlights that international and national EHDI guidelines may not be transferable to clinical practice in South Africa due to contextual constraints. Studies by [3] and Meyer et al. [61] highlight delays in amplification in South Africa. The current study's findings advocate for the timely provision of early amplification and/or cochlear implantation and confirm that auditory input is key to communication outcomes in children with hearing loss [13,20]. These findings further motivate an increase in budget allocation to meet the demands for hearing amplification devices and may contribute toward initiatives for affordable and accessible service delivery in LMICs. As far as timing of intervention and communication outcomes, current findings highlight that early identification, diagnosis, and amplification are crucial for achieving age-appropriate communication skills. The study emphasizes the need for timely intervention to mitigate the negative impact of delayed communication skills on speech intelligibility, language development, educational outcomes, and cognitive development. Furthermore, the incongruence between guidelines and practice demonstrated by current findings shows that despite guidelines like the 1-4-8 EHDI in South Africa, there are challenges in translating these guidelines into practice, leading to delays in access to intervention services. Addressing these incongruences requires additional training for therapists and improving the capacity of healthcare systems to deliver timely interventions.

The degree of improved hearing provided by amplification devices is associated with better speech and language development in children with hearing loss [16]. However, the issue of successful amplification is multifaceted and must be carefully considered. While the current study's findings show that the duration of hearing amplification is associated with decreased odds of delay in speech and cognitive linguistics, it is important to recognize that the mere provision of amplification does not guarantee positive outcomes. Successful amplification depends on several factors, including the appropriateness of the device, proper fitting, consistent use, and ongoing maintenance. This concurs with the findings by Tomblin et al. [16]. Additionally, access to high-quality hearing devices and the ability to maintain their use is a significant challenge in resource-constrained settings. These findings support the early provision of well-fitted hearing aids and/or cochlear implants, but they also highlight the need for a comprehensive approach to amplification. Ensuring the availability of affordable, well-fitted hearing devices, as well as providing families with the necessary support for consistent device use, is crucial for improving speech and language outcomes. Adequate budget allocation and initiatives for increasing affordability and accessibility of hearing devices are crucial for achieving optimal outcomes in this context.

Findings of the current study indicate that children in the LSL-SA approach attend therapy for a significantly shorter duration than those in TSLT. These findings concur with the exploratory study [51] and with reports indicating substantial health gains within the

Disability-Adjusted Life Years (DALYs) [62]. These findings directly influence the financial, human and infrastructure resource constraints and raise implications for managing the burden of disease in South Africa.

The findings of this study show that human resource constraints in providing communication intervention services foment a linguistic mismatch between speech-language therapists and/or audiologists and the population they serve within the South African context. This concurs with the findings of numerous studies [3,24,63]. The findings of this study thus raise implications of implementing an adapted first-world intervention approach that requires contextually relevant and linguistically responsive evidence. Early communication interventionists remain accountable for acquiring reliable and valid evidence in communication approaches and need to consider resources from a cultural and linguistic perspective, as it is key to effective clinical service provision in South Africa (Health Professions Council of South Africa [64]. This study's retrospective design limits its ability to establish causality or definitively attribute outcomes to specific interventions. A well-designed prospective study incorporating randomized controlled methods would be essential to confirm these findings and draw more robust conclusions about the comparative efficacy of LSL-SA and TSLT approaches.

Results examining whether associations exist *between the selected study variables (i.e., age at diagnosis of hearing loss, age at amplification, duration of amplification, hearing amplification device, age at the start of EI, duration of EI, degree of the aided audiogram, home language vs. language used in therapy) and the communication outcomes (controlling for the communication intervention approach and type of hearing amplification device)*, reveal that children with hearing loss who have access to EI (which includes the diagnosis of hearing loss, fitting of hearing amplification devices, and adopting a linguistically appropriate communication approach, i.e., communication methods, resources or interventions that are tailored to the language needs and cultural background of the child) at the earliest opportunity increase their chances of achieving age-appropriate communication outcomes. This is despite the participant sample not adhering to the South African 1-4-8 EHDI guidelines. These results concur with the literature that children with earlier diagnosed hearing loss and amplification that quickly follow demonstrate more advanced language outcomes than those diagnosed and fitted with hearing amplification devices later [13,16,65]. Results further indicate that communication outcomes are hindered when the communication intervention approach does not incorporate linguistically appropriate care. This finding concurs with outcomes described in the exploratory study [51] and is particularly relevant in the South African context.

When examining *the type of school recommended after EI based on communication outcomes* as a predictor of success, results show that children with hearing loss enrolled in an LSL communication approach outperformed children with hearing loss enrolled in a TSLT communication approach. These findings again confirm those of [51] and Goldblatt and Pinto [66], who state that significant associations exist between language function and academic progress as an outcome of EI. Spoken language is often seen as a gateway to inclusive education and social competence [67, 68]. However, it is important to note that this study's focus on only two intervention approaches—TSLT and LSL-SA-excludes other options, such as SASL or bilingual approaches, which may better align with Deaf culture and identity and offer a more inclusive range of communication options for families. The findings, therefore, are limited in their generalizability, particularly for families who prefer or have access to alternative communication strategies. While the LSL-SA approach may support academic progress in some contexts, future research should consider the broader perspectives of the Deaf community and explore how different approaches, including sign language, can contribute to more culturally responsive, inclusive educational outcomes.

5. Conclusions

This study highlights the critical role of EHDI in improving communication outcomes for children with hearing loss. The findings highlight the importance of timely amplification, structured intervention approaches, and family-centered therapies in promoting age-appropriate language development. Moreover, the study emphasizes the need for context-specific solutions in LMICS, where resource constraints pose challenges to implementing optimal EHDI programs. These insights can inform policymakers and clinicians working toward improved access and inclusivity in early intervention services globally. Results from this study emphasize the importance of adapting EI communication approaches to local contexts, ensuring cultural sensitivity, linguistic responsiveness and continuity of care. To promote truly inclusive education and societal participation, there is an urgent need to integrate spoken language approaches with robust support for sign language and bilingual communication. This requires addressing systemic inequities and fostering interventions that uphold the linguistic and cultural rights of all children with hearing loss. The LSL-SA approach emphasizes family involvement, with parents playing an active role in reinforcing language learning in everyday contexts. This family-centered approach is shown to increase the odds of achieving age-appropriate communication outcomes for infants and young children with hearing loss in South Africa. However, despite its effectiveness, the LSL-SA approach faces significant barriers in South Africa. There are only 51 LSL-SA therapists and 7 LSLS Cert.AVT® therapists nationwide, which limits the availability and accessibility of this intervention. The capacity–demand ratio is further compounded by the disparities between the public-private healthcare sectors, with 82.6% of the population relying on an overburdened public healthcare system, while only 17.4% have access to private healthcare [69]. Thus, the imperative of developing updated policies and guidelines for children with hearing loss in South Africa is emphasized. These policies, as well as practices, should align with inclusive frameworks that integrate diverse communication options.

Although this study was conducted in South Africa, its findings offer valuable insights for other LMICs and underserved populations globally. The evidence supporting earlier amplification, structured early intervention, and linguistic considerations can guide policymakers in designing sustainable, contextually appropriate hearing healthcare frameworks. Future research should explore how these findings translate into diverse settings, ensuring equitable access to effective communication interventions worldwide.

6. Limitations of the Study

When interpreting the findings of this study, several limitations must be considered. Given that this study adopted a retrospective design, randomization was not feasible. The children were grouped based on the interventions they had already received. Consequently, the assignment to one of the intervention groups was not randomized but rather reflective of the services offered by each school at the time the child's intervention took place. This lack of randomization introduces the potential for selection bias, as factors such as the availability of resources and institutional preferences may have influenced the assignment to one of the intervention groups. To mitigate this bias, the researchers cross-validated the intervention groups with retrospective records, ensuring that children had received the intervention assigned by their school. Furthermore, the two intervention groups were matched for gender and type of amplification device, which helped reduce potential bias. However, some limitations may remain due to the non-random assignment.

Despite these limitations, the findings provide valuable context-specific evidence on communication outcomes for children with hearing loss.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data relevant to the study are included in the article.

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Abbreviations

The following abbreviations are used in this manuscript:

LSL-SA	Listening and Spoken Language-South Africa
TSLT	Traditional Speech-Language Therapy
EHDI	Early Hearing Detection and Intervention
NHS	Newborn Hearing Screening
EI	Early Intervention
AVT	Auditory Verbal Therapy
LMIC	Low-middle-income country
ECD	Early Childhood Development
SASL	South African Sign Language
NDP	National Development Plan
HPCSA	Health Professions Council of South Africa
CI	Cochlear Implant
DALYs	Disability-Adjusted Life Years

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Appendix P

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Communication Intervention in South Africa: Advocating for the Listening and Spoken Language Approach

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Adhering to Early Hearing Detection and Intervention (EHDI) guidelines is critical for the timely identification and management of infants with hearing impairment. Early intervention specifically focusses on family-centred communication interventions, of which the Listening and Spoken Language–South Africa (LSL-SA) approach is available for children with hearing impairment in South Africa. Studies have evidenced significant benefits for children with hearing impairment enrolled in LSL-SA compared to those enrolled in Traditional Speech-Language Therapy (TSLT), that is, age-equivalent communication outcomes, shorter duration of therapy until discharge, meritorious academic performance and integration into a hearing society. Despite these positive outcomes related to the LSL-SA approach, significant contextual barriers hinder effective implementation nationwide.

Contribution: The successful implementation of EHDI guidelines in South Africa hinges on overcoming barriers through tailored healthcare strategies and contextualised delivery. Adapting frameworks such as LSL-SA to fit the local context is crucial for advancing equitable access to EHDI services, positively impacting children with hearing impairment and their families. This article highlights the systemic challenges in South Africa in optimising resources by adopting linguistically appropriate and culturally responsive early intervention approaches to champion hearing healthcare initiatives. Effective collaboration among diverse stakeholders is essential for enhancing the uptake of EHDI guidelines and translating policy into impactful communication interventions. Implementing the core principles of the LSL-SA approach will not only ensure access to this specialised service for suitable candidates but may also alleviate specific barriers to EHDI implementation within TSLT approaches.

Keywords: early intervention; EHDI; Listening and Spoken Language; communication outcomes; hearing impairment; contextual healthcare; South Africa; speech-language therapy; audiology; family-centred care.

In South Africa, a low-middle-income country (LMIC), children with hearing impairment face unique challenges in accessing health services crucial for their development and societal integration (Bush et al., 2017; World Health Organization [WHO], 2016). The Health Professions Council of South Africa's (HPCSA) Professional Board for Speech, Language, and Hearing Professions, in alignment with the Joint Committee on Infant Hearing's (JCIH) 2007 position statement, drafted an Early Hearing Detection and Intervention (EHDI) guideline (HPCSA, 2018). This guideline proposes to identify, diagnose and provide intervention for children with hearing impairment at the earliest stages of infancy, enabling effective communication and promoting their full developmental potential (HPCSA, 2018). According to the HPCSA, South African speech-language therapists (SLTs) and audiologists play a crucial role in achieving developmental goals by offering fair, accessible and equitable early childhood development services that account for contextual realities. They are also responsible for providing specialised rehabilitation services to children with hearing impairment and their families, as outlined in the HPCSA EHDI Guideline (HPCSA, 2018; Khoza-Shangase, 2021b; Pascoe & Singh, 2023; Pillay et al., 2020). The choice of communication intervention approach plays a pivotal role in determining speech-language acquisition and overall educational outcomes of children with hearing impairment (Casoojee et al., 2024; Casoojee & Khoza-Shangase, 2022; Maluleke et al., 2021a). The current landscape of early communication interventions in South Africa for children with hearing impairment and their families employs one of the following two approaches:

1. Traditional Speech-Language Therapy (TSLT) is a more cost-effective intervention approach, given the challenges within South Africa (Casoojee et al., 2021). It encompasses a range of communication methods, from visual-gestural approaches such as sign language, total

communication and cued speech to auditory methods involving natural gestures, speechreading and visual cues combined with amplification (Casoojee et al., 2021). Sign language acquisition follows a developmental trajectory analogous to spoken language, provided children with hearing impairment receive consistent input from fluent signers from birth (Lillo-Martin & Henner, 2021). However, the acquisition context varies significantly: while deaf children with deaf signing parents have an optimal linguistic environment for sign language acquisition, more than 90% of deaf children are born to hearing, non-signing families (NIH, 2015). In these cases, a lack of exposure to spoken language because of hearing impairment and insufficient proficiency in sign language among parents result in delayed language acquisition (Hall et al., 2017).

2. Listening and Spoken Language-South Africa (LSL-SA) is a postgraduate diploma offered through the University of Stellenbosch, which serves as an additional licensing course following an undergraduate qualification. It is based on the LSLS Certified Auditory-Verbal Therapist (LSLS Cert. AVT®) qualification by the AG Bell Academy. The LSL-SA emphasises auditory-verbal techniques aimed at maximising a child's ability to listen, understand spoken language and speak (Estabrooks, 2020). Seven of the 10 LSL principles involve parents training their children to integrate listening skills into communication and social development. Blose and Joseph (2018) found that one or two hours of weekly intervention were insufficient to address early auditory and language deprivation in children with hearing impairment, which highlights the importance of empowering South African parents to become primary facilitators of their child's speech and language development (Casoojee et al., 2024a; Khoza-Shangase, 2022). The LSL principles further advocate for early diagnosis of hearing impairment and prompt audiological management, utilising advanced hearing technology for maximum auditory stimulation benefits. These principles bind LSL interventionists (AG Bell Academy, 2018), leveraging natural developmental listening, language, speech and cognition patterns to promote effective communication. An LSL approach aims to facilitate the educational and social integration of children with hearing impairment into mainstream schools (AG Bell Academy, 2018).

A global body of evidence supports the effectiveness of the LSL approach (Auditory Verbal UK, 2023). Emphasising natural language development and cognitive growth through structured therapy activities, the LSL approach involves parents as partners in fostering listening and language skills during daily routines and play (Chowdhry, 2010). Research demonstrates that children with hearing impairment in LSL programmes attain spoken language commensurate with their normal hearing peers, irrespective of hearing technology, and make similar progress in listening skills, reading, mathematics and self-esteem (Cupples et al., 2017; First Voice, 2023; Fulcher et al., 2012; Hitchins & Hogan, 2018; Mortazavi & Mortazavi, 2017; Noel et al., 2023; Percy-Smith et al., 2017). Research further indicates that children with hearing impairment enrolled in LSL programmes achieve comparable academic progress, societal interaction and social role fulfilment as their normal hearing peers, promoting better social integration within a predominantly hearing society (Constantinescu-Sharpe et al., 2017).

The rationale for advocating the broader adoption and integration of the LSL approach within the South African context is justified by empirical evidence, its adaptability to local challenges and the potential to improve access and equity in services for children with hearing impairment. This article further explores how the LSL approach can be practically applied amid contextual challenges such as access to services, service delivery issues, continuity of care, language and cultural barriers, and socio-economic disparities (Khoza-Shangase, 2021b).

Overcoming barriers and enhancing LSL-SA implementation for improved outcomes

Effective healthcare must integrate contextual considerations to optimise intervention outcomes, ensure intervention relevance and address sustainability challenges to achieve widespread impact (Coles et al., 2020). Adapting approaches such as LSL-SA to meet the specific needs of children with hearing impairment is crucial. This involves fostering collaboration among early interventionists, SLTs, audiologists, parents, educators and government stakeholders. By integrating contextualised healthcare practices within communication interventions such as the LSL approach, South Africa can significantly enhance the quality of care, support holistic development and promote societal integration for children with hearing impairment (Hlayisi et al., 2024; Khoza-Shangase & Mophosho, 2018). Leveraging effective, collaborative strategies is key to overcoming the challenges presented by the high prevalence of child hearing impairment in South Africa and achieving successful implementation of the LSL-SA approach.

In 2021, South Africa recorded nearly 1 million births (Stats SA, 2021), with an estimated 3 to 6 out of every 1000 babies born with hearing impairment (Khoza-Shangase, 2021a). Congenital hearing impairment is particularly prevalent in the public healthcare sector (Khoza-Shangase, 2021b), which serves 82.6% of the population (Stats SA, 2016). This sector faces significant strain, exacerbated by a shortage of skilled health professionals, including SLTs and audiologists (Matthews & Van Wyk, 2018). Only 22.0% of SLTs and audiologists are employed in public healthcare, highlighting a critical shortfall of 2800 professionals and the need for a 300.0% growth rate by 2030 to meet healthcare demands (Pillay et al., 2020). In addition, South Africa grapples with the limited availability of LSL-SA interventionists, with only 51 LSL-SA therapists and six qualified LSLS Cert.AVT® therapists nationwide, predominantly concentrated in the private healthcare sector located in urban areas (Casoojee et al., 2024b; South African Cochlear Implant Group, 2022). This disparity underscores challenges in public–private healthcare sectors and urban–rural service provision in meeting the needs of children with hearing impairment. Addressing these disparities necessitates a concerted effort to (1) increase the number of trained LSL-SA and LSLS Cert. AVT® qualified therapists across South Africa, (2) acquire funding to support the development and delivery of LSL-SA programmes and investment in research, (3) coordinated management, (4) community and stakeholder engagement, (5) infrastructure development (access to facilities and technology integration), and (6) evaluation and feedback mechanisms.

The HPCSA EHDI Guidelines (2018) emphasise the roles of SLTs and audiologists in promptly selecting, fitting and monitoring amplification devices. The guidelines recommend that SLTs and audiologists with expertise in cochlear implants participate in assessing candidacy for such devices (HPCSA, 2018). The LSL-SA approach rests heavily on a child's access to the acoustic features of speech provided by hearing aids and cochlear implantation (Casoojee et al., 2021; Dettman et al., 2016). Addressing the accessibility and cost issues associated with these devices (Casoojee et al., 2021; Khoza-Shangase, 2021b) is crucial to making LSL-SA a viable option within the South African public healthcare sector. Solutions could include increasing the availability of hearing aids and cochlear implants through public healthcare programmes, subsidising costs to make them more affordable and advocating government funding and support. By improving access to these amplification devices, South Africa can enhance the implementation of the LSL-SA approach, ensuring children with hearing impairment benefit from its proven effectiveness.

Children with disabilities in South Africa face significant barriers to healthcare and education because of limited access to appropriate interventions, which diminishes their potential for success (Kuper & Hancock, 2020). Despite efforts by the South African Department of Basic Education to create an inclusive education system, progress remains slow (Khumalo & Hodgson, 2017). Research by Casoojee et al. (2024) shows that children with hearing impairment enrolled in LSL-SA achieve age-equivalent language outcomes and are more likely to qualify for mainstream schooling compared to those in TSLT. The study, which matched learners by age and classification of hearing impairment, excluded those with unilateral profound hearing impairment or bilateral profound hearing impairment with significant comorbidities, highlights that 64% of the TSLT cohort and 77% of the LSL-SA cohort wore cochlear implants, while 36% of the TSLT cohort and 23% of the LSL-SA cohort used hearing aids. These findings underscore the need to address accessibility to LSL-SA and cost issues related to hearing devices to enhance the viability of LSL-SA. Supporting LSL-SA aligns with the National Development Plan 2030's goals for early intervention, inclusive education, and continuity of care (Casoojee et al., 2024b).

Children with hearing impairment enrolled in LSL-SA were enrolled in therapy for a shorter duration until discharge than those enrolled in TSLT. This is a significant finding, particularly in LMICs, offering a possible reduction in the global burden of disease caused by hearing impairment in this context (Casoojee et al., 2024). In a country with limited resources, constrained socio-economic support by the state, as well as capacity versus demand of SLTs and audiologists and workforce challenges (Khoza-Shangase, 2022; Khoza-Shangase et al., 2021; Pillay et al., 2020), these positive outcomes of LSL-SA are financially, and quality of life justified to be pursued. Research attests that implementing an LSL-SA intervention approach is key to improving communication outcomes for children with hearing impairment (Casoojee et al., 2024. By reducing therapy duration and improving communication outcomes, LSL-SA addresses both cost and quality-of-life concerns effectively. Leveraging the benefits of LSL-SA, includes (1) advocating for increased funding and support for LSL-SA programmes, (2) expanding training opportunities for SLTs and audiologists, and (3) ensuring that LSL-SA is integrated into public healthcare policies. By focussing on these areas, South Africa can enhance the implementation of LSL-SA, making it a viable and impactful solution for improving the lives of children with hearing impairment.

Despite the above-stated positive findings associated with the LSL-SA approach, a study by Casoojee et al. (2024a) reveals that its effectiveness is compromised by a lack of culturally sensitive and linguistically appropriate resources. This is particularly important in South Africa, where linguistic and cultural diversity is critical to effective clinical service provision (HPCSA, 2019; Khoza-Shangase & Mophosho, 2021; Maluleke & Khoza-Shangase, 2022; Mophosho et al., 2022). Therefore, LSL-SA interventionists must prioritise the development and implementation of resources that are both culturally and linguistically responsive to meet the needs of diverse communities (Taylor, 2016). In the South African context, providing LSL-SA intervention in a language disparate from the home language of children with hearing impairment and their families does not respond to their needs, resulting in poorer communication outcomes (Al Shamsi et al., 2020; Khoza-Shangase & Kalenga, 2023).

A significant barrier to effective communication arises when healthcare providers, especially SLTs and audiologists, do not share a first language with the population they serve (Khoza-Shangase & Kanji, 2021; Khoza-Shangase & Mophosho, 2018; Pillay & Kathard, 2015). In South Africa's multilingual context, isiZulu is the most spoken language, followed by isiXhosa, Afrikaans and English (Dauncey, 2023). Only 5% of SLTs and audiologists in South Africa speak an African language as their mother tongue, highlighting workforce demographic incongruities (Khoza-Shangase & Mophosho, 2018). English is the Lingua Franca in South Africa, posing challenges in meeting diverse family needs, particularly in implementing the LSL-SA approach. Furthermore, the population group of SLTs and audiologists in South Africa are classified as white (59.7%), followed by Indian (15.4%), black (15.2%), mixed race (4.7%) and an unidentified population group of these professionals of 4.7% (Pillay et al., 2020). Conversely, risk profile studies of childhood hearing impairment in South Africa indicate that the most prevalent languages and cultures are first-language speakers of an African language as opposed to English and Afrikaans (35%) (Ehlert & Coetzer, 2020; Kuschke et al., 2020; Louw et al., 2018; Swanepoel et al., 2013). To address these disparities and enhance the effectiveness of the LSL-SA approach, several culturally sensitive modifications are required, including (1) the development of multilingual resources to bridge the communication gap and ensure interventions are accessible and relevant to diverse families, (2) cultural sensitivity training of SLTs and audiologists to effectively connect with the families of children with hearing impairment, (3) involving parents as partners to ensure the intervention is more readily accepted and implemented, (4) training of LSL-SA interventionists from diverse linguistic backgrounds (Casoojee et al. 2024a). By integrating these modifications, the LSL-SA approach can become more effective and inclusive, mitigating these challenges significantly (Casoojee et al., 2024b; Maluleke et al., 2021b; Maluleke, 2024; Matthews & Van Wyk, 2018).

To improve access to the LSL-SA communication intervention approach in South Africa, it is imperative that SLTs and audiologists address the diverse needs of children with hearing impairment and their families, employing pragmatic, linguistically appropriate, and culturally sensitive resources and skills. Implementing LSL-SA resources that are both linguistically and culturally congruent can foster strong partnerships with parents and caregivers, significantly improving therapy outcomes (Casoojee et al., 2024a; Khoza-Shangase, 2019; Maluleke, 2024; Maluleke et al., 2023). The Patients' Rights Charter in South Africa advocates the importance of equitable healthcare access and effective communication between providers and patients to achieve optimal health outcomes (HPCSA, 2016; Jardien-Baboo et al., 2019; Khan et al., 2023). By integrating these approaches, the LSL-SA method can be more responsive to the South African context, ultimately enhancing the quality of care for children with hearing impairment.

Conclusion

This article advocates for access to the LSL-SA intervention approach, underscoring its significant benefits for children with hearing impairment who meet the candidacy criteria. By leveraging the contextual research evidence (Casoojee et al. 2024a, 2024b; Casoojee et al., 2024; Taylor, 2016), it emphasises the urgent need for equitable and effective interventions in South Africa. The LSL-SA approach is particularly compelling, as it addresses the unique needs of children with hearing impairment and their families achieving age-appropriate communication outcomes, academic achievements and societal inclusion (Mirzoev & Kane, 2017; Weiner, 2021). Notably, children with hearing impairment enrolled in LSL-SA were recommended for mainstream schooling based on their communication outcomes after early intervention, suggesting a positive step towards an inclusive society and potentially reducing the cost of hearing impairment within a resource-constrained LMIC milieu (Casoojee et al., 2024).

Despite the challenges posed by limited resources and workforce constraints, the potential benefits of LSL-SA transcend these obstacles. This article calls for the engagement of various stakeholders – academic institutions, healthcare providers, SLTs, audiologists, government officials and professional bodies – to champion policies supporting LSL-SA implementation. Key actions include securing funding, reframing training programmes, capacity building among SLTs, audiologists and educators, and launching public awareness campaigns to ensure the widespread adoption of LSL-SA and its benefits for suitable candidates among children with hearing impairment and their families in South Africa.

Adapting LSL-SA to fit the South African context is crucial to establishing contextually relevant care that meets the unique needs of children with hearing impairment and their families. By upholding patient rights to timely and effective communication intervention (WHO, 2024), South Africa has the opportunity to set a precedent for inclusive and responsive healthcare practices in LMICs. This proactive stance not only addresses immediate needs but also paves the way for a more equitable, empowered and inclusive society.

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Author's contributions

A.C. declares that she is the sole author of this opinion article.

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