



**PREDICTORS OF RESILIENCE AMONG ADOLESCENTS LIVING IN RURAL
MPUMALANGA IN 2018: A CROSS SECTIONAL STUDY**

Michelle Snijder

A research report submitted to the Faculty of Health Sciences, University of
Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree
MSc Epidemiology & Biostatistics.

Submitted: Johannesburg, June 2023.

I Michelle Snijder declare that this Research Report is my own, unaided work. It is being submitted for the Degree of MSc in Epidemiology & Biostatistics at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

2nd day of June 2023 in Johannesburg

Dedication:

Dedicated to my parents and siblings who have continuously supported me throughout this journey.

Abstract:

Literature suggests that resilience can be reached by practicing behaviours, thoughts and attitudes that promote resilience. To understand which behaviours, thoughts and attitudes foster resilience, predictors of resilience should be studied. This study aimed to examine predictors of resilience among adolescents living in the rural Mpumalanga Province, South Africa. Data were collected using a questionnaire from a sample of 245 adolescents between 13.1 and 15.2 years (median age 14.1 (13.1-15.2); sex 52.7% female and 47.4% male). The questionnaire included questions from depression, stress and resilience scales as well as additional questions relating to communication with parents, and socio-demographic characteristics. The 20 question Centre for Epidemiological Studies Depression Scale (CES-D) measured depression, the 10-item Perceived Stress Scale (PPS-10) measured stress while the 25-item Connor Davidson Resilience Scale (CD-RISC-25) measured resilience. The prevalence of resilience was estimated at 46.1%. The findings suggest that perceptions of stress did not significantly predict resilience. Experiencing depressive symptoms and healthy interpersonal relationships significantly predicted high resilience. Although healthy relationships with parents predicted high resilience, adolescents relied more on relationships with friends to build resilience. However, regularly meeting with friends predicted low resilience, while always meeting with friends decreased the chances of low resilience. Thus, the study suggests that healthy relationships with both parents and friends may predict high resilience. However, when relationships with friends replaces that of parents, low resilience results. Finally, this study supports the need for further studies on the validity and acceptability of the PPS-10 and CES-D scales in the South African context.

Acknowledgements:

I would like to thank my supervisors for their continued guidance, support, and patience.

Supervisors:

Professor Sumaya Mall (University of the Witwatersrand)

Professor F. Xavier Gómez-Olivé Casas (University of the Witwatersrand)

Dr Delér Shakley (Gothenburg University)

Further, I would like to thank the Sheiham Family Programme on Social Determinants of Health for funding the data collection.

Table of contents:

Declaration:	i
Dedication:	ii
Abstract:	iii
Acknowledgements:	iv
Table of contents:	v
List of figures:	vii
List of tables:	viii
List of abbreviations:	ix
1 Chapter 1: Introduction	1
1.1 Background – Placing Adverse Childhood Experiences (ACEs) and resilience in context.....	1
1.2 Defining Resilience.....	5
1.3 A consideration of the resilience process.....	6
1.4 Literature review of predictors of resilience.....	7
1.4.1 An examination of the effect of perceptions of stress and age on resilience outcomes	7
1.4.2 An examination of the effect of character traits and depression on resilience outcomes	10
1.4.3 An examination of the effect of interpersonal relationships on resilience outcomes.....	11
1.4.4 An examination of the effect of the environment on resilience outcomes.....	13
1.4.5 Studies of resilience in South Africa in select samples	14
1.5 Problem statement.....	16
1.6 Justification.....	16
1.7 Research question.....	17
1.8 Aim	18
1.9 Objectives	18
2 Chapter 2: Methods	19
2.1 Description of primary study	19
2.2 Secondary analysis	21
2.2.1 Study design	21
2.2.2 Deriving the analytical sample	21
2.2.3 Study population	22
2.2.4 Data management	22

2.2.5	Measures	25
2.2.6	Data analysis	27
2.2.7	User agreement for the Connor Davidson Resilience Scale (CD -RISC)...	30
2.2.8	Ethical Considerations	30
3	Chapter 3: Results	31
	Table 1: Summary of missing responses.....	31
	Table 2: Comparison of participants with at least one missing response and those with no missing responses by socio-demographic variables	32
	Table 3: Description of socio-demographic characteristics and their relationship with resilience among adolescents in Agincourt, rural Mpumalanga (n=245)	34
	Table 4: Description of predictor variables and their relationship with resilience among adolescents in Agincourt, rural Mpumalanga (n=245).....	38
	Table 5: Logistic regression of predictors associated with high resilience among adolescents in rural Mpumalanga.....	43
4	Chapter 4: Discussion and limitations	44
4.1	Discussion	44
4.2	Limitations	48
5	Chapter 5: Conclusion	48
6	Chapter 6: References	49
7	Appendices	65
7.1	Appendix 1: Plagiarism Declaration.....	65
7.2	Appendix 2: Ethical Clearance Certificate.....	66
7.3	Appendix 3: Comparison of participants with at least one missing response and those with no missing responses by interpersonal relationship variables.....	67
7.4	Appendix 4: Logistic regression of factors associated with high resilience among adolescents in rural Mpumalanga, complete case analysis	70
7.5	Appendix 5: Turnitin Report.....	71

List of figures:

Figure 1: The mediating effect of resilience level on the relationship between adversity and health outcomes

Figure 2: The mediating effect of predictor variables on the relationship between adversity and health outcomes

Figure 3: The mediating effect of perceptions of stress on the relationship between adversity and resilience level

Figure 4: The mediating effect of frequency of stress on the relationship between adversity and resilience level

Figure 5: The modifying effect of age on perceptions of stress and its effect on the relationship between adversity and resilience level

Figure 6: The mediating effect of character traits on the relationship between adversity and resilience level

Figure 7: The moderating effect of depression on character traits and its effect on the relationship between adversity and resilience level

Figure 8: The mediating effect of interpersonal relationships on the relationship between adversity and resilience level

Figure 9: Directed Acyclic Graph of variables associated with resilience

List of tables:

Table 1: Summary of missing responses

Table 2: Comparison of participants with at least one missing response and those with no missing responses by socio-demographic variables

Table 3: Description of socio-demographic characteristics and their relationship with resilience among adolescents in Agincourt, rural Mpumalanga (n=245)

Table 4: Description of predictor variables and their relationship with resilience among adolescents in Agincourt, rural Mpumalanga (n=245)

Table 5: Logistic regression of predictors associated with high resilience among adolescents in rural Mpumalanga

Appendix 1: Comparison of participants with at least one missing response and those with no missing responses by interpersonal relationship variables

Appendix 2: Logistic regression of factors associated with high resilience among adolescents in rural Mpumalanga, complete case analysis

List of abbreviations:

ACEs – Adverse Childhood Experiences

USA – United States of America

UK – United Kingdom

BRFSS - Behavioural Risk Factor Surveillance System

DSM-5 - Diagnostic and Statistical Manual for Mental Disorders

HIV/AIDS – Human Immunodeficiency virus and acquired immunodeficiency syndrome

PHIV+ - Perinatally HIV infected adolescent

HDSS - Agincourt Health and Socio-Demographic Surveillance System

CD-RISC-10 - 10 item Connor Davidson Resilience Scale

CD-RISC-25 - 25-item Connor Davidson Resilience Scale

PPS-10 - 10-item Perceived Stress Scale

CES-D - Centre for Epidemiological Studies Depression Scale

MAR - Missing at random

MCAR - Missing completely at random

MNAR - Missing not at random

CCA - Complete case analysis

MI - Multiple imputation

MICE - Multiple imputation by chained equations

DAG - Directed acyclic graph

BDI - Beck's Depression Inventory

1 Chapter 1: Introduction

Section overview

This chapter will introduce the concept of resilience in adults and in adolescents. The latter is central to this research report. Section 1.1 will contextualise the relation between Adverse Childhood Experiences (ACEs) and resilience. Sections 1.2 and 1.3 will present a theoretical, conceptual model of resilience. Section 1.4 will summarise the literature on important predictors of resilience both globally and within the rural South African context. Following this, sections 1.5 and 1.6 will demonstrate the importance of examining predictors of resilience among adolescent within the rural South African context. Lastly, the research question, aim and objectives of this research report will be presented in sections 1.7, 1.8 and 1.9.

1.1 Background – Placing Adverse Childhood Experiences (ACEs) and resilience in context

The term ACEs refers to the experience of a stressful or traumatic event during childhood or adolescence, usually before the age of 18 (Felitti *et al.*, 1998; Gilgoff *et al.*, 2020; Schroeder *et al.*, 2021). The prevalence of exposure to ACEs is high globally as suggested by a range of nationally representative cross-sectional studies (Felitti *et al.*, 1998; Green *et al.*, 2010; Stein *et al.*, 2010; Bellis *et al.*, 2014, 2015). Studies from the United Kingdom (UK) and the United States of America (USA) suggest that approximately 50% of participants were exposed to at least one ACE during childhood or adolescence (Felitti *et al.*, 1998; Green *et al.*, 2010; Bellis *et al.*, 2014, 2015). In the UK, the most prevalent ACE children and adolescents experienced was parental separation (22.6%) followed by verbal (17.3%) and physical abuse (14.3%) (Bellis *et al.*, 2014). In the USA, data from 1998 suggested that the most prevalent ACE children and adolescents experienced was a parent who abused substances (25.6%) followed by sexual abuse (22.0%). The third highest ACE was living with a household member with a mental illness (18.8%) (Felitti *et al.*, 1998). Recent results of the Behavioural Risk Factor Surveillance

System (BRFSS) from 34 USA states collected between 2009 and 2017 found that the prevalence of experiences of ACEs was 57.8%. The most prevalent ACE children and adolescents experienced was emotional abuse (33.5%), parental separation (28.2%) and a parent who abused substances (28.2%) (Giano, Wheeler and Hubach, 2020). Giano and colleagues used the same BRFSS data, however, they focused on American Indians and Alaska Natives. They found that approximately 72.0% of participants experienced at least one ACE during childhood or adolescence (Giano *et al.*, 2021). The mean number of ACEs children and adolescents experienced was 2.3. However the mean number of ACEs were higher for females (2.5) compared to males (2.1) (Giano *et al.*, 2021).

Synthesised data examining the prevalence of ACEs from multiple countries suggested similar findings. A systematic review from high- and middle-income countries outside of Africa suggested that the prevalence of at least one ACE was 57.0% (Hughes *et al.*, 2017). The World Mental Health Survey data from 10 countries across Europe, Asia and North and South America, suggested that the prevalence of ACEs ranged from 30.0% to 65.0% (Stein *et al.*, 2010). In European, Asian and North and South American countries, the prevalence of at least three or four ACEs was less than 15.0% and the mean number of ACEs an individual experienced was 3.2 (Green *et al.*, 2010; Bellis *et al.*, 2015; Hughes *et al.*, 2017).

In South Africa, where the present study is set, a study conducted in the rural Eastern Cape Province in 2010 suggested high prevalence of ACEs (Jewkes *et al.*, 2010). The study found that regular physical abuse (of any form) was the highest occurring ACE in both males (84.9%) and females (73.8%) followed by physical hardship – 35.0% in females and 20.8% in males (Jewkes *et al.*, 2010). Among females, sexual abuse was highly prevalent as 83.3% of them reported to have often/very often experienced any form of sexual abuse (Jewkes *et al.*, 2010).

Results of a study conducted in Agincourt, in the Mpumalanga Province of South Africa where this study is set, suggested that the most prevalent ACEs were parental mental illness, parental alcohol or substance abuse (72.0%), physical abuse (35.0%) and fighting or arguing with a parent (25.0%) (Kobayashi *et al.*, 2020). A study conducted in Soweto, in the Gauteng Province (South Africa), found that the highest prevalence of ACEs adolescents experienced were community violence (91.0%),

domestic violence (82.0%), emotional neglect (82.0%) and divorced or deceased parents (75.0%) (Kidman *et al.*, 2018). Furthermore, 52.0% of participants experienced at least eight ACEs during childhood or adolescence with the mean number of ACEs experienced being 7.3 (Kidman *et al.*, 2018). Therefore, although experiences of ACEs are high globally, the findings suggest that children and adolescents within rural and low income urban South Africa, experience a higher frequency of adversity compared to their peers in other parts of the world.

Studies from across the globe suggest that experiences of ACEs may impact adolescent and adult health outcomes (Felitti *et al.*, 1998; Gilbert *et al.*, 2009; Hughes *et al.*, 2017; Kidman *et al.*, 2018; Samodien *et al.*, 2021; Schroeder *et al.*, 2021). Experiencing adversity early on in life may induce epigenetic and biological changes that may predict adverse adolescent and adult health outcomes (Perry, 2001; Jewkes *et al.*, 2010; Boyce, 2012; Samodien *et al.*, 2021). Adverse health outcomes associated with ACEs include obesity, depression, poor mental health outcomes, suicide attempts, unsafe sex, alcoholism, cancer, heart diseases, respiratory diseases and jaundice or hepatitis (Felitti *et al.*, 1998; Gilbert *et al.*, 2009; Hughes *et al.*, 2017; Kidman *et al.*, 2018; Samodien *et al.*, 2021; Schroeder *et al.*, 2021). Additionally, some authors have identified a dose-response relationship between the number of ACEs a child or adolescent experiences and the chance of experiencing adverse health outcomes (Felitti *et al.*, 1998; Stein *et al.*, 2010; Bellis *et al.*, 2015; Kidman *et al.*, 2018). Bellis and colleagues found that the risk of developing a cardiovascular disease increased by 24.0% when one ACE was experienced and by 211.0% when at least four ACEs were experienced (Bellis *et al.*, 2015).

However, despite data suggesting the relationship between experiences of ACEs and adverse health outcomes, some children and adolescents with high resilience may not develop these adverse health outcomes (Masten, 2001; Chen and Kuo, 2020; Chung *et al.*, 2020; Ollmann *et al.*, 2021; T. S. Lee *et al.*, 2021; Varma *et al.*, 2021). The term resilience refers to an individual's ability to overcome adversity and experience positive outcomes (Felitti *et al.*, 1998; Masten, 2001; Rutter, 2006; Hornor, 2017; Gee, 2021). Thus, resilience may mediate the effect of ACEs on health outcomes (see figure 1).



Figure 1: The mediative effect of resilience level on the relationship between adversity and health outcomes

Emerging literature suggests that in the face of adversity, high resilience – in both adults and adolescents - may be associated with fewer depressive symptoms, less symptoms of anxiety, reduced suicidal behaviours, less neurotic behaviour, reduced self-harm, and improved posttraumatic adjustment (Campbell-sills, Cohan and Stein, 2006; Goldstein, Faulkner and Wekerle, 2013; Anyan and Hjemdal, 2016; Karatzias *et al.*, 2017; Ye *et al.*, 2020; Chen and Kuo, 2020; Chung *et al.*, 2020; Ran *et al.*, 2020; Ollmann *et al.*, 2021; T. S. Lee *et al.*, 2021; Varma *et al.*, 2021). A study among adolescents living in Khayelitsha (South Africa) - most of whom were affected by HIV - suggested that high resilience decreased hyperactivity and improved attention and relationships with peers (Kuo *et al.*, 2019). Although the benefits of resilience have been well studied, there is a subset of resilience literature that investigates resilience as an outcome (Olajubu *et al.*, 2021; Tankersley *et al.*, 2021; Varma *et al.*, 2021). Researchers are interested in understanding factors and mechanism that promote high resilience and thus improve outcomes (Masten, 2001; Theron, 2020; Parviniannasab *et al.*, 2021). This body of research specifically focusses on promoting adolescent resilience for the following reasons.

In the literature, there is consensus that resilience can be developed through learnt behaviours, thoughts and attitudes (McAllister and McKinnon, 2009; Pines *et al.*, 2012; Mc Gee *et al.*, 2020; Walsh *et al.*, 2020). Others have suggested that, due to rapid development, adolescence is the opportune life stage to learn resilience (Soleimanpour, Geierstanger and Brindis, 2017; Forbes *et al.*, 2021). Furthermore, pathophysiological pathways to adverse health outcomes are initiated and consolidated when children and adolescents are exposed to adversity (Perry, 2001; Jewkes *et al.*, 2010; Boyce, 2012; Hornor, 2017; Gee, 2021; Samodien *et al.*, 2021). Thus, interventions to rectify or stall the progression of these pathophysiological pathways should be implemented in early childhood and adolescence (Soleimanpour, Geierstanger and Brindis, 2017; Forbes *et al.*, 2021).

Cortina and colleagues identified a need to develop interventions that may build resilience among adolescents in rural Mpumalanga (South Africa) (Cortina *et al.*, 2013). Further, a study in rural Mpumalanga (South Africa) identified cognition as a potential area of intervention to improve resilience (Cortina *et al.*, 2016). However, as will be described below and in the literature review, there is a need to identify further behaviours, thoughts and attitudes that may be targeted to promote resilience among rural adolescents. In order to identify areas of intervention to promote resilience as an outcome, it is important to understand the concept of resilience, how it is developed as well as factors that predict it.

1.2 Defining Resilience

Resilience is a complex, context dependent process (Fergus and Zimmerman, 2005; Gartland *et al.*, 2011; Bowes and Jaffee, 2013; Hornor, 2017). Some suggest that resilience should be defined in terms of the context, population, risk and promotive factors, and outcomes (Fergus and Zimmerman, 2005). This is because resilience is not a character trait, albeit some individuals possess character traits that encourage resilience (Luthar and Zelazo, 2003; Fergus and Zimmerman, 2005; Rutter, 2013). Rather, it is the process of relying on individual traits (known as assets) as well as external factors in the environment (known as resources) to overcome adversity (Beauvais, 2002; Fergus and Zimmerman, 2005; Greenberg, 2006; Hornor, 2017). Furthermore, this process is dynamic as the availability of resources varies between life stages and environments (Fergus and Zimmerman, 2005; Gartland *et al.*, 2011; Rutter, 2013; Hornor, 2017). This resilience process will be described in more detail below.

1.3 A consideration of the resilience process

There are three main components of the resilience process: adversity, positive outcomes and predictors (consisting of assets and resources) (Masten, 2001; Fergus and Zimmerman, 2005; Greenberg, 2006; Hornor, 2017). The resilience process starts with adversity and ends with positive outcomes (i.e., good psychological outcomes) (Masten, 2001; Fergus and Zimmerman, 2005; Rutter, 2006; Gartland *et al.*, 2011; Hornor, 2017). These positive outcomes are achieved as a result of predictor variables mediating the effect of adversity (see figure 2) (Masten, 2001; Fergus and Zimmerman, 2005; Greenberg, 2006; Gartland *et al.*, 2011; Hornor, 2017; Jongen *et al.*, 2019).

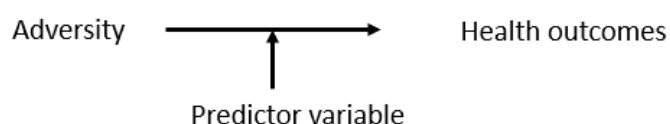


Figure 2: The mediative effect of predictor variables on the relationship between adversity and health outcomes

Understanding how these three components interact along this process can become complex as the timing and combination of each factor at play may affect resilience (Greenberg, 2006; Bowes and Jaffee, 2013; Hornor, 2017; Forbes *et al.*, 2021).

The resilience process starts with adversity - which can include apparent and subtle experiences of stressful or traumatic events (Fergus and Zimmerman, 2005). Masten (2001) states that for an individual to be classified as resilient, adversity must be experienced. As described above, adversity includes abuse – including physical, sexual or emotional, - as well as neglect – either physical or emotional- and household dysfunction – such as domestic violence, mental illness, substance abuse or criminal behaviour by a family member, divorce, or separation of parents (Felitti *et al.*, 1998; Dong *et al.*, 2004; Crouch *et al.*, 2017; Schroeder *et al.*, 2021). Examples of adversity can include poverty, war, racism or perceived discrimination, low birthweight, chronic disease and chronic pain (Luthar and Cicchetti, 2000; Masten, 2001; Wright, Masten and Narayan, 2013; Arruda *et al.*, 2021).

To be classified as resilient, positive outcomes must be experienced. However, there are different standards for classifying or defining an outcome as positive (Masten,

2001): i) based on societal standards (i.e. observed developmental milestones can be compared with standard milestones specified by age and societal context) (Masten, 2001); ii) reduced or the inexistence of psychopathological symptoms (i.e., fewer depressive symptoms) (Masten, 2001; Chung *et al.*, 2020). It has also been proposed that both these factors should be considered when defining an outcome as positive (Masten, 2001). It should be noted that positive outcomes such as positive adjustment, coping, competence and improved health outcomes (i.e., fewer depressive symptoms) are sometime incorrectly viewed as resilience (Fergus and Zimmerman, 2005; Dias *et al.*, 2015; García-León *et al.*, 2019). Furthermore, in some instances, researchers use positive outcomes as a proxy for resilience, however, these positive outcomes are not synonymous with resilience (Anyan and Hjemdal, 2016; Chung *et al.*, 2020; Hall *et al.*, 2021; Theron *et al.*, 2022).

The third component of the resilience process includes predictor variables of which a number have been identified in the literature. Some examples include spirituality, optimism, positive learning experiences, self-esteem, esteem for others, hope, having hobbies, accepting help and community safety (Fergus and Zimmerman, 2005; McAllister and McKinnon, 2009; Rutter, 2012; Hornor, 2017; van Breda, 2017; Jongen *et al.*, 2019; Chung *et al.*, 2020; Parviniannasab *et al.*, 2020). These predictors are generally summarised into three categories; i) individual factors (i.e., cognitive ability); ii) the quality of interpersonal relationships (i.e., emotional support); and iii) environmental factors (i.e., the safety of the environment) (Greenberg, 2006; Hornor, 2017; Parviniannasab *et al.*, 2020). These three categories will be considered in more detail in the literature review in the section below:

1.4 Literature review of predictors of resilience

1.4.1 An examination of the effect of perceptions of stress and age on resilience outcomes

Factors relating to stress - such as perceptions of stress, which is measured by various scales - are important predictors of resilience (García-León *et al.*, 2019; Sahu *et al.*, 2019; Chen and Kuo, 2020; Ye *et al.*, 2020). A stressor is an agent that is perceived as threatening to an individual's physical and/or psychological

homeostasis (Hornor, 2017). Stress refers to the interpretation as well as physiological and behavioural response to the perceived threat or stressor (Banny *et al.*, 2013; Oken, Chamine and Wakeland, 2015; Hornor, 2017; García-León *et al.*, 2019). Therefore, stress refers to the perception and response to adversity.

According to the literature, perceptions of stress may potentially mediate the relationship between adversity and resilience (see figure 3) (Wilks and Croom, 2008; Anyan and Hjemdal, 2016; García-León *et al.*, 2019; Sahu *et al.*, 2019; Ye *et al.*, 2020; Olajubu *et al.*, 2021).

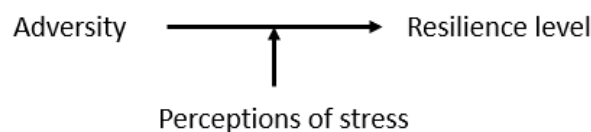


Figure 3: The mediative effect of perceptions of stress on the relationship between adversity and resilience level

The same stressor may be perceived as mild to one person and debilitating to another, or an asset to one and a risk to another (Masten, 2001; Fergus and Zimmerman, 2005). The literature suggests that in both adults and adolescents, higher perceptions of stress predicted lower levels of resilience (Wilks and Croom, 2008; Anyan and Hjemdal, 2016; García-León *et al.*, 2019; Sahu *et al.*, 2019; Chen and Kuo, 2020; Ye *et al.*, 2020; Olajubu *et al.*, 2021). Chen and colleagues found that adolescents who perceived their lives as more stressful were more likely to display suicidal behaviours compared to those who perceived their live as less stressful (Chen and Kuo, 2020).

In addition to perceptions of stress, the literature suggests that the frequency of exposure to stress may mediate the relationship between adversity and resilience (see figure 4) (Cicchetti and Rogosch, 2009; Oken, Chamine and Wakeland, 2015; Hornor, 2017).

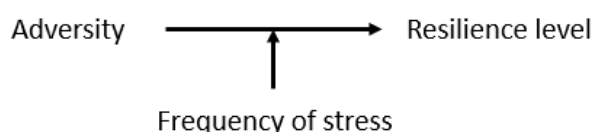


Figure 4: The mediative effect of frequency of stress on the relationship between adversity and resilience level

Exposure to few, mild stressful events result in the release of mild levels of stress hormones which allows the individual to develop self-regulating strategies, thus lowering perceptions of stress (Cicchetti and Rogosch, 2009; Hornor, 2017). Conversely, chronic exposure to stress releases consistent high levels of stress hormones which can negatively affect physiological systems (Taylor, 2010; Hornor, 2017). Some authors found that in both adults and adolescents chronic stress predicted low levels of resilience while few, mild stressful events predicted increased resilience (Windle, 2011; Rutter, 2012; Oken, Chamine and Wakeland, 2015; García-León *et al.*, 2019; Chen and Kuo, 2020). Chen and colleagues found that adolescents with persistently elevated levels of perceived stress had a higher risk of suicide ideation (Chen and Kuo, 2020).

However, this association between perceptions of stress and resilience can be modified by age (see figure 5).

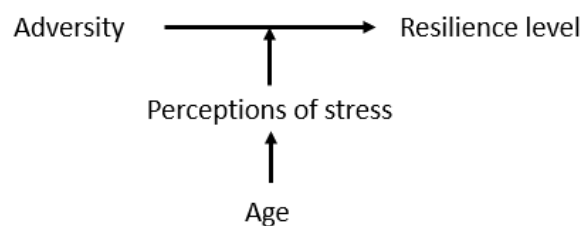


Figure 5: The modifying effect of age on perceptions of stress and its effect on the relationship between adversity and resilience level

The literature suggests that the perceptions of stress decrease as age increases (García-León *et al.*, 2019; Sahu *et al.*, 2019; Olajubu *et al.*, 2021). Furthermore, older individuals may be exposed to more stressors compared to younger individuals. This exposure to more frequent stressors encourages the resilience process, resulting in older individuals being more resilient than younger individuals (García-León *et al.*, 2019; Gilan *et al.*, 2020; Eli *et al.*, 2021; Varma *et al.*, 2021)). Although this seems to be the general trend, Horner suggests that experiencing stress in the early years of life can induce genetic adaptations that reduce adverse outcomes by encouraging resilience (Hornor, 2017).

1.4.2 An examination of the effect of character traits and depression on resilience outcomes

The effect of character traits in the resilience pathway is rather dynamic. A study by Rakhshani and Furr suggested that character traits can influence an individual's experience of adversity. Further, there is some evidence that adversity may influence character traits (Rakhshani and Furr, 2021). Their findings indicate that being extraverted and highly conscientious resulted in experiencing less severe adversity. While experiencing adversity improved emotionality but reduced agreeableness (Rakhshani and Furr, 2021). Further, the literature suggests that each individual's temperament and character traits may mediate the relationship between adversity and resilience (see figure 6). For the purposes of this study, the mediative effect of character traits will be considered.

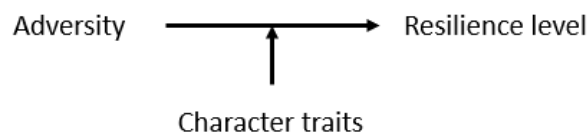


Figure 6: The mediative effect of character traits on the relationship between adversity and resilience level

Some authors suggest that resilience resources (i.e., psychosocial support programmes or a family member as social support) are available in all environments (van Breda, 2017; Parviniannasab *et al.*, 2020). While different individuals will rely on different resources, it is necessary for the individual to make use of the available resources (Cicchetti and Rogosch, 1997; van Breda, 2017). Thus, an individual's initiative may predict resilience. Furthermore, personality differences can influence resilience (Gartland *et al.*, 2011; Masten and Barnes, 2018). In both adults and adolescents, character traits such as good emotional regulation, empathy, having a balanced view, good problem-solving skills, high self-esteem, good social skills, hope and optimism predict high resilience (Cicchetti and Rogosch, 1997; Gartland *et al.*, 2011; Shatté, 2012; Cortina *et al.*, 2016; Shatté *et al.*, 2017; Chen and Kuo, 2020; Tankersley *et al.*, 2021; Varma *et al.*, 2021).

Although the predictive effect of these character traits on resilience has been well established, conditions that may restrict these traits are still to be properly explored. As per the Diagnostic and Statistical Manual for Mental Disorders (DSM-5), depressed individuals tend to present with a lack of interest, a sense of hopelessness, indecisiveness and reduced concentration or thinking (American Psychiatric Association, 2013). Thus, individuals suffering from depression may possess character traits associated with high resilience, yet their depression may counteract the protective effect of these traits (see figure 7).

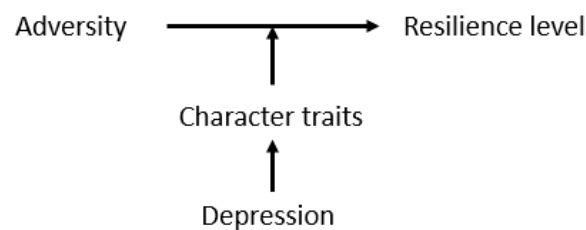


Figure 7: The moderating effect of depression on character traits and its effect on the relationship between adversity and resilience level

To the best of my knowledge, one study has observed the effect of depression on resilience, and it was conducted on healthy undergraduate students at the University of Granada, Spain. The study investigated the relationship between resilience, several stress variables, and psychopathological conditions. They found that higher resilience was correlated with lower depression scores (García-León *et al.*, 2019). However, I am not conscious of any study that has studied the effect of depression on resilience in adolescents.

1.4.3 An examination of the effect of interpersonal relationships on resilience outcomes

The quality of interpersonal relationships has long been recognised as an important mediator between adversity and resilience (see figure 8) (Werner and Smith, 1982; Rutter, 2013).

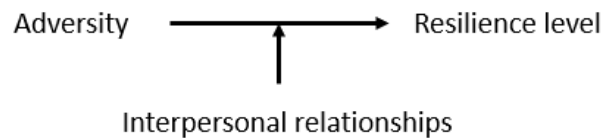


Figure 8: The mediative effect of interpersonal relationships on the relationship between adversity and resilience level

An overview of the literature by Gee suggests that the caregiver relationship is the most important predictor of resilience during adolescence (Gee, 2021). This relationship creates opportunities for the adolescent to learn emotional control and regulation techniques as well as inform a healthy response to adversity (Gee, 2021). However, the literature suggests that healthy interpersonal relationships among both adults and adolescents predicts high resilience. Poor interpersonal relationships which may be characterised by interpersonal sensitivities – characterised by difficulty in judging social cues – a sense of estrangement and being bullied predicted lower resilience (García-León *et al.*, 2019; Tankersley *et al.*, 2021). On the other hand, healthy interpersonal relationships which may be characterised by prosocial behaviours, good communication, support from colleagues, friends, parents, guardians, extended family, and other adults within the community predicted higher resilience (Zwack and Schweitzer, 2013; Collishaw *et al.*, 2016; Houpy *et al.*, 2017; Fritz *et al.*, 2018; Mahmoud and Rothenberger, 2019; Parviniannasab *et al.*, 2020; Eli *et al.*, 2021; Hall *et al.*, 2021; Olajubu *et al.*, 2021; T. S. Lee *et al.*, 2021).

A systematic review by Fritz and colleagues suggested that parental involvement as well as positive parenting and family environment, predicted high resilience. The predictive effect of the parental relationship on adolescent resilience has been studied in more depth. Some authors suggest that receiving emotional support from both parents predicted high resilience (Collishaw *et al.*, 2016; Mahedy *et al.*, 2018). However, an inverse relationship between the quality of the inter-parental relationship and emotional support from the father was identified (Mahedy *et al.*, 2018). This suggests that when the mother provided insufficient emotional support, compensation from the father predicted high resilience (Collishaw *et al.*, 2016; Mahedy *et al.*, 2018). Furthermore, Collishaw and colleagues, found that when a parent was depressed, expressing their emotions with the adolescent predicted high resilience (Collishaw *et al.*, 2016).

The type of relationship relied on by adolescents for resilience is influenced by culture and context (Fergus and Zimmerman, 2005; Parviniannasab *et al.*, 2020; Hall *et al.*, 2021). The literature suggests that regardless of the quality of other relationships, healthy relationships with adults in the community (i.e., teachers) are an important predictor of resilience (van Breda, 2017; Hall *et al.*, 2021). Despite this, culture and context can influence which relationships have a greater predictive effect (Parviniannasab *et al.*, 2020; Hall *et al.*, 2021). For example, Iranian adolescents rely predominantly on relationships with family members to build resilience (Parviniannasab *et al.*, 2020). While Hispanic adolescent girls rely more on relationships with their mothers to build resilience (Hall *et al.*, 2021). Although healthy interpersonal relationships generally seems to predict higher resilience, culture and context influence which relationships have a greater predictive effect (Parviniannasab *et al.*, 2020; Hall *et al.*, 2021). This highlights the influence of context on resilience.

1.4.4 An examination of the effect of the environment on resilience outcomes

The environment or context affects every aspect of the resilience process. It affects the types of adversity present, the perceptions of adversity, the availability of resilience resources, the acceptability of relying on resources as well as the timing and combination of factors at play (Fergus and Zimmerman, 2005; Greenberg, 2006; Bowes and Jaffee, 2013; Hornor, 2017; Forbes *et al.*, 2021). For example, adversity is more prevalent in rural areas compared to urban areas (Felitti *et al.*, 1998; Jewkes *et al.*, 2010; Bellis *et al.*, 2014). As seen earlier, sexual abuse and substance abuse among parents is more prevalent in rural South Africa compared to high- and middle-income USA and the UK (Felitti *et al.*, 1998; Jewkes *et al.*, 2010; Bellis *et al.*, 2014). Environment may also affect the availability of resources. For example, it is common for rural parents to move to cities to find work (Armstrong, 2011; Shilubane *et al.*, 2014). Accordingly, parental support as a resilience resource may not be as available to rural adolescents compared to urban adolescents. Thus, to understand behaviours, thoughts and attitudes that promote resilience in a specific context, it is imperative to have a robust understanding of factors predicting resilience within that

same context. Thus, predictors of resilience within the same context of this study - rural South Africa - will be considered below.

1.4.5 Studies of resilience in South Africa in select samples

A scoping review of adolescent resilience promoting factors in sub-Saharan Africa (SSA) – including South Africa - found that children and adolescents relied on structural (i.e., a safe environment), spiritual and cultural factors to promote high resilience (Theron, 2020). However, personal, and relational factors were the most prominent predictors of high resilience (Theron, 2020). Within the SSA context, agency (taking initiative to improve circumstances) promoted high resilience. However, in some cases it led to adolescents dropping out of school, joining armed forces, and engaging in transactional sex (Theron, 2020). Healthy relationships were described as close, warm, and interdependent while affective support from a past or present partner, peer, family member, community member, service provider or professional promoted high resilience (Theron, 2020). In some communities, taking caring for an animal promoted comfort and build a sense of self-worth which resultantly improved resilience (Theron, 2020).

Similar to the SSA context, a systematic review of adolescent resilience promoting factors in South Africa found that adolescents primarily relied on personal and relational resilience to promote high resilience (van Breda and Theron, 2018). Among adolescents living in rural South Africa, several character traits that predict high resilience have been suggested in the literature. Van Breda conducted a multi-site study which aimed to represent the diversity of South African youth. The findings of the study suggest that high self-expectations, bouncebackability, optimism, and distress tolerance predicted higher resilience (van Breda, 2017). Cortina and colleagues conducted a study in Agincourt, South Africa, a region with a high community HIV/AIDS prevalence. Their findings suggest that positive cognitive interpretation improved resilience by improving coping, self-esteem, and hope (Cortina et al., 2016).

Choe and colleagues examined resilience among Zulu speaking adolescents in violent contexts. Their findings suggest that adult involvement, which encompassed

parental monitoring as well as maternal and teacher support, predicted high resilience (Choe, Zimmerman and Devanarain, 2012). More recent studies conducted among children living with HIV/AIDS in the Eastern and Western Cape, KwaZulu-Natal and Mpumalanga provinces have similar findings. These studies suggested that support from siblings, and caregivers (which can include a biological parent, adoptive parent, guardian or other family member) predicted high resilience (Bhana *et al.*, 2016; Sharer *et al.*, 2016; Shenderovich *et al.*, 2021). Factors relating to the type and quality of support may also influence resilience outcomes. Bhana and colleagues suggest that perinatally HIV infected adolescents (PHIV+) who lived in crowded households had lower resilience (Bhana *et al.*, 2016). They suggested that in such households, the level of support provided by the caregiver is low, as the caregiver is financially and emotionally strained (Bhana *et al.*, 2016). Furthermore, they suggest that high supervision from a caregiver predicted high resilience (Bhana *et al.*, 2016).

A study conducted within the South African Resilient Youth in Stressed Environments study site (SA RYSE) – a high risk area with a high prevalence of poverty- suggested that caregivers/parents are an important source of resilience. They found that warm relationships with a caregiver/parent predicted high resilience through improving school engagement (Theron, Ungar and Jan, 2022). Similarly, at this same site, experiencing warmth from a caregiver promoted high mental health resilience (Theron *et al.*, 2022)

Some authors suggest that the type of support that predicts high resilience differs by sibling and caregiver relationships (Sharer *et al.*, 2016; Shenderovich *et al.*, 2021). Sharer and colleagues suggest that instrumental support (i.e., monetary support) rather than emotional support from a sibling predicted high resilience (Sharer *et al.*, 2016). While emotional support, instrumental support and healthy communication with a caregiver predicted high resilience (Sharer *et al.*, 2016; Shenderovich *et al.*, 2021). Although healthy communication with a caregiver was identified to predict high resilience, some authors suggest that communicating less on difficult topics predicted high resilience (Bhana *et al.*, 2016). Van Breda's study - which was representative of South African youth - suggested that participation in social activities as well as relationships with family, teachers, a boyfriend or girlfriend, community members and role models improved resilience (van Breda, 2017). A sense of lack of

belonging decreased resilience by hindering relationships with family and community (van Breda, 2017).

The literature cited above suggests that South African studies have examined predictors of resilience in specific samples especially among those affected by HIV (Bhana *et al.*, 2016; Sharer *et al.*, 2016; Shenderovich *et al.*, 2021). Kuo and colleagues' hypothesise that adolescents with HIV may have unique risk factors for psychopathologies (Kuo *et al.*, 2019). Thus, findings may not be generalisable.

1.5 Problem statement

South African adolescents in rural areas display higher resilience compared to urban adolescents (van Breda, 2017). Some authors have suggested that it is important to understand this phenomenon, thus, there is a need to study resilience and its predictors among rural South African adolescents. (Cortina *et al.*, 2013; Kuo *et al.*, 2019). However, from the overview in section 1.4.5, predictors of resilience among adolescents in rural South Africa, have not been studied among representative samples which - according to a scoping review - is necessary in understanding resilience promoting factors (Theron, 2020).

Additionally, existing literature on resilience is dominated by observing the mediating effect of resilience on adversity and negative outcomes (Campbell-sills, Cohan and Stein, 2006; Karatzias *et al.*, 2017; Chung *et al.*, 2020; Ye *et al.*, 2020; Ollmann *et al.*, 2021). Literature on the mediating effect of predictors on adversity is limited. Consequently, knowledge of behaviours, thoughts and attitudes that promote resilience is limited, especially within the South African context.

1.6 Justification

The literature suggests that due to a number of physical, social, and cognitive adjustments that occur during adolescence, adolescents are vulnerable to poor

mental health outcomes (Leussis and Andersen, 2008; Blakemore and Mills, 2014; Bilsen, 2018; Farley, 2020). Yet the availability of and access to mental health services in rural South Africa is limited (Vergunst, 2018). Thus, adolescents in rural South Africa are especially vulnerable to poor mental health outcomes. Although García-León and colleagues suggest that depression may predict resilience outcomes, the literature has shown that high resilience was associated with improved mental health outcomes among adolescents (García-León *et al.*, 2019; Chung *et al.*, 2020; Ollmann *et al.*, 2021; T. S. Lee *et al.*, 2021; Varma *et al.*, 2021). Thus, by understanding factors that promote resilience among rural adolescents, Public Health interventions that bolster resilience may be implemented. These interventions may reduce rural adolescents' vulnerability to poor mental health outcomes in future.

Further, rural to urban migration for study and employment is prevalent in South Africa (Armstrong, 2011; Shilubane *et al.*, 2014). Mthiyane and colleagues suggest that when rural adolescents migrate to urban areas, they experience poor mental health outcomes (Mthiyane *et al.*, 2021). The author further suggests that older adolescents and young adults are unable to adjust to the stress and pressures of urban life, resulting in these poor mental health outcomes (Mthiyane *et al.*, 2021). It is known that resilience may enable individuals to successfully adapt to adversity (Masten, Best and Garmezy, 1990; Masten and Barnes, 2018). Generating knowledge on predictors of resilience in rural areas may provide scientific evidence to inform resilience promoting Public Health interventions. In turn, these interventions may enable adolescents to positively adjust to urban areas should they relocate to seek employment.

1.7 Research question

Are perceptions of stress, depression, and interpersonal relationships predictors of resilience (either low or high) among adolescents living in rural Mpumalanga in 2018?

1.8 Aim

To examine the perceptions of stress, depression, interpersonal relationships, and their relationship to resilience among adolescents living in rural Mpumalanga in 2018.

1.9 Objectives

1. To examine the prevalence and socio demographic correlates (including age, sex) of resilience among adolescents living in rural Mpumalanga in 2018.
2. To examine the perceptions of stress, depression and interpersonal relationships among adolescents living in rural Mpumalanga in 2018.
3. To examine whether there is a relationship between perceptions of stress, depression and interpersonal relationships and resilience among adolescents living in rural Mpumalanga in 2018.

2 Chapter 2: Methods

Section overview

This chapter will provide an overview of the methodology of the primary study – in section 2.1- and this study -in section 2.2. The study design, study site, study population, data collection methodology and tools as well as data management and analysis will be described. Lastly, ethical considerations will be presented.

2.1 Description of primary study

Study Design

The primary study design was that of a cross-sectional study which aimed to examine if high stress and low stress resilience during adolescence were associated with hypertension in the same developmental period. Hypertension refers to elevated blood pressure levels with a systolic blood pressure greater or equal to 140mmHg (≥ 140 mmHg) or a diastolic blood pressure greater or equal to 90mmHg (≥ 90 mmHg) (World Health Organization, 2021).

Study site

The primary study was conducted at the Agincourt Health and Socio-Demographic Surveillance System (HDSS) site located in Agincourt, Mpumalanga Province (South Africa). The HDSS was initiated in 1992 with the enumeration of the population living in the area. Annual census rounds update the household roster by collecting vital events - births, deaths and migrations. The Agincourt HDSS is run by the MRC/Wits Rural Public Health and Health Transitions Research Unit, part of the School of Public Health at the University of the Witwatersrand. It consists of 31 villages with an estimated population size of 116 000 individuals. Migration in and out of the HDSS for work purposes is common with a number of Mozambican in-migrants residing within the site. Access to electricity, running water, proper sanitation, tarred roads and high-quality education are scarce (Kahn *et al.*, 2012).

Study sample

Sampling was conducted in 2018. The inclusion criteria stipulated that participants had to permanently live within the HDSS site and had to be between the ages of 13 and 14 years in the 2018 census round. Participants who met the inclusion criteria were selected through random sampling and were invited to join the study at their homes. Informed consent was obtained from parents/guardians and assent consent was obtained from minor participants as follows: at the time data were collected for the primary study, the studies information sheet was read out to the parents/guardians of the adolescents. Only if parents consented, then the information sheet was read to the potential participants for their assent. Therefore, parents/guardians signed informed consent forms first and then participants signed assent forms. Once informed consent was obtained data were collected (between December 2018 and March 2019) using questionnaires, physical examinations blood and hair samples. A total of 300 males and females aged 13 and 14 years were randomly selected to participate in the study. From them 287 (95.7%) were contacted and 42 adolescents (14.6%) refused to participate. Participants who were 14 years old at recruitment and 15 years old upon the interview day were included in the study. Therefore, the final study sample was made up of 245 male and female adolescents between the ages of 13 and 15 years.

Measures

Questionnaires were administered in a private setting and the data collector recorded answers using a small computer. Interviews were conducted in the Xitsonga language and lasted around 1-2 hours. Participants were not compelled to answer the questions. The questionnaire included questions from depression, stress and resilience scales as well as additional questions relating to communication with parents, peer relations and school satisfaction. The questionnaire was translated into the Xitsonga language and responses were translated back into English. The following scales were used to measure depression, stress and resilience respectively: the 20 question Centre for Epidemiological Studies Depression Scale (CES-D), the 10-item Perceived Stress Scale (PPS-10) and the 25-item Connor Davidson Resilience Scale (CD-RISC-25) (Radloff, 1977; Cohen, Kamarck and Mermelstein, 1983; Connor and Davidson, 2003). All scales have sound

psychometric properties and have been used in African contexts (Jewkes *et al.*, 2010; Irusen *et al.*, 2021; Teshome *et al.*, 2021; Makhubela, 2022). Following the HDSS's existing Standard Operational Procedure, those participants who were distressed by the questions in the questionnaire were referred to the closest social worker for support.

Physical examinations, blood tests and hair samples were collected after written consent was given. Participants received their test results back and results were properly explained to them. Participants whose results fell outside of the normal ranges were referred to the local health facility to receive medical care.

2.2 Secondary analysis

2.2.1 Study design

The study design of this study was that of a cross sectional study as data were collected in 2018 (into 2019), and no follow up data were included in the analysis (Gordis, 2008).

2.2.2 Deriving the analytical sample

A study conducted in a similar context to this study - Khayelitsha, Eastern Cape Province, South Africa - found that 51.3% of adolescents (aged 13-15 years old) were resilient (Kuo *et al.*, 2019). Therefore, to detect a resilience prevalence of 51.3% with a confidence level of 95% and a precision of 7%, a minimum of 196 participants were required. The analytic sample consisted of 245 eligible participants. Since the dataset include more participants than the required minimum sample size, all participants were included in the analysis.

2.2.3 Study population

The analytic sample was the study sample which consisted of 245 male and female adolescents (13-15 years old) who lived in the rural Mpumalanga Province, South Africa in 2018. This was described in the primary study above.

2.2.4 Data management

Data were managed and analysed using STATA 17. The raw data consisted of value labelled variables. Each value labelled variable had a corresponding string variable. Value labels of all variables were then verified using the corresponding string variable. The next paragraphs will mention which value labels were corrected and detail how different variables were created.

Socio-demographic variables

The value label for 'type of accommodation' was corrected. The categories of the variables 'adult with whom adolescent lives' and 'households income source' were re-coded and relabelled to resemble each other. 'Both parents, one parent/guardian, older sibling/family member and none' were the assigned categories. The categories (1-5) of 'socio-economic status' were labelled 'lower class, quintile 2, quintile 3, quintile 4 and higher class' respectively. The variable 'age (years)' was calculated using interview and birth dates and divided by 365.25. 'Age groups' was generated by categorising 'age (years)' into 13, 14 and 15 years. No further data management was conducted on the variables 'sex', 'village', and 'share home with a distant relative'.

Resilience

In this study, new variables for 'resilience score' and 'resilience status' were generated. The variable 'resilience score' was calculated by summing the codes for each question and dichotomised to generate a new variable 'resilience status'. Zhou and colleagues dichotomised the CD-RISC-25 score using quartile deviation (Zhou *et al.*, 2021). Others have dichotomised the 10 item Connor Davidson Resilience Scale (CD-RISC-10) using the median of their study (Kuo *et al.*, 2019; Macía *et al.*,

2022). The literature emphasised the importance of defining resilience in terms of the population being studied (Masten, 2001; Fergus and Zimmerman, 2005). Therefore, the CD-RISC-25 score in this study was dichotomised using the median (median = 61) of the analytic sample. Thus, participants with CD-RISC-25 scores ≥ 61 were considered as having high resilience while those with scores <61 were considered to have low resilience.

Perceptions of stress

In this study, a new variable 'perceptions of stress score' was generated. The codes were recoded to match Cohen's recommendation (Cohen, Kamarck and Mermelstein, 1983). The PPS-10 score was then calculated by summing the codes of the questions.

Depression

In this study a new variable for 'depression score' and 'depression status' were generated. Prior to generating scores, the value label for 'could not shake off the blues' was corrected. The codes for the positively stated questions were reversed so that 'rarely (less than 1 day) = 3' and 'most of the time (5-7days) = 0'. The depression score was then calculated by summing the codes of the questions and dichotomised using Radloff's cut-off (Radloff, 1977). Therefore, in this study, participants with scores greater or equal to 16 (≥ 16) were considered to have symptoms consistent with depression (in this study referred to as depressed) while those with scores lower than 16 (<16) were considered to have symptoms consistent with no depression (in this study referred to as not depressed).

Interpersonal relationships

The value label for 'get friend support' was corrected. No further data management was required for interpersonal relationship questions.

Managing missing data: multiple imputation

Missing observations were identified in 4 variables with percentages of missingness ranging from 0.8% to 44.5%. According to Madley-Dowd and colleagues the mechanism of missingness, rather than the percentage of missingness should inform the method of handling missing data (Madley-Dowd *et al.*, 2019). The mechanism of

missingness – the potential mechanism that ‘caused’ missing observations- are classified as missing not at random (MNAR), missing completely at random (MCAR) or missing at random (MAR) (Rubin, 1976; K. J. Lee *et al.*, 2021). The literature suggests that data that are MCAR should be handled using complete case analysis (CCA) while data with a MAR mechanism should be handled using multiple imputation (MI) (Jakobsen *et al.*, 2017). There is no test that can ascertain the true mechanism of missingness, it is up to the discretion of the investigator (Bono *et al.*, 2007; Austin *et al.*, 2021; K. J. Lee *et al.*, 2021). However, Austin and colleagues suggest that if observed variables are associated with missingness it backs the assumption that data is MAR (Austin *et al.*, 2021). In this study, income source and several interpersonal relationship variables were associated with missingness. Thus, coupled with discretion, the mechanism of missingness was considered MAR and MI was the recommended method of handling missing data. Furthermore, MI is a recommended approach to dealing with missing data in epidemiological studies (Resseguier *et al.*, 2013; Eekhout, Van De Wiel and Heymans, 2017; Madley-Dowd *et al.*, 2019; Austin *et al.*, 2021). Van Ginkel and colleagues suggest that MI is appropriate for imputing both exposure and outcome variables (van Ginkel *et al.*, 2020). Additionally, MI is an appropriate methodology for handling missing data in the CES-D scale and other rating scales such as the PPS-10 and CD-RISC-25 scales (Resseguier *et al.*, 2013). Therefore, in this study, multiple imputation by chained equations (MICE) was used to handle missing data.

Imputation using MICE was conducted as follows. Variables associated with missingness were adjusted for in the imputation model and the percentage of missingness (45.7% rounded to 46%) informed the number of imputations to perform (Austin *et al.*, 2021). The variables associated (at the 10% significance level) with missingness were as follows: ‘parent understand’, ‘enough time from parents’, ‘talk with parents’, ‘share feeling with father’, ‘argue with mother’, ‘share feeling with mother’, ‘meet with friends’, ‘fun with friends’, ‘share with friends’, ‘friends help each other’, and ‘friends support each other’ (see appendix 3). ‘Income source’ was also associated with missingness, however, since it had missing observations and was imputed, it was not used to predict missing observations. Although data were considered to be MAR, there is always a possibility that the data is MCAR, thus it is good practice to perform sensitivity analysis using CCA (Resseguier *et al.*, 2013;

Jakobsen *et al.*, 2017; K. J. Lee *et al.*, 2021). Following this recommendation, CCA was used as a sensitivity analysis. To conduct CCA all participants with at least one missing observation were dropped from a copy of the dataset.

2.2.5 Measures

Socio-demographic variables

Socio-demographic information was gathered using a self-reported questionnaire. The questionnaire included questions relating to 'date of birth', 'sex', 'village' the adolescent resided in, 'adult with whom adolescent lives', whether the adolescent 'shared their home with distant relatives', 'type of accommodation', 'source of income', and 'socio-economic status'.

Resilience variable

Resilience was quantified using the 25-item Connor Davidson Resilience Scale (CD-RISC-25). The CD-RISC-25 is a self-reported questionnaire that consists of 25 questions. Participants rate their experience in the last month from '0 = rarely true' to '4 = nearly all of the time' which is then summed to produce a resilience score that ranges from 0-100. Higher resilience scores suggest higher resilience (Connor and Davidson, 2003). According to Jørgensen and Seedat in Connor and Davidson, the CD-RISC-25 is valuable for measuring resilience among school attending adolescents living in South Africa (Connor and Davidson, no date; Jørgensen and Seedat, 2008). Furthermore, the scale is well validated with an internal consistency of Cronbach alpha = 0.89 (Connor and Davidson, 2003). Among South African adolescents, the scale showed a reliability coefficient of 0.93 (Jørgensen and Seedat, 2008).

Perceptions of stress variable

Perceptions of stress were quantified using the 10-item Perceived Stress Scale (PPS-10). The PPS-10, a self-reported questionnaire, assesses how 'unpredictable, uncontrollable, and overloaded' participants perceived their lives in the last month (Cohen, Kamarck and Mermelstein, 1983). Participants rate their experience in the

last month from '0 = never' to '4 = very often'. Responses are then summed, with positively stated question's scores being reversed, to produce a stress score ranging from 0 to 40. Higher stress scores indicate higher perceptions of stress (Cohen, Kamarck and Mermelstein, 1983). The PPS-10 scale displayed good reliability and consistency in the South African context with internal consistency of Cronbach alpha = 0.79 (Makhubela, 2022).

Depression variable

Depression symptoms were assessed using the Centre for Epidemiological Studies Depression Scale (CES-D). The CES-D, a self-reported questionnaire, consists of 20 questions. Participants rate how they felt in the previous week from '0 = rarely (less than 1 day)' to '3 = most of the time (5-7 days)'. Responses are then summed, with positively stated question's scores being reversed, to produce a depression score ranging from 0-60. Scores of 16 or above are considered to have symptoms consistent with depression (Radloff, 1977). The CES-D scale is a reliable tool for measuring depression with an alpha>0.85 (Hann, Winter and Jacobsen, 1999).

Interpersonal relationships variables

Interpersonal relationship information was gathered using a self-reported questionnaire. The questionnaire included questions to assess the relationship of adolescents with parents and friends. Additionally, questions relating to bullying were included. For each interpersonal relationship question adolescents answered with 'never', 'seldom', 'sometimes', 'often' or 'always'.

The following variables were considered to assess the adolescent's relationship with parents; 'understood by parents', 'loved by parents', 'enough time from parents', 'treated fairly by parents', 'talk to parents', 'argue with father', 'argue with mother', 'share feelings with father' and 'share feelings with mother'.

The following variables were considered to assess the adolescent's relationship with friends; 'meet with friends', 'have fun with friends', 'talk with friends', 'friends help each other' and 'get support from friends'.

To assess bullying, the following variable were considered; 'been bullied by others', 'bully others' and 'been bullied on internet'.

2.2.6 Data analysis

The data analysis phase consisted of several steps which are outlined below:

First the data were examined by calculating descriptive statistics. Descriptive statistics were generated using potential socio-demographic and predictor variables, based on previous literature (García-León *et al.*, 2019; Cheung, Xie and Huang, 2020; Chung *et al.*, 2020; Ye *et al.*, 2020; Gee, 2021; Olajubu *et al.*, 2021; Parviniannasab *et al.*, 2021). Means and standard deviations were utilised to explore continuous variables and frequencies. Percentages were utilised to explore categorical variables. Further, a prevalence estimate of resilience was estimated.

Second, bivariate analysis was conducted. Relationships between socio-demographic variables and resilience were examined. The relationship between age and resilience was examined using a Mann Whitney U test. The relationship between sex and resilience were examined using a Pearson Chi Square test. The relationship between additional sociodemographic variables and resilience were examined using a Fisher's exact test. Relationships between predictor variables and resilience were examined using a two-sided independent t-test and Fisher's Exact test. The relationship between perceptions of stress and resilience were investigated using a two-sided independent t-test. The relationship between depression, interpersonal relationships, and resilience were examined using a Fisher's Exact test. At the bivariate stage of analysis, a significance level of 10% was adhered to. The assumption of normal distribution was investigated using graphical techniques.

Third, once the exploratory phase was complete, logistic regression was employed to examine whether there was a relationship between perceptions of stress, depression and interpersonal relationships and resilience. Potential third variable effects from socio-demographic variables were also considered. A number of steps were followed to employ logistic regression techniques, an iterative process to build the model:

First, since this report is investigating predictors of resilience – general rather than specific - among adolescents living in rural Mpumalanga in 2018, only variables that showed a significant relationship with resilience (at the 10% level) in the bivariate stage were considered for the logistic regression model. These variables were

individually added to the model and assessed whether they improved the fit of the model. To assess the fit of the model, a likelihood ratio test with a 5% significance level was used. The variables associated with resilience at the bivariate stage were systematically added as follows. 'Depression status' was the first variables added to the model. Following this, 'understood by parents', 'enough time from parents', 'talk to parents', 'share feelings with mother', 'share feelings with father', 'meet friends', 'fun with friends', 'talk with friends', 'friends helping each other', 'get friend support', 'been bullied', 'bully others', 'village' and 'income source'. 'Meet with friends' and 'village' improved the fit of the model, thus at this stage the preliminary model consisted of 'resilience status' as the outcome variable and 'depression status', 'meet with friends' and 'village' as the explanatory variables.

Second, variables associated with resilience, as per the literature, were individually added to the preliminary model and tested to improve the fit of the model using the same iterative process. Figure 9 is a visual summary of a directed acyclic graph (DAG) of the literature with adequate citations, presented below.

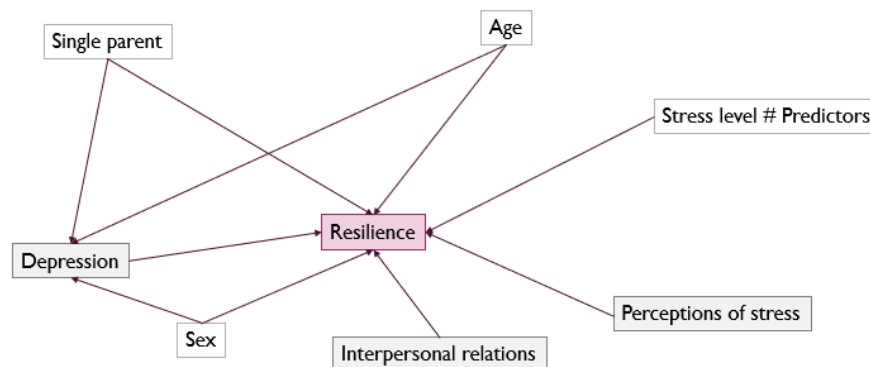


Figure 9:Directed Acyclic Graph of variables associated with resilience

Age and sex have been found to be associated with both resilience and depression and thus are potential confounders (García-León *et al.*, 2019; Chung *et al.*, 2020; Eli *et al.*, 2021; Parviniannasab *et al.*, 2021). Thus, 'age (years)', 'age categorical' and 'sex' were systematically included in the model and tested to investigate whether

they improved the fit of the model. However, they did not improve the fit of the model and thus were excluded from the model.

Although perceptions of stress was not significantly associated with resilience in the bivariate stage, the literature indicated that it is an important variable to consider in resilience research (Hornor, 2017; García-León *et al.*, 2019; Olajubu *et al.*, 2021). Thus, perceptions of stress was included in the model, however, it did not improve the fit of the model and thus was removed.

Chen and colleagues found that participants with high levels of stress relied on a portion of associated resilience factors (namely optimism and hope) to achieve the outcome of no suicidal behaviour (Chen and Kuo, 2020). This may suggest that adolescents may rely on different resilience resources, in the face of high levels of stress. Thus, as per Chen and colleagues, perceptions of stress score was dichotomised using the median (in this study the median stress score was 15.0) (Chen and Kuo, 2020). The new dichotomised variable was included in the model and interacted with predictor variables that were significantly associated with resilience in the bivariate analysis in the following order: 'depression status', 'understood by parents', 'enough time from parents', 'talk to parents', 'share feelings with mother', 'share feelings with father', 'meet with friends', 'fun with friends', 'talk with friends', 'friends helping each other', 'get friends support', 'been bullied', and 'bully others'. For most interaction variables, there was insufficient data to investigate the interaction. However, the interaction term between the dichotomised 'perceptions of stress variable and 'talk with friends' had sufficient data to investigate the interaction. However, it did not improve the fit of the model at the 5% significance level and thus was excluded from the model.

There was evidence that living in a single parent home had an effect on both resilience and depressive symptoms and thus is a potential confounder (Chung *et al.*, 2020). However, the variable 'adult with whom adolescent lives with' did not improve the fit of the model and was excluded.

None of the variables identified in the literature as important in understanding predictors of resilience improved the fit of the model. Thus, 'depression', 'meet with friends' and 'village were included in the model as independent variables with resilience as the dependent variable.

The final logistic regression model was developed using the original dataset with missing observations. The final model was then run on the dataset with both complete cases only and with imputed values. To perform the sensitivity analysis, the standard errors of the models run on the complete cases dataset and imputed dataset were compared. The results suggested that the regression model run on the imputed data was the best model. Thus, results from the imputed data will be presented. Results from CCA are presented in appendix 4 for reference.

2.2.7 User agreement for the Connor Davidson Resilience Scale (CD -RISC)

A User agreement for the Connor-Davidson Resilience Scale was completed by both my supervisor (for her own use) and for a nested student project.

2.2.8 Ethical Considerations

Data collected were de-identified and kept on a password secured server in the MRC/Wits Agincourt Research Unit and the student laptop. Ethical clearance was granted by both the University of the Witwatersrand Human Research Ethics Committee (Medical) (Ethical certificate number No. M220671) and the Mpumalanga Health Research and Ethics Committee (Approval Reference Number MP_201811_002).

3 Chapter 3: Results

Section overview

This chapter will present the study findings. Firstly, results relating to the management of missing data will be presented in tables 1 and 2. Secondly, results from the exploratory phase of analysis will be presented in tables 3 and 4. Lastly, results from the inferential phase of analysis will be presented in tables 5 and 6.

The analytic sample consisted of 245 participants, including some participants that left individual questions blank. Consequently, there were a number of questions with missing responses presented in table 1. All variables, except depression, had few missing responses representing between 0.4% and 1.6% of all responses. Depression status, with 109 blank answers (44.5%), was calculated considering the high percentage of missing responses. Missing responses were described in the descriptive statistics and then imputed using MICE. Logistic regression was run on the imputed dataset.

Table 1: Summary of missing responses

Variable	Number of missing responses	% of questions left blank
Source of income	4	1.6
Resilience status	4	1.6
Tend to bounce back after illness	1	0.4
Do not give up when things look hopeless	1	0.4
Take the lead in problem solving	1	0.4
Must act on a hunch	1	0.4
Depression status	109	44.5
My appetite was poor	36	14.7
Everything done was an effort	90	36.7
Perceptions of stress score	2	0.8
Upset by something that happened unexpectedly	1	0.4
Was able to control irritations in life	1	0.4

As presented in table 2, there were no significant differences by age, sex, living arrangements or socio-economic status between participants who left at least one question blank [112 (45.7%)] and those who responded to all questions [133

(54.3%)] Participants seemed to differ significantly on income source although there was no clear trend in the difference.

Table 2: Comparison of participants with at least one missing response and those with no missing responses by socio-demographic variables

Variable	Number of participants with missing responses [n (%)]		P-value
	At least one [(n=112)]	None [(n=133)]	
Age [Median(range)]	13.9 (13.1- 15.2)	14.1 (13.2 – 15.1)	0.332
Age group			
13	57 (50.9)	64 (48.1)	0.902
14	49 (43.8)	62 (46.6)	
15	6 (5.4)	7 (5.3)	
Sex			
Female	62 (55.4)	67 (50.4)	0.437
Male	50 (44.6)	66 (49.6)	
Living arrangements indicators			
Village			
1	40 (35.7)	51 (38.4)	0.744
2	12 (10.7)	15 (11.3)	
3	39 (34.8)	49 36.8)	
4	21 (18.8)	18 (13.5)	
Adult with whom adolescent lives			
Both parents	35 (31.3)	34 (25.6)	0.538
One parent/ guardian	73 (65.2)	95 (71.4)	
Older sibling	3 (2.7)	4 (3.0)	
None/ I am head of household	1 (0.9)	0 (0.0)	
Share home with distant relative			
Yes	30 (26.8)	27 (20.3)	0.231
No	82 (73.2)	106 (79.7)	
Type of accommodation			
Owned home	111 (45.7)	132 (54.3)	0.706
Rented home	1 (50.0)	1 (50.0)	
Economic indicators			
Source of income			
Both parents	9 (8.0)	6 (4.5)	0.097
One parent/guardian	52 (46.4)	56 (42.1)	
Older sibling/ Other family member	23 (20.5)	33 (24.8)	
None	24 (21.4)	38 (28.6)	
Missing	4 (3.6)	0 (0.0)	
Socio-economic status			
Lower class	38 (33.9)	35 (26.3)	0.128
Quintile 2	25 (22.3)	41 (30.8)	
Quintile 3	23 (20.5)	36 (27.1)	
Quintile 4	14 (12.5)	15 (11.3)	
Higher class	12 (10.7)	6 (4.5)	

Table 3 presents the socio-demographic characteristics of adolescents and considers how these characteristics relate to resilience. The results indicate that there were more females (52.7%) than males (47.4%). The mean age of adolescents was 14.0 years old with the youngest being 13.1 years old and eldest 15.2 years old. Most adolescents were 13 (49.4%) and 14 (45.3%) years old with only 5.3% being 15 years old.

Regarding living arrangement indicators, most adolescents lived with one parent/guardian (68.6%), followed by both parents (28.2%) with only a minority living with an older sibling (2.9%). Only one adolescent reported to be the head of the household (0.4%). Most adolescents did not share their home with a distant relative (76.7%) and most lived in owned homes (99.2%).

Regarding economic indicators, most households received income from one parent/guardian (44.1%) followed by an older sibling/other family member (22.9%) and both parents (6.1%). A quarter of the households had no income (25.3%). Over 80.0% of the adolescents lived in homes within the three lowest socio-economic status quintiles: 29.8% in the lower class; 26.9% in the second lowest quintile and 24.1% in the third lowest quintile.

Although there were observed differences in resilience by age and sex, these differences were not found to be significant.

Resilience levels differed significantly by village ($p=0.025$) with village 3 presenting the highest level of resilience (40.7%). Other living indicator variables were not associated with resilience.

No significant relationship between socio-economic status and resilience ($p=0.594$) and resilience and incomes source ($p=0.104$) was identified.

Table 3: Description of socio-demographic characteristics and their relationship with resilience among adolescents in Agincourt, rural Mpumalanga (n=245)

Variable	Frequency (%)	Resilience [n (%)]			P-value
		Higher [113 (46.1)]	Lower [128 (52.2)]	Missing data* [4 (1.6)]	
Age [Median(range)]	14.0 (13.1 – 15.2)	14.1 (13.1-15.1)	14.0 (13.1-15.2)	13.6 (13.3 – 13.9)	0.868
Age group					
13	121 (49.4)	54 (47.8)	63 (49.2)	4 (100.0)	0.431
14	111 (45.3)	53 (46.9)	58 (45.3)	0 (0.0)	
15	13 (5.3)	6 (5.3)	7 (5.5)	0 (0.0)	
Sex					
Female	129 (52.7)	62 (54.9)	63 (49.2)	4 (100.0)	0.131
Male	116 (47.4)	51 (45.1)	65 (50.8)	0 (0.0)	
Living arrangements indicators					
Village					
1	91 (37.1)	36 (31.9)	53 (41.4)	2 (50.0)	0.025
2	27 (11.0)	7 (6.2)	20 (15.6)	0 (0.0)	
3	88 (35.9)	46 (40.7)	41 (32.0)	1 (25.0)	
4	39 (15.9)	24 (21.2)	14 (10.9)	1 (25.0)	
Adult with whom adolescent lives					
Both parents	69 (28.2)	37 (32.7)	32 (25.0)	0 (0.0)	0.416
One parent/ guardian	168 (68.6)	72 (63.7)	92 (71.9)	4 (100.0)	
Older sibling	7 (2.9)	3 (2.7)	4 (3.1)	0 (0.0)	
None/ I am head of household	1 (0.4)	1 (0.9)	0 (0.0)	0 (0.0)	
Share home with distant relative					
Yes	57 (23.3)	22 (19.5)	35 (27.3)	0 (0.0)	0.222
No	188 (76.7)	91 (80.54)	93 (72.7)	4 (100.0)	
Type of accommodation					
Owned home	243 (99.2)	111 (98.2)	128 (100.0)	4 (100.0)	0.244
Rented home	2 (0.8)	2 (1.8)	0 (0.0)	0 (0.0)	

Economic indicators					
Source of income					
Both parents	15 (6.1)	7 (6.2)	8 (6.3)	0 (0.0)	0.104
One parent/guardian	108 (44.1)	56 (49.6)	49 (38.3)	3 (75.0)	
Older sibling/ Other family member	56 (22.9)	26 (23.0)	30 (23.4)	0 (0.0)	
None	62 (25.3)	23 (20.4)	39 (30.5)	0 (0.0)	
Missing data	4 (1.6)	1 (0.9)	2 (1.6)	1 (25.0)	
Socio-economic status					
Lower class	73 (29.8)	33 (29.2)	38 (29.7)	2 (50.0)	0.594
Quintile 2	66 (26.9)	30 (26.6)	36 (28.1)	0 (0.0)	
Quintile 3	59 (24.1)	23 (20.4)	34 (26.66)	2 (50.0)	
Quintile 4	29 (11.8)	16 (14.2)	13 (10.2)	0 (0.0)	
Higher class	18 (7.4)	11 (9.7)	7 (5.5)	0 (0.0)	

*Missing responses for the resilience status, but not other variables

To further explore the data, predictor variables and their relationship with resilience were explored and are presented in table 4. From table 4, the mean score of perceptions of stress among adolescents was 15.0. The prevalence of depression among adolescents was 17.1%.

Perceptions of stress were not associated with resilience ($p=0.598$).

A significant relationship between depression status and resilience levels ($p<0.001$) was identified. Of those with high resilience, 65.5% of adolescents did not respond to at least one depression scale question while 19.5% were not depressed and 15.0% were depressed. In this sample, adolescents had good relationships with their parents. The data suggests that the percentages of good relationships with parents increased across categories as most participants reported having never argued with either their mother (66.1%) or father (86.1%). Additionally, other variables also show that participants felt always understood by their parents (46.1%), always loved by their parents (69.4%), always received enough time from their parents (45.7%), were always treated fairly by their parents (65.7%) and always talked with their parents (44.1%). However, adolescents were reluctant to share feelings with either parent with most participants reporting to have never shared feeling with their mother (89.4%) or father (64.5%).

Overall, there seems to be a positive significant association between good relationships with parents and high resilience. Most adolescents with high resilience reported to have always felt understood by parents, always received enough time from parents and always talked to parents. Furthermore, most adolescents with high resilience reported to have never argued with either their mother or their father. Being loved by a parent, being treated fairly by a parent, and arguing with their mother or their father showed no significant relationship with resilience.

Adolescents had good relationships with friends, with most adolescents always meeting with friends (48.2%), always having fun with friends (51.0%), and always having friends that help each other (42.5%). On the other hand, adolescents were on the extremes when asked about speaking with friends, with a third seldom (29.8%) or always (29.8%) speaking with friends. Over a third of the adolescents always got support from friends (35.9%), a fifth seldom got support from friends (21.2%) and 9.0% never got support from friends.

All friend relationship factors were associated with resilience ($p < 0.001$ for all factors). Most adolescents with high resilience reported to always meet with friends, always have fun with friends, always talk with friends, always had friends that help each other and always received support from friends.

With regards to bullying, percentages increased across categories with most adolescents never having been bullied (74.3%), never bullied others (85.3%) and never been bullied on the internet (92.7%).

The results suggest that there was a significant relationship between being bullied, bullying others and resilience levels. Most adolescents with high resilience reported to have never been bullied and never bullied others. There was no significant relationship between cyber bullying and resilience.

Table 4: Description of predictor variables and their relationship with resilience among adolescents in Agincourt, rural Mpumalanga (n=245)

Variable	Frequency (%)	Resilient [n (%)]			P-value
		Higher [113 (46.1%)]	Lower [128 (52.2%)]	Missing data* [4(1.6)]	
Perceptions of Stress Score					
Perceptions of Stress mean (standard deviation)	15.0 (5.0)	14.9 (5.9)	15.2 (4.1)	12 (3.7)	0.598
Depression Status					
Depression					
Yes	42 (17.1)	17 (15.0)	25 (19.5)	0 (0.0)	<0.001
No	94 (38.4)	22 (19.5)	72 (56.3)	0 (0.0)	
Missing data [#]	109 (44.5)	74 (65.5)	31 (24.2)	4 (100.0)	
Interpersonal Relations					
Relationship with Parent					
Understood by parents					
Never	9 (3.7)	6 (5.3)	3 (2.3)	0 (0.0)	0.022
Seldom	21 (8.6)	5 (4.4)	15 (11.7)	1 (25.0)	
Sometimes	40 (16.3)	18 (15.9)	22 (17.2)	0 (0.0)	
Often	62 (25.3)	21 (18.6)	40 (31.3)	1 (25.0)	
Always	113 (46.1)	63 (55.8)	48 (37.5)	2 (50.0)	
Loved by Parents					
Never	3 (1.2)	2 (1.8)	1 (0.78)	0 (0.0)	0.483
Seldom	7 (2.9)	1 (0.9)	6 (4.7)	0 (0.0)	
Sometimes	18 (7.4)	10 (8.9)	8 (6.3)	0 (0.0)	
Often	47 (19.2)	18 (15.9)	28 (21.9)	1 (25.0)	
Always	170 (69.4)	82 (72.6)	85 (66.4)	3 (75.0)	
Enough time from parents					
Never	24 (9.8)	10 (8.9)	14 (10.9)	0 (0.0)	0.010
Seldom	29 (11.8)	8 (7.1)	21 (16.4)	0 (0.0)	
Sometimes	33 (13.5)	17 (15.0)	16 (12.5)	0 (0.0)	
Often	47 (19.2)	14 (12.4)	32 (25.0)	1 (25.0)	
Always	112 (45.7)	64 (56.6)	45 (35.2)	3 (75.0)	

Treated fairly by parent(s)					
Never	5 (2.0)	2 (1.7)	3 (2.3)	0 (0.0)	0.521
Seldom	5 (2.0)	2 (1.7)	3 (2.3)	0 (0.0)	
Sometimes	21 (8.6)	9 (8.0)	12 (9.4)	0 (0.0)	
Often	53 (21.6)	18 (15.9)	34 (26.6)	1 (25.0)	
Always	161 (65.7)	82 (72.6)	76 (59.4)	3 (75.0)	
Talk to parent(s)					
Never	26 (10.6)	8 (7.1)	17 (13.3)	1 (25.0)	0.005
Seldom	20 (8.2)	3 (2.7)	17 (13.3)	0 (0.0)	
Sometimes	39 (15.9)	19 (16.8)	20 (15.6)	0 (0.0)	
Often	52 (21.2)	22 (19.5)	30 (23.3)	0 (0.0)	
Always	108 (44.1)	61 (54.0)	44 (34.4)	3 (75.0)	
Argue with father					
Never	211 (86.1)	99 (87.6)	108 (84.4)	4 (100.0)	0.877
Seldom	19 (7.8)	7 (6.2)	12 (9.4)	0 (0.0)	
Sometimes	6 (2.5)	2 (1.8)	4 (3.1)	0 (0.0)	
Often	6 (2.5)	3 (2.7)	3 (2.3)	0 (0.0)	
Always	3 (1.2)	2 (1.8)	1 (0.8)	0 (0.0)	
Argue with mother					
Never	162 (66.1)	73 (64.6)	85 (66.4)	4 (100.0)	0.681
Seldom	44 (18.0)	19 (16.8)	25 (19.5)	0 (0.0)	
Sometimes	18 (7.4)	9 (8.0)	9 (7.0)	0 (0.0)	
Often	12 (4.9)	5 (4.4)	7 (5.5)	0 (0.0)	
Always	9 (3.7)	7 (6.2)	2 (1.6)	0 (0.0)	
Share feelings with mother					
Never	219 (89.4)	93 (82.3)	122 (95.3)	4 (100.0)	0.072
Seldom	7 (2.9)	5 (4.4)	2 (1.6)	0 (0.0)	
Sometimes	2 (0.8)	1 (0.9)	1 (0.8)	0 (0.0)	
Often	7 (2.9)	6 (5.3)	1 (0.8)	0 (0.0)	
Always	10 (4.1)	8 (7.1)	2 (1.6)	0 (0.0)	

Share feelings with father					
Never	158 (64.5)	68 (60.2)	89 (69.5)	1 (25.0)	0.024
Seldom	27 (11.0)	9 (8.0)	18 (14.1)	0 (0.0)	
Sometimes	22 (9.0)	12 (10.6)	9 (7.0)	1 (25.0)	
Often	17 (6.9)	11 (9.7)	5 (3.9)	1 (25.0)	
Always	21 (8.6)	13 (11.5)	7 (5.5)	1 (25.0)	
Relationship with friends					
Meet with friends					
Never	12 (4.9)	8 (7.1)	4 (3.1)	0 (0.0)	<0.001
Seldom	20 (8.2)	7 (6.2)	13 (10.2)	0 (0.0)	
Sometimes	27 (11.0)	9 (8.0)	18 (14.1)	0 (0.0)	
Often	68 (27.8)	16 (14.2)	51 (39.8)	1 (25.0)	
Always	118 (48.2)	73 (64.6)	42 (32.8)	3 (75.0)	
Fun with friends					
Never	10 (4.1)	6 (5.3)	4 (3.1)	0 (0.0)	<0.001
Seldom	14 (5.7)	4 (3.5)	10 (7.8)	0 (0.0)	
Sometimes	20 (8.2)	9 (8.0)	11 (8.6)	0 (0.0)	
Often	76 (31.0)	20 (17.7)	55 (43.0)	1 (25.0)	
Always	125 (51.0)	74 (65.5)	48 (37.5)	3 (75.0)	
Talk with friends					
Never	39 (15.9)	14 (12.4)	25 (19.5)	0 (0.0)	<0.001
Seldom	73 (29.8)	20 (17.7)	52 (40.6)	1 (25.0)	
Sometimes	38 (15.5)	16 (14.2)	22 (17.2)	0 (0.0)	
Often	22 (9.0)	11 (9.7)	10 (7.8)	1 (25.0)	
Always	73 (29.8)	52 (46.0)	19 (14.8)	2 (50.0)	
Friends helping each other					
Never	19 (7.8)	7 (6.2)	12 (9.4)	0 (0.0)	<0.001
Seldom	36 (14.7)	7 (6.2)	29 (22.7)	0 (0.0)	
Sometimes	48 (19.6)	17 (15.0)	31 (24.2)	0 (0.0)	
Often	38 (15.5)	14 (12.4)	23 (18.0)	1 (25.0)	
Always	104 (42.5)	68 (60.2)	33 (25.8)	3 (75.0)	

Get friend support					
Never	22 (9.0)	5 (4.4)	16 (12.5)	1 (25.0)	<0.001
Seldom	52 (21.2)	15 (13.3)	36 (28.1)	1 (25.0)	
Sometimes	47 (19.2)	18 (15.9)	29 (22.7)	0 (0.0)	
Often	36 (14.7)	16 (14.2)	20 (15.6)	0 (0.0)	
Always	88 (35.9)	59 (52.2)	27 (21.1)	2 (50.0)	
Bullied					
Been bullied					
Never	182 (74.3)	94 (83.2)	85 (66.4)	3 (75.0)	0.035
Seldom	34 (13.9)	7 (6.2)	26 (20.3)	1 (25.0)	
Sometimes	16 (6.5)	7 (6.2)	9 (7.0)	0 (0.0)	
Often	11 (4.5)	5 (4.4)	6 (4.7)	0 (0.0)	
Always	2 (0.8)	0 (0.0)	2 (1.6)	0 (0.0)	
Bully others					
Never	209 (85.3)	102 (90.3)	103 (80.5)	4 (100.0)	0.035
Seldom	16 (6.5)	3 (2.7)	13 (10.2)	0 (0.0)	
Sometimes	11 (4.5)	2 (1.8)	9 (7.0)	0 (0.0)	
Often	4 (1.6)	4 (3.5)	0 (0.0)	0 (0.0)	
Always	5 (2.0)	2 (1.8)	3 (2.3)	0 (0.0)	
Been bullied on internet					
Never	227 (92.7)	107 (94.7)	117 (91.4)	3 (75.0)	0.119
Seldom	4 (1.6)	0 (0.0)	3 (2.3)	1 (25.0)	
Sometimes	9 (3.7)	3 (2.7)	6 (4.7)	0 (0.0)	
Often	4 (1.6)	2 (1.8)	2 (1.6)	0 (0.0)	
Always	1 (0.4)	1 (0.9)	0 (0.0)	0 (0.0)	

*Missing responses for the resilience status, but not other variables

#Missing responses for depression status, but not resilience

Once the exploratory phase of analysis was complete, inferential analysis was conducted to explore - in more depth - the relationship between predictor variables and resilience while considering the effect of socio-demographic variables. The results are presented in table 5.

The findings presented in table 5 show that there was no significant association between high resilience and depression ($p=0.248$).

Overall, meeting friends regularly reduced the adolescents' chances of high resilience compared to never meeting with friends. However, always meeting with friends had less of a reductive effect on high resilience. Seldom meeting with friends decreased the chances of high resilience by 80% ($OR=0.20$; $p=0.053$). Sometimes meeting with friends decreased the chances of high resilience by 86% ($OR=0.14$; $p=0.013$). Often meeting with friends decreased the chances of high resilience by 88% ($OR=0.12$; $p=0.003$). Always meeting with friends decreased the chances of high resilience by 27% ($OR=0.73$; $p=0.646$), although this association was not significant.

The village that the adolescent lived in significantly predicted high resilience. Living in village 2 decreased the chances of high resilience by 49% ($OR=0.51$; $p=0.211$) compared to village 1. Living in villages 3 increased the chances of high resilience by 2-fold ($OR=2.25$; $p=0.022$) and in village 4 by 2.6-fold ($OR=2.65$; $p=0.029$), compared to village 1.

A regression model with low resilience as the outcome of interest was also run. This model did not add any new associations; thus, it was not presented in this report.

Table 5: Logistic regression of predictors associated with high resilience among adolescents in rural Mpumalanga

High Resilience	Odds ratio	Standard errors	95% Confidence interval	P-value
Depression Status				
Depression				
Yes	1.64	0.70	0.71 – 3.82	0.248
No	1			
Relationship with friends				
Meet with friends				
Never	1			
Seldom	0.20	0.17	0.04 - 1.02	0.053
Sometimes	0.14	0.11	0.03 - 0.67	0.013
Often	0.12	0.09	0.03 - 0.50	0.003
Always	0.73	0.50	0.19 - 2.79	0.646
Living arrangements indicators				
Village				
1	1			
2	0.51	0.27	0.18 - 1.46	0.211
3	2.25	0.80	1.12 - 4.51	0.022
4	2.65	1.18	1.11 - 6.36	0.029

4 Chapter 4: Discussion and limitations

Section overview

Section 4.1 of this chapter will begin by summarising and examining the main findings of this study in the context of South African and global literature. Following this, potential limitations of this study will be considered in Section 4.2.

4.1 Discussion

This study aimed to examine predictors of resilience among adolescents living in rural Mpumalanga. The important findings of this study show that 46.1% of adolescents had high resilience. There was no association between age and high resilience nor sex and high resilience. Furthermore, the findings from the bivariate analysis of socio-demographic and predictors variables with resilience suggest that rural adolescents rely on interpersonal relationships to build resilience. On the other hand, living arrangements had little effect on resilience levels.

The village which the adolescent resided in, was associated with resilience. Other socio-demographic variables were not associated with resilience.

Perceptions of stress were not associated with high resilience, while symptoms of depression were associated with high resilience. Most adolescents with high resilience were not depressed. Although there was a large proportion of missing data, this same relationship was observed when missing observations were imputed and the final logistic regression model was conducted.

The results suggest that healthy interpersonal relationships predicted resilience among rural adolescents. Approximately half of parental variables and all friend variables were associated with high resilience. Furthermore, 'meeting with friends' was the only interpersonal relationship variable that significantly improved the logistic regression model. This may indicate that adolescents rely more on relationships with friends than parents to build resilience.

Regularly feeling understood by parents, receiving enough time from parents, and talking with parents predicted high resilience. Never sharing feelings with a mother or

father predicted high resilience. While never having bullied others or been bullied by others was predictive of high resilience.

Regularly meeting with friends, having fun with friends, talking with friends, receiving support from friends, and having friends that regularly help each other predicted high resilience. Once the logistic regression model was developed, it was found that adolescents who never met with friends were more likely to have high resilience compared to those that ever met with friends.

Eli and colleagues suggested that among adolescents (ages 10-17) residing in Qinghai-Tibet Plateau, China, an increase in age was associated with an increase in resilience (Eli *et al.*, 2021). Other studies suggested similar findings (Gilan *et al.*, 2020; Varma *et al.*, 2021). The results of this study suggest otherwise. One explanation for this could be that ages of participants in this study ranged from 13-15 years, thus there was little variation in age.

The literature suggests an association between sex and resilience (Chung *et al.*, 2020; Parviniannasab *et al.*, 2021). A study among adolescents residing in Hong Kong, China found that females were more resilient than males (Chung *et al.*, 2020). However, the findings of this study suggest that sex is not associated with resilience.

Among adolescents with high resilience, most adolescent came from village 3, followed by villages 1, 4, and 2. When considering the socio-economic status profile of adolescents from these villages the following was found. Although most adolescents fell under the lower socio-economic quintiles a greater proportion of adolescents from the lower class and quintile 2 resided in villages 1 and 3 followed by villages 4 and 2. This may suggest that residing in a village or area with lower socio-economic status may predict high resilience. This is consistent with Van Breda's finding that South African adolescents from poorer neighbourhoods had higher resilience compared to those from comparatively wealthier neighbourhoods (van Breda, 2017). The current study suggests that household socio-economic status may not predict resilience, but village socio-economic status may. Perhaps group rather than individual socio-economic status is more predictive of resilience albeit Van Breda discourages group based resilience research (van Breda, 2017).

Although income source was associated with missingness, the data were assumed to be MAR. Thus, the fact that some variables within the dataset were associated

with missingness was considered. Furthermore, a sensitivity analysis indicated that this assumption produced the better model.

The finding of this study contradicts that of the literature which suggests that higher perceptions of stress predict low resilience (García-León *et al.*, 2019; Sahu *et al.*, 2019; Chen and Kuo, 2020; Ye *et al.*, 2020). This contradictory finding may be explained by the tool used to measure perceptions of stress in this study, the PPS-10. The PPS-10 has been used and validated among young adults and adolescents in African contexts (Fincham *et al.*, 2009; Lemma *et al.*, 2012; El Ansari and Berg-Beckhoff, 2015; Boukrim *et al.*, 2021; Manzar *et al.*, 2021; Makhubela, 2022). Furthermore, Fincham and colleagues, validated the English version of the PPS-10 scale among South African adolescents (Fincham *et al.*, 2009). In this study, the scale was translated into the Xitsonga language. Thus, it may be possible that the contradictory findings of this study may be attributed to an insufficiently validated Xitsonga version of the PPS-10.

The findings of this study contradict the findings of García-León and colleagues, albeit they studied the predictive effect of depression on resilience in adults (García-León *et al.*, 2019). This contradictory result may be explained by a potential unobserved third variable. Van Breda suggested that children who lived in children's homes (i.e., orphanages) had higher resilience due to the intensive psychosocial support and development that was offered in these institutions (van Breda, 2017). Thus, resilience may be higher among depressed adolescents as depressed adolescents may seek out psychosocial support which may build resilience. Another explanation for this contradictory finding may be a large proportion of missing observations (44.5%). Although all participants answered most questions in the questionnaire, there were two questions with a large proportion of missing responses. Nel and colleagues conducted a qualitative study investigating how educated Venda, Tsonga and Pedi speaking undergraduate students responded to the Beck's Depression Inventory (BDI) (Nel *et al.*, 2015). They found that participants perceived the BDI as difficult to understand, culturally unfriendly and some questions were considered taboo (Nel *et al.*, 2015). In this present study, one of the questions in the CES-D with a large proportion of missing observations stated, 'I did not feel like eating; my appetite was poor'. A study on the nutritional status of rural South African children – conducted in the Agincourt HDSS – found that malnutrition was

prevalent among this group (Kimani-Murage *et al.*, 2011). Given the high prevalence of malnutrition, a question regarding appetite and hunger may be considered inappropriate resulting in adolescents leaving the question blank. Furthermore, in this study the CES-D was translated into the Xitsonga language. The large proportion of missing observations may be related to the translation being unclear or confusing. Thus, it is possible that adolescents in this study did not understand questions in the CES-D or found this question inappropriate resulting a large number of missing responses. Since - to my knowledge - the psychometric properties of the CES-D translated into the Xitsonga language have not been research as yet, further studies on the CES-D in the Xitsonga language would be beneficial.

The findings of this study, that healthy relationships with parents, friends and the absence of bullying predict high resilience, is consistent with the literature (Sharer *et al.*, 2016; van Breda, 2017; Parviniannasab *et al.*, 2020; Eli *et al.*, 2021; Hall *et al.*, 2021; Olajubu *et al.*, 2021; Shenderovich *et al.*, 2021; Tankersley *et al.*, 2021).

Unlike the Iranian and Hispanic cultures, within rural South Africa, the findings suggests that the relationship between friends may have a greater predictive effect on resilience (Parviniannasab *et al.*, 2020; Hall *et al.*, 2021). This may be because living with a relative, rather than biological parents, is common within rural communities (Armstrong, 2011; Shilubane *et al.*, 2014; Shenderovich *et al.*, 2021). Thus, adolescents may not be able to rely on a relationship with their parents as a resilience resource.

This study found that the more the adolescent meets with friends (seldom, sometimes, and often), the lower their chances of high resilience except those who always meet with friends. Those who always meet with friends have a greater chance of high resilience, albeit low. The literature suggests that relationships with caregivers are an important resilience resource for adolescents (Gee, 2021). This relationship allows the caregivers to teach the adolescents emotional regulation and control and helps guide their response to adversity (Gee, 2021). Perhaps adolescents who meet with friends intermittently (seldom, sometimes, and often) are unable to form healthy relationships with caregivers. Thus, they may succumb to adversity as they are not adequately equipped to face it. Furthermore, it may be that those who always meet with friends have a greater chance of high resilience as their relationship with friends replaces the relationship with a caregiver. Adolescents who

always meet with friends may be vulnerable with their friends. Thus, they may receive some support and guidance from friends which may help promote some resilience.

4.2 Limitations

This study contains inherent limitations. Firstly, due to the nature of cross-sectional studies, temporality and thus causality cannot be established (Gordis, 2008).

Secondly, due to the complexity and interrelated nature of resilience it is possible that unobserved factors may have influenced the findings, reducing the reliability of the findings (Masten, 2001; Fergus and Zimmerman, 2005; Gartland *et al.*, 2011).

Thirdly, since resilience is context dependent, results from this study may not be generalisable (Fergus and Zimmerman, 2005).

In this study, the CD-RISC-25 score was dichotomised. This may result in a loss of information on the differences in resilience between individuals and may also reduce the reliability of the measure (Maccallum *et al.*, 2002; Altman and Royston, 2006).

Further, large proportions of missing data may reduce the reliability of the results.

Furthermore, since resilience and depression status were imputed, there is opportunity for bias.

5 Chapter 5: Conclusion

The results suggest that although income factors and group socio-economic status may predict high resilience, adolescents seem to rely more on interpersonal relationship factors for resilience. Regular interaction and support from both parents and friends may predict high resilience. However, the findings suggest that once the relationship with friends replaces the relationship with parents, low resilience results. Findings further suggest that further studies on the validity and acceptability of the PPS-10 and CES-D scales withing the South African context are needed.

6 Chapter 6: References

- Altman, D.G. and Royston, P. (2006) 'The cost of dichotomising continuous variables', *BMJ*, 332(May), p. 2006.
- American Psychiatric Association (2013) *Diagnostic and statistical manual of mental disorders: DSM-5*. 5th edn. Washington D.C: American Psychiatric Publishing.
- El Ansari, W. and Berg-Beckhoff, G. (2015) 'Nutritional correlates of perceived stress among university students in Egypt', *International Journal of Environmental Research and Public Health*, 12(11), pp. 14164–14176. Available at: <https://doi.org/10.3390/ijerph121114164>.
- Anyan, F. and Hjemdal, O. (2016) 'Adolescent stress and symptoms of anxiety and depression : Resilience explains and differentiates the relationships', *Journal of Affective Disorders*, 203, pp. 213–220. Available at: <https://doi.org/10.1016/j.jad.2016.05.031>.
- Armstrong, L.L. (2011) *The anatomy of rural-urban youth suicidal ideation—Who is at greatest risk. What factors to target. How to intervene*. University of Ottawa.
- Arruda, M.A. et al. (2021) 'Resilience and vulnerability in adolescents with primary headaches: A cross-sectional population-based study', *Headache*, 61(3), pp. 546–557. Available at: <https://doi.org/10.1111/head.14078>.
- Austin, P.C. et al. (2021) 'Missing data in clinical research: A tutorial on Multiple Imputation', *Canadian Journal of Cardiology*, 37(9), pp. 1322–1331. Available at: <https://doi.org/10.1016/j.cjca.2020.11.010>.
- Banny, A.M. et al. (2013) 'Vulnerability to depression: A moderated mediation model of the roles of child maltreatment, peer victimization, and 5-HTTLPR genetic variation among children from low-SES backgrounds', *Development and Psychopathology*, 25(5), pp. 599–614. Available at: <https://doi.org/10.1017/S0954579413000047>.Vulnerability.
- Beauvais, F. (2002) 'Drug Use, Resilience, and the Myth of the Golden Child', in *Resilience and development : positive life adaptations*. Boston: Springer US, pp. 101–107. Available at: https://doi.org/10.1007/0-306-47167-1_5.

Bellis, M. *et al.* (2014) 'National household survey of adverse childhood experiences and their relationship with resilience to health-harming behaviors in England', *BMC Medicine*, 12(1). Available at: <https://doi.org/10.1186/1741-7015-12-72>.

Bellis, M.A. *et al.* (2015) 'Measuring mortality and the burden of adult disease associated with adverse childhood experiences in England: A national survey', *Journal of Public Health (United Kingdom)*, 37(3), pp. 445–454. Available at: <https://doi.org/10.1093/pubmed/fdu065>.

Bhana, A. *et al.* (2016) 'Resilience in perinatal HIV+ adolescents in South Africa', *AIDS Care*, 28, pp. 49–59. Available at: <https://doi.org/10.1080/09540121.2016.1176676>.

Bilsen, J. (2018) 'Suicide and Youth: Risk Factors', *Frontiers in Psychiatry*, 9(October), pp. 1–5. Available at: <https://doi.org/10.3389/fpsy.2018.00540>.

Blakemore, S.J. and Mills, K.L. (2014) 'Is adolescence a sensitive period for sociocultural processing?', *Annual Review of Psychology*, 65, pp. 187–207. Available at: <https://doi.org/10.1146/annurev-psych-010213-115202>.

Bono, C. *et al.* (2007) 'Missing data on the Center for Epidemiologic Studies Depression Scale: A comparison of 4 imputation techniques', *Research in Social and Administrative Pharmacy:RSAP*, 3(1), pp. 1–27. Available at: <https://doi.org/10.1016/j.sapharm.2006.04.001>.

Boukrim, M. *et al.* (2021) 'COVID-19 and confinement: Effect on weight load, physical activity and eating behavior of higher education students in southern Morocco', *Annals of Global Health*, 87(1), pp. 7–18. Available at: <https://doi.org/10.5334/aogh.3144>.

Bowes, L. and Jaffee, S.R. (2013) 'Biology, genes, and resilience: toward a multidisciplinary approach', *Trauma Violence Abuse*, 14(3), pp. 195–208. Available at: <https://doi.org/doi:10.1177/1524838013487807>.

Boyce, W.T. (2012) 'A Biology of Misfortune', *Focus*, 29(1), pp. 1–6. Available at: <http://www.irp.wisc.edu/publications/focus/pdfs/foc291.pdf>.

van Breda, A.D. (2017) 'A comparison of youth resilience across seven South African sites', *Child and Family Social Work*, 22(1), pp. 226–235. Available at:

<https://doi.org/10.1111/cfs.12222>.

van Breda, A.D. and Theron, L.C. (2018) 'A critical review of South African child and youth resilience studies, 2009–2017', *Children and Youth Services Review*, 91, pp. 237–247. Available at: <https://doi.org/10.1016/j.chidyouth.2018.06.022>.

Campbell-sills, L., Cohan, S.L. and Stein, M.B. (2006) 'Relationship of resilience to personality , coping , and psychiatric symptoms in young adults', *Behaviour Research and Therapy*, 44(4), pp. 585–599. Available at: <https://doi.org/10.1016/j.brat.2005.05.001>.

Chen, Y.-L. and Kuo, P.-H. (2020) 'Effects of perceived stress and resilience on suicidal behaviors in early adolescents', *European Child & Adolescent Psychiatry*, 29(6), pp. 861–870. Available at: <https://doi.org/10.1007/s00787-019-01401-w>.

Cheung, S., Xie, X. and Huang, C.C. (2020) 'Mind over matter: Mindfulness, income, resilience, and life quality of vocational high school students in China', *International Journal of Environmental Research and Public Health*, 17(16), pp. 5701–5714. Available at: <https://doi.org/10.3390/ijerph17165701>.

Choe, D.E., Zimmerman, M.A. and Devanarain, B. (2012) 'Youth violence in South Africa: Exposure, attitudes, and resilience in Zulu adolescents', *Violence and Victims*, 27(2), pp. 166–182. Available at: <https://doi.org/doi: 10.1891/0886-6708.27.2.166>.

Chung, J. et al. (2020) 'Relationships among resilience , self-esteem , and depressive symptoms in Chinese adolescents', *Journal of Health Psychology*, 25(13–14), pp. 2396–2405. Available at: <https://doi.org/10.1177/1359105318800159>.

Cicchetti, D. and Rogosch, F.A. (1997) 'The role of self-organization in the promotion of resilience in maltreated children', *Development and Psychopathology*, 9(4), pp. 797–815. Available at: <https://doi.org/10.1017/s0954579497001442>.

Cicchetti, D. and Rogosch, F.A. (2009) 'Adaptive coping under conditions of extreme stress: Multilevel influences on the determinants of resilience in maltreated children.', *New directions for child and adolescent development*, 2009(124), pp. 47–59. Available at: <https://doi.org/10.1002/cd.242>.

Cohen, S., Kamarck, T. and Mermelstein, R. (1983) 'A global measure of perceived

stress', *Journal of Health and Social Behavior*, 24(4), pp. 385–396. Available at: <https://doi.org/https://doi.org/10.2307/2136404>.

Collishaw, S. *et al.* (2016) 'Mental health resilience in the adolescent offspring of parents with depression: A prospective longitudinal study', *The Lancet Psychiatry*, 3(1), pp. 49–57. Available at: [https://doi.org/10.1016/S2215-0366\(15\)00358-2](https://doi.org/10.1016/S2215-0366(15)00358-2).

Connor, K. and Davidson, J. (no date) *Connor-Davidson resilience scale (CD-RISC)* © *manual*.

Connor, K.M. and Davidson, J.R.T. (2003) 'Development of a new Resilience scale: The Connor-Davidson Resilience scale (CD-RISC)', *Depression and Anxiety*, 18(2), pp. 76–82. Available at: <https://doi.org/10.1002/da.10113>.

Cortina, M.A. *et al.* (2013) 'Childhood Psychological Problems in School Settings in Rural Southern Africa', *PLoS ONE*, 8(6), pp. e65041–e65041. Available at: <https://doi.org/10.1371/journal.pone.0065041>.

Cortina, M.A. *et al.* (2016) 'Cognitive styles and psychological functioning in rural South African school students: Understanding influences for risk and resilience in the face of chronic adversity', *Journal of Adolescence*, 49(1), pp. 38–46. Available at: <https://doi.org/10.1016/j.adolescence.2016.01.010>.

Crouch, E. *et al.* (2017) 'Assessing the interrelatedness of multiple types of adverse childhood experiences and odds for poor health in South Carolina adults', *Child Abuse & Neglect*, 65, pp. 204–211. Available at: <https://doi.org/10.1016/j.chiabu.2017.02.007>.

Dias, R. *et al.* (2015) 'Resilience of caregivers of people with dementia: a systematic review of biological and psychosocial determinants', *Trends in Psychiatry and Psychotherapy*, 37(1), pp. 12–19. Available at: <https://doi.org/10.1590/2237-6089-2014-0032>.

Dong, M. *et al.* (2004) 'The interrelatedness of multiple forms of childhood abuse , neglect , and household dysfunction &', *Child Abuse & Neglect*, 28(7), pp. 771–784. Available at: <https://doi.org/10.1016/j.chiabu.2004.01.008>.

Eekhout, I., Van De Wiel, M.A. and Heymans, M.W. (2017) 'Methods for significance testing of categorical covariates in logistic regression models after multiple

imputation: Power and applicability analysis', *BMC Medical Research Methodology*, 17(1), pp. 129–141. Available at: <https://doi.org/10.1186/s12874-017-0404-7>.

Eli, B. *et al.* (2021) 'Depression in children and adolescents on the Qinghai-Tibet Plateau : Associations with resilience and prosocial behavior', *International Journal of Environmental Research and Public Health*, 18(2), pp. 440–452. Available at: <https://doi.org/https://doi.org/10.3390/ijerph18020440>.

Farley, H. (2020) 'Assessing mental health in vulnerable adolescents, *Nursing*', *Nursing*, 50(10), pp. 48–53.

Felitti, V.J. *et al.* (1998) 'Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults: The Adverse Childhood Experiences (ACE) Study', *American journal of preventive medicine*, 14(4), pp. 245–258. Available at: [https://doi.org/https://doi.org/10.1016/s0749-3797\(98\)00017-8](https://doi.org/https://doi.org/10.1016/s0749-3797(98)00017-8).

Fergus, S. and Zimmerman, M.A. (2005) 'Adolescent resilience: A framework for understanding healthy development in the face of risk', *Annual Review of Public Health*, 26(1), pp. 399–419. Available at: <https://doi.org/10.1146/annurev.publhealth.26.021304.144357>.

Fincham, D.S. *et al.* (2009) 'Posttraumatic stress disorder symptoms in adolescents: Risk factors versus resilience moderation', *Comprehensive Psychiatry*, 50(3), pp. 193–199. Available at: <https://doi.org/10.1016/j.comppsy.2008.09.001>.

Forbes, E.E. *et al.* (2021) 'A Social Affective Neuroscience Model of Risk and Resilience in Adolescent Depression: Preliminary Evidence and Application to Sexual and Gender Minority Adolescents', *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, 6(2), pp. 188–199. Available at: <https://doi.org/https://doi.org/10.1016/j.bpsc.2020.07.020>.

Fritz, J. *et al.* (2018) 'A Systematic Review of Amenable Resilience Factors That Moderate and/or Mediate the Relationship Between Childhood Adversity and Mental Health in Young People', *Frontiers in Psychiatry*, 9. Available at: <https://doi.org/10.3389/fpsy.2018.00230>.

García-León, M.Á. *et al.* (2019) 'Relationship between resilience and stress:

Perceived stress, stressful life events, HPA axis response during a stressful task and hair cortisol.', *Physiology & behavior*, 202, pp. 87–93. Available at: <https://doi.org/10.1016/j.physbeh.2019.02.001>.

Gartland, D. *et al.* (2011) 'Development of a multi-dimensional measure of resilience in adolescents : the Adolescent Resilience Questionnaire', *BMC Medical Research Methodology*, 11, pp. 134–144. Available at: <https://doi.org/https://doi.org/10.1186/1471-2288-11-134>.

Gee, D.G. (2021) 'Early Adversity and Development: Parsing Heterogeneity and Identifying Pathways of Risk and Resilience', *The American journal of psychiatry*, 178(11), pp. 998–1013. Available at: <https://doi.org/10.1176/appi.ajp.2021.21090944>.

Giano, Z. *et al.* (2021) 'Adverse childhood events in American Indian/Alaska Native populations', *American journal of preventive medicine*, 60(2), pp. 213–221. Available at: <https://doi.org/10.1016/j.amepre.2020.08.020>.Adverse.

Giano, Z., Wheeler, D.L. and Hubach, R.D. (2020) 'The frequencies and disparities of adverse childhood experiences in the U.S.', *BMC Public Health*, 20(1). Available at: <https://doi.org/10.1186/s12889-020-09411-z>.

Gilan, D. *et al.* (2020) 'Psychomorbidity, resilience, and exacerbating and protective factors during the SARS-CoV-2-pandemic', *Deutsches Arzteblatt International*, 117(38), pp. 625–632. Available at: <https://doi.org/10.3238/arztebl.2020.0625>.

Gilbert, R. *et al.* (2009) 'Burden and consequences of child maltreatment in high-income countries', *The Lancet*, 373(9657), pp. 68–81. Available at: [https://doi.org/10.1016/S0140-6736\(08\)61706-7](https://doi.org/10.1016/S0140-6736(08)61706-7).

Gilgoff, R. *et al.* (2020) 'Adverse Childhood Experiences, Outcomes, and Interventions', *Pediatric Clinics of North America*, 67(2), pp. 259–273. Available at: <https://doi.org/10.1016/j.pcl.2019.12.001>.

van Ginkel, J.R. *et al.* (2020) 'Rebutting existing misconceptions about multiple imputation as a method for handling missing data rebutting existing misconceptions about multiple imputation as a method for handling missing data', *Journal of Personality Assessment*, 102(3), pp. 297–308. Available at:

<https://doi.org/10.1080/00223891.2018.1530680>.

Goldstein, A.L., Faulkner, B. and Wekerle, C. (2013) 'The relationship among internal resilience, smoking, alcohol use, and depression symptoms in emerging adults transitioning out of child welfare', *Child Abuse and Neglect*, 37(1), pp. 22–32. Available at: <https://doi.org/10.1016/j.chiabu.2012.08.007>.

Gordis, L. (2008) *Epidemiology*. 4th edn. Philadelphia: Saunders Elsevier.

Green, J.G. et al. (2010) 'Childhood adversities and adult psychopathology in the National Comorbidity Survey Replication (NCS-R) I: Associations with first onset of DSM-IV disorders', *Archives of general psychiatry*, 67(2), pp. 113–123. Available at: <https://doi.org/10.1001/archgenpsychiatry.2009.186.Childhood>.

Greenberg, M.T. (2006) 'Promoting resilience in children and youth: preventive interventions and their interface with neuroscience', *Annals of New York Academy of Sciences*, 1094(1), pp. 139–150. Available at: <https://doi.org/https://doi.org/10.1196/annals.1376.013>.

Hall, M. et al. (2021) 'Positive relationships with adults and resilience to suicide attempt among New Mexico Hispanic adolescents', *International Journal of Environmental Research and Public Health*, 18(19). Available at: <https://doi.org/https://doi.org/10.3390/ijerph181910430>.

Hann, D., Winter, K. and Jacobsen, P. (1999) 'Measurement of depressive symptoms in cancer patients. Evaluation of the Center for Epidemiological Studies Depression Scale (CES-D)', *Journal of Psychosomatic Research*, 46(5), pp. 437–443. Available at: [https://doi.org/https://doi.org/10.1016/S0022-3999\(99\)00004-5](https://doi.org/https://doi.org/10.1016/S0022-3999(99)00004-5).

Hornor, G. (2017) 'Resilience', *Journal of Pediatric Health Care*, 31(3), pp. 384–390. Available at: <https://doi.org/10.1016/j.pedhc.2016.09.005>.

Houpy, J.C. et al. (2017) 'Medical student resilience and stressful clinical events during clinical training.', *Medical education online*, 22(1). Available at: <https://doi.org/10.1080/10872981.2017.1320187>.

Hughes, K. et al. (2017) 'The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis', *The Lancet Public Health*, 2(8), pp. e356–e366. Available at: [https://doi.org/10.1016/S2468-2667\(17\)30118-4](https://doi.org/10.1016/S2468-2667(17)30118-4).

Irusen, H. *et al.* (2021) 'COVID-19 related anxiety in men with localized prostate cancer at tertiary hospitals in the Cape Town, South Africa', *Cancer control : journal of the Moffitt Cancer Center*, 28, pp. 1–6. Available at: <https://doi.org/10.1177/10732748211024239>.

Jakobsen, J.C. *et al.* (2017) 'When and how should multiple imputation be used for handling missing data in randomised clinical trials - A practical guide with flowcharts', *BMC Medical Research Methodology*, 17(1), pp. 162–172. Available at: <https://doi.org/10.1186/s12874-017-0442-1>.

Jewkes, R.K. *et al.* (2010) 'Associations between childhood adversity and depression, substance abuse and HIV and HSV2 incident infections in rural South African youth', *Child Abuse & Neglect*, 34(11), pp. 833–841. Available at: <https://doi.org/https://doi.org/10.1016/j.chiabu.2010.05.002>.

Jongen, C. *et al.* (2019) 'Instruments for Measuring the Resilience of Indigenous Adolescents: An Exploratory Review.', *Frontiers in public health*, 7, pp. 194–208. Available at: <https://doi.org/10.3389/fpubh.2019.00194>.

Jørgensen, I.E. and Seedat, S. (2008) 'Factor structure of the Connor-Davidson resilience scale in South African adolescents', *International journal of adolescent medicine and health*, 20(1), pp. 23–32. Available at: <https://doi.org/10.1515/IJAMH.2008.20.1.23>.

Kahn, K. *et al.* (2012) 'Profile: Agincourt health and socio-demographic surveillance system', *International Journal of Epidemiology*, 41(4), pp. 988–1001. Available at: <https://doi.org/10.1093/ije/dys115>.

Karatzias, T. *et al.* (2017) 'Depression and resilience mediate the relationship between traumatic life events and ill physical health: results from a population study', *Psychology, Health & Medicine*, 22(9), pp. 1021–1031. Available at: <https://doi.org/10.1080/13548506.2016.1257814>.

Kidman, R. *et al.* (2018) 'Childhood adversity increases the risk of onward transmission from perinatal HIV-infected adolescents and youth in South Africa', *Child Abuse & Neglect*, 79, pp. 98–106. Available at: <https://doi.org/10.1016/j.chiabu.2018.01.028>.

Kimani-Murage, E.W. *et al.* (2011) 'Nutritional status and HIV in rural South African children', *BMC Pediatrics*, 11. Available at: <https://doi.org/10.1186/1471-2431-11-23>.

Kobayashi, L.C. *et al.* (2020) 'Adverse childhood experiences and domain-specific cognitive function in a population-based study of older adults in rural South Africa', *Psychology and Aging*, 35(6), pp. 818–830. Available at: <https://doi.org/10.1037/pag0000552>.Adverse.

Kuo, C. *et al.* (2019) 'Resilience and psychosocial outcomes among South African adolescents affected by HIV', *AIDS*, 33, pp. S29–S34. Available at: <https://doi.org/10.1097/QAD.0000000000002177>.Resilience.

Lee, K.J. *et al.* (2021) 'Framework for the treatment and reporting of missing data in observational studies: The Treatment And Reporting of Missing data in Observational Studies framework', *Journal of Clinical Epidemiology*, 134(14), pp. 79–88. Available at: <https://doi.org/10.1016/j.jclinepi.2021.01.008>.

Lee, T.S. *et al.* (2021) 'Resilience as a mediator of interpersonal relationships and depressive symptoms amongst 10th to 12th grade students', *Journal of Affective Disorders*, 278, pp. 107–113. Available at: <https://doi.org/10.1016/j.jad.2020.09.033>.

Lemma, S. *et al.* (2012) 'Sleep quality and its psychological correlates among university students in Ethiopia: A cross-sectional study', *BMC Psychiatry*, 12(1), pp. 237–244. Available at: <https://doi.org/10.1186/1471-244X-12-237>.

Leussis, M.P. and Andersen, S.L. (2008) 'Is adolescence a sensitive period for depression? Behavioral and neuroanatomical findings from a social stress model', *Synapse*, 62(1), pp. 22–30. Available at: <https://doi.org/10.1002/syn.20462>.

Luthar, S.S. and Cicchetti, D. (2000) 'The construct of resilience: Implications for interventions and social policies', *Development and Psychopathology*, 12(4), pp. 857–885. Available at: <https://doi.org/10.1017/S0954579400004156>.

Luthar, S.S. and Zelazo, L.B. (2003) 'Research on resilience: An integrative review', in S.S. Luthar (ed.) *Resilience and vulnerability: Adaptation in the context of childhood adversities*. Cambridge University Press, pp. 510–550. Available at: <https://doi.org/DOI:10.1017/CBO9780511615788.023>.

Maccallum, R.C. *et al.* (2002) 'On the Practice of Dichotomization of Quantitative

Variables', 7(1), pp. 19–40. Available at: <https://doi.org/10.1037//1082-989X.7.1.19>.

Macía, P. *et al.* (2022) 'Role of resilience and emotional control in relation to mental health in people with cancer', *Journal of Health Psychology*, 27(1), pp. 211–222. Available at: <https://doi.org/10.1177/1359105320946358>.

Madley-Dowd, P. *et al.* (2019) 'The proportion of missing data should not be used to guide decisions on multiple imputation', *Journal of Clinical Epidemiology*, 110, pp. 63–73. Available at: <https://doi.org/10.1016/j.jclinepi.2019.02.016>.

Mahedy, L. *et al.* (2018) 'Resilience in high-risk adolescents of mothers with recurrent depressive disorder: The contribution of fathers', *Journal of Adolescence*, 65(1), pp. 207–218. Available at: <https://doi.org/10.1016/j.adolescence.2018.03.016>.

Mahmoud, N.N. and Rothenberger, D. (2019) 'From burnout to well-Being: A focus on resilience', *Clinics in Colon and Rectal Surgery*, 32(6), pp. 415–423. Available at: <https://doi.org/10.1055/s-0039-1692710>.

Makhubela, M. (2022) 'Assessing psychological stress in South African university students: Measurement validity of the perceived stress scale (PSS-10) in diverse populations', *Current Psychology*, 41(5), pp. 2802–2809. Available at: <https://doi.org/10.1007/s12144-020-00784-3>.

Manzar, M.D. *et al.* (2021) 'Psychometric properties of the Generalized Anxiety Disorder-7 Scale in Ethiopian university students', *Bulletin of the Menninger Clinic*, 85(4), pp. 405–427. Available at: <https://doi.org/10.1521/BUMC.2021.85.4.405>.

Masten, A.S. (2001) 'Ordinary magic. Resilience processes in development', *American Psychologist*, 56(3), pp. 227–238. Available at: <https://doi.org/10.1037//0003-066X.56.3.227>.

Masten, A.S. and Barnes, A.J. (2018) 'Resilience in children: Developmental perspectives', *Children*, 5(7), pp. 98–114. Available at: <https://doi.org/10.3390/children5070098>.

Masten, A.S., Best, K.M. and Garmezy, N. (1990) 'Resilience and development: Contributions from the study of children who overcome adversity', *Development and Psychopathology*, 2(4), pp. 425–444. Available at: <https://doi.org/DOI:https://doi.org/10.1017/S0954579400005812>.

Mc Gee, S.L. *et al.* (2020) “ ‘ Some call it resilience ’: A profile of dynamic resilience-related factors in older adult survivors of childhood institutional adversity and maltreatment’, *Child Abuse & Neglect*, 107, pp. 104565–104591. Available at: <https://doi.org/10.1016/j.chiabu.2020.104565>.

McAllister, M. and McKinnon, J. (2009) ‘The importance of teaching and learning resilience in the health disciplines: A critical review of the literature’, *Nurse Education Today*, 29(4), pp. 371–379. Available at: <https://doi.org/10.1016/j.nedt.2008.10.011>.

Mthiyane, N. *et al.* (2021) ‘Common mental disorders and HIV status in the context of DREAMS among adolescent girls and young women in rural KwaZulu-Natal, South Africa’, *BMC Public Health*, 21(1), pp. 478–490. Available at: <https://doi.org/10.1186/s12889-021-10527-z>.

Nel, K.A. *et al.* (2015) ‘A comparison of responses on the Becks Depression Inventory-11 (BDI 11) amongst the Pedi, Tsonga and Venda cultures of Limpopo Province, South Africa: indigenous knowledge system in health care’, *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD)*, 21, pp. 279–290. Available at: <http://reference.sabinet.co.za/document/EJC183634>.

Oken, B.S., Chamine, I. and Wakeland, W. (2015) ‘A systems approach to stress, stressors and resilience in humans’, *Behavioural brain research*, 282, pp. 144–154. Available at: <https://doi.org/10.1016/j.bbr.2014.12.047>.

Olajubu, A.O. *et al.* (2021) ‘Stress and resilience among pregnant teenagers in Ile-Ife, Nigeria’, *European Journal of Midwifery*, 5(9). Available at: <https://doi.org/10.18332/ejm/134181>.

Ollmann, T.M. *et al.* (2021) ‘The interaction of 5 - HTT variation , recent stress , and resilience on current anxiety levels in adolescents and young adults from the general population’, *Depression and Anxiety*, 38(3), pp. 318–327. Available at: <https://doi.org/10.1002/da.23101>.

Parviniannasab, A.M. *et al.* (2020) ‘Haemophiliac adolescents’ perspectives of resilience: A qualitative study based on the resilience in illness model’, *Clinical Child Psychology and Psychiatry*, 25(2), pp. 346–358. Available at: <https://doi.org/10.1177/1359104519890905>.

Parviniannasab, A.M. *et al.* (2021) 'The relationship between coping strategies and resilience among adolescents with beta - thalassemia major', *Journal of child and adolescent psychiatric nursing*, 34(4), pp. 329–334. Available at: <https://doi.org/10.1111/jcap.12339>.

Perry, B.D. (2001) 'The neurodevelopmental impact of violence in childhood', in D. Schetky and E. Benedek (eds) *Textbook of child and adolescent forensic psychiatry*. Washington DC: American Psychiatric Press, pp. 221–238. Available at: https://www.researchgate.net/publication/253039874_The_Neurodevelopmental_Impact_of_Violence_in_Childhood.

Pines, E.W. *et al.* (2012) 'Stress resiliency, psychological empowerment and conflict management styles among baccalaureate nursing students', *Journal of Advanced Nursing*, 68(7), pp. 1482–1493. Available at: <https://doi.org/10.1111/j.1365-2648.2011.05875.x>.

Radloff, L.S. (1977) 'The CED-D scale: A self-report depression scale for research in the general population', *Applied Psychological Measurement*, 1(3), pp. 385–401. Available at: <https://doi.org/https://doi.org/10.1177/014662167700100306>.

Rakhshani, A. and Furr, R.M. (2021) 'The reciprocal impacts of adversity and personality traits: A prospective longitudinal study of growth, change, and the power of personality', *Journal of personality*, 89(1), pp. 50–67. Available at: <https://doi.org/10.1111/jopy.12541>.The.

Ran, H. *et al.* (2020) 'Resilience mediates the association between school bullying victimization and self-harm in Chinese adolescents', *Journal of Affective Disorders*, 277, pp. 115–120. Available at: <https://doi.org/10.1016/j.jad.2020.07.136>.

Resseguier, N. *et al.* (2013) 'Dealing with missing data in the Center for Epidemiologic Studies Depression self-report scale: A study based on the French E3N cohort', *BMC Medical Research Methodology*, 13(1), pp. 28–39. Available at: <https://doi.org/10.1186/1471-2288-13-28>.

Rubin, D.B. (1976) 'Inference and missing data', *Biometrika*, pp. 581–592. Available at: <https://doi.org/10.1093/biomet/63.3.581>.

Rutter, M. (2006) 'Implications of resilience concepts for scientific understanding',

Annals of New York Academy of Sciences, 1094(1), pp. 1–12. Available at:
<https://doi.org/https://doi.org/10.1196/annals.1376.002>.

Rutter, M. (2012) 'Resilience as a dynamic concept', *Development and Psychopathology*, 24(2), pp. 335–344. Available at:
<https://doi.org/10.1017/S0954579412000028>.

Rutter, M. (2013) 'Annual Research Review : Resilience – clinical implications', *Journal of Child Psychology and Psychiatry*, 54(4), pp. 474–487. Available at:
<https://doi.org/10.1111/j.1469-7610.2012.02615.x>.

Sahu, M. et al. (2019) 'Perceived stress and resilience and their relation with the use of the mobile phone among nursing students', *Investigacion y Educacion en Enfermeria*, 37(3), pp. e05-e14. Available at:
<https://doi.org/10.17533/UDEA.IEE.V37N3E05>.

Samodien, E. et al. (2021) 'Non-communicable diseases - A catastrophe for South Africa', *South African Journal of Science*, 117(5/6). Available at:
<https://doi.org/10.17159/SAJS.2021/8638>.

Schroeder, K. et al. (2021) 'The association between adverse childhood experiences and childhood obesity: A systematic review', *Obesity Reviews*, 22(6). Available at:
<https://doi.org/10.1111/obr.13204>.

Sharer, M. et al. (2016) 'The power of siblings and caregivers: Under-explored types of social support among children affected by HIV and AIDS', *AIDS Care*, 28, pp. 110–117. Available at: <https://doi.org/10.1080/09540121.2016.1178942>.

Shatté, A. et al. (2017) 'The positive effect of resilience on stress and business outcomes in difficult work environments.', *Journal of occupational and environmental medicine*, 59(2), pp. 135–140. Available at:
<https://doi.org/10.1097/JOM.0000000000000914>.

Shatté, A.J. (2012) 'Resilience in work and in life', in V. Pulla, A. Shatte', and S. Warren (eds) *Perspectives on Coping, Resilience*. New Delhi: Authors Press Books, pp. 444–479.

Shenderovich, Y. et al. (2021) 'Relationships with caregivers and mental health outcomes among adolescents living with HIV: A prospective cohort study in South

Africa', *BMC Public Health*, 21(1), pp. 172–183. Available at:
<https://doi.org/10.1186/s12889-020-10147-z>.

Shilubane, H.N. *et al.* (2014) 'Psychosocial correlates of suicidal ideation in rural South African adolescents', *Child psychiatry and human development*, 45(2), pp. 153–162. Available at: <https://doi.org/10.1007/s10578-013-0387-5>.

Soleimanpour, S., Geierstanger, S. and Brindis, C.D. (2017) 'Adverse Childhood Experiences and Resilience: Addressing the Unique Needs of Adolescents', *Academic Pediatrics*, 17(7), pp. S108–S114. Available at:
<https://doi.org/10.1016/j.acap.2017.01.008>.

Stein, D.J. *et al.* (2010) 'Early childhood adversity and later hypertension: Data from the World Mental Health Survey', *Annals of Clinical Psychiatry*, 22(1), pp. 19–28.

Tankersley, A.P. *et al.* (2021) 'Risk and resilience factors for mental health among transgender and gender nonconforming (TGNC) youth: A systematic review', *Clinical Child and Family Psychology Review*, 24(2), pp. 183–206. Available at:
<https://doi.org/10.1007/s10567-021-00344-6>.

Taylor, S.E. (2010) 'Mechanisms linking early life stress to adult health outcomes', *Proceedings of the National Academy of Sciences of the United States of America*, 107(19), pp. 8507–8512. Available at: <https://doi.org/10.1073/pnas.1003890107>.

Teshome, A. *et al.* (2021) 'Perceived stress and associated factors among health care professionals working in the context of COVID-19 pandemic in public health institutions of southern Ethiopia 2020', *PLoS ONE*, 16(6), p. e0252809. Available at:
<https://doi.org/10.1371/journal.pone.0252809>.

Theron, L. (2020) 'Resilience of sub-Saharan children and adolescents: A scoping review', *Transcultural Psychiatry* [Preprint]. Available at:
<https://doi.org/10.1177/1363461520938916>.

Theron, L. *et al.* (2022) 'Adolescent Mental Health Resilience and Combinations of Caregiver Monitoring and Warmth : A Person-centred Perspective', *Journal of Child and Family Studies*, 31(10), pp. 2860–2870. Available at:
<https://doi.org/10.1007/s10826-022-02287-0>.

Theron, L., Ungar, M. and Jan, H. (2022) 'Pathways of resilience : Predicting school

engagement trajectories for South African adolescents living in a stressed environment', *Contemporary Educational Psychology*, 69(2). Available at: <https://doi.org/10.1016/j.cedpsych.2022.102062>.

Varma, P. *et al.* (2021) 'Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: A global cross-sectional survey', *Progress in neuro-psychopharmacology & biological psychiatry*, 109(3), pp. 110236–110244. Available at: <https://doi.org/DOI:10.1016/j.pnpbp.2020.110236>.

Vergunst, R. (2018) 'From global-to-local: rural mental health in South Africa', *Global Health Action*, 11(1). Available at: <https://doi.org/10.1080/16549716.2017.1413916>.

Walsh, P. *et al.* (2020) 'Learning and teaching approaches promoting resilience in student nurses: An integrated review of the literature', *Nurse Education in Practice*, 45(2), pp. 102748–102760. Available at: <https://doi.org/10.1016/j.nepr.2020.102748>.

Werner, E.E. and Smith, R.S. (1982) *Vulnerable but invincible: A study of resilient children*. New York: McGraw-Hill.

Wilks, S.E. and Croom, B. (2008) 'Perceived stress and resilience in Alzheimer's disease caregivers: Testing moderation and mediation models of social support', *Aging and Mental Health*, 12(3), pp. 357–365. Available at: <https://doi.org/10.1080/13607860801933323>.

Windle, G. (2011) 'What is resilience? A review and concept analysis', *Reviews in Clinical Gerontology*, 21(2), pp. 152–169. Available at: <https://doi.org/10.1017/S0959259810000420>.

World Health Organization (2021) *Hypertension*. Available at: <https://www.who.int/news-room/fact-sheets/detail/hypertension> (Accessed: 11 October 2022).

Wright, M.O., Masten, A.S. and Narayan, A.J. (2013) 'Resilience Processes in Development: Four Waves of Research on Positive Adaptation in the Context of Adversity', in S. Goldstein and R. Brooke (eds) *Handbook of Resilience in Children*. Bostons, MA: Springer, pp. 15–37. Available at: https://doi.org/10.1007/978-1-4614-3661-4_2.

Ye, Z. *et al.* (2020) 'Resilience , Social Support , and Coping as Mediators between

COVID-19-related Stressful Experiences and Acute Stress Disorder among College Students in China', *Applied Psychology: Health and Well-Being*, 12(4), pp. 1074–1094. Available at: <https://doi.org/10.1111/aphw.12211>.

Zhou, J. et al. (2021) 'The prevalence and correlative factors of depression among Chinese teachers during the COVID-19 outbreak', *Frontiers in Psychiatry*, 12. Available at: <https://doi.org/10.3389/fpsyt.2021.644276>.

Zwack, J. and Schweitzer, J. (2013) 'If Every Fifth Physician Is Affected by Burnout, What About the Other Four? Resilience Strategies of Experienced Physicians', *Academic Medicine : Journal of the Association of American Medical Colleges*, 88(3), pp. 382–389. Available at: <https://doi.org/doi: 10.1097/ACM.0b013e318281696b>.

7 Appendices

7.1 Appendix 1: Plagiarism Declaration



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I MICHELLE SNIJDER (Student number: 1617903) am a student registered for the degree of MSc EPIDEMIOLOGY & BIostatISTICS in the academic year 2023.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: 

Date: 01 JUNE 2023

7.2 Appendix 2: Ethical Clearance Certificate

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG



R14/49 Miss Michelle Snijder

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220671 MED22-04-090

NAME: Miss Michelle Snijder
(Principal Investigator)
DEPARTMENT: School of Public Health
Epidemiology and Biostatistics

PROJECT TITLE: Predictors of resilience among adolescents living in rural
Mpumalanga in 2018: A cross sectional study

DATE CONSIDERED: 26/06/2022

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Prof Xavier Gomez-Olive and Dr Sumaya Mall

APPROVED BY: 
Dr C Penny, Chairperson, HREC (Medical)

DATE OF APPROVAL: 27/07/2022

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Philip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed June and will therefore be due in the month of June each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

7.3 Appendix 3: Comparison of participants with at least one missing response and those with no missing responses by interpersonal relationship variables

Variable	Response Status [n (%)]		P-value
	Incomplete (n=112)	Complete (n=133)	
Relationship with parent			
Understood by parents			
Never	7 (77.8)	2 (22.2)	<0.001
Seldom	9 (42.9)	12 (57.1)	
Sometimes	13 (32.5)	27 (67.5)	
Often	14 (22.6)	48 (77.4)	
Always	69 (61.1)	44 (38.9)	
Loved by parents			
Never	2 (66.7)	1 (33.3)	0.447
Seldom	2 (28.6)	5 (71.4)	
Sometimes	8 (44.4)	10 (55.6)	
Often	17 (36.2)	30 (63.8)	
Always	83 (48.8)	87 (51.2)	
Enough time from parents			
Never	10 (41.7)	14 (58.3)	<0.001
Seldom	7 (24.1)	22 (75.9)	
Sometimes	13 (39.4)	20 (60.6)	
Often	14 (29.8)	33 (70.2)	
Always	68 (60.7)	44 (39.3)	
Treated fairly by parent(s)			
Never	4 (80.0)	1 (20.0)	0.387
Seldom	3 (60.0)	2 (40.0)	
Sometimes	10 (47.6)	11 (52.4)	
Often	20 (37.7)	33 (62.3)	
Always	75 (46.6)	86 (53.4)	
Talk to parent(s)			
Never	10 (38.5)	16 (61.5)	0.001
Seldom	7 (35.0)	13 (65.0)	
Sometimes	11 (28.2)	28 (71.8)	
Often	18 (34.6)	34 (65.4)	
Always	66 (61.1)	42 (38.9)	
Argue with father			
Never	92 (43.6)	119 (56.4)	0.495
Seldom	12 (63.2)	7 (36.8)	
Sometimes	3 (50.0)	3 (50.0)	
Often	3 (50.0)	3 (50.0)	
Always	2 (66.7)	1 (33.3)	
Argue with mother			
Never	72 (44.4)	90 (55.6)	0.112
Seldom	18 (40.9)	26 (59.1)	
Sometimes	9 (50.0)	9 (50.0)	
Often	5 (41.7)	7 (58.3)	
Always	8 (88.9)	1 (11.1)	

Share feelings with mother			
Never	91 (41.6)	128 (58.5)	0.001
Seldom	5 (71.4)	2 (28.6)	
Sometimes	1 (50.0)	1 (50.0)	
Often	6 (85.7)	1 (14.3)	
Always	9 (90.0)	1 (10.0)	
Share feelings with father			
Never	70 (44.3)	88 (55.7)	0.057
Seldom	7 (25.9)	20 (74.1)	
Sometimes	12 (54.6)	10 (45.5)	
Often	9 (52.9)	8 (47.1)	
Always	14 (66.7)	7 (33.3)	
Relationship with friends			
Meet with friends			
Never	7 (58.3)	5 (41.7)	<0.001
Seldom	7 (35.0)	13 (65.0)	
Sometimes	8 (29.6)	19 (70.4)	
Often	18 (26.5)	50 (73.5)	
Always	72 (61.0)	46 (39.0)	
Fun with friends			
Never	5 (50.0)	5 (50.0)	<0.001
Seldom	8 (57.1)	6 (42.9)	
Sometimes	6 (30.0)	14 (70.0)	
Often	19 (25.0)	57 (75.0)	
Always	74 (59.2)	51 (40.8)	
Talk with friends			
Never	15 (38.5)	24 (61.5)	<0.001
Seldom	18 (24.7)	55 (75.3)	
Sometimes	16 (42.1)	22 (57.9)	
Often	9 (40.9)	13 (59.1)	
Always	54 (74.0)	19 (26.0)	
Friends helping each other			
Never	9 (47.4)	10 (52.6)	<0.001
Seldom	8 (22.2)	28 (77.8)	
Sometimes	9 (18.8)	39 (81.3)	
Often	15 (39.5)	23 (60.5)	
Always	71 (68.3)	33 (31.7)	
Get friend support			
Never	12 (54.6)	10 (45.5)	<0.001
Seldom	13 (25.0)	39 (75.0)	
Sometimes	13 (27.7)	34 (72.3)	
Often	12 (33.3)	24 (66.7)	
Always	62 (70.5)	26 (29.6)	

Bullied				
Been bullied				
Never	86 (47.3)	96 (52.8)	0.208	
Seldom	14 (41.2)	20 (58.8)		
Sometimes	4 (25.0)	12 (75.0)		
Often	6 (54.6)	5 (45.5)		
Always	2 (100.0)	0 (0.0)		
Bully others				
Never	95 (45.5)	114 (54.6)	0.369	
Seldom	6 (37.5)	10 (62.5)		
Sometimes	4 (36.4)	7 (63.6)		
Often	3 (75.0)	1 (25.0)		
Always	4 (80.0)	1 (20.0)		
Been bullied on internet				
Never	105 (46.3)	122 (53.7)	0.739	
Seldom	2 (50.0)	2 (50.0)		
Sometimes	3 (33.3)	6 (66.7)		
Often	1 (25.0)	3 (75.0)		
Always	1 (100.0)	0 (0.0)		

7.4 Appendix 4: Logistic regression of factors associated with high resilience among adolescents in rural Mpumalanga, complete case analysis

High Resilience	Odds ratio	Standard errors	95% Confidence interval	P-value
Depression Status				
Depression				
Yes	1.45	0.70	0.56 – 3.72	0.441
No	1			
Relationship with friends				
Meet with friends				
Never	1			
Seldom	0.26	0.31	0.02 - 2.76	0.263
Sometimes	0.11	0.13	0.01 - 1.09	0.059
Often	0.22	0.24	0.03 - 1.84	0.163
Always	0.84	0.90	0.10 - 6.92	0.871
Living arrangements indicators				
Village				
1	1			
2	0.81	0.73	0.14 - 4.72	0.812
3	5.26	2.99	1.73 - 16.01	0.004
4	2.86	1.97	0.74 - 11.00	0.127

7.5 Appendix 5: Turnitin Report

