

https://dspace.org/

Effectiveness of Training Programmes for and Assessment of Quality of Care Provided by Community Health Workers Undertaking Comprehensive Care in Low- and Middle-Income Countries

Babalola, Olukemi

2025
University of the Witwatersrand, Johannesburg
https://hdl.handle.net/10539/50017
Babalola, Olukemi. (2025). Effectiveness of Training Programmes for and Assessment of Quality of Care Provided by Community Health Workers Undertaking Comprehensive Care in Low- and Middle-Income Countries [PhD thesis, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/50017

Downloaded from a DSpace repository. https://dspace.org/

EFFECTIVENESS OF TRAINING PROGRAMMES FOR AND ASSESSMENT OF QUALITY OF CARE PROVIDED BY COMMUNITY HEALTH WORKERS UNDERTAKING COMPREHENSIVE CARE IN LOW- AND MIDDLE-INCOME COUNTRIES

Candidate

Olukemi Babalola

STUDENT NUMBER: 669557

Supervisors

Prof Frances Griffiths and Prof Jane Goudge

Original published work

submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy

September 2025

DECLARATION

I, **Olukemi Babalola**, declare that this thesis is my own unaided work. It is being submitted in fulfilment of the degree of Doctor of Philosophy to the School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg. This work has not been submitted previously for any degree or examination at this or any other university.

I am aware that plagiarism is wrong, and I confirm that this thesis is my own unaided work except where I have explicitly indicated otherwise. I have read the sections on referencing and plagiarism in the Wits Plagiarism Policy. 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, including suspension or permanent expulsion, 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.



Student signature

Date of submission

30 September 2025

DEDICATION

With great pride and joy and total gratitude to my Lord and Saviour Jesus Christ, I hereby dedicate this work to the two people who have inspired me the most, Late Chief Jacob Taiwo Israel Babatola (JP). You had so much conviction that I could do this even when I had no such faith in myself. Your faith in me has outlived you!

And to you Mr Ayokunle Babalola, for inspiring me to strive to be better than myself with the way you pursue your goals with such total vigour and doggedness. I am very proud to be your mom.

ACKNOWLEDGEMENTS

I acknowledge and deeply appreciate the collective support and contributions of the following individuals and groups without whom this work would not have been possible.

Prof Jane Goudge invited me to join the Centre for Health Policy (CHP), School of Public Health and along with Prof Frances Griffiths nudged and encouraged my enrolling for a PhD when I was fast giving up on this dream that I held for years. They both facilitated the MRC UK and SARChi funding, which partly funded my study. I am profoundly thankful to both Profs Jane Goudge and Frances Griffiths for being my supervisors and mentors, and for providing me with timeous comments, insightful feedbacks and unwavering and encouraging support that went far beyond supervisor-supervisee relationships. You shared your expertise and networks and encouraged me to showcase my uniqueness, and these have shaped my work and outputs. I am grateful that this journey has been with you both and that this collaboration has continued; I still have much to learn from both of you. Among important networks you introduced me to, I also acknowledge Prof Celia Brown (University of Warwick, UK). Celia never ceases to amaze me how she always responds so cheerfully and ever promptly to every request for support and review. Even though you were not my supervisor, you spent hours using your vast wealth of experience to coach and mentor me. Thank you for your friendship and poems. They always bring a smile when the drudgery of PhD makes going difficult.

To Prof Jonathan Levin, you refused to be my supervisor but performed this function and more. Thank you for always making time whenever I needed help or a second eye to ensure my analysis was on-point. In particular, I appreciate your humility. You always say thank you for my being so understanding when your horrendously busy world meant we had to reschedule. My thanks also go to Prof Laetitia Rispel who is my ‘unofficial supervisor’. I am grateful for the time you took to follow-up with me on my progress whenever we happen to meet, and for giving me the opportunity to ask about your progress with your book in return. Glad you got it sorted! Dr Duane Blaauw, for his thoroughness and exceptional meticulosity. You drilled these very wonderful traits in me. Thanks for your very exceptional patience for my many writing retreats away from work that you gladly released me to attend, to ensure as you would always say, “you should have graduated 2 years ago”. I also thank you Duane for all the wonderful years of

working together on the SOPRIMA project. To the PhD administrative team, Prof Kathleen Kahn, Prof Jude Igumbor, Dr Tafadzwa Makonese and Mr Paul Bohloko, for such incredible and clear commitment to advancing knowledge and providing support to ensure we actually do graduate. I am so indebted to you collectively and independently. . Finally, I sincerely thank and acknowledge the Head of School, Prof Tobias Chirwa for your encouraging support and very exemplary leadership. In particular, I felt particularly honoured and very pleasantly surprised that you visited my office in person to commiserate with me when my dear brother Mr Tosin Babatola passed. Thank you so much for all that you have been doing to steer the ship of the school so well.

To my colleagues, for their collaborative spirit and for fostering a supportive academic environment, for acting as sounding boards, for sharing your knowledge and friendships and for the opportunities to run projects together, co-teach and co-supervise. Dr Prudence Ditlopo demystified how to approach the writing of a protocol with me during my very first attempt, with Dr Nonhlanhla Nxumalo, I have acquired invaluable learnings through our co-supervisions of Master of Public Health students. My co-PhD colleagues and post-docs both within and without CHP, and many other colleagues who enriched my PhD journey.

To my family, especially the highfliers of Jesus Christ in our home, Sistamo, Tbabs, Kunsle, Belle and Tess, and God's representative in my life, my friend/hubby, Omoniyi mi, for being there so continuously and unconditionally, for loving me despite me, for accepting my incessant absence in the course of this journey, particularly for moving out of our bedroom. I love you hubby and Super achievers to the moon and back. To my parents, thank you for your determination to believe in education when you brought us up in an environment where schooling was not the common norm. My mom, for agreeing to spend time with me by traveling to South Africa in your 90s and being so independent, despite your age. You are so inspiring. To my siblings both late and resting in the Lord (Folorunso and Tosin Babatola), I so miss you both even though I really do not remember Folorunsho, my mom's pain set the pace for remembering. And alive, my brother, Segun Babatola, this PhD is part of my gifts for your 70th birthday in August, thank you for your faith, confidence and believe in my abilities. To my older sisters, (Bunmi and Funmilayo), and younger (Foluso, the Ikanrede of the Babatola family), as well as your spouses and children. I am grateful for how you have stood by me knowing I am just

peculiarly different and yet loving me and believing in me all the same. I love you all back in a big way.

I cannot but thank Prof Emmanuel Ojo and his family, Prof Nicola Christofides, Prof and Dr Nyasulu, for their kind support, for being my friends, and as I always say, you are the ones who supported my South Africa relocation journey. To my friends in missions, Mr and Mrs Roland Omodia, Mr and Dr Odubade, Dr and Mrs Odetoyinbo and Dr Gbonju Adeyemo, for the prayers, encouragement, being burden bearers and for constant checking up. You were part of this journey. I so appreciate you all.

I am deeply indebted to all the study participants, the team leaders, facility managers and district officials, without whom this study would have been impossible as well as for their willingness to generously contribute their time and experiences. By opening up yourself to daily observations and for providing insights on what you do or are expected to do, you contributed immensely to the success of this study. I sincerely appreciate you for this depth of involvement. Also, to Sedibeng Health District and Tshwane Health District in Gauteng Province and Ehlanzeni Health District in Mpumalanga Province, for permitting me to conduct this study.

PRESENTATIONS ARISING FROM THIS THESIS

1. **Babalola O,** Goudge J, Levin J, Brown C, Griffiths F. Assessing the utility of a quality-of-care assessment tool used to assess comprehensive care services provided by community health workers in South Africa. The Wits School of Public Health Biennial Research Day, 8th and 9th of September 2021 (poster presentation)

2. **Babalola O,** Levin J, Goudge J, Brown C, Griffiths F. Use of a quality-of-care assessment tool for determining community health workers' quality-of-care scores and associated factors: A cross-sectional observational study in South Africa. 2022 conference of the Public Health Association of South Africa (PHASA), Durban (eThekwini), South Africa; 11 – 14 September 2022 (oral presentation)

3. **Babalola O,** Brown C, Goudge J, Babalola J, Natasha Khamisa, Johnson S, Griffiths F. Effectiveness of existing national or large-scale CHW training programmes for comprehensive care in low- and middle-income countries: A systematic review. The Wits School of Public Health Research Day and CARTA Conference, 14th and 15th of September 2023 (oral presentation).

4. **Babalola O,** Goudge J, Levin J, Brown C, Griffiths F. Assessing the utility of a quality-of-care assessment tool used in assessing comprehensive care services provided by community health workers in South Africa, in 2020. 3rd International Conference on Public Health in Africa (CPHIA 2023), Mulungushi International Conference Centre, Lusaka, Zambia; 27-30 November 2023 "Breaking Barriers: Repositioning Africa in the Global Health Architecture" (oral presentation)

   Babalola O, Brown C, Goudge J, Babalola J, Natasha Khamisa, Johnson S, Griffiths F. Effectiveness of existing national or large-scale CHW training programmes for comprehensive care in low- and middle-income countries: A systematic review. 2025 conference of the Public Health Association of South Africa (PHASA), Western Cape: Goudini Spa; 6 – 9 April 2025 (poster presentation)

PUBLICATIONS ARISING FROM THIS PHD STUDY

This PhD thesis is based on four original research articles, for which as the lead author, I contributed the conceptualisation, data collection, cleaning, management, coding and analysis. I personally performed the write-up of the findings reported in each article. The citations for these articles are as follows:

1. **Babalola O,** Brown C, Goudge J, Babalola J, Natasha Khamisa, Johnson S, Griffiths F. Effectiveness of existing national or large-scale CHW training programmes for comprehensive care in low- and middle-income countries: A systematic review (Submitted to Plos One)

2. **Babalola O,** Brown C, Goudge J, Babalola J, Johnson S, Griffiths F. Assessment tools and their utility for evaluating experience and outcomes of community health care worker training for comprehensive care in low- and middle-income countries: A systematic review of the evidence (In draft)

3. **Babalola O,** Goudge J, Levin J, Brown C, Griffiths F. Assessing the utility of a quality-of-care assessment tool used in assessing comprehensive care services provided by community health workers in South Africa. Front Public Health 2022;10:868252. https://doi.org/10.3389/fpubh.2022.868252

4. **Babalola O,** Levin J, Goudge J, Griffiths F. Community health workers' quality of comprehensive care: a cross-sectional observational study across three districts in South Africa. Frontiers in Public Health. 2023 Dec 14;11:1180663. https://doi.org/10.3389/fpubh.2023.1180663

Additional publications related to this PhD study

5. Goudge J, de Kadt J, **Babalola O**, Muteba M, Tseng Y, Malatji H, Rwafa T, Nxumalo N, Levin J, Thorogood M, Daviaud E, Watkins J & Griffiths F. Household coverage, quality and costs of care provided by community health worker teams and the determining factors: findings from a mixed methods study in South Africa. *BMJ Open*, 2020;10:e035578. https://doi.org/10.1136/bmjopen-2019-035578

6. Griffiths F, **Babalola O**, Brown C, de Kadt, Malatji H, Thorogood M, Tseng Y, Goudge J. Development of a tool for assessing quality of comprehensive care provided by community health workers in a community-based care programme in South Africa. *BMJ Open*, 2019;9:e030677. https://doi.org/10.1136/bmjopen-2019-030677

7. Goudge J, **Babalola O**, Malatji H, Levin J, Thorogood M, Griffiths F. The effect of a roving nurse mentor on household coverage and quality of care provided by community health worker teams in South Africa: a longitudinal study with a before, after and 6 months post design. BMC Health Service Research 23, 186 (2023). https://doi.org/10.1186/s12913-023-09093-4

FUNDING

During my PhD study, I received the following financial support:

1. Medical Research Foundation. Title "Strengthening supportive supervision to build capacity and trust, ensuring community health workers are an integral part of the health system" (Grant number: MRF-145-0017-DG-GOUD-C0949], Awarded to Professor Jane Goudge. I was a co – Principal Investigator and took the lead on all the grant application, implementation and reporting processes.

2. Medical Research Council UK, Department of International Development (DFID), Economic and Social Research Council (ESRC) and Wellcome Trust under the Joint Health Systems Research Initiative (JHSRI) (Grant number: MR/NO15908) awarded to Professor Jane Goudge.

3. The South African National Research Foundation (NRF) through the South African Research Chair (SARChi) in Health Systems and Policy awarded to the Centre for Health Policy, University of the Witwatersrand, and held by Professor Frances Griffiths (Grant number: 87369).

4. 2018 Early Career Academic Development Programme Award by the Centre for Learning, Teaching and Development (CLTD) and the Wits Research Office, in collaboration with the Wits Transformation and Employment Equity Office in support of the
professional development of early career academics (ECAs).

5. The University of the Witwatersrand Staff Bursary Award for the payment of my tuition throughout the duration of my PhD.

ABSTRACT

Background

The use of community healthcare workers (CHWs) remains a strategy for improving access to healthcare of vulnerable groups particularly in low- and middle-income countries (LMICs). CHWs are often unlicensed, have minimal training in healthcare, and provide community-based services. To maximise their potential, effective and continuous training is essential. However, the range of CHWs activities is increasing towards more comprehensive healthcare services in many countries. These national comprehensive CHW programmes need standards of practice, training and assessment to ensure quality-of-care. The training programmes designed for CHWs within such national programmes, methods of assessing the training programmes, and how training influences the quality of comprehensive care provided by CHWs, need evaluation. This PhD study thus asks: What are the LMIC experiences of assessing CHW training programmes to enable CHW to provide comprehensive care, and how can the resulting quality-of-care provided by trained CHWs within a comprehensive care programme be assessed?

Objectives

The PhD study had three parts and aims. 1) To conduct two related systematic reviews: To identify existing LMIC CHW training programmes for comprehensive care and synthesise evidence on their effectiveness and to synthesise evidence on the tools used to evaluate experience and outcomes of CHW training and the utility of such tools. 2) To assess the utility (i.e. validity and reliability) of one recently designed tool for assessing the quality of CHWs comprehensive care in South Africa. 3) To determine messages/activities scores derived from the proportion of health messages given in the households by CHWs who provide comprehensive care in South Africa, and the associated factors.

Methods

To identify and synthesise evidence on the effectiveness of CHWs training programmes for comprehensive care and assessment methods in LMIC, two related systematic reviews were conducted using a similar search strategy but slightly different screening criteria. The study design applied in the two related systematic reviews included the pre- and post-intervention

study design, prospective observational, randomised controlled trial, and repeat cross-sectional study design. The search strategy was guided by the PICOS (Population, Intervention, Comparison, Outcome and Study design) framework. The search was conducted in three databases (PubMed, CINAHL and Cochrane Review) from 12 September 1978 (Alma Ata) until end 2023. The Kirkpatrick's four hierarchies (Kirkpatrick and Kirkpatrick 2006) was used to provide evidence on the utility of post-training assessment tools.

The empirical works in this PhD study drew on data from a previous intervention study (Batlhokomedi Project) that was conducted over a 3-year period which included the development of a tool (quality-of-care assessment tool) for assessing the quality of comprehensive services provided by CHWs. To assess the utility of the developed tool, this PhD utilised the repeated measure data collected in the previous project by direct observation of CHWs during 18 household visits. Multilevel modelling and Bland Altman plot were performed to estimate inter-rater reliability (IRR) between paired observers' assigned quality-of-care messages and communication scores. Using primary rating data from 21 CHWs and three team leaders in two primary health care facilities per province I determined the agreement index (should be ≥85%, else, revise the tool), including whether the tool covered everything that happens during their household visits (face validity) and whether they were happy to be assessed using the tool (acceptability). For content validity, using a panel of six experts' rating data on 11 items of the tool, the content validity index (CVI) of individual items (I-CVI) or entire scale (S-CVI) was calculated. Then, to determine factors associated with the quality of comprehensive care based on data collected using the validated tool, a measure (messages/activities scores) was derived from the proportion of health messages given or activities provided by 34 randomly-selected CHWs during 376 household visits in three South African districts, using a cross-sectional study design. Multilevel models were fitted to identify associated factors of messages/activities score, adjusted for the clustering of observations within CHWs. The models were adjusted for fieldworkers and study facilities as fixed effects.

Results

On the effectiveness of CHW training, the review included 14 articles from 12 LMICs. Most training packages were on maternal and child health (MCH)-related programmes, now referred to as narrower comprehensive care package. Three studies evaluated trainings on care packages

encompassing health conditions in addition to MCH (now referred to as wider comprehensive care package). From pre-training assessment, scores improved significantly at post-training (from 5.7 to 62.8 percentage points [pp]). Compared to immediate post training, scores decreased significantly 2-12 months after training (from 12.5 and 34.0 pp). Between assessment periods, scores decreased by 10.3 pp for CHW groups with lower (primary) educational background but increased by 1.8 pp for those with higher (secondary) education. Health professional-led training resulted in 10.3 pp increased score while peer CHW-led training showed 1.9 pp decrease.

On the assessment tools and their utility for evaluating experience and outcomes of CHW training, the review included 30 studies from 15 LMICs that have reported any type of tools; however, less than half (n=13, 43.3%) provided any evidence of utility. Majority of the studies were conducted in the Sustainable Development Goals era (2016-2023; n=15, 50%), reported assessment tools on the narrower range of comprehensive care packages (involving maternal and child health-related programmes; n=24, 80%) and across a spectrum of training interventions (initial and/or refresher and/or supportive supervision; 14, 47%). The most commonly used tools were questionnaire-based (including written, self-completed, interviewer administered or tablet-based; n=19) followed by checklists/observation instruments (n=8). IRR (n=9, 69%) was mostly assessed, either singly (n=4) or in combination (e.g., along with face, content validity; n=5). Only one study reported more than two utility types (face/content/construct/IRR/re-test/reproducibility). Of the 13 studies, most (n=12, 92%) used objective measures (i.e., not self-reported) but only one utilised an evaluation model by reporting the Kirkpatrick level of evaluation.

Collectively, the findings show that CHWs programmes in LMICs are performing comprehensive care that can be considered under ‘narrower’ and ‘wider’ scopes, and for these, there is evidence of effectiveness of CHW training programmes mostly on the ‘narrow’ comprehensive care scope related to maternal and child health. For these programmes, tools have been developed to assess the gains of training, mostly structured questionnaires and checklists that are self or interviewer-administered or applied while observing the performance of the CHWs during household visits. However, evidence on the utility of these assessment tools is limited, with no validated tool showing evidence of high-quality utility. Regarding the wider comprehensive care scope, limited evidence of comparable level of effectiveness exists but the

relevance of well-trained and empowered supportive supervision may be more relevant on an ongoing basis. Availability of evidence of use of evaluation models in comprehensive care training programme is limited, based only on the Kirkpatrick's four levels of training evaluation. The quality-of-care assessment tool validated within this study has a high acceptability (agreement index ranged from 88% to 100% in three sites but was 64% in one site), face (agreement index ranged from 88% to 100% in all four sites) and content validity (I-CVI was 95%), and the IRR was substantial for quality-of-care messages (77%) but not for communication score (14%). To determine factors associated with the quality of comprehensive care, data collected using the validated quality-of-care messages component of the tool demonstrated important factors related to the messages provided by, and activities of CHWs, across CHW teams. The messages/activities score increased with each extra 5-minute increase in visit duration (1.5%; 95% confidence interval [CI], 0.5 to 2.5, p=0.003) and marginally for having a household member with HIV (4.8%, p=0.067). However, the messages/activities scores decreased in households with either hypertension (5.1%; 95% CI, 0.2 to 10.0, p<0.040), children/babies (10.1%; 95% CI, 4.0 to 16.2, p=0.001), diabetes (15.5%; 95% CI, 9.9 to 21.2, p<0.001), increasing household size (3.6%; 95% CI, 1.6 to 5.7, p=0.001), increasing number of household conditions (21.7%; 95% CI, 18.2 to 25.1, p<0.001) and members with either TB (13.4%; 95% CI, 3.5 to 23.3, p=0.008) or cough (17.5%; 95% CI, 9.7 to 25.3, p<0.001).

Conclusions

In the current context of task shifting to CHWs, this category of workers with limited training is taking on a much broader remix of work than they were used to including narrower and wider comprehensive care scopes. This study identifies methods and tools, and their utility, to measure effectiveness of training in LMICs, including a tool previously developed but which was validated in this study. The messages component of this tool facilitated the identification of variations in performance of individual CHWs and CHW teams who provide comprehensive care. The tool may be used in summative/formative assessments of CHWs. Such assessments, reflections and discussions with CHW on performance may encourage and support quality of comprehensive healthcare provision. Future studies should explore possible digitisation of the validated tool to facilitate immediate feedback and support of CHWs, peers and supervisors.

Keywords: CHWs, Validation, Training, LMIC, Performance, Quality of care, Assessment tool, Evaluation model, South Africa

TABLE OF CONTENTS

Contents

DECLARATION i
DEDICATION ii
ACKNOWLEDGEMENTS iii
PRESENTATIONS ARISING FROM THIS THESIS vi
PUBLICATIONS ARISING FROM THIS PHD STUDY vii
FUNDING ix
ABSTRACT x
TABLE OF CONTENTS xv
LIST OF TABLES xx
LIST OF FIGURES xxi
LIST OF APPENDIXES xxii
ACRONYMS AND ABBREVIATIONS xxiii
CHAPTER 1: INTRODUCTION 1
1.1. Background 1
1.1.1. Who are the CHWs? 1
1.1.2. CHW programmes in LMICs 2
1.1.3. Assessment of the CHW competency 3
1.1.4. Evaluation models of CHW training programme 4
1.2. Problem statement and justification 4
1.3. Research questions, aims and objectives 6
1.3.1. The PhD study research questions 6
1.3.2. Research aims 6
1.3.3. Specific objectives 6
1.4. Outline of the integrated narrative 9
CHAPTER 2: LITERATURE REVIEW 11
2.1. Introduction 11
2.2. CHW programmes, definitions, nomenclature, classification and roles of CHWs 11
2.2.1. Historical perspective on the CHW programmes 11
2.2.2. CHW definition, types and nomenclature 14
2.2.3. Expanding roles of CHWs 17

2.3. CHW training, supervision and training effectiveness 19
2.3.1. CHW training programme governance and management 19
2.3.2 Types of CHW training 20
2.3.3. Transition from narrow vertical disease to more comprehensive training programmes 21
2.3.4. Integrated training package 23
2.4. CHW competency, performance or quality of care 25
2.4.1. Assessing the competency, performance or quality of care 25
2.4.2. Factors influencing competency, performance or quality of care 29
2.5. Evaluation models of the CHW training programme 29
2.6. History of South African National Policies, Political Situation, WBPHCOT and Healthcare Delivery in South Africa 32
2.6.1. History of South African Healthcare Delivery 32
2.6.2. The South African CHW Curriculum, Training Processes and CHW Roles 33
2.7. The summary of the literature review 36
CHAPTER 3: METHODOLOGY AND METHODS 38
3.1. Introduction 38
3.2. Methodology 39
3.2.1. Kirkpatrick's four levels of training evaluation applied to this PhD 39
3.2.2. Assessing the utility of a quality of care assessment tool 41
3.3. Methods 44
3.3.1. Methods of the systematic review 44
3.3.2. Methods of the empirical study 45
3.3.3. Researcher's positionality 49
3.3.4. Ethical consideration 50
CHAPTER 4: PhD PAPER 1 53
4.1. **Title:** Effectiveness of existing national or large-scale community health worker training programmes for comprehensive care in low- and middle-income countries: A systematic review 54
4.1.1. Abstract 54
4.1.2. Introduction 55
4.1.3. Methods 57
4.1.4. Results 61
4.1.5 Discussion 73
4.1.6. Conclusions 77
CHAPTER 5: PhD PAPER 2 79

5.1 Title: Assessment tools and their utility for evaluating the experience and outcomes of community health care worker training for comprehensive care in low- and middle-income countries: A systematic review of the evidence 80
5.1.1. Abstract 80
5.1.2. Introduction 82
5.1.3 Methods 85
5.1.4 Results 89
5.1.5. Discussion 107
5.1.6 Conclusion 112
CHAPTER 6: PhD PAPER 3 114
6.1. **Title:** Assessing the utility of a quality-of-care assessment tool used in assessing comprehensive care services provided by community health workers in South Africa 115
6.1.1. Abstract 115
6.1.2. Introduction 117
6.1.3. Methods 119
6.1.4. Results 125
6.1.5. Discussion 130
6.1.6. Conclusion 132
CHAPTER 7: PhD PAPER 4 134
7.1. **Title:** Community health workers' quality of comprehensive care: a cross-sectional observational study across three districts in South Africa 135
7.1.1. Abstract 135
7.1.2. Introduction 137
7.1.3. Methods 140
7.1.4. Results 144
7.1.5. Discussion 150
7.1.6. Conclusion 152
CHAPTER 8: INTEGRATED DISCUSSION 153
8.1. Key findings 153
8.2. Emerging findings 156
8.2.1. Effective training programmes for CHW exists on comprehensive care in LMICs 156
8.2.2. Assessing CHW performance on comprehensive care, factors of performance and evaluation models 164
8.2.3. Implications of the study findings for CHW training programmes in LMICs 167
8.2.4 Implications of the study findings for CHW training programmes in South Africa 169

CHAPTER 9: RECOMMENDATIONS 171
9.1. Recommendations 171
9.1.1. Recommendations for health system and policy in LMICs and South Africa 171
9.1.2. Recommendations for national CHW training programme developers and implementers in LMICs including South Africa 172
9.1.3. Recommendations to strengthen research and use of evidence 173
9.2. Strength and limitations 173
9.3. Areas for further research 174
CHAPTER 10: CONCLUSIONS 176
REFERENCES 178
APPENDICES 221
Appendix 3. 1: The quality-of-care assessment tool 221
Appendix 3.1a: Household visit entry component 221
Appendix 3.1b: Patient conditions, messages and action component 222
Appendix 3.1c: Household visit exit and FW assessment component 223
Appendix 3.1d: Deriving the messages/activities score for a hypothetical 'Household 1' 224
Appendix 3. 2: Fieldwork manual for completing the quality-of-care assessment tools 225
Appendix 3. 3: PROSPERO Registration message 232
Appendix 3. 4: Ethics and Institutional Approvals 233
Appendix 3.4a: Wits HREC (Medical) clearance certificate 233
Appendix 3.4b: Batlhokomedi Project ethical clearance certificate 234
Appendix 3.4c: Tshwane District Health Authority approval letter 235
Appendix 3.4d: Ehlanzeni District Health Authority approval letter 236
Appendix 3. 5: Information sheet for face validity/acceptability of the quality-of-care assessment tool 237
Appendix 3. 6: Information sheet for observing the quality of CHW services 239
Appendix 3. 7: Information sheet for experts on content validity of the quality-of-care assessment tool 241
Appendix 3. 8: Consent form for the face validity of the quality of care assessment tool 243
Appendix 3. 9: Consent form for the audio recording of the CHW questionnaire workshop on face validity/acceptability of the quality-of-care assessment tool 244
Appendix 3. 10: Consent form for observing the quality of CHW services 245
Appendix 3. 11: Revised Batlhokomedi information sheet for observing the quality of CHW services 246

Appendix 3. 12: Revised Batlhokomedi consent form for observing the quality of CHW services 247
Appendix 3. 13: Letter of Batlhokomedi data release 248
Appendix 6. 1: Questionnaire for face validity of the quality-of-care assessment tool 249
Appendix 6. 2: Expert questionnaire for content validity of the quality-of-care assessment tool 251

LIST OF TABLES

Table 1. 1: PhD aim, objectives, research questions and sub-questions 8
Table 2. 1: CHW cadres, roles, and types of training 16
Table 2. 2: Results of the scoping review for studies evaluating tools assessing community health worker performance in LMICs[a] 27
Table 2. 3: Objectives and existing literature and gaps regarding the PhD topic 36

Table 3. 1: Types of utility 42

Table 4. 1: The PICOS table 58
Table 4. 2: Characteristics of the included studies and comprehensive care package 63
Table 4. 3: Characteristics of the CHWs 67
Table 4. 4: Description of the study outcome in the included studies 68

Table 5. 1: Table showing the PICOS search strategy 86
Table 5. 2: Studies that have reported any type of tool for assessing CHW knowledge, skills, competence, quality of care or performance 92
Table 5. 3: Tools with any evidence of utility 103
Table 5. 4: Assessment tools with any evidence of utility, what was measured as the outcome and level of Kirkpatrick's evaluation models 106

Table 6. 1: The quality-of-care assessment tool structure 119
Table 6. 2: Type of utility, study design, data collection method, participants and data collected 120
Table 6. 3: Percentage agreement of ratings by CHWs, OTLs, province and overall. 126
Table 6. 4: Quality-of-care mean messages and communication scores difference by paired observers by site 128
Table 6. 5: Estimated inter-rater reliability in multilevel modelling analysis. 130

Table 7. 1: Description of household members who engaged with the CHW (or, for children, engagement can be by their carer only) 144
Table 7. 2: Description and burden of conditions of household members who engaged with the CHW (or, for children, engagement can be by their carer only) 145
Table 7. 3: The characteristics of the CHWs 146
Table 7. 4: CHWs activities 146
Table 7. 5: Messages/activities scores of CHW visits by selected household and CHW characteristics 148
Table 7. 6:Results of fitting multilevel models for factors associated with the messages/activities scores 149

Table 8. 1: Emerging findings 154

LIST OF FIGURES

Figure 2. 1: Essential health service areas for which CHW programmes have shown some effectiveness[19] 19
Figure 2. 2: Primary health care re-engineering framework based on the district health model 33

Figure 3.1: Kirkpatrick's four levels of training evaluation applied to this PhD 39
Figure 3. 2: Maps of Gauteng and Mpumalanga Provinces and Districts 48

Figure 4. 1: Flow diagram of the study selection 62
Figure 4. 2: Changes in knowledge and skill scores 70
Figure 4. 3:Changes in the proportions of community health workers providing adequate care 71

Figure 5. 1: Community Health Worker Performance Measurement Framework 85
Figure 5. 2: Flow diagram of the study selection 90

LIST OF APPENDIXES

Appendix 3. 1: The quality-of-care assessment tool 221
Appendix 3. 2: Fieldwork manual for completing the quality-of-care assessment tools 225
Appendix 3. 3: PROSPERO Registration message 232
Appendix 3. 4: Ethics and Institutional Approvals 233
Appendix 3. 5: Information sheet for face validity/acceptability of the quality-of-care assessment tool 237
Appendix 3. 6: Information sheet for observing the quality of CHW services 239
Appendix 3. 7: Information sheet for experts on content validity of the quality-of-care assessment tool 241
Appendix 3. 8: Consent form for the face validity of the quality of care assessment tool 243
Appendix 3. 9: Consent form for the audio recording of the CHW questionnaire workshop on face validity/acceptability of the quality-of-care assessment tool 244
Appendix 3. 10: Consent form for observing the quality of CHW services 245
Appendix 3. 11: Revised Batlhokomedi information sheet for observing the quality of CHW services 246
Appendix 3. 12: Revised Batlhokomedi consent form for observing the quality of CHW services 247
Appendix 3. 13: Letter of Batlhokomedi data release 248

Appendix 6. 1: Questionnaire for face validity of the quality-of-care assessment tool 249
Appendix 6. 2: Expert questionnaire for content validity of the quality-of-care assessment tool 251

ACRONYMS AND ABBREVIATIONS

Abbreviation	Description
CHEW	Community Extension Health Worker
CHP	Centre for Health Policy
CHW	Community Health Worker
c-IMCI	Community-based Integrated Management of Childhood Illnesses
COVID-19	Coronavirus disease 2019
CVI	Content Validity Index
DHS	District health System
DoH	Department of Health
EPHPP	Effective Public Health Practice Project
FM	Facility Manager
HCSI	Home Visit Communication Skills Inventory
HEP	Health Extension Programme
HEW	Health Extension Worker
HIV	Human immunodeficiency virus
HR	Human Resources
I-CVI	Individual items CVI
IRR	Inter-rater Reliability
IMCI	Integrated Management of Childhood Illnesses
I-TECH	International Training and Education Centre for Health
LMIC	Low- and Middle-Income Countries
M&E	Monitoring and Evaluation
mMRIGs	Mobile media-rich interactive guidelines
NCD	Non-communicable disease
NGO	Non-Government Organisation
OTL	Outreach Team Leader
PDoH	Provincial DoH
PHC	Primary Health Care
PICOS	Population, intervention, comparison, outcome, study design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
S-CVI	Scale CVI

SDG	Sustainable Development Goals
TB	Tuberculosis
UHC	Universal Health Care
WBPHCOT	Ward-based Primary Health Care Outreach Team
WHO	World Health Organisation

CHAPTER 1: INTRODUCTION

This introduction chapter provides a background to how the effectiveness of community health care workers (CHWs) training programme for comprehensive care are being assessed in low- and middle-income countries (LMICs), including South Africa. An attempt is made to define what comprehensive care is. This is followed by literature review of CHW training programmes for comprehensive care with a focus on that of South Africa particularly after the 1978 Alma Ata declaration on primary health care (PHC). Assessment methods of CHW training programme for comprehensive care, the utility of such methods and use in facilitating ongoing assessments of CHW competency, are reviewed. The findings of this PhD are presented using the Kirkpatrick's four levels of training evaluation. The PhD's overall aim and objectives are also presented here.

1.1. Background

1.1.1. Who are the CHWs?

Globally, there are challenges in the delivery of equitable access to healthcare due to shortages in the health workforce.[1,2] Access to effective healthcare by vulnerable populations, who mostly reside in rural and remote areas, falls short of the expected standard.[3] The uses of CHWs are major approaches to addressing gaps in the equitable distribution of health and inadequate human resource for health.[1,4,5] CHWs, working within the PHC team, have the potential to reduce inequities in access to health.[6,7] As defined by the WHO, "CHWs should be members of the communities where they work, should be selected by the communities, should be answerable to the communities for their activities, should be supported by the health system……"[8] CHWs, an umbrella term for lay health workers, bear different titles in different programmes including Health Extension Workers (HEWs) in Ethiopia and Accredited Social Health Activist (ASHA) and Anganwadi workers (AWWs) in India.[9-15] The activities of these CHWs occur mostly in the community and rural areas; however, they also function in settings such as hospitals, public and private clinics, within educational systems, and under non-governmental organisations (NGOs) and non-profit organisations (NPOs).

Historically, CHWs provide disease-specific, community-based services, focusing on single piecemeal disease programmes and conditions including immunisation services and family planning.[5,16] Over time, the CHWs roles have been evolving, occasioned by changes in disease burden patterns in LMICs.[5] Thus, CHWs are becoming 'generalists', providing a wider range of

healthcare services (comprehensive healthcare).[16,17] These wider range of services are increasingly being referred to as 'comprehensive care' despite a lack of consensus on what constitutes a comprehensive care package.[18] However, services that includes a range of promotive/preventive and some curative care are among those considered 'comprehensive'.[18]

To maximise the potentials of CHWs, effective training is required, if their services are to be safe, effective and of adequate quality.[14,19,20] The CHWs are a diverse group, and there is evidence that they receive diverse training, that may be formal and structured in nationally established educational institutions, or informal and of varying content and duration.[21] The CHW training often occur both prior to the CHW employment and on an on-going basis.[22] For the training, different packages and approach have been reported.[6] The CHWs, within the vertical disease programmes often had informal or shorter durations of trainings and fewer qualifications.[23] However, overtime, as the scope of CHW roles are changing, the training packages and approaches are also changing to empower the CHWs for their increasing role.

After being trained, there is need for knowledge about the effectiveness of training programmes designed for CHWs, the way the training is being given, and how training programmes are influencing the competency, performance or quality of care of services that CHWs render. The complementary training of CHWs within CHW programmes has to be effective to provide adequate support to CHWs who need to provide increasingly complex services to meet community health needs.[19]

1.1.2. CHW programmes in LMICs

CHW programmes in LMICs are shaped by distinct health system contexts and population health needs.[24,25] In Ethiopia, the HEW program exemplifies a government-led, relatively formalized CHW cadre with a structured two-year training curriculum focused on preventive, promotive, and basic curative services within rural communities.[26] The program fosters integration into PHC but faces challenges with workload and resource limitations.[26,27] Kenya's community health strategy includes CHWs as volunteer cadres supported by periodic training and supervision, emphasizing community participation and linkage to formal health facilities.[28] Efforts continue to clarify CHW roles and define career progression pathways within an evolving decentralized health system. In South Africa, the WBPHCOT model integrates CHWs into a multidisciplinary team with a focus on comprehensive household-level care and health promotion, though issues of

remuneration and supervision remain significant barriers.[29] Other LMICs such as Bangladesh and India deploy CHWs in larger-scale, disease-specific campaigns, with variable formalization and integration into health systems.[30,31] These country-specific models underscore the importance of contextualizing CHW roles, training, and support mechanisms to optimize effectiveness and sustainability in diverse health system settings. Success across these settings hinges on continuous curriculum review, adequate funding, community engagement, and alignment with national health strategies to advance equitable health coverage.

1.1.3. Assessment of the CHW competency

An understanding of key issues relating to effectiveness of training, what training is happening where, when and how, can be a stepping stone to understanding CHW competency, performance or quality of care after training. As noted by the WHO, "the quality of health services, their efficacy, efficiency, accessibility, and viability depend mainly on performance of those who deliver them". Furthermore, quality performance is also a stepping stone to achieving good health outcomes and results from the application of current knowledge. As Lohr and Schroeder defined quality-of-care, it is "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge".[32] Although there are specific indicators that have been used in assessing quality-of-care of other healthcare worker cadres, for CHWs, this is difficult to assess because most of their activities, which are largely unsupervised, occur in households. This difficulty in assessing CHWs quality-of-care is premised on the absence of indicators, which as defined, are "measurable elements of practice performance for which there is evidence or consensus that it can be used to assess the quality, and hence change in the quality-of-care provided".[33] For CHWs, there is inadequate evidence or consensus on acceptable indicators of the quality of the care CHWs provide.

Furthermore, even though training is vital to ensuring optimal performance, consistent evidence has shown that what a healthcare worker is taught to do does not directly determine what they actually do.[34] Between being taught and actually doing, there are myriads of factors complexly influencing actual performance. Despite adequate knowledge and skills, several factors including the individual level (demographics, ability, motivation) and organisational -level (equipment, supportive supervision, materials).[34-36] However, within the context of comprehensive care,

evaluation tools of quality performance are lacking and the extent to which such a tool, if available, can identify important factors to enhance optimal performance need be known.

1.1.4. Evaluation models of CHW training programme

The outcomes of training are assessed using various approaches including the pre- and post-training assessments,[37] observer assessment of CHW skills,[38,39] end-user interviews[40] and self-reports.[41] Pre- and post-training assessment enables assessment of effectiveness of training by measuring specific outcomes[37]; however, this approach which focuses on the assessment of knowledge and skills only, is unable to assess competency or demonstrate behavioural change following training.[42] The use of various evaluation models have been reported. Kirkpatrick's four-level evaluation model,[43-45] and Kaufman's five-levels of evaluation[44] have been suggested to standardise the evaluation of training.[42] To support continuous evaluation of the entire training process, model elements may need to be integrated to ensure that relevant individual and contextual factors influencing transfer of knowledge is considered.[46]

Therefore, this PhD study seeks to understand the LMIC experiences of assessing CHW training programmes to enable CHW to provide comprehensive care. To achieve this, I undertook two related systematic reviews to identify studies on existing training programmes on comprehensive care in LMIC, assessed the effectiveness of such training programmes and identify evidence on available tools for evaluating such CHW training programmes and the utility of such tools. In this PhD study, within the South African context, I examined the utility (validity and reliability) of a quality-of-care assessment tool developed for evaluating the quality of comprehensive care of CHWs in a previous 3-year intervention study (referred to as the "Batlhokomedi" project, and described in Chapter 4). I then applied this validated quality-of-care assessment tool to examine the level of performance of three CHW teams within a comprehensive care programme, and explored individual-level (demographics e.g., age and education [background and CHW-related training] and visit characteristics e.g., visit duration) and household-level (size and type of conditions) factors of performance.

1.2. Problem statement and justification

There is growing interest in creating both nationwide CHW programmes, and for CHW to provide a more comprehensive range of services (rather than focusing on single diseases or population group) in LMICs including South Africa. Ensuring effective training is all the more important

when CHWs are expected to provide a wider and complex range of tasks.[47] From recent evidence in LMICs including the WHO-commissioned 15 systematic review on CHW training and working condition, comprehensive care programmes have remained largely unexplored.[48,49] Furthermore, limited evidence suggests that increasing CHW workload might affect the quality of service.[13] Therefore, there is need to determine effectiveness of training on CHW comprehensive care programmes. This will help identify best practices in the support of CHWs training processes towards the increasing roles CHWs must play within comprehensive healthcare programmes particularly in LMICs.

In South Africa, similar to several LMICs, national CHW training curricula are undergoing continuous review to identify appropriate CHW roles and required training.[26,28,50,51] Such continuous review will facilitate a more enhanced CHW programme.[26,28,50,51] This suggests the need for continuous assessment of the quality of care of CHWs within comprehensive healthcare programmes. Therefore, this study can serve as a baseline on which to measure subsequent progress. It is also necessary to measure the extent to which CHWs can use the knowledge and skills they acquired during training.[52] Post-training assessment tools, to assess the quality of trained CHW services, can support the improvement of CHW training programmes. However, there is little work on methods to assess the quality of care provided by the CHW after training.[53]

Furthermore, my examination of international and national experience of effectiveness of training for comprehensive care will contribute to knowledge on how to evaluate and strengthen CHW training programmes as well as the broader implementation of assessment of training for community based-care.[54,55] Finally, from the findings of this PhD study, I will draw lessons for potential users and beneficiaries in diverse LMIC including South Africa settings on what can be adapted for local use. Such potential users and beneficiaries are diverse and span multiple levels, including CHWs, health policymakers and planners, facility managers and health system administrators, community members and service users, non-governmental organizations and donors. Additionally, academic and research institutions as well as training institutions and curriculum developers. Collectively, these users and beneficiaries constitute the ecosystem essential for strengthening CHW programs and advancing equitable PHC coverage.

1.3. Research questions, aims and objectives

1.3.1. The PhD study research questions

The guiding research question and sub-questions for this PhD are as follows:

Overall research question: What are the low- and middle-income countries' (LMICs) experiences of assessing the effectiveness of CHW training programmes to enable CHWs to provide comprehensive care, and how can the resulting quality-of-care provided by trained CHWs within a national comprehensive care programme be assessed?

Sub-questions

- What is the evidence on the effectiveness of CHW training programmes on comprehensive care in LMIC?
- What assessment tools exist for evaluating CHW training programmes for comprehensive care in LMIC and what evidence exist on their utility?
- How valid and useful is the quality-of-care assessment tool, previously developed in the Batlhokomedi Project in South Africa, for assessing the quality of care of CHWs who perform comprehensive care during household visits?
  - ✓ What is the utility (face validity, content validity and inter-rater reliability) of the quality-of-care assessment tool?
- What factors are associated with the quality of care (messages/activities scores) of CHWs who provide comprehensive care across two South African provinces?

1.3.2. Research aims

The overall aim of the PhD study was to provide evidence on the quality of comprehensive care provided by CHWs and the effectiveness of their training.

1.3.3. Specific objectives

- To conduct a systematic review to synthesise evidence on national or large-scale CHW training programmes for comprehensive care in LMICs to:
  - ✓ Identify existing CHW training programmes for comprehensive care and synthesise evidence on their effectiveness.

- ✓ Identify the tools that have been used to evaluate gains in CHW knowledge and skills as a result of attending the training and provide evidence for their utility.

- To assess the usefulness (i.e., validity, reliability etc.,) of a tool developed to assess the quality of care provided by CHWs after attending the South African national training programme.
- To apply the validated quality of care assessment tool for determining the CHW quality of comprehensive care during household visits and associated factors:
  - ✓ Determine the messages/activities scores derived from the proportion of health messages given in the households by CHWs who provide comprehensive care in South Africa, and
  - ✓ Identify the associated factors
- To develop recommendations for operationalising or supporting productive CHW training assessment processes.

Table 1. 1: PhD aim, objectives, research questions and sub-questions

Study aims	Objectives	Research question
. To conduct a systematic review to synthesise evidence on national or large-scale CHW training programmes for comprehensive care in LMICs	To identify existing LMIC CHW training programmes for comprehensive care and synthesise evidence on their effectiveness	What is the evidence on the effectiveness of CHW training programmes on comprehensive care in LMIC?
	. To synthesise evidence on the tools used to evaluate the experience and outcomes of training of CHW and the utility of such tools.	What assessment tools exist for evaluating CHW training programmes for comprehensive care in LMIC and what evidence exists on their utility?
To assess the usefulness (i.e. validity and reliability) of the quality-of-care assessment tool developed to assess the quality-of-care provided by CHWs after attending the national training programme	To assess the utility (i.e., validity and reliability) of a tool for assessing the quality of CHW comprehensive care in South Africa	How valid and useful is the quality-of-care assessment tool, previously developed in South Africa, for assessing the quality of care of CHWs who perform comprehensive care during household visits? What is the utility (face validity, content validity and inter-rater reliability) of the quality-of-care assessment tool?
To determine the factors associated with the quality of comprehensive care in three districts from two South African provinces using the validated assessment tool in Objective 3.	To determine the messages/activities scores derived from the proportion of health messages given in the households by CHWs who provide comprehensive care in South Africa and to identify the associated factors	What factors are associated with the quality of care (messages/activities scores) of CHWs who provide comprehensive care across two South African provinces?

1.4. Outline of the integrated narrative

This integrated narrative consists of 9 chapters.

Chapter 1: Provides an introduction to the PhD study looking at the relevance of CHW programmes for UHC. The move from narrow vertical-disease-focused programmes towards comprehensive care, the value of and challenges around CHW training for comprehensive care, and availability of tools and indicators for assessing quality- of-care. It describes the study's problem statement, justification, research questions, and aims and objectives.

Chapter 2: This chapter drew on international evidence on CHW training programmes for comprehensive care with a focus on the South African context, including its history, highlighting key national policies on CHW training programme. It further provides evidence on quality-of-care indicators and its associated factors. It reviewed how effectiveness of CHW training programme for comprehensive care has been assessed.

Chapter 3: The overall methodology and methods used in this PhD as well as in the larger Batlhokomedi project including the evaluation method applied in this PhD study, the quality-of-care assessment tool, study designs, study sites, sampling methods, data collection methods, and data management and analysis are described. It also documents the researcher's positionality and ethical procedures.

Chapters 4 – 7: These chapters present the study results using a block format wherein each published scholarly article is presented per chapter.

Chapter 4: synthesised evidence on exiting CHW training programmes for comprehensive care and summarises findings on effectiveness, by reporting changes in knowledge and skills.

Chapter 5: provides preliminary findings of evidence on existing assessment tools for evaluating CHW training programmes for comprehensive care in LMIC and their utility.

Chapter 6: presents findings on the utility (face validity, content validity and inter-rater reliability) of the quality-of-care assessment tool for assessing comprehensive care provided by CHWs during household visits.

Chapter 7: identifies factors associated with the quality-of-care (messages/activities scores) of CHWs who provide comprehensive care in South Africa.

Chapter 8: is the integrated discussions of Chapters 5 – 7. A summary of the three papers is provided, followed by presentation and discussion of overarching themes in relation to literature. Study contributions to the field of health system and policy, recommendations and conclusions are also provided.

Chapter 9: The implications of the study, recommendations, limitations and future research are provided in this chapter.

Chapter 10: The conclusion of the study is provided in this final chapter.

CHAPTER 2: LITERATURE REVIEW

"Live as if you were to die tomorrow. Learn as if you were to live forever". — Mahatma Gandhi

2.1. Introduction

This literature review chapter provides an outline of the focus of this thesis by delving into the history of how CHW training programmes have evolved over time, including how the training has addressed the changing roles towards comprehensive care particularly in LMIC. By using the Kirkpatrick's' evaluation model, I provide evidence of effectiveness of CHW training programme on comprehensive care including on common approaches to training and supervision that impacts effectiveness of training. By focusing on the South African context, I validated and applied a tool for assessing the quality of care of CHWs who provide comprehensive care.

2.2. CHW programmes, definitions, nomenclature, classification and roles of CHWs

2.2.1. Historical perspective on the CHW programmes

Historically, CHW programmes are nearly a century old, beginning with the earliest documented illiterate farmers who received a short training to provide rural health services in China, during the 1920s-1930s.[56,57] In the 1950s, the Chinese CHWs were referred to as barefoot doctors, received 3-month training, and spent their time equally between their health activities and farming.[58-60] Within the 3-month training period, time was allocated to both theoretical training and acquisition of practical skills and ongoing supportive training ensures improved knowledge and skills.[57,60]

The barefoot doctor health worker model gained traction in the 1960s to bridge the gap of the absent modern physicians in rural and poor communities of the developing world whose services appear to be mostly 'forced' on the people.[61,62] This led to the emergence and utilisation of health workers with limited training in health, who could complement highly trained health workers in several African (Tanzania), Asian (India, Indonesia), Central American (Honduras) and South American (e.g., Venezuela) countries.[56,57,63] This approach, otherwise referred to as "task-shifting", exemplifies the bridging of the shortfalls in human resources for health by CHWs.[64-71]

The roles of CHWs, who were initially illiterate farmers, and later including others such as students, housewives or female retirees, were to provide rural health services after receiving a short training.[56-58,60] These services included the recording of administrative data (births and deaths); administering vaccines; giving first aid and treating minor ailments (e.g., common cold and fever); giving health talks and keeping essential medications (e.g., aspirin, antacids, penicillin); and maintaining people well in hygienic conditions.[56-58,60] The adoption of CHW programmes for the provision of health services and incorporations into the health system, focusing on rural populations, was documented for several developing countries by the WHO in 1975.[57] The document include the story of successes of the CHW programmes in addressing the world's problems, mostly related to infectious diseases (e.g., cholera, leprosy, plague, small pox, malaria) despite differences in approach and style of implementation.

The training of CHWs has been heterogeneous. Besides the 3-month barefoot doctors' training duration, the Cuban CHWs undergo a 3-week training to provide services to 300 individuals on MCH-related services.[57] The Guatemala "health promoters" are selected by a community committee, undergo a once-weekly training for a minimum of one year to enable them treat common ailments such as diarrhoea and pneumonia, and are supervised by older health promoters.[57] In India, of three or four potential middle-aged female village health workers recommended by the village council, one is selected by the physician and trained two days a week at the main health centre using flash cards, flannelgraphs, and other audiovisual aids during group discussions, demonstrations, and formal lectures; and weekly in the field by a mobile health team.[57] Training on health priorities includes feeding and nutrition education, group health education, immunisation, vital statistics, family planning methods and danger signs of pregnancy.[57] The difficulties of the health team are discussed at a weekly meeting. Furthermore, in Tanzania, there are different cadres of "primary health workers", trained to cover different services to 65% of Tanzanians living in rural areas.[57] The village medical helpers undergo training over a 3-6 month period at a district hospital to treat minor ailments, provide first-aid treatment for more serious diseases, and assist fellow villagers to prevent common diseases.[57] Maternal and child health aides (MCH aides) are trained on a standardized national curriculum over 18 months (including a 6- month practical field training) to provide higher level MCH services including normal deliveries, and preschool and family and school health services.[57] Health auxiliaries should have previous health and community development, and are trained on

general health education, promotion of village sanitation and activities improving environmental health and health campaigns.[57] Rural medical aides, the physician substitute in rural health centres, are trained over a 3-year period on the treatment of simple diseases on an outpatient basis, initial treatment of serious illness, pending referral, care after discharge and immunisation and community health programmes.[57]

The Alma-Ata declaration on PHC in September 1978 introduced or rejuvenated the relevance of CHWs in achieving Health-for-All by the year 2000.[25,72] The birth of several CHW programmes particularly in LMICs in the 1970s and 1980s, saw the persistence of three important characteristics of the barefoot doctor programme. The focus of care was more promotive and preventive than curative, the span of training was short, and the CHWs were selected from local communities where they performed their activities.[57,60] However, in the 1980s and 1990s, numerous challenges plagued the sustenance of the programmes with many governments losing interests because of financial crisis and shift in political focus, and training prioritised clinical care professionals.[25,63,68]

After several decades of the inconsistent interest in CHWs globally, there is renewed interests and recommitment to national CHW programmes including in LMICs. Initially in 2000, due to the eight UN Millenium Development Goals, the CHW roles have been integral reducing child mortality (MDG 4), improving maternal health (MDG 5) and combating HIV/AIDS, malaria and other diseases (MDG 6).[73-75] CHWs extend the reach of health systems by delivering promotive, preventive, and basic curative services at the community level, including nutrition education, immunizations, maternal and newborn care, and disease treatment and referral.[73-75] Now with the shift in agenda towards the Sustainable Development Goals (SDGs) adopted in 2015, the foundational contributions of CHWs under the MDGs underscore their continued importance in achieving universal health coverage (UHC) and health equity goals.[73-75] The 2018 WHO guidelines for optimising the contributions of CHWs and in 2019, the 72nd session of the World Health Assembly, have re-emphasised the importance of CHWs in achieving the SDGs.[19,25,76,77]

The third SDG emphasises the need to achieve UHC to ensure "that all people and communities can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship".[49,78] These historic changing landscapes have brought

about the need for an understanding of how national CHW training programmes in LMICs have developed, and substantiates the necessity of this PhD study The next section discusses how CHW is defined, the CHW typology and nomenclature.

2.2.2. CHW definition, types and nomenclature

The need for CHWs is due to the shortages in the health workforce, which affects equitable access to quality healthcare by all people.[3-5,79,80] The term "CHW" is regarded as an umbrella term for everyone considered to be a lay person who provides basic health care.[81] The term embodies several nomenclatures or titles generally named "CHWs".[82,83] These include HEWs, ASHAs, Lady Health Workers (LHWs), Health Surveillance Assistants (HSAs), community health extension workers (CHEWs), and the community health assistants (CHAs).[9-12,14,15,84] They can be men or women, young or old, illiterate or with little education, married or unmarried.[82] CHWs are often unlicensed, have minimal training in healthcare, are members of the community that they serve and provide community-based services.[49,85]

As defined by a WHO Study Group, CHWs "should be members of the communities where they work, should be selected by the communities, should be answerable to the communities for their activities, should be supported by the health system but not necessarily a part of its organization, and have shorter training than professional workers".[8] The International Labour Organisation defines CHWs as those who "provide health education and referrals for a wide range of services, and provide support and assistance to communities, families and individuals with preventive health measures and gaining access to appropriate curative health and social services. They create a bridge between providers of health, social and community services and communities that may have difficulty in accessing these services".[86] The element of 'trust' was emphasised by the American Public Health Association (APHA) that defined CHWs as

> "a frontline public health worker who is a trusted member of and/or has an unusually close understanding of the community served. This trusting relationship enables the worker to serve as a liaison/link/intermediary between health/social services and the community to facilitate access to services and improve the quality and cultural competence of service delivery. A community health worker also builds individual and community capacity by increasing health knowledge and self-sufficiency through a range of activities such as outreach, community education, informal counselling, social support, and advocacy".

Two reports 15 years apart shows how the definition of CHWs has changed with shifts in CHW background and entry trainings overtime.[21,87] According to Lewin et al. CHWs are "any health worker carrying out functions related to health care delivery; trained in some way in the context of the intervention; and having no formal professional or paraprofessional certificated or degreed tertiary education".[87] Abimbola et al. distinguished between three categories of CHWs (lay health workers, level 1 and level 2 paraprofessionals) based on their level of education prior to recruitment and subsequent pre-service training.[85] The key distinguishing factor between the three categories is formal training. Differences in training are mostly related to the differences in roles assigned to CHWs.[85]

Since the term CHW covers a wide range of cadres under different CHW programmes, attempts have been made to distinguish between levels of CHWs using criteria such as remuneration, recruitment and employment conditions, and duration of training.[63,88] On one end, the CHW level was described as including employed full-time, paid, and undergo formal pre-service training; on the other end, they include volunteers who work intermittently and undergo few days of training (Table 2.1).[63,88]

Table 2. 1: CHW cadres, roles, and types of training

Level	Terms of service, training and recruitment	Roles
4	• Paid a salary • Worked full-time • Undergo pre-service training of ≥1-year duration • Recruitment: not necessarily from the area	• Routine preventive services (e.g., immunization, family planning) • Case management of few conditions (e.g., childhood illnesses). • The roles may be performed in a peripheral health unit (e.g., health post) or outreach sites. (This cadre may fit more under the nursing associate professional category of the ILO definition of CHWs instead).
3	• Paid a salary • Work more or less full-time • Undergo initial training of one to several months duration + additional training of up to a year after recruitment • Recruitment: usually from the area but may not originate from the of practice	• May perform roles that are rather similar to those described for the Level 4 CHWs.
2	• Volunteer • Certain regular duties (activities may occur each week). • May undergo regular short training (of up to several days per time) possibly + initial training over several weeks. • Recruitment: usually from and live within their local communities.	• May be involved in o case management of childhood illness, o dispensing some medications (e.g., birth control pills or antenatal iron supplements) o distributing commodities (e.g., insecticide-treated bed nets or condoms). o rarely, may administer injectable contraceptives (e.g., Depo-Provera • In some programmes, their duties and employment conditions may tend towards those of Level 3 CHWs including: o considerable part-time activities (e.g., 10–20 hours weekly) o receive financial incentives that may be performance- or commission-based. • In other programmes, they may perform regular functions but: o spend less time (e.g., ≤5 hours each week) o receive minimal to no financial incentives
1	• Volunteer • Intermittent duties • Training: a few days usually. • Recruitment: always local.	• Roles: mostly limited to health promotion, • May also support periodic campaign activities (e.g., distribution of insecticide-treated bed nets, ivermectin, or vitamin A) • May support during immunization campaigns.

CHW, community health workers; ILO, International Labour Organisation

A more recent series of reviews on CHW programmes described CHWs under three categories such as auxiliary health workers, HEWs and community health volunteers (CHVs).[89] This categorisation is also premised on the CHWs training duration and remuneration, with CHVs likely to have minimal training duration of a few days and remuneration that may or may not be formal.[90] There is progression towards professionalisation, a process that involves CHWs in a more established occupation with a clear scope of work, standardised pre-entry requirements, training and remuneration, within more established health systems.[90] The demand for a resilient health system by communities has been considered to include professionalized CHWs who in

full-time capacity are proficient in providing clinical care and referral services in the community.[90-92]

2.2.3. Expanding roles of CHWs

The CHWs are considered as integral to the PHC approach for addressing population health.[63,93] Their roles complements those of other health teams to ensure the goal of providing "….essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community ….bringing health care as close as possible to where people live and work….. ".[72] The International Labour Organisation described that the CHWs should be carrying out tasks that include: " (a) providing education to communities and families on a range of health issues including family planning, control and treatment of infectious diseases, poisoning prevention, HIV risk factors and measures to prevent transmission, risk factors associated with substance abuse, domestic violence, breastfeeding and other topics; (b) assisting families to develop the necessary skills and resources to improve their health status, family functioning and self-sufficiency; (c) conducting outreach efforts to pregnant women, including those who are not involved in prenatal, health or other community services, and other high risk populations living to help them with access to prenatal and other health care services; (d) ensuring parents understand the need for children to receive immunizations and regular health care; (e) working with parents in their homes to improve parent-child interaction and to promote their understanding of normal child development; (f) providing advice and education on sanitation and hygiene to limit the spread of infectious diseases; (g) storing and distributing medical supplies for the prevention and cure of endemic diseases such as malaria and tuberculosis and instructing members of the community in the use of these products; (h) assisting families in gaining access to medical and other health services".[86]

It is particularly challenging describing the roles of CHWs in view of the numerous nomenclatures, cadres and roles as well as inconsistency in the terms used to describe components of interventions within CHW programmes.[94] In LMICs, particularly in rural areas, CHWs were particularly relevant in preventive and promotive roles while in addition, some provided some curative services to address prevalent disease conditions and health-related events contributing to high mortality or morbidity, especially in women and children.[63] The CHWs

provided services to address communicable diseases (malaria, HIV); health events (family planning, nutrition supplements); and health-related conditions (e.g., MCH).[63] The close link of CHWs with the families and their cultural knowledge makes them effective in enabling access to healthcare services, including use of medications, screening for early identification of complications and referral. However, most of these roles are narrow-focused, positioned within vertical piecemeal programmes, disease-specific interventions and single-disease/condition programmes. These roles vary and include home-based carer role, TB direct observed therapy, family planning and health education.[24,66,95,96]

As CHWs are becoming more relevant within health systems because of persistent human resources for health constraints, UHC, changing disease and demographic profiles, and limited value of vertical programmes, their roles are evolving.[5] CHWs are becoming 'generalists' or are providing a wider range of healthcare services (or comprehensive care).[16,97] The CHWs are now providing services beyond infectious diseases and MCH services to addressing NCDs (e.g., hypertension, diabetes, depression, cancers).[18,98-102] The roles of CHWs are also expanding to providing responses to disease outbreaks, including pandemics such as COVID-19, which they often provide on an ad-hoc basis.[103-105] This requires their involvement in early detection through surveillance activities, screening, contact tracing and referral. They also support infection prevention and control through health education and testing.[103-105] There is evidence that CHW programme are showing evidence of effectiveness across a wide range of services (Figure 2.1). However, expanding roles require careful planning for adequate skill transfer. This can only be achieved through effective training and support, combined with ongoing monitoring and evaluations to optimise the CHW programmes.[18,24,88]

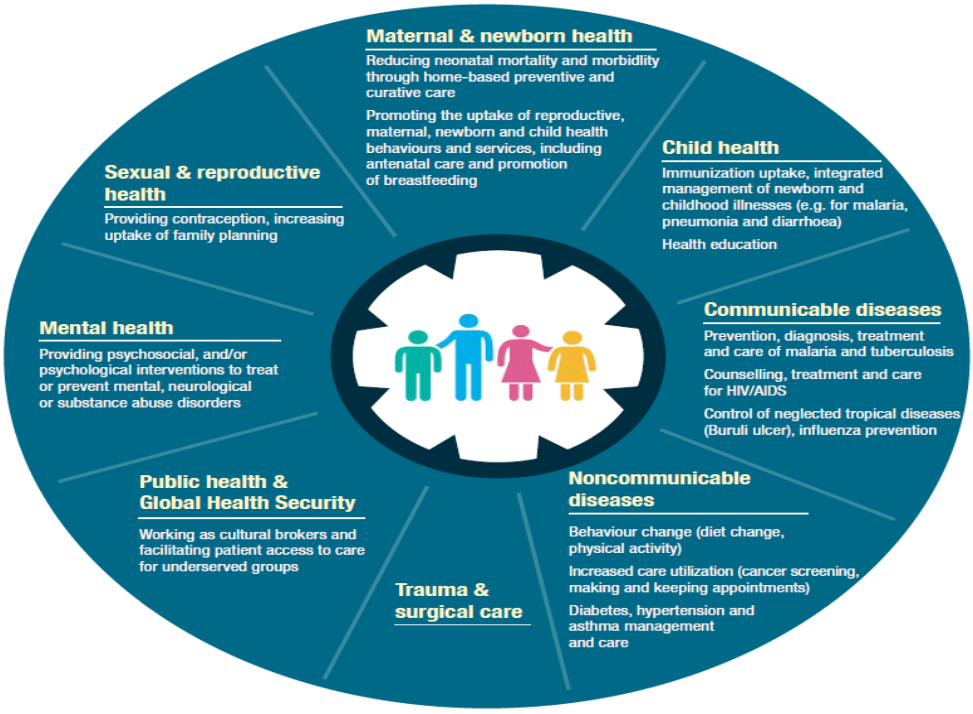


Figure 2. 1: Essential health service areas for which CHW programmes have shown some effectiveness[19]

In the next section, I provide my reflections on the training programmes available for equipping CHWs, the organisation of training programmes, implementation and approach to assessing the effectiveness of training.

2.3. CHW training, supervision and training effectiveness

CHWs are considered cheaper to train and employ than other professionals of medical care including doctors and nurses, they can also be counted on to stay in the rural areas after training.[106] To support their disease preventive, health promotive, health education, screening and treatment roles, training packages are developed targeting the CHW tasks before deployment and ongoing.[19,90,107,108]

2.3.1. CHW training programme governance and management

Previously, most CHWs programmes were under NGOs, CBOs and even university-led groups, who as intermediaries of governments, recruited CHWs and provided them with mostly basic training.[89,109,110] Challenges of NGO-led programmes include short lifespan, due to limited funding, inefficient managerial capacity and narrow disease focus of funding organisations.[89,111-113] Under NGOs and CBOs, difficulty in tracking the minimum training standard required for CHWs, and use of inconsistent approach to and quality of training, because of diverse

curriculums have been reported.[114,115] Lack of integration of training packages also encourage duplicative efforts, occasioned by overlapping components across different training packages.[114] Moreover, previous trainings were considered too theoretical, mostly classroom-based, too complex, and tend to take place in locations far removed from the CHWs residence or place of work.[116-118] Therefore, among recommendations to strengthen the governance and management of training programmes for CHWs are calls for national CHW programmes.[119] Within such programmes, the lowest limit of standards for identifying the required baseline skills and competencies of trained CHWs by cadre can be set when governments are not heavily dependent on donor funding.[89,114] Further, training can then include sets of materials and activities to ensure competency, not just acquisition of knowledge, with oversight functions of governing committees or implementation by a training institute.[24,118] Thus, large-scale national CHW programmes are emerging which because they are more costly to run, could be better implemented with a more effective monitoring that allows for more standard practice.[88,89,120,121]

2.3.2 Types of CHW training

Unlike the training for medical professionals, CHW training programmes do not currently follow set standards regarding the training processes or how they are assessed, and neither is it clear whether a more specific or more broad focused training is better.[122,123] This is understandable, given the diverse roles CHWs perform, specific within different programmes. Therefore, the WHO recommendation for flexibility in training programmes and assessment approaches towards targeting the health needs of the community, plus training on broader sets of core competencies, may equip the CHWs both specifically while also providing necessary basic skills.[19] Studies agree that both initial (pre-employment) and continuing/refresher training are important to improve CHW competency and performance.[19,108,124,125] In fact, it is considered that good continuing training may be more important than the background criteria for selecting CHWs.

Pre-employment training is an important start off point for ensuring that individuals acquire the knowledge, skills and competencies needed before commencing specific roles. It also ensures that previously unemployed individuals are able to "seek, obtain and sustain" employment.[126-128] Therefore, pre-employment training programmes serves as preparatory for ensuring that individuals can get, keep, and keep doing well in a job. This type of training should cover technical skills (competency domains specific for CHW functioning) and broader social skill set

or ‘soft skills’ including communication, interpersonal, problem-solving and counselling and community mobilisation.[19] Training formats usually include classroom-based training with instructor-led sessions, practical hands-on training during field practices and simulations, and more recently, digital courses, through online or web-based training.[19] For CHWs, pre-employment training curriculum is better designed nationally or sub-nationally, considering local diseases and health-related events.[19]

Without regular refresher training, during which CHWs undergo structured revisiting of essential knowledge and skills, prior skills and knowledge may be quickly lost regardless of the HCP category; this is even more important for CHWs.[63,108] Such regular refresher trainings may be used to provide updates on topics including health promotion and disease prevention strategies, reproductive, maternal, newborn, child, and adolescent health care, and communicable disease management such as HIV/TB and malaria.[63,108] Trainings often emphasize practical skills like referral processes, tracing patients for follow-up, case management, and use of health information systems. Modules also cover communication skills, behaviour change techniques, quality assurance in service delivery, and customer care.[63,108] A review categorised all in-service support to facilitate regular training after pre-employment training, including refreshers or any follow-on training, as “ongoing training”.[108] Ongoing trainings also include “supportive supervision“ which entails continuing activities and supervisory visits to help facilitate improved CHW knowledge and skills.[108,129,130] Ongoing training may involve either refresher training on knowledge and skills only, or as a combination of both refresher training and supportive supervision.[108] An understanding of how CHWs are supported within comprehensive care programmes are particularly crucial given their expanding roles and has been explored in this PhD study.

Evidence regarding challenges with ongoing trainings include that they occur infrequently after pre-employment training if at all, and involve insufficient quality of training to improve CHW quality of care.[36,131-135] Evidence is also limited regarding the extent of incorporation of trainings of those who support or collaborate with CHWs in training curriculums.[123]

2.3.3. Transition from narrow vertical disease to more comprehensive training programmes

Within vertical disease programmes, CHWs mostly receive informal or short duration trainings and have fewer qualifications.[122] For example, basic health workers (or auxiliaries) in

Bangladesh in the mid-70s received training on immunisation against communicable diseases and family planning.[136] The village health volunteers in Lao PDR were trained to vertically diagnose and treat malaria since 2004.[137] In sub-Saharan countries, most CHWs were initially trained and deployed primarily for one of HIV, TB and malaria programmes, in vertical approaches.[138] However, this narrow health promotion focus is now being replaced by a comprehensive framework with trainings on a wider mix of preventive, promotive, curative, and rehabilitative activities for CHWs employed by the government or NGO, paid or volunteers, with or without certification.[90,139,140]

Changing disease patterns and CHW roles also inform changes in the development of training packages and entry requirements and CHW cadres, with training packages being revised or modified.[90,141,142] For example, in the mid-1970s, in Tanzania, the government designed different training packages for different CHW cadres (village medical helpers [VMH], MCH aides, health auxiliaries and rural medical aides [RMAs]) to address basic health needs in the community.[106] These CHWs undergo 3-6-month to at least 3 years of training, and their entry requirement included 7-year primary school leaving certificate and selection by the villagers. However, medical assistants (selected RMAs), who perform heavier workload of overseeing rural health centres, had ongoing modifications of training duration (initially 18-month full-time to 3 years) and background education (initially 10-years and later secondary education).[106] Furthermore, as Ethiopia and Rwanda moved toward multi-cadre CHW systems combining formal low-level salaried workers and community volunteers to meet expanding roles, they gradually shifted family planning tasks to CHWs as their programmes matured.[63] Brazil's Family Health Programme also reflects an epidemiological shift with CHWs adopting more rehabilitative and preventive roles focused on NCDs, such as hypertension and diabetes, matching growing chronic disease burdens.[63,143]

To assist different LMIC governments, the WHO developed a three-course training to equip CHWs on components of MCH, HIV/AIDS, IMCI and ICCM programmes.[144] This was aimed at reducing newborn and child mortality, promoting healthy child development, and adapted by countries for separate implementation or in addition to other training packages.[24] The WHO/UNICEF also designed other training packages targeting sick children (ICCM, IMCI), family planning, safe abortion and MNCH.[145-147] Evidence of successful implementation of these

training programmes were reported in Ethiopia, Ghana and Malawi.[114] In these countries, training efforts emphasized clear curricula, appropriate tools for health promotion, refresher training schedules, and reliable supply chains for essential commodities, enabling CHWs to deliver vital maternal, newborn, and child health services at the community level.[114] Therefore, for the newer health demands, greater levels of training and skills are required to enhance CHWs' roles.[23] Thus, it is important to learn from best practices in training CHWs for comprehensive care in LMICs including South Africa, to maximise the quality of CHWs training programmes, and maximise the benefit of comprehensive care programmes.

2.3.4. Integrated training package

Regardless of the focus of training packages, an increasing body of evidence agree that the transfer of technical knowledge is insufficient to equip CHWs for their roles [24,119,148] Currently, recommendations are that trainings build practical skills to address critical areas necessary to enhance CHW quality of care including such as communication, problem solving and critical thinking.[24,119,149] Since these skills are needed across all CHWs roles, integrated training package or curriculum is being advocated to provide opportunity for a dedicated module on soft skills, leaving more room for skill-based learning modules addressing communities' health needs. Increasingly, as evidence of effectiveness of CHW programme continue to emerge, countries are developing more integrated training packages including those for addressing the continuum of care of expanded scope of MCH-related roles.[119,122] However, the enthusiastic decision of governments to keep adding to the CHWs tasks necessitates careful review of how training for comprehensive care is being organised.[24]

The extent to which individual countries have addressed the new landscape concerning CHWs as the major focus to address gaps in workforce and the design of CHW training differs. Not all countries have CHW programmes that are entrenched within its national health system. Even among those who do, there is limited information concerning the effectiveness of the training programmes in various countries. In most countries, evidence on the CHW training programme is often restricted to the duration of training, the content that is covered as well as the pre and post-training assessment approach within vertical or narrower programmes.[150]

Furthermore, in several countries, there are challenges related to differences in training approaches and the scope of CHW work with a mismatch between prerequisite education and the

extent of work required in their new role, The use of the term 'comprehensive' may also connote different things in different countries.[4,150] To draw lessons for best practices, what has worked within CHWs programme and what has not in different countries could be used to draw further understanding on best practices concerning CHW training programmes.

Countries that have developed innovative approach to ensuring adequate coverage of healthcare within the national health system and for comprehensive care by CHWs include Ethiopia with its national Health Extension Programme (HEP).[151] This programme, including 18 HEP healthcare packages, involve well-structured approach to training and retraining as well as incorporation into the national government paid workforce, with evidence of the effectiveness of the programme reported on improved knowledge of and practices in maternal and newborn health care among others.[152-154] Earlier review of its training input, processes and output showed challenges related to inadequate facilities for training of workers, lack of community stakeholder participation in the recruitment of health workers, poor entry qualifications of recruited health workers, and exposure to practical skills were said to be lacking.[155] Over the years, concerted efforts to improve the challenges in its early phase has resulted in improved healthcare delivery in several of its HEP packages.[156] However, ongoing evidence continues to identify persisting deficiency in long-term workers performance, including on antenatal and newborn care, childhood illness classifications, and treatment guideline adherence, that may be unrelated to deficient knowledge and skills immediate post-training.[157-162]

Therefore, the complementary training of CHWs within such large-scale programmes as Ethiopia HEP has to be effective to provide adequate support to CHWs who need to provide increasingly complex services to meet community health needs.[19] As showed by past evidence, comprehensive care programmes by CHWs have remained largely unexplored.[6,107] Evidence on existing national CHW training programme for comprehensive care within LMIC' contexts are also lacking. Evidence exists on the effectiveness of CHW programme including improved knowledge and practices of maternal and newborn health care,[163] maternal, newborn, and child health care practices[164] and integrated community cases management[165] following training. Critical to ensuring effectiveness of CHW programme is the effectiveness of training addressing wider and more integrated comprehensive care. To what extent the expanding roles of CHWs are

incorporated into an integrated training package can help in understanding effectiveness of training in LMICs and has been examined in this PhD study.

2.4. CHW competency, performance or quality of care

2.4.1. Assessing the competency, performance or quality of care

As evidence has shown, competency (the possession of knowledge, skills and capabilities for effective job performance), performance (application of competency in the real world) and quality of care (to what extent performance achieves the desired outcome) are interrelated. Among other factors, competency, performance and quality of care are influenced by quality training. As aptly summarised, inadequate exposure of CHWs to quality training may limit their potential or even make them 'unsafe'.[20,90] hence, it is important to assess CHW quality of care once trained. Quality-of-care dimensions include assess (whether community members get the care they need) and effectiveness in clinical and interpersonal care (relates to the extent to which health received benefits those with health needs).[166] Quality of care is also influenced by other dimensions such as equity, efficiency and safety.[166]

Assessing performance and quality-of-care within comprehensive care is difficult.[167,168] Regarding quality of care, the Donabedian's structure, process and outcome framework provide comprehensive indicators for measuring quality-of-care.[52,169] For structural indicators, these include measures such as number of workers, appropriate infrastructure, and funding for tools and equipment.[52,170] Communication, diagnosis, treatment and adherence to standards of practice are among process measures.[171] Long-term outcome measure include mortality (long-term) while immediate outcomes measures include medication adherence, health services utilisation, and community healthcare-seeking or lifestyle behavioural changes.[172,173] An assessment encompassing these quality-of-care elements would be challenging, necessitating complex studies and tools.[89,174]

To assess the quality of CHW care, various methods of assessment have been reported in LMICs.[108,175-178] Among these are the use of written or oral tests,[179-181] direct observation of CHW practice, sometimes by a trained evaluator,[177-179,182,183] monitoring of activities such as vaccine distribution via smartphones,[184] and usage of facility-based administrative data to determine indicators such as number of household visits, patients seen or community meetings organised,[185] or a combination.[175,179,181] Limitations of these methods include the lack of a

standardised approach.[176] Moreover, validated tools targeting the required indicators either focus on single diseases, limited range of comprehensive services, or have inter-rater reliability (IRR) concerns.[186-191] With limited availability of validated tools and standardized measures, opportunity for a comprehensive assessment is limited.[25,173,176,192] In an effort to address this gap, Agarwal, Sripad et al. conceptualised a "Community Health Worker Performance Measurement Framework".[167] The suggested useful indicators based on this framework include "level of knowledge of CHWs," "extent of service delivery", "service quality" and "reporting of data". However, past studies have addressed separately these indicators while assessing performance with few reporting evidence of utility of existing tools (Table 2.2). In this PhD study, we focused on the process measures, to determine how the quality of health care of trained CHWs may be assessed and identified gaps prioritised for corrections timeously. This is because the expanding roles of the lower-skilled CHWs are mostly performed away from the health facilities, often without support, in the community.[20]

Table 2. 2: Results of the scoping review for studies evaluating tools assessing community health worker performance in LMICs[a]

CHW Performance Measurement Framework indicator for CHW competency[b]	Previous study author and year	Scope of CHW work (single disease/condition or comprehensive care)	Performance measure	How was the indicator measured (assessment methods)?	Type of tool designed for data collection (assessment tools)	Type of utility reported for the assessment tools
-CHW knowledge	Bailey 1996[180]	Diarrhoea case management	Knowledge score	Case-based pre-test and post-test before and after training	Written/oral examination	None
	Gautham et al. 2015[179]	Integrated Management of Childhood Illnesses (IMCI)	Pre- and post-training test score	Assessment of pre- and post-training were based on	Simple assessment instrument	None
-Service delivery/quality	Ayele et al. 1993[182]	All activities specified in the job description for community health agents (any CHW included in the study was required to be performing at least one activity)	Completion of activities by CHWs as set by the government was used to derive a functional status score.	Direct observation by supervisor at onset, three and six months.	Checklist	None
	Agarwal, Gallo, Finlay 2013[193]	Community-based Integrated Management of Childhood Illness (c-IMCI)	The mean percentage of correctly performed activities was calculated as the Community-based Integrated Management of Childhood Illness (c-IMCI) performance score (score 0-100)	Direct observation by trained experts	Expert observers scored the encounters using a standard observation checklist.	Proportion of recommended treatments that were prescribed correctly by CHWs were compared to gold standard
	Ashraf et al. 2015[185]	Household visits for environmental inspections, counselling on women's and children's health, and referrals	The number of household visits completed over the study period.	Administrative data	Signed receipts per household visited	Validation via household report of CHW activity and comparison to HMIS administrative data
	Gautham et al. 2015 Gautham, Iyengar et al. 2015)	Integrated Management of Childhood Illnesses (IMCI)	Protocol compliance following training on guideline-based care in use of mHealth system	Trained field investigators observed the CHW care to adult/paediatric patients	Media-rich, mobile phone–based clinical guidance system for managing fevers, diarrhoeas and respiratory problems by rural health provider–mobile media-rich interactive guidelines (mMRIGs)	Two validated clinical guidelines were adapted and deployed in cell phones

	Andreoni 2016[184]	Polio vaccination drives	Closeness to vaccine distribution policy objective	By smartphone application	CHW self-completed a vaccination monitoring application on a smartphone	None
	Bossuroy et al. 2016[194]	TB case detection	TB case detection rate	Administrative data	Treatment card tracker was completed by survey staff to document patient-related treatment data using information from CHW Treatment card	Tracker card data were compared against government records
	Taylor et al. 2018[175]	Case management of malaria, diarrhoea, pneumonia, pregnancy and newborn care, family planning and under-nutrition.	Relationship between selection scores and on-the-job performance	Data collected via phone-based application	Written tests and one-to-one interview	Predictive reliability
	Laurenzi et al. 2020[186]	Maternal and infant wellbeing, child nutrition, immunization, HIV/AIDS prevention and treatment, and access to social and health services.	Home Visit Communication Skills Inventory (HCSI) score	The HCSI's 21 items covering active listening, active delivery, and active connecting domains, was used to score English transcripts of audio-recorded home visits interactions between CHWs and their maternal care clients.	Home Visit Communication Skills Inventory, a 21-item checklist	Inter-rater reliability
-Data reporting*						

LMIC, low and middle-income countries; CHW, community health workers; TB, tuberculosis

Notes: The data reported in Table X were obtained through search in PubMed until February 28, 2020.

*No study assessed data reporting as a factor alone in LMIC.

[a]Table 2.2(see[38])

[b]Agarwal et al. (2019)[167]

2.4.2. Factors influencing competency, performance or quality of care

Limited studies have assessed the influencing factors of CHW performance in the context of comprehensive care. Kawakatsu et al. reported that performance was associated with CHWs' individual-level factors (marital status and educational level), supervisor-level factors (number of supervisions received) and community-level factors (household size).[195] Evidence has also suggested the importance of sociodemographic factors (including age, gender and education) on CHW performance.[18,196] Recently, in Kenya, Njororai et al. investigated the demographic and environmental factors affecting CHW performance.[197] In this self-reported, questionnaire-based survey of 309 mixed cadre CHWs (volunteers, community HEWs who provide supervisory roles to CHWs and retired CHWs), the key factors of performance included having a secondary education and poor communication skills. However, these previous studies assessed performance or quality of care using different measures. Kawakatsu et al. based performance on previous 6-month submitted reports by CHWs to their supervisors, health knowledge, and household coverage.[195] Njororai et al. categorised performance (as poor/better) using contextual information based on whether the CHWs were available, participated, or were responsive to CHW work.[195,197] Therefore, there is need for an assessment of background and clinical factors of CHW performance related to their comprehensive care work, provided during household visits, using a validated tool, which I explored in this PhD study.

2.5. Evaluation models of the CHW training programme

To verify that the set objectives of CHW training programmes are achieved during the life span of programmes, ongoing evaluation is required.[115] Evaluation identifies systematically whether the training intervention achieved a positive change in trainee performance, behaviour and attitude.[198,199] By evaluating training programmes, information on the strength and weaknesses in the training components (e.g., training curriculum, teaching aids, location, trainers, training style) that can affect training effectiveness, can be identified and addressed.[199] Whether training is relevant or positioned to meet individuals' learning and organisational needs are also identified.[20] Moreover, the cost of planning, designing, and implementing training programmes demand evidence of effectiveness.[37] Therefore, evaluation of training programmes is considered a critical aspect, requiring incorporation into training programme design.[198]

Various evaluation models have provided frameworks for assessing training effectiveness and outcomes. The Kirkpatrick's four-level evaluation model,[45] which is concerned with evaluating

whether training worked and to what extent, has been widely used to evaluate CHW training programmes.[42,149,200,201] These four levels include i) learners' '*reaction'* to the training and training environment, evaluated through verbal or written feedbacks on extent of understanding of training content or satisfaction, is usually assessed immediately after training.[149,198,202,203] ii) The '*learning'* level, which evaluates whether learning occurs i.e. if the learner acquired knowledge and/or skills following training, is often assessed pre- and post-multiple choice questions.[149,203] iii) Whether learning changes participants' daily activities or '*behaviour'* in the work locations is measured long-term particularly by managers and supervisors using assessment tools to rate changes in behaviour.[200] iv) Whether the desired '*results'* or organisational goals and behavioural changes are achieved, following training, is assessed at population level, using designs such as RCTs and pre- and post.[200] Although considered a simplified approach with wide acceptance by many training developers, the model is reported to be defective because it focuses more on outcomes and fails to account for prior training resources or intervening factors influencing outcomes [43,45,204-206] Therefore, various other models have attempted to address these drawbacks.

The Kaufman's 5-level evaluation model provides an expanded framework that considers evaluation beyond training.[44] Kaufman provided an expanded focus to Kirkpatrick's level 1 '*reaction'* scope by additionally focusing on inputs (availability and quality of training materials that may impact learning). However, Kirkpatrick levels 2 (whether desired learning occurred), 3 (whether learning is being applied on the job) and 4 (organisational benefits resulting from change applied due to learning) are similar to Kaufman's level 2 ("*acquisition,*" whether knowledge is gained and applied in the required roles), 3 ("*application,*" how effectively individuals applied the knowledge gained), and 4 ("*organisational outcome,*" what the organisation benefited overall). Furthermore, Kaufman goes further to consider the organisational contribution to society and individual clients as a result of training as a fifth level, which as evidence suggests, is difficult to evaluate.[198]

The necessity of the Brinkerhoff six-level model was premised on the narrow focus of the Kirkpatrick's model on training only.[207] According to Brinkerhoff, Kirkpatrick's model is more outcome-focused, and only involves the learning of skills that can be applied in the workplace to achieve desired result.[207] By this model, the need for training evaluation even at the pre-developmental stages, to determine if it would be worthwhile to implement a training at all or revise inputs, was emphasised.[207] Thus, Brinkerhoff model expanded on Kirkpatrick's four-

levels with the addition of two levels that formatively evaluate pre-training requirements (levels 1, "*goal setting*" and 2, "*programme design*").[46] The remaining four levels (levels 3 "*programme implementation*"; 4 "*immediate outcomes*"; 5 "*intermediate or usage outcomes*"; and 6 "*impacts and worth*") corresponds to Kirkpatrick's levels 1 to 4, respectively.[207] With this expansion, the need to incorporate evaluation into the training programme is emphasised. Although regarded as a thorough approach, the drawback to the Brinkerhoff model is that it is capital intensive, time-consuming and may be impractical in the real-world setting due to many constraints and limitations.[46]

Another model used to improve on the limitations of the Kirkpatrick's model is the four-level "*context*, *input*, *reaction*, *outcome* (CIRO)" model developed by Warr et al.[46,198] It provides a more robust evaluation prior to training, but similar to Kirkpatrick's after training. The level 1 consideration of contextual issues may include individual training needs, organisational factors such as the set goals and environmental issues such as culture, with potentials to influence training effectiveness.[46] Level 2 "*input*" evaluates the training design and delivery environment, whether materials and human resources are available in adequate quantity and quality.[46] The levels 3 (*reaction*) and 4 (*immediate, intermediate and ultimate outcomes*) correspond to levels 1 and 2-4 of Kirkpatrick's, respectively. Although the CIRO level 3 and Kirkpatrick's level 1 (*reaction*) are similar, the CIRO model provides opportunity for trainees to comment on how to strengthen the training programme.[46] Despite evidence of the usefulness of the model in evaluating training efficacy, it appears to be more relevant in evaluating management-level training programmes.[208] Moreover, it is deficient in evaluating behaviours; therefore, its relevance to lower-level HCPs such as CHWs is questionable.

In light of the renewed interest in a scaled-up CHW programmes to address the goal of UHC and widening range of CHW roles towards more comprehensive care, there is need for on-going, iterative approach to evaluating the CHW training programmes.(84) To what extent evaluation models were utilised in assessing CHW training programmes for comprehensive care were examined in this PhD study.

In the next section, I focused on the context of the national CHW programme, known as the [1]Ward-based Primary Healthcare Outreach Team (WBPHCOT) programme, in South Africa, the setting

[1] Ward-based PHC Outreach Teams (WBPHCOT) is a component of the PHC re-engineered model and located within PHC facilities. The PHC re-engineered model aims to strengthen PHC services and provide integrated services to households, through the WBPHCOT among others. WBPHCOT are located and perform activities within catchment

for the primary data collection in this PhD study. As part of this section, I discussed the history of CHW programme in South Africa including CHW roles, highlighting key national policies, training programme and CHW national curriculum.

2.6. History of South African National Policies, Political Situation, WBPHCOT and Healthcare Delivery in South Africa

2.6.1. History of South African Healthcare Delivery

The health and health policy in South Africa were affected largely by the history of the nation. Discriminatory policies, which affected the healthcare of the majority of people, persisted until the democratic government era in 1994.[64,209] However, the legacy of the apartheid regime seems to have persisted despite attempts at correcting the ills of past era. The PHC system was revitalised as a strategy of the National Department of Health as an approach to achieve its 2010-2014 programme of action of ensuring an improved health status for the entire population of South Africa.[210] An important policy effort to ensure an improved health status for the South African population is the re-engineering of the PHC system.[210] A key intention of the re-engineering approach is a well-functioning decentralised district health system (DHS) with a health promoting community-based health system model (Figure 2.2).

areas, which are located within municipalities. The services provided by WBPHCOT include PHC services, community outreach services, preventative, promotive, curative, and palliative services. An outreach team leader (OTL) oversees and guides each WBPHCOT activities. A policy framework has been developed to provide direction to WBPHCOT through set goals and objectives.

.

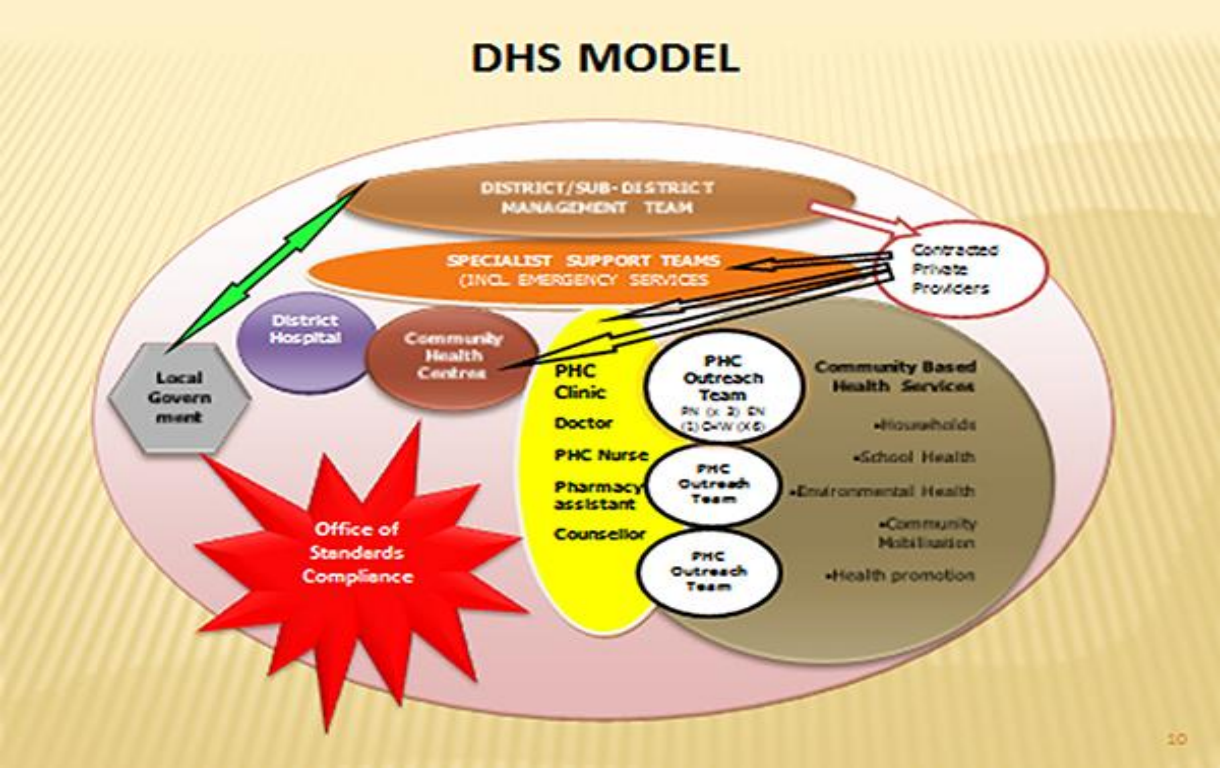


Figure 2. 2: Primary health care re-engineering framework based on the district health model

Within this system is the WBPHCOT, which is comprised of CHWs and their team leaders. The community- and facility–based teams form the PHC team components of the clinics in districts. The clinics, the first level of health facilities in the PHC system, function alongside community health centres and district hospitals to form the DHS. The comprehensive and integrated preventive, promotive, curative and rehabilitative services of the CHWs, referred to as the WBPHCOT programme, are positioned as a continuum within this level of health system. The oversight function of the DHS lies with the district health management (DMT). The DHS suffers from the top-down decision-making processes and inadequate managerial capabilities, among others.[211] These challenges are more evident especially at sub-district level where the mechanisms of PHC operations are most complex.[212] It is likely that these challenges influence the implementation and assessment of CHW training, in provinces, differently.

2.6.2. The South African CHW Curriculum, Training Processes and CHW Roles

There is a long history of CHW programmes in South Africa, including largely NGOs-led programmes that had their major focus on specific diseases including HIV and tuberculosis.[64,110,213] The implementation of the WBPHCOT is premised on several policy instruments in South Africa (Bill or Rights, National Health Act, and the Skills Development Act among others). These are to

ensure that the South African citizens have access to equitable healthcare and provide opportunity through which the skills of the South African Workforce including CHWs are developed. In other words, CHWs could have a career path within the health system through standardized national training. Over time, WBPHCOT programme is evolving towards a well-standardised programme.[29,109] There are descriptions of eligibility criteria, job descriptions and standardized trainings for the CHWs.[214]

A curriculum change within the South African context is considered a means of social reconstruction to enhance new skills, knowledge, values and attitudes as well as to redress race and gender inequality. However, it is uncertain whether the CHW training curriculum is a response to the lack of entrepreneurial skills towards job creation or strictly driven as a political initiative with no bearing to the reality of the learner.[215] It is also uncertain to what extent the 'teachers', who are said to be at the centre of curriculum change, are involved in curriculum discussions, which tend to follow a top down approach.[216]

The activities of WBPHCOT based on the policy framework include "health promotion, primary prevention of disease, healthy behaviour counselling, treatment adherence counselling, secondary disease prevention through basic screening".[29] Other activities include "appropriate referral and basic therapeutic, rehabilitative and palliative care services".[29] A [2]two -phased training curriculum of CHWs has been developed (in print) with these activities in mind.[29,214] Phase 1 include a two-10-day training at the district level followed by practicum, was commenced in 2012. Topics included are roles of a CHW; basic understanding on health, PHC, PHC re-engineered model, and WBPHCOT; and continuum of care and patients' rights. Assessments included pre- and post-tests (scores ≥80% is a pass). Phase 2, commenced in 2014, follows successful completion of Phase 1 and is taught over a 5-day contact session, with a practical skill component. However, several challenges have persisted.[50,217] These include differential, inadequate and inconsistent payments of stipends. CHWs are faced with inadequate

[2] The South African Department of Health (NDoH) developed a two-phased training manual in print in 2012. Phase 1 included a two-10-day training at the district level followed by practicum. Topics included are roles of a CHW; basic understanding on health, PHC, PHC re-engineered model, and WBPHCOT; continuum of care and patients' rights. Assessments included pre- and post-tests (scores ≥80% is a pass). Phase 2 follows successful completion of Phase 1 and was taught over a 5-day contact session, with a practical skill component. The CHWs learn how to promote health and prevent illnesses in the community, community mobilisation and working with the community, basic knowledge of how to identify conditions such as hypertension, diabetes, HIV, tuberculosis, malaria, stroke and heart problems. Others were the health of a man and woman, old people, aging, youths, domestic violence and injury, child abuse, social support services, palliative care and the care of the mouth and teeth.

infrastructure and lack of essential equipment including stationeries, kitbags, uniforms, protective clothing and workspaces.[116,218,219] The reported challenges also include issues with on-going training, supervision, staff shortages and integration into the PHC facilities.[116,219] Moreover, CHWs were mostly trained on specific diseases, and supervision is often by newly graduated, often younger and less experienced team leaders.[116,217,219-221] Differences also exist regarding how many households a WBPHCOT is meant to provide healthcare services to. These critical limitations surrounding effectiveness of training has important influence on CHW performance. A recent assessment of the programme identified the following challenges: differences across provinces and districts in CHW activities, hours of work, daily number of households to visit, and availability of weekly supportive training and oversight supervision.[222] Moreover, differences have also been reported in training protocols by different departments of health, varying length and duration of trainings, with some CHWs better trained than others, and differences in entry qualifications.[50]

The South African government just published the "2024 Community Health Worker (CHW) Training Materials for Foundation Phase" based on inputs from various NDoH programmes.[223] The training materials include participant/facilitator manuals, pre/post assessment tests including the scoring templates, a CHW work integrated learning and a booklet of screening tools.[223] The recent training materials are to serve as updates for the Phases 1 and 2 CHW training curriculums as well as the International Training and Education Centre for Health (I-TECH) curriculum published (in print) in 2018.[223] The addition to the 2024 curriculum includes an update on NCDs such as cancers, and mental health.

Prior to this, a new "in-service skills development training programme," called the "Ward-based Primary Healthcare Outreach Team In-service Skills Development Package," was developed by the NDoH with the support of the U.S. President's Emergency Plan for AIDS Relief and conducted by I-TECH.[224,225] The topics covered include an introduction to ethics and confidentiality, communication, health promotion, screening, referral, tracing, and psychosocial support. A household tool handbook was also compiled. The content of the training is said to be aligned to the scope of CHW work as well as that of their outreach team leaders (OTLs, these are qualified nurses). The approach to training includes "group discussions, case presentations, scenario-based role play, small group activities, and interactive presentations". These approaches were used to understand example scenarios set in the curriculum as well as on-the-job setting scenarios to develop CHWs' and leaders' skills. The OTLs were trained by "master trainers"

who had received training from I-TECH facilitators. In turn, the OTLs trained the CHWs with master trainers directly observing. I-TECH provided the training to about 1600 OTLs and 22,000 CHWs between February and September 2019.[224,225] Against these changing contexts of CHW training in South Africa, there is need to systematically examine the performance of CHWs who provide comprehensive care and understand influencing factors of CHW comprehensive care performance.

2.7. The summary of the literature review

Table 2.3 provides the summary of the research topics examined in this study, the gaps identified in the literature and scholarly contributions that this PhD contributes

Table 2. 3: Objectives and existing literature and gaps regarding the PhD topic

Objectives addressed in this PhD	Existing evidence and identified gaps
To identify existing CHW training programmes for comprehensive care and synthesise evidence on their effectiveness. (Paper 1)	Increasingly, LMICs are showing interest in national CHW programmes whose CHWs provide more comprehensive care services (considered as involving more than one disease or conditions and based on services that are largely promotive and preventive in nature). Although several studies have reported on the effectiveness of CHW programmes, little is known about the effectiveness of the training necessary to accomplish their widening roles. It is therefore important to be able to identify different CHW programmes that can be considered as comprehensive in scope and how effective the training designed to equip CHWs to provide comprehensive care services.
To identify the tools that have been used to evaluate gains in CHW knowledge and skills as a result of attending the training and evidence for their utility. (Manuscript draft for Paper 2)	Increasing evidence shows the growth of studies evaluating the effectiveness of CHW training programmes although most are reported on single diseases or narrow scope of comprehensive care. Evidence suggests that few studies evaluate training outcome using various evaluation models e.g., Kirkpatrick's four levels. Synthesised evidence on the utility of assessment tools as well as on evaluation models employed in evaluating effectiveness of training for comprehensive care is lacking.
To determine whether the quality-of-care assessment tool that was developed within a 3-year intervention study to enhance the quality of CHW care in South Africa is valid or useful for assessing the quality of comprehensive care CHWs provide when visiting households (Paper 3)	The assessment of the performance and quality of care of CHWs who provide comprehensive care require standardized metrics, validated tools and indicators, which are lacking. Several existing tools target single diseases or narrower range of comprehensive care. Existing frameworks focusing on key indicators that can be used to measure what the CHWs know, can do or document, and how effective the quality of care they provide is, may suggest a more efficient approach to assessing their performance for timely corrections.
To determine CHW quality of care measured as messages/activities scores derived from the proportion of health messages given in the households with conditions visited by CHWs who provide comprehensive care in South Africa and identified the associated factors. (Paper 4)	CHWs' activities occur largely during household visits, which often go unsupervised and unassessed, long-term. Ongoing assessment is needed to identify gaps in CHW competency and improve any such gaps. The need is all the more crucial as CHW programmes become increasingly comprehensive

CHWs, community health workers; LMICs, low- and middle-income countries; MCH, maternal and child health; NCDs, non-communicable diseases; IRR, inter-rater reliability

In chapter 2, I have documented the background and literature review of this PhD study. In the following section, in two major subsections, I briefly described the Methodology and Methods. I addressed the broader, overarching principles and strategies applied in the entire study, including the Kirkpatrick evaluation model, in the Methodology subsection. The study setting, sites, design and ethical considerations used in this study are briefly introduced in the Methods subsection.

CHAPTER 3: METHODOLOGY AND METHODS

"Nothing has such power to broaden the mind as the ability to investigate systematically and truly all that comes under thy observation in life".

- Marcus Aurelius (121-180) was a Roman Emperor and Stoic philosopher

3.1. Introduction

This chapter documents the overall methodological and methodical approaches used in this PhD study. The methodology documents the rationale for the use of an evaluation model, the Kirkpatrick evaluation model, for assessing effectiveness of CHW training for comprehensive care. and use of assessment tools with evidence of utility (validity and reliability) in evaluating CHW gains (outcomes) following training. Here, I also report the different utility types (validity, reliability) which I examined both in the systematic review and as part of the primary study where I evaluated the utility of a quality-of-care assessment tool. Further, I describe the background study, named the Batlhokomedi study, informing the development of the quality-of-care assessment tool which I validated as part of this PhD study. Finally, I provided a description of the quality-of-care assessment tool. Brief description of the methods, including the study setting, sites and designs are also documented in a separate subsection of this chapter, and how the different components of this PhD study are tied together. The methods do not comprehensively document the approaches and tools already reported in the individual paper chapters, but rather, I provide the rationale for the choice of the PhD study designs and justify the overall structure of the PhD. The researcher positionality and ethical considerations are also described in this chapter.

The studies are reported based on the study design employed. Two related systematic reviews (objectives 1 and 2) cover the entire LMICs while cross-sectional study design was used in the two primary studies (objectives 3 and 4). The decision to report the methods along the study designs is to allow for clarity since objectives 1 and 2, based on the two related systematic reviews, identified articles that utilised multiple study designs.

3.2.Methodology

3.2.1. Kirkpatrick's four levels of training evaluation applied to this PhD

The Kirkpatrick's evaluation model is a widely used approach to evaluating training programmes, and recently, is increasingly becoming utilised in evaluating CHW training programmes.[42,200,226] The model, named after the author and introduced in 1959, is reported as a simplified approach to evaluation.[227] Although the model has limitations in failing to account for prior training resources or intervening factors influencing outcomes, I consider it to be appropriate for evaluating the effectiveness of CHW training programmes for comprehensive care examined in this PhD study (see Figure 1). The justification for the use of the model is provided in the subsequent paragraphs. For this PhD study, the model provides a framework with which to locate the findings in an integrated manner, and aid in the interpretation of findings.

EVALUATION TYPE	EVALUATION DESCRIPTION AND CHARACTERISTICS	Objective 1: Systematic review to identify existing LMIC CHW training programmes for comprehensive care and synthesise evidence on their effectiveness	Objective 2: Systematic review to synthesise evidence on the tools used to evaluate gains in CHW knowledge and skills and the utility of such tools	Objective 3: To assess the utility (i.e. validity and reliability etc.) of a tool for assessing the quality of CHWs comprehensive care in South Africa	Objective 4: To determine factors associated with the CHWs quality of comprehensive care in three districts of South Africa
LEVEL 1 REACTION	REACTION EVALUATION is how the delegates felt, and their personal reactions to the training or learning experience	☑	☑	☒	☒
LEVEL 2 LEARNING	LEARNING EVALUATION is the measurement of the increase in knowledge or intellectual capability from before to after the learning experience	☑	☑	☑	☒
LEVEL 3 BEHAVIOR	BEHAVIOR EVALUATION is the extent to which the trainees applied the learning and changed their behavior, and this can be immediately and several months after the training, depending on the situation	☑	☑	☑	☑
LEVEL 4 RESULT	RESULTS EVALUATION is the effect on the business or environment resulting from the improved performance of the trainee - it is the acid test	☑	☑	☒	☒

Figure 3.1: Kirkpatrick's four levels of training evaluation applied to this PhD

© Donald Kirkpatrick's Learning Evaluation Model 1959; review and contextual material Alan Chapman 1995-2007
https://www.ag.ndsu.edu/evaluation/documents/kirkparicks-four-levels-of-training-evaluation-in-detail

According to Kirkpatrick, effective training programmes must meet the needs of the trainees; therefore, it is necessary to assess effectiveness of training programme to ensure that such needs

are being met.[45] The needs, and whether they are met can be assessed, including by asking either the trainees, their managers, or others who are familiar with the work CHWs are trained on, or by testing or reviewing the trainees reports.[45] In this regard, the model provides a useful approach.

Evaluation involves systematic data collection and should be planned along with the training programme, in line with the training objectives.[45] However, evaluation is a complex process requiring several complex factors. These factors are also complexly interacting with other attributes within the organisational setting, and within and between individual trainee and training situations. The CHW programme has challenges related to insufficient funding and poor prioritisation of monitoring and evaluation by programme planners in the context of other competing programme needs such as CHW remuneration and supplies.[228] Indeed, evidence suggests that even when pre-intervention data are available, they are often not applied by programme planners in designing and implementing interventions.[229] Therefore, a successful CHW programme that will incorporate an evaluation model requires much thinking and planning to determine what can be strategically and systematically targeted in monitoring and evaluating CHW programmes, considering its competing needs.[45] As has been reported previously, an evaluation of which training works and to what extent, may be sufficient for CHW programmes since programme planners are more concerned with CHWs doing what they are taught and that it is done consistently well.[200] These support an evaluation model such as Kirkpatrick's whose levels provide information on ongoing steps during and following training. Quality assessment tools and methods can then be utilised for data collection, to assess effectiveness of training or gains following training.[45]

Kirkpatrick's four levels of evaluation which are **reaction**, **learning**, **job performance (behaviour)** and **organisational impact** can help in identifying available and applicable assessment tools, utilise evaluation data to understand various aspects of training, indicate the level of training that is being assessed and determine the effectiveness of a CHW training programme for comprehensive care.[45,227,230] The four levels assess the **reaction** to training (e.g., post-training surveys used to evaluate level of satisfaction of trainees), the students' resulting **learning** (pre- and post-test assessment), **job performance or behavioural change** (assess whether learning has transformed into practice e.g., using checklist, observation or interview), and **organisational impact or results** (assessing the effect of training against the primary goal in the primary intervention environment through set indicators).

The four levels of evaluation assess 10 components that Kirkpatrick consider to be basic requirements of an effective training programme.[45] These requirements include that training be based on the participant's needs, have learning objectives, occur at scheduled times and in the appropriate location with required training materials. It also requires that attending participants meet desired selection criteria. Training should be delivered by effective trainers, use effective training methods and techniques including teaching aids, be successful in achieving set goals, be satisfactory to the participants, and include an evaluation component.[45]

In the next subsection, I delve into why knowing the utility of an assessment tool is relevant and the common utility types in educational research.

3.2.2. Assessing the utility of a quality of care assessment tool

Post-training assessment tools that can assess the quality of services provided by trained CHWs have a vital role in enabling effectiveness of CHW training programmes. Prior to and after training, it is important to assess what knowledge gap exists and whether the training achieved its goals. For example, whether the skills of the CHW improve such that they are able to provide appropriate and quality services. To assess learning and skills, assessment tools are essential and their psychometric properties or utility need be determined. This is important because if outcomes of assessments are to help in shaping training delivery and curriculum development to optimise competence, performance and quality of care, the utility of assessment tools should be of a high quality.[231,232] In this PhD study, I utilised one of the more common frameworks for assessing the utility of an assessment tool (reliability, validity, and transferability).[231] Table 3.1 describes various types of utility considered in this PhD study.

Table 3. 1: Types of utility

Type of Utility	Definition	Measures
VALIDITY		
Face	The extent to which an instrument seems to measure what it is intended to measure	Ratings from CHWs and their nurse supervisors to see if they consider that the assessment tool covers everything that it is meant to cover or how relevant the tool is to the care that CHWs are expected to provide. Face content addresses the following questions: • "Do intended users understand the tool and its domains?" • "Does it make sense to them i.e.is it relevant to what they are expected to know?" • "Do they know why the tool contains these domains and what else it should have contained?"
Content	Whether all facets of a construct of interest are being measured sufficiently or appropriately by the item(s) intended to represent it. Or the degree to which an instrument has an appropriate sample of items for the construct being measured	• This is a posteriori attempt to evaluate the relevance of a scale's content through expert assessment (Lynn 1986). • A minimum of three and maximum of 10 experts, use a 3-5 point scale to rate the relevance of each item.[233] • Content Validity Indices (CVI) is derived by using ratings assigned by content experts to assess the relevance of each item and determine whether the tool includes a comprehensive set of items to adequately measure the construct of interest.[234] • There are two types of CVI: o Individual item (I-CVI) which is derived from the number of experts giving a rating of either 4 or 5 divided by the total number of experts. A score of .80 to 1.00 is highly relevant. According to Lynn (1986), I-CVIs should not be lower than .78. o Overall scale content validity (S-CVI), by definition, all experts have to agree that any individual item is relevant in order for it to count toward the S-CVI or the proportion of items
Criterion	Do the results of a particular test, or measurement, correspond to results gathered using a different, validated tool, measuring the same construct.	This answers the question: Do the scores from an assessment tool give consistent results compared to a previously validated but similar tool?
Construct	This is the degree to which a measure relates to other variables as expected within a system of theoretical relationships	Factor analysis is used to measure the inter-correlation between components or constructs, which then allows its different dimensions to be grouped in other to identify those with related items under the same dimension. A confirmatory factor analysis is used to establish that the measurement model fits the actual data
Transferability	This refers to the extent to which the results of a test can be transferred to a different context, settings or participants	This is done by providing evidence that the results obtained in one context or setting is applicable in another.
RELIABILITY: Whether a particular technique, applied repeatedly to the same object, yields the same result each time		
Inter-observer reliability	When more than one observer rates the same people, events, or places	Two observers are asked to observe the same event or interaction. If their ratings are similar, I can have much confidence that the ratings reflect the true state of the event rather than the orientations of the observers. The level of correlation between the scores of the two observers measures the inter-observer reliability.
Internal consistency	• This is a measure of how well related although different items all measure the same thing. This is applied to groups of items thought to measure different aspects of the same concept. • Since one single item is only able to bring out only one aspect of a concept, then, with several different items, more information can be gained.	Cronbach's alpha is derived to: • determine the degree of internal consistency. • It is a function of the number of items in the scale and the degree of their inter-correlations. • Cronbach's alpha ranges from 0 to 1. • It measures the proportion of variability that is shared among items (covariance). • When items all tend to measure the same thing they are highly related and alpha is high. • When items tend to measure different things they have very little correlation with each other and alpha is low.

Below, I describe the context within which a post-training quality-of-care assessment tool was developed as part of a 3-year intervention study, the Batlhokomedi study. During the development of this tool, I served as a researcher and project manager within the project, and in this capacity, I contributed to the review of qualitative data collected while observing the

activities of the CHWs during household visits and contributed to literature search and charting of information towards the development of the tool. The tool was developed to bridge a gap of the lack of a comprehensive tool for assessing the multiple outcomes of comprehensive care, which is becoming the norm of national CHW programmes.[235] In this PhD, I evaluated the utility of this assessment tool to further strengthen the discuss around the relevance of the use of high-quality tool in evaluating the quality of comprehensive care by CHWs following training.

Batlhokomedi study

The Centre for Health Policy at the University of the Witwatersrand and Sedibeng Department of Health conducted this study from 2016-2019. The study focused on the implementation of the WBPHCOT programme in Sedibeng Health District, Gauteng Province.[218,235,236] The Batlhokomedi study has five specific objectives:

1. To describe, cost and compare six existing CHW programmes that provide comprehensive care in order to identify factors that facilitate or impede success.

2. To develop strategies to strengthen existing care drawing on the new South African policy and the lessons learned in Phase one.

3. To implement the evidence-informed strategies in two pilot sites to support the development of that model.

4. To evaluate the strategies to provide evidence on the design, implementation, cost and effectiveness as well as acceptability to the community.

5. To contribute practical recommendations to strengthen policy, implementation and practice in similar settings.

In the Batlhokomedi study, to assess the quality-of-care that the CHWs provide pre- and post-training, a quality-of-care assessment tool that was developed by the project researchers was used in a baseline survey and 18 months later in an endline survey across two sites in Sedibeng District. The description of the assessment tool that was developed is briefly presented below.

The quality-of-care assessment tool (Appendix 3.1a-c)

The tool has three main domains including:

a) The first domain is for an understanding of the CHWs intention for the visit to the household on a particular day and their previous encounters with the household. This forms the background of the CHW visit. OR ***Prior engagement***: questions in this section ask about the CHWs previous encounters with the household as well as their intention for the current visit. This enables the observer to understand the background of the CHW visit, and how the history might shape the current visit.
b) The second domain provides understanding into the context within which the interaction between the CHW and household takes place. For example, the type of house, whether interaction occurred inside or outside the main entrance of the house and whether there were disruptions or not.
c) The third domain covers the conditions, messages and actions section. This domain consists of a list of the potential health conditions that could be identified among household members as well as the messages and actions that CHWs would be expected to provide as part of care. A scoring system, showing a hypothetical household, was developed to show how the scoring is used to determine the performance of the CHW (Appendix 3.1d). The CHW is given a score of 0 or 1 depending on whether a message was given or action performed. A total score for the visit is then computed based on the conditions identified by the CHW, the relevant messages or actions that the CHW could have provided, and those actually given or taken. This domain also contains demographic characteristics of patients, whether patients were referred and further actions by the CHWs after referral of patients.

To complete the assessment tool, a fieldwork manual was developed as a guide (Appendix 3.2). The manual is a resourceful material to guide the trained observer on what to observe and what/what not to score. It provides clear information and potential scenarios regarding whether the interaction or activities of CHWs are relevant for scoring using the assessment tool.

Below, in the Methods section, I provide brief descriptions of how I performed the systematic review and primary data collection phases. Researcher positionality and ethical statements were also described.

3.3. Methods

3.3.1. Methods of the systematic review

The necessity of systematic review is premised on the availability of multiple evidence on the same topic that when synthesised, can identify variations in practice and suggest ways of

addressing them or whether current practice is adequately supported by evidence.[237] Evidence from systematic review can therefore provide guidance on policy decision-making. Therefore, systematic review is considered necessary in this PhD study as it enables evidence synthesis on available national or large-scale CHW training programmes for comprehensive care in LMICs, how effective the trainings are and how the outcome such as quality of care, competence or performance, are measured.

In the systematic review, I considered comprehensive care to be combinations of health activities involving more than one disease or conditions using promotive and preventive approaches.[16,17] The study design applied in the two related systematic reviews included a pre- and post-intervention study design, prospective observational, randomised controlled trial, and repeat cross-sectional study design. These study designs were used to provide evidence on the effectiveness of the training for comprehensive care and tools for assessing effectiveness. The search strategy was guided by the PICOS (Population, Intervention, Comparison, Outcome and Study design) framework. The search was conducted in three databases (PubMed, CINAHL and Cochrane Review) from 12 September 1978 (Alma Ata) to 31 December 2023. The Kirkpatrick's four hierarchies [45] was used to provide evidence on the utility of post-training assessment tools.

As a follow-up to the evidence obtained from the two related systematic reviews, I conducted primary data collection in South Africa to assess the utility of an assessment tool for evaluating comprehensive care of CHWs following training and to examine outcomes of training and its associated factors. Below, I provide brief description of these empirical studies.

3.3.2. Methods of the empirical study

Study setting

The empirical PhD study was conducted in South Africa, a country of 60.1 million people, most of whom reside in Gauteng Province (15.81 million people, 26.3%).[238] As of 2018, the South African Gini coefficient of 0.67 reflects the dual economy of the nation as one of the highest and most persistent inequality rates globally.[239] South Africa has a quadruple burden of disease: maternal, newborn and child health; HIV/AIDS and TB; NCDs; and violence and injury.[239] However, despite good policy and health expenditure, the South African health system performance has been poor since the 1994 democratic rule.[239] The public sector within which CHWs mostly function, provides care to 81% of the population, with the rest served by the private sector.[239] CHWs play a critical role within the health system workforce in South Africa

(22%), with unequal relevance across provinces. For example, in Mpumalanga Province, CHWs constitute up to 35% of the workforce, but less so in Gauteng Province (18%), but coming second after the nursing workforce.[238] Although the policy uncertainty around CHW programme is largely being resolved, however, challenges persist around implementation and CHW salary scales.[116,238]

Study sites

The empirical part of this PhD study was conducted in two (Gauteng and Mpumalanga) South African Provinces and included five clinic facilities overall. In Gauteng Province, two of these clinics are in Sedibeng District and one in Tshwane District. In Mpumalanga Province, two are in Ehlanzeni District. The study sites were selected to ensure inclusion of diverse settings to reflect the diversity around how the national CHW programme is being implemented in South Africa. All the sites have operational CHW programmes that are at different stages of maturity. Sedibeng District and Tshwane District have been involved in several research studies in the field of Public Health. The Batlhokomedi study within which this PhD is positioned was conducted in Sedibeng District. Tshwane is considered the district with one of the most advanced CHW programmes in South Africa and was one of the pilot district for the NHI implementation. Their previous and ongoing involvement in research also facilitates research feasibility and access. Although Mpumalanga is also a province with vast involvement in research, the Ehlanzeni District included in this study features CHW programme that had just been incorporated into the national programme at the time of this PhD study. Therefore, the CHW programme was in its very early stages. The district was also not an NHI pilot site. This diversity was to facilitate comparative analysis to understand how contextual factors influenced outcomes, thereby enhancing the generalisability or transferability of findings.

Sedibeng District has approximately 1,039,908 people in 330,326 households, about half of whom are women, 12.3% live in informal households in plastic and corrugated iron-made shacks while others live in brick houses, mainly provided by the government.[240] About half (50.7%) of the population are unemployed, live in poverty (48.5%) and depend on the government for social grants.[240] The two clinics are located approximately 30 km from the district centre.

The population in Tshwane District include 3,555,741 people living in 1,136,876 households. Of these, 51%, 22.6%, 29.6%, and 16.4% are women, are unemployed, live under the poverty line

or in informal households, respectively.[241] The one facility included from Tshwane is at a distance of about 32 km from the district centre.

Ehlanzeni District (Mpumalanga Province) include 1,856,753 people living in 514,000 households. Of these, 48%, 53%, 6%, 43% and 68% have no formal schooling experience, are women, live in informal households, are unemployed or live in poverty, respectively.[242] The two facilities in Ehlanzeni District are about 138 km and 126 km respectively away from the district centre.

These three districts (Figure 3.2) include disadvantaged communities where the populace experience inadequate shelter, food insecurity, and high disease burdens, and have limited access to health services, transport, water, and electricity.

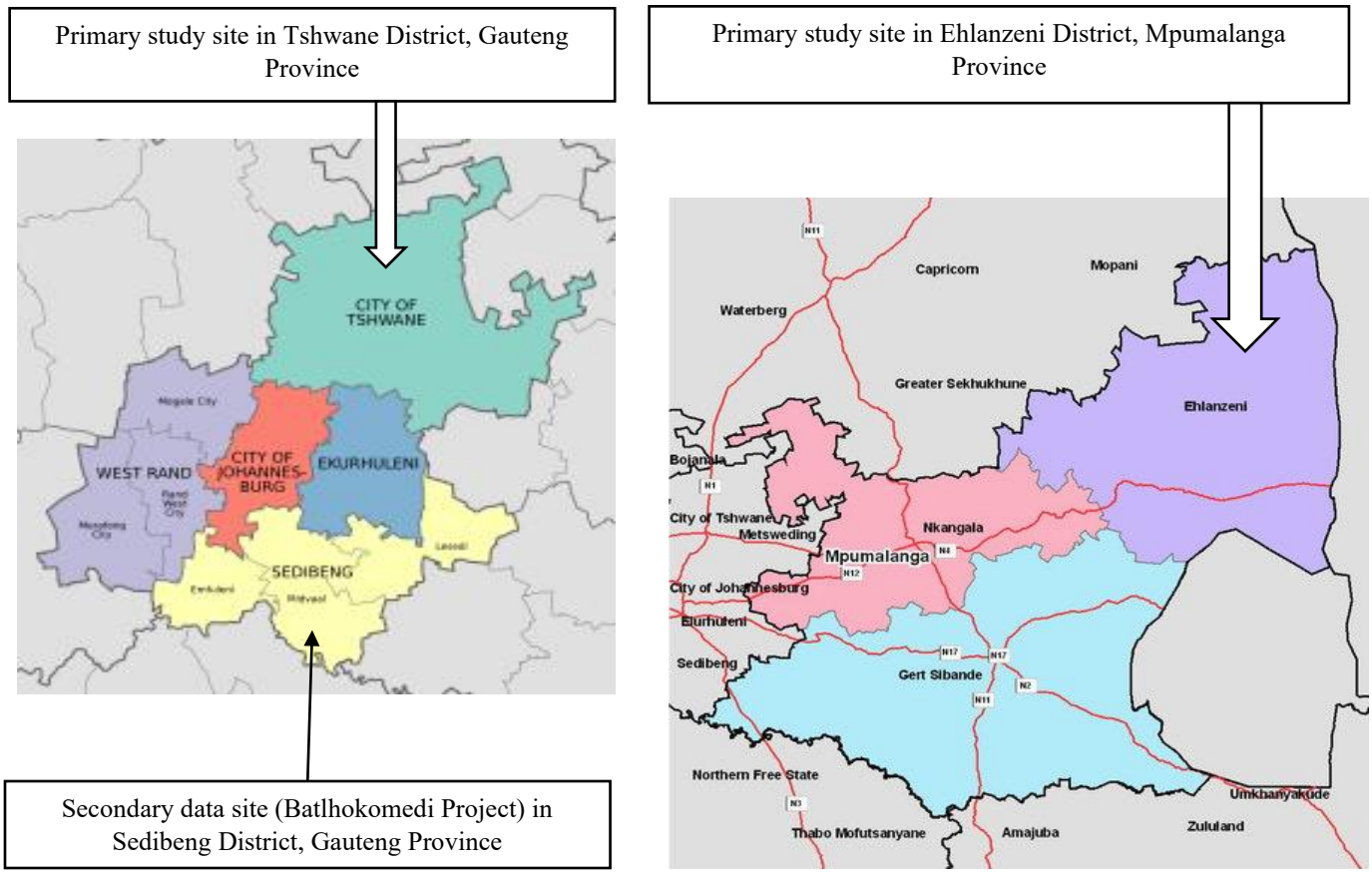


Figure 3. 2: Maps of Gauteng and Mpumalanga Provinces and Districts

Study design

Both the primary and secondary quantitative data analysed in this PhD study were collected using cross-sectional study design. This study design was used to obtain data that were analysed to provide evidence on the utility of the quality-of-care assessment that I previously describe, and to assess the quality of comprehensive care (defined as messages/activities scores) provided by the CHWs as well as the associated factors of the quality of comprehensive care.

To provide evidence on acceptability and face validity of the quality-of-care assessment tool, I conducted a participatory workshop with 6 to 10 purposively selected CHWs who could read fairly easily or were proficient or confident in the use of English and team leaders to gather information regarding their acceptability and willingness to be scored using the assessment tool. During the workshop which lasted for one hour at each of the four sites, I conducted an interactive session on the items in the paper-based assessment tool that was distributed to each CHW and team leader. I first introduced them to the tool's purpose, explaining that it is based on the national CHW curriculum and is meant to convey what they do. I also explained that it is

meant to be applied by observing their activities during household visit by a non-medical observer. I allowed them to look through the items to be sure it is clear to them and that they could understand the content of the tool. They were allowed to clarify about the purpose and raise a question if they considered any aspect to be unclear. During the discussion, I remained neutral by only referring to what is already on the tool and no effort was made to make it simpler for them to understand. After the interactive session, a paper-based questionnaire was distributed to each CHW and team leader to use in providing answers regarding the extent to which our tool covers everything that happens on household visits and how happy they were for their home visits to be assessed using the tool.

Below, I provide a brief overview of my positionality as a researcher during this primary data collection phase.

3.3.3. Researcher's positionality

My role was that of an outsider. Although I am Black, I am not South African and could not speak the participants' indigenous languages besides English. Moreover, being a Black medical doctor has important relevance in a space where racial inequality has declined since the end of apartheid, paving the way towards a "*hierarchy of unequal classes*".[243] In all of my interactions with the study participants, I was constantly aware of this. I was constantly drawn to medical care conversations, even as a researcher. Although Black, I am consistently mistaken to be South African by my body build. Thus, spontaneously, participants tend to initiate conversations using their local languages other than English. Since the social context of my study participants is similar to that in Nigeria where I was born and grew up, I had a natural flare for speaking back their words to them in the same language. This ends up with all of us in outbursts of laughter at my poor language imitation. This tends to neutralize the importance of our social class differences. My project management experience in similar South African districts (Ekurhuleni and Sedibeng), also influenced my navigation of this space.

My study was mostly quantitative; in the limited qualitative component, maintaining a neutral perspective was easy as all tools were either self-reported or completed by trained fieldworker observers. However, in a workshop I held to facilitate the qualitative component, being self-aware that my position may influence the data being collected, I was careful to listen without exerting influence. The supervisory roles of my supervisors and support of research assistants also served in validating my findings.

Below, I described the various aspects of ethical issues in undertaking this study and how I addressed them.

3.3.4. Ethical consideration

This PhD study components required a separate protocol for the systematic review component which was registered in PROSPERO (Reg. No.: 2020 CRD42020209937) (Appendix 3.3). The rest of the PhD study protocol received ethical approval from the Medical Human Research Ethics Committee (HREC) of the University of the Witwatersrand, Johannesburg (approval number M190933). Respective approval was also obtained from Ehlanzeni (MP-2020001-002) and Tshwane Districts Research Committees (GP-202001-012) for the inclusion of participants from their various settings. The certificate of approvals from all ethical committees identified me as the Primary Investigator. The Wits University HREC (Medical), Ehlanzeni and Tshwane Districts Research Committees approval certificates can be viewed in Appendix 3.4a-d

In all the settings, for the different components of the PhD study, the study details were explained, and an information sheet was given to each participant. These included information sheets for face validity (Appendix 3.5), CHW quality-of-care observations (Appendix 3.6) and expert review of the quality-of-care assessment tool (Appendix 3.7). The participants provided their written informed consent forms for face validity questionnaire workshop/discussion participation (Appendix 3.8) and audio recording (Appendix 3.9) as well as for CHW quality-of-care observations (Appendix 3.10), before participating in this study. For observations during the household visits, each CHW sought and obtained verbal consent from each head of household before the trained observer is allowed to enter to perform observations. Permission was granted by each of the four facility managers to recruit participants during the study period. In compliance with the POPIA Act, for the secondary data analysis, under the Batlhokomedi Project, each CHW and their OTLs were provided a revised information sheet and consent form for the anonymous future use of their primary data previously collected by the Batlhokomedi Study researchers in Sedibeng District (Appendixes 3.11 and 3.12). The Batlhokomedi Project Principal Investigator, Prof Jane Goudge, also provided a letter of data release (Appendix 3.13).

In the next four chapters, I present the publications that were outputs from this PhD study, aiming to highlight the findings based on each study objective. Together, they show the importance of assessment of effectiveness of CHW training, approach to assessment, relevance

of assessment tools and evaluation models, given the comprehensive care scope, particularly in LMICs.

RESEARCH FINDINGS

CHAPTERS 4 - 7

CHAPTER 4: PhD PAPER 1

This paper, with citation below, is under review in *Plos One*

Babalola Olukemi, Goudge Jane, Brown Celia, Babalola Joseph, Natasha Khamisa, Johnson Samantha, Griffiths Frances. Effectiveness of existing national or large-scale community health worker training programmes for comprehensive care in low- and middle-income countries: A systematic review

4.1. **Title:** Effectiveness of existing national or large-scale community health worker training programmes for comprehensive care in low- and middle-income countries: A systematic review

4.1.1. Abstract

Background: There is growing interest in low-income and middle-income countries (LMICs) in community health worker (CHW) programmes whose CHWs can provide a comprehensive range of services (for more than one diseases/conditions using promotive and preventive approaches). However, little is known about the effectiveness of the training necessary to accomplish their widening roles. We aim to identify existing LMIC CHW training programmes for comprehensive care and synthesise evidence on their effectiveness.

Methodology: We searched three electronic databases (PubMed/MEDLINE, CINAHL, and Cochrane Library) to identify peer-reviewed studies until December 2023. We used the PICO framework: Participants (CHWs), Intervention (training), Comparison (before and after or no training), and Outcome (change in knowledge and skills score). Quality of included studies was assessed using the Effective Public Health Practice Project (EPHPP)'s Quality Assessment Tool.

Results: The review included 14 articles from 12 LMICs. Effectiveness was evaluated using pre and post, cross-sectional, randomised controlled trials, and longitudinal study designs. Most training packages were on maternal and child health (MCH)-related programmes. Three studies evaluated trainings on care packages encompassing health conditions beyond MCH. Most common training method was the cascade training-of-trainer model which included peer CHW trainers in two studies. Significant improvement in scores occurred at post-training ranging from 5.7 to 62.8 percentage points (pp) from pre-training assessment. Compared to the immediate post training, significant decreases occurred in scores 2-12 months after training ranging from 12.5 and 34.0 pp. Between assessment periods, CHW groups with lower (primary) educational background showed decreased score of 10.3 pp while those with higher (secondary) education showed 1.8 pp increased score. Health professional-led training resulted in 10.3 pp increased score while peer CHW-led training showed 1.9 pp decrease.

Conclusions: Our findings show that CHWs with limited pre-employment education can be trained effectively on comprehensive care programmes such as community maternal and newborn health, MCH, integrated management of childhood illnesses. Although the post-training

scores declined over time, the scores did not decline below the pre-training scores. Insufficient evidence exists regarding effectiveness of CHW training for a full comprehensive care package. Therefore, future studies should consider the full packages of comprehensive care in LMICs.

Keywords: Community healthcare worker, comprehensive care, training, effectiveness

4.1.2. Introduction

Community health workers

Community health workers (CHWs) are members of a community within which they perform mostly promotive and preventive healthcare services after having receiving some training. They often belong to a formal health system, and they could be managed by the government or an implementing non-governmental organisation (NGO).[8,21,66,244] Globally, interest in nationwide programmes where CHWs provide a comprehensive range of services is growing. Many countries are formally integrating or have integrated CHWs into their health system, including Ugandan village health team, Pakistan's Lady Health Worker Program, Malawi's HSAs, government-employed CHEWs in Kenya, CHWs in Rwanda, and CHAs in Zambia.[15,245-250] The training of CHWs within such programmes has to be effective if the investment in this workforce is to be realised.

Comprehensive care programmes in LMICs

Traditionally, CHW programmes were focused on single diseases or health-related events including immunisation services and family planning.[17,251] Although CHW programmes are becoming more comprehensive there is no established definition of CHW comprehensive care. Previous studies have described comprehensive care as covering a wide range of diseases and health-related events such as HIV/TB, maternal-child health (MCH) and chronic non-communicable diseases (NCDs), with a strong preventive/promotive approach.[17,251] Comprehensive care packages often include integrated management of childhood illnesses (IMCI) involving treatment of minor illnesses; screening and reporting of disease outbreaks; and screening and prevention activities.[252] CHW programmes are also relevant in community management of pandemics such as COVID-19,[253-256] and for cardiovascular diseases, diabetes, cancers, and mental health.[18,42] Comprehensive care packages vary between LMICs, due to prevalent diseases and conditions. For example, South Africa moved away from a "loosely structured and highly diverse community care system" focused on HIV and TB, to its current more "formalized, comprehensive and integrated PHC outreach programme".[251] CHW roles in

providing care for people with disability, people with dementia, older adults, adolescents, during disasters, and in facilitating healthy lifestyle choices are also being explored.[257,258] It has been suggested that a balance is needed in CHW workload, requiring careful consideration by programme planners regarding appropriate and acceptable roles for CHWs within comprehensive care programmes.[18,250]

Training for comprehensive care programmes in LMICs and its evaluation

For CHW programmes to be effective, training is critical including continuous/ongoing and supportive supervision, necessary to develop highly skilled CHWs.[259] CHWs should receive training on the range of health issues within their scope of work prior to deployment and on an on-going basis.[260] With the expansion of roles and tasks within comprehensive care programmes, several different approaches to CHW training have been used.[259] For example, the Bangladesh CHWs, *Shasthya Shebikas*, employed within a large NGO-led programme, undergo a 21-day basic training.[88] This equips them with content including MCH (family planning, pregnancy-related services, delivery, immunisation); communicable diseases (TB screening and therapy); treatment of minor ailments; data administration services as well as training on hygiene, nutrition and eye care.[88] About 10-12 *Shasthya Shebikas* are supervised by each "*Shasthya Kormi*". The "*Shasthya Kormis*" undergo theoretical and field trainings and each of the two trainings occur over a 14-day period. The trainings cover how to conduct health education and antenatal and postnatal checks and provide pre-pregnancy care and reproductive health and nutrition services. The "*Shasthya Kormis*" are in turn supervised by "Area Managers" and provide a wider range of services than *Shasthya Shebikas*. Comprehensive care packages of South Africa's CHWs and Brazil's community health agents (CHAs) are similar. These include MCH (prenatal, neonatal, childcare including breastfeeding, immunisation); IMCI; communicable diseases (screening of HIV/AIDS, TB) and NCDs (hypertension, diabetes), which cover promotive, preventive, rehabilitation and household registration services. However, the training approaches differ. Until 2019, South Africa implemented a two-phased training programme for comprehensive care which included a 10-day theory-based curriculum and a 5-day, skills-based training provided by master trainers.[29,261] This training package required that their outreach team leaders (OTLs), who are qualified nurses, receive a once-off 5-day training. The Brazilian CHAs' curriculum involves instructional learning and practical skills acquisition during a 50-day training.[88] Within family health teams, in local clinics, CHAs are supervised by nurses and doctors in the same team.[88]

The outcomes of training are evaluated using various approaches including the pre- and post-training assessments [37], observer assessment of CHW skills [38,39], end-user interviews [40] and self-reports.[41] Pre- and post-training assessment enables evaluation of effectiveness of training by measuring specific outcomes [37], however, this approach, focused on the assessment of knowledge and skills only, is unable to assess competency or demonstrate behavioural change following training.[42] Thus, to support assessment of CHW competency following training for comprehensive care, individual and contextual factors influencing transfer of knowledge may need to be considered.[46]

The WHO-commissioned 15 systematic reviews to provide evidence to help optimise CHW programmes including their training and working conditions.[107,259] The findings suggest non-uniformity in the support provided to optimize CHW programmes and non-replication of what works across national CHW programmes. In relation to training, the guidelines recommend consideration of CHW scope of work, prior knowledge and required competencies in establishing a pre-service training duration but noted that more comprehensive training may be infeasible or unnecessary. To further on the recommendation for curriculum content focusing on all aspects of services including prevention, promotion, diagnosis, treatment and care, and that training modalities ensure a balance between theory and skills, it is important to determine the effectiveness of training for different comprehensive care packages within national CHW programmes. This systematic review addresses the question: What CHW training programmes for comprehensive care exist in LMIC and what is the evidence on the effectiveness of the training programmes?

4.1.3. Methods

We conducted a systematic evidence review using narrative synthesis. Due to the lack of a clear definition of 'comprehensive care' and its many possible outcomes, we utilised the narrative synthesis approach (rather than one that requires a well-defined single outcome).[262] We investigated the similarities and differences between studies as well as the relationships between the reported data.[263] The protocol for this systematic review is registered in PROSPERO (registration no: 2020 CRD42020209937). We report the search and screening results using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram.[264]

Our search strategy was based on the following PICOS approach (Table 1). We applied some inclusion and exclusion criteria (population, setting and intervention) in the search phase and the remaining (outcome, comparison and study design) in the screening phase (Table 4.1).

Table 4. 1: The PICOS table

PICOS Category	Approach	Examples of search terms
Population/setting	CHWs under various titles including community health worker, community health aides, family planning personnel, and village health workers in LMICs.	Health extension workers, Anganwadi workers, community-based health workers, health assistants Used full list of LMICs, as classified by the 2020 World Bank Group
Intervention – comprehensive care	Existing CHW training programme that are: 1. comprehensive care (combinations of health activities, involving more than one disease or condition using promotive and preventive approaches) 2. national or cover at least an administrative district.	*Applied at the screening phase*
Intervention – training	CHW training programmes.	Training, education, curriculum, and development
Outcomes	Pretraining and immediate post-training scores, or immediate and longer post-training knowledge and/or skills scores.	*Applied at the screening phase*
Comparison	Scores from CHW who had no training, or usual training, or scores prior to training	*Applied at the screening phase*
Study design	Pre and post observational study design, quasi-experimental non-randomised study design, RCTs were included	*Applied at the screening phase*

Notes: CHW, community health worker; LMIC, low- and middle- income countries; RCT, randomised controlled trial

Inclusion and exclusion criteria

Inclusion criteria

Available studies relevant to the training of CHWs were included if they met the following criteria:

1. The main subject was community health workers (including country specific names of the role)
2. The CHWs provided comprehensive care using promotive and preventive approaches for the following:
    1. One of the following care packages: HIV/TB, MCH, IMCI, and/or
    2. Combinations of diseases or conditions from at least two of these groups: communicable diseases, NCDs, mental health, care of the elderly and persons with disability, oral health
3. The CHW were working in any LMICs as classified by The 2020 World Bank Group (http://databank.worldbank.org/data/download/site-content/CLASS.xls)
4. Studies specified the type of training programme and reported either pre- and immediate post-training knowledge and/or skills scores, or immediate and longer post-training knowledge and/or skills scores for the CHWs.

5. Primary study with quantitative data or mixed method design reporting both quantitative and qualitative data.
6. Had a full text

Exclusion criteria

During the screening phase, studies were excluded if they were:

1. Only focused on other healthcare workers (such as doctors, nurses, or other allied healthcare professionals such as skilled birth attendants or traditional birth attendants), without reporting separately on CHWs.
2. Focused on CHW training programme for a single disease.
3. Only concerned a high-income country
4. Not in English
5. Review articles, qualitative studies, commentaries, protocols, conference abstracts and letters.
6. Reporting on training that took place before September 1978 (Declaration of Alma Ata)

Search strategy

We developed a comprehensive search strategy guided by a medical librarian (SJ) to identify available primary studies on effectiveness of CHW training programmes for comprehensive care from 12 September 1978 (Alma Ata) to 31 December 2023. The 12 September 1978 cut-off date was adopted because of its relevance to Alma Ata Declaration in which CHWs were recognised as pivotal to achieving comprehensive PHC.[82] We adapted the search terms of previously published reviews which assessed the implementation of training for CHWs in LMICs.[21,42,82,260,265,266] To develop our master search string (see PUBMED search terms in Supplementary Table 4.1), the search terms for 'community health workers' and the abbreviated terms such as 'CHWs' were combined with subject headings on 'training' and its key terms e.g., "Education", "Curriculum," "Problem-Based Learning" and "Staff Development," to identify English language abstracts of original research articles. We also used the index-linked Medical Subject Headings (MeSH) as alternative search terms. Eligible LMIC settings were as classified by The 2020 World Bank Group (http://databank.worldbank.org/data/download/site-content/CLASS.xls). Boolean operators, 'AND' and 'OR' were used in combining the search terms, along with use of wildcards.

To ensure a balance between identifying all possible relevant studies and efficiency in the use of resources (time and fund), we searched three databases, the PubMed, CINAHL, and Cochrane

Library.[267,268] We searched for other relevant studies in the reference lists of included articles. Where necessary, we contacted the Wits Medical Library or authors of included papers, for sourcing articles without full text. The lead author (OB), guided by SJ, FG, CB and JG, conducted the search for the articles.

Study screening and selection

At the screening phase, we included all observational and quasi experimental studies as well as randomised controlled trials (RCTs) on initial (pre-service) and/or ongoing CHW comprehensive care or "generalist" trainings, according to our adopted definitions for comprehensive care. The outcome of interest, skills and/or knowledge scores criteria were also applied during the screening phase. We collated and exported the search results into EndNote X9, and duplicates were removed. OB conducted the screening (title and abstract) using the Covidence software (www.covidence.org). Each article title and abstract was screened in Covidence by a second independent reviewer (JB or NK). Either OB and/or JB and NK retrieved and screened the full text of all articles that had been considered to be potentially relevant, guided by JG and FG. Throughout these stages, any disagreements between reviewers were resolved by discussions among all three reviewers during weekly meetings.

Data extraction

Using a data extraction template designed in Microsoft Excel, data were extracted independently by pairs of OB and JB, OB and NK or JB and NK. We extracted the following variables: authors, year of publication, country in which the study took place, study design, study setting, study population (CHWs or CHW client, sample size), characteristics of CHWs (gender, age, entry qualification, years of experience, paid/unpaid, recruitment criteria and scope of work), characteristics of training (content/curriculum, training duration, trainers, and approach to training), phase of training (pre-service, on-going and supervision) and study outcomes (pre and post training assessment results) (see Tables 4.2 to 4.4).

Quality assessment

We assessed the quality of included studies using the Effective Public Health Practice Project (EPHPP)'s Quality Assessment Tool for Quantitative Studies.[269] This assessment tool was developed to assess the quality of evidence from a wide range of study types on public health interventions. We assigned a rating of strong, moderate or weak for each study using the six items (selection bias, study design, confounders, blinding, data collection methods, and withdrawals and drop-outs) in the EPHPP tool. "Strong" rating was premised on inclusion of a

representative study sample, study design that is least prone to selection bias such as RCT, use of a validated data collection tool and evidence of low drop-out rate among the participants. OB and JB independently assessed the quality of evidence from each article. Disagreements between ratings were resolved through discussions. We included all studies regardless of the rating.

Data analysis

We performed a narrative synthesis of included studies reporting average pre-training, immediate post-training and longer post-training scores of the cohorts in each study, using the changes in scores to assess effectiveness (Table 4.2). We computed a mean score for a study if the authors reported separate mean scores by region, training component or disease case management, or percentages, for studies reporting proportions. However, if scores of sequential trainings were presented, we included them separately in order to assess to what extent any benefits were sustained.

Data were tabulated in Excel Microsoft Office 365 software to explore differences and similarities in included studies. We present extracted data using tables and figures. We performed the computation of mean scores across CHW groups in Stata 18 (StataCorp. 2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC.). We could not perform a meta-analysis due to the heterogeneity of included studies.

4.1.4. Results

Search results

Our search yielded 10,673 citations. After removing duplicates, 10,077 titles and abstracts were screened. From the 154 studies assessed for a full article review, 14 studies met the inclusion and exclusion criteria. Figure 4.1 shows the flow diagram of the study selection. The included studies were undertaken between 1979 to 2019 and published between 1980 and 2023, with increasing numbers of studies published in recent years.

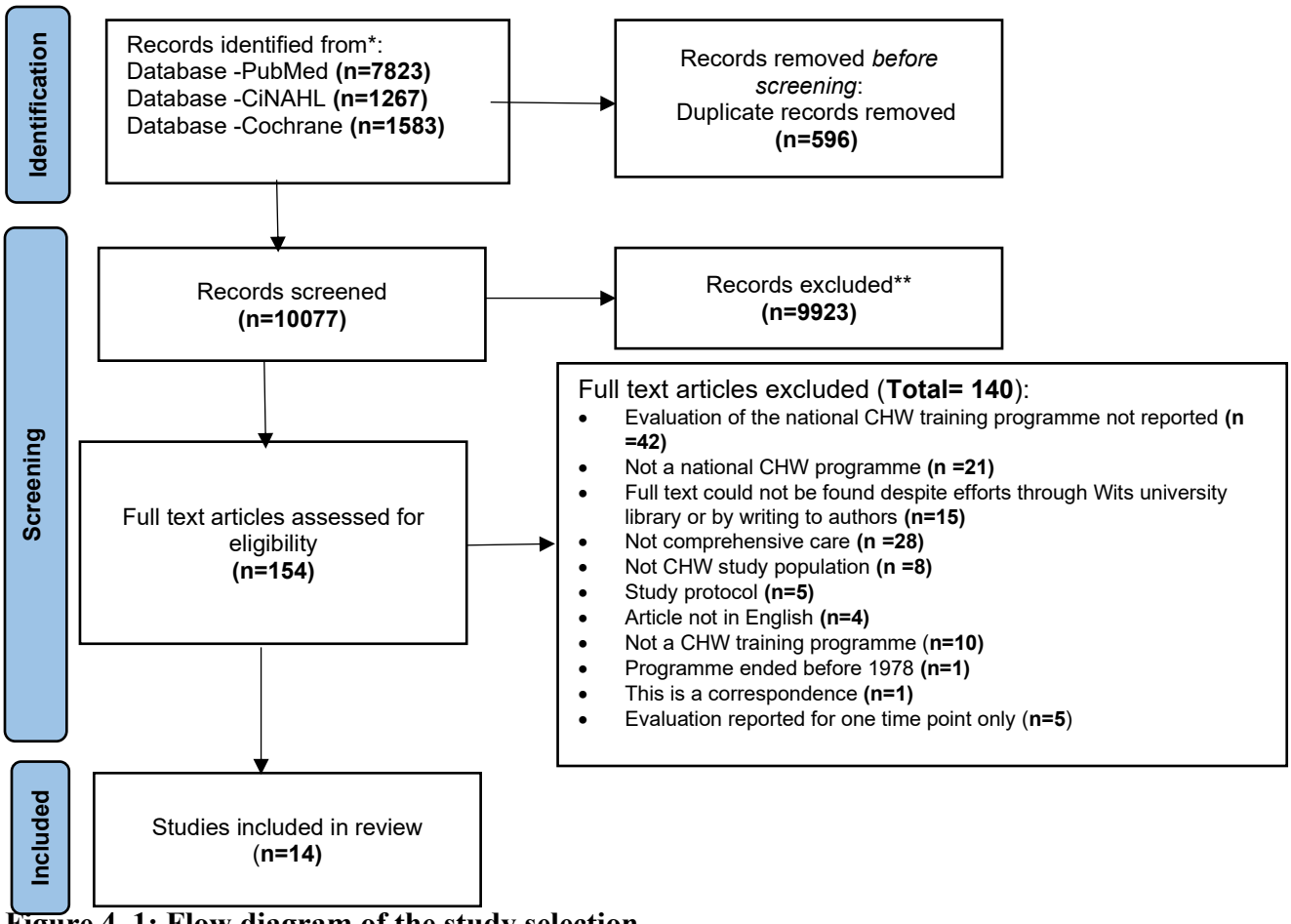


Figure 4. 1: Flow diagram of the study selection

Characteristics of included studies and comprehensive care package

Table 2 presents the characteristics of the 14 included studies. The 14 studies were conducted in 12 LMICs; there were two from Ethiopia [270,271] and two from India.[272,273] Most studies evaluated training on a comprehensive care package focusing on maternal and child health or child health components only. However, the care package in three studies encompassed conditions beyond maternal and child health.[124,225,274] The comprehensive national training programme in Papua New Guinea covered the following four common conditions: impetigo, acute otitis media, pneumonia and tuberculosis.[124] The MCH programme in Tanzania also covered conditions such as tuberculosis and leprosy.[275]

Table 4. 2: Characteristics of the included studies and comprehensive care package

Outcome period	Authors and date	Study design	Comprehensive care package	Training						Trainers	Used mHealth
				Knowledge content	Skill content	Duration	Methods	Site	Materials		
Pre- and immediate post training	Dynes et al 2013 (Ethiopia)	Non-experimental, descriptive design with pre and post training assessments	CMNH training programme for HEWs and vCHPs	Delivery and essential care in postnatal period to prevent maternal and newborn death and disability	Mother: • Care at delivery • Postpartum health assessment • Counselling e.g., illness recognition Newborn: • Postnatal health assessment • Counselling e.g., handwashing	Not reported	• Cascade training approach • Pictorial presentations	Not reported	• TACs, which are pictorial checklist	Federal and regional staff trained supervisors & MCH Coordinators	No
	Knettell et al 2017 (Haiti)	Quantitative pre- and post-course satisfaction survey and tests of knowledge	Annual volunteer-led training programme for CHWs with a specific focus on MCH	• Seeking regular primary health care, • prevention of common infectious diseases and infections, • Identifying complicated and fatal health concerns requiring immediate intervention, • Ways of maintaining good sanitation and hygiene in the home.	• Administering vaccinations • Monitoring chronic conditions, • Health education, • Communication • Referral	1 week offered yearly	• Lecture format with visual aids, demonstrations, trainee participation. • Questions and answers	Not reported	• Course curriculum and textbook guidelines	MCH course instructors: volunteers formally trained in health sciences (registered nurses, public health specialist, and laboratory scientist).	No
	Sharma et al 2021 (India)	Quasi-experimental, non-randomized, controlled study with pre-and post-training assessments	A comprehensive training programme: PACE on life skills and financial literacy.	Content on improving ASHAs life skills including decision-making skills, problem-solving skills, time and stress management skills, and interpersonal communication	To enhance effective implementation of the ASHAs healthcare related trainings, ASHAs underwent trainings on the following modules: • Communication skills, • Problem-solving and decision-making skills • Time and stress management skills, • Financial literacy	6-7 months (theory and practical)	• A cascade model of training • Interactive modules	Health facilities	• Visuals, pictorials, games, and plays	Master trainers	No
	Udani 1980 (India)	Pre- and post-training questionnaire	Health and ICDS	• Antenatal, natal and postnatal care of mothers, family planning • Infant feeding, • Immunization, • Weighing a child, • Hygiene, natal care, colostrum, • Diarrhoea, worm infestation and skin infection, • Nutritious food	• Recording of weight, • Plotting the weight chart, • Diagnosing common childhood ailments, • distribution of food supplements	Training + refresher: 2 days versus No prior training: 5 days	• Not reported	Not reported	• Not reported	Not reported	No
	vanRoosmalen et al 1986 (Tanzania)	Pre- and post-training design	MCH	• MCH services, reporting and statistics • Expanded programme of immunization (EPI), and cold chain • What is primary health care • Preventing and managing malnutrition • Epidemiology, prevention and management of measles • Oral rehydration for diarrhoeal diseases • Antenatal care and traditional midwifery • Family planning • Follow up of tuberculosis and leprosy • Being a leader at village level • Cooperation with other community workers.	• Selecting pregnant women at risk • Immunization of under-fives • Prevention and early management of malnutrition, • Plotting weights on the road-to-health card • Interpreting growth curves.	3 days	• Lectures and group discussions	Not reported	• Not reported	Not reported	No

Pre, immediate post, and ≥2 months after	Mantell et al 2022 (South Africa)	Secondary data/KAP pre- and post-training survey	WBPHCOT programme	*CHWs* • Focus on the most prevalent health conditions in the community, including HIV/AIDS. • Classroom skills training on key clinical topics *OTL* • Cross-cutting skills in ethics and confidentiality, communication, health promotion, screening, referrals, tracing, psychosocial support, M&E, supportive supervision, and mentoring.	*CHWs* • Field-based training, including on-site practical training *OTL* • Ongoing supportive supervision and refresher trainings for CHWs	Classroom: CHW: 5 days OTL: 7 days Practical: CHW: 9 wks OTL: 8 wks	• Not reported	Classroom and on-site clinic-based settings	• Competency-based curriculum. • M&E tools adapted to mHealth platform • Daily and weekly summary activity sheets, household record forms, and OTL monthly activity summary forms	Conducted by the International Training and Education Centre for Health (I-TECH)	Yes
	Nelson et al 2012 (South Sudan)	Pre- and post-training OSCEs	Community-based maternal, newborn and child emergency	Knowledge on healthy pregnancy, danger signs during labour, bleeding after delivery, newborn care, dehydration & malnutrition, danger signs during pregnancy, preparing for delivery, bleeding after delivery, danger signs in children	• Pictorial checklists focusing on identifying danger signs, performing appropriate life-saving care, and providing early referral. • Use of reusable equipment and commodities including newborn breathing bag-mask device, thermometer, scissors, umbilical cord ties, gloves, etc.	5 days	• Training-of-trainers model • Targeted training, pictorial checklists • Reusable equipment and commodities	Not reported	• Trainer's manual Trainer's flipchart • Maternal and newborn training mannequins • Durable, water-resistant backpack	Federal and state ministries of health recruited trainers	No
	Melo et al 2018 (Brazil)	Randomised, controlled Pre and post and 1 year post assessments	CHW training for MCH	• Mother's and infant's health and wellbeing, • Preventive practices and prenatal visits, • Care for labour and delivery, • Common postpartum problems, • Essential newborn care on breastfeeding, nutrition, accident prevention and immunization, • Infant development, • Promoting parent-child interaction, • Assessing family environment, • Identifying socioeconomic and psychosocial problems • Effective communication with parents and family.	• Identifying risk factors and warning signs in pregnant women, • Identifying risk factors and warning signs in young infants • Antenatal care routine, • Newborn care routine, • Childcare routine, • Child development	4 days	• Action-oriented training. • Pedagogy of autonomy and problem-based methodologies • Case studies • Active learning, simulations, interactive activities	Not reported	• Action-oriented guide	Mentioned as trainers only	No
	Soremekun et al 2023 (Mozambique)	Superiority open label two-arm cluster-RCT	A technology-based (mHealth) intervention package 'inSCALE' to support iCCM programmes	To complement the iCCM training of CHWs, intervention arm CHWs underwent training on the use of mHealth tools consisting of a sick child decision support algorithm with audio and images to ensure adherence to iCCM treatment protocols	• Ability to use mHealth tools (phones) to -Track consultations with sick children, make diagnoses and management decisions, -Report statistics and send it weekly to a central server, -Request stock from supervising facilities, -maintain a register of patients attended to	4 days	• A cascade approach	Not reported	• Samsung Galaxy smartphones with "the inSCALE app" that included an electronic sick child clinical decision support algorithm, • Solar charger • Solar lamp	Master trainers Facility- and community-based trainers	Yes
Pre and ≥3 months after	Uzochukwu et al 2008 (Nigeria)	Cross-sectional design with before and after training intervention assessment	IMCI module adapted from WHO IMCI	• IMCI case management of malaria, diarrhoeal disease, pneumonia and measles	• Signs and symptoms of IMCI • Appropriate treatment • Caregiver counselling about how to administer medicines, continuity of care and clinic visit • Appropriate home care • Correct clinical assessment, classification and treatment of the child • Identifying immunized children and those with incomplete immunization	4 days	• Classroom component included lectures and interactive sessions. • Supervised clinical practice in the state general hospital.	Classroom and the state general hospital settings	• The Nigerian-adapted IMCI algorithm, which contains the same topics as the World Health Organization's IMCI training module	Not reported	No

Immediate post and ≥1years after	Ashwell et al 1995 (Papua New Guinea)	Pre- and post-test assessments	National CHW programme	Clinical management of patients presenting with the signs and symptoms of four common clinical case scenarios - impetigo, acute otitis media, pneumonia and tuberculosis	• Undertaking comprehensive history and systematic examination for all cases, other than those with very minor illness • Criteria for correct diagnosis and treatment as set out in the Papua New Guinea standard treatment manuals	2 years	• Not reported	Not reported	• A new competency-based curriculum	Not reported	No
	Gobeza yehu et al 2014 (Ethiopia)	Pre-post study design	Community Maternal and Newborn Health (CMNH) training	• Antenatal care and birth preparedness practices, • Illness recognition, and referral, • Eliminating potentially harmful practices e.g., pre-lacteal feeding, adding oil or butter on cord stump, and bathing the newborn before 24 hours	• Conduct CMNH meetings with pregnant women to -Plan for birth -Ensure availability of misoprostol by CHW -Ensure clean environment -Referral plan -Dietary advise • After birth: -Check baby for good colour, breathing, cord care -Placenta delivery -Breastfeeding	Not reported	• Cascade training approach • Pictorial presentation, storytelling, discussion, and demonstrations • Practice using pictorial checklists called TACs.	On-site	• Demonstration kit (newborn, placenta, uterus, and breast models; razor blade; 5% chlorine; cord tie; soap; waterproof placenta container; apron; cloths; and a cup, bowl, and spoon) • TAC booklet • Master list, guide team record, and trainers' manual	Federal and regional staff trained supervisors & MCH Coordinators	No
3 yearly assessments	Kelly et al 2001 (Kenya)	3 cross-sectional surveys	Simplified version of WHO's IMCI guidelines under the Community Initiatives for Child Survival Project	• Provision of care for children with ARIs, diarrhoea, and malaria • Referral of severely ill children to health facilities • Counselling of caregivers on continued care of sick children at home and on health-related and disease prevention (e.g., immunisation) behaviours	• Use of algorithms developed for checking for general danger signs and symptoms, and classifying disease severity • -Use of job aids e.g., clinical registers and flow sheets • -Treatment of diseases using drugs from medicine kits replenished through a cost-recovery-financing system	Initial: 3 weeks Refreshers: 1 week	• Initial: lectures, reviewing case scenarios, role-playing and clinical practice • Refreshers: Above plus reviewing videotaped consultations	District hospital (practice also occurs in local pharmacies)	• Management of the Sick Child (MSC) guideline • Flipcharts • Treatment and counselling cards • Clinical register (job aid)	Project staff	No
	Ebbs et al 2023 (Uganda)	Prospective observational study (2016-2019)	CHW programme	Knowledge of basic medical skills	• Assess respirations • Assess pulse • Manual blood pressure • Haemorrhage control • Rapid trauma evaluation • Record temperature	5 days	• Train-the trainer approach • Community participatory training method combined with mHealth • Didactic training on specified skills • Peer training by CHWs promoted to 'instructor or advanced CHW' cadres after obtaining a score of >80% in the first two years assessments	Health ministry quarters	• Training curriculum, educational materials, including videos and quizzes	Local and foreign health professionals including -A team of Uganda physicians -Advanced CHWs	Yes

ICDS, Integrated Child Development Scheme; RMAs, rural medical aides; MCHAs, mother and child health aides; HAs, health auxiliaries; MCH, maternal and child health; IMCI, integrated management of childhood illnesses; iCCM, Integrated Community Case Management; WBPHCOT, Ward-based Primary Health Care Outreach Team; OTL, outreach team leader; inSCALE, Innovations At Scale For Community Access and Lasting Effects; PACE, Personal Advancement and Career Enhancement; CHWs, community health workers; NPOs, nonprofit organisations; CHEWs, Community health extension workers; IMCI, integrated management of childhood illnesses; ARIs, acute respiratory infections; vCHPs, volunteers Community Health Promoter

The training method used in six studies was the cascade training-of-trainer model which involved increasing numbers of trainees during successive rounds of training.[41,270,271,273,274,276] Trainers, including nurses, physicians and public health specialists, were mostly from the Ministry of Health and elsewhere within the health system. However, in three studies, CHWs provided training to their peers.[270,271,274] Ebbs et al reported the combined use of mHealth with a train-the trainer model in which previously trained CHWs were promoted to "advanced CHW" or an instructor position after scoring >80% in the first two years of training. These "advanced CHWs" participated in redesigning training materials using an mHealth application and could also use the mHealth app to maintain their own level of competency. Detailed content of the comprehensive care packages is shown in Table 4.2.

Characteristics of the CHWs

The characteristics of the CHWs reported in the 14 studies are shown in Table 4.3 below. The youngest and oldest mean ages were 22.7 (range 19-26) years in Papua New Guinea,[124] and 45.0 standard deviation [SD] 10.1) years in Brazil,[277] respectively. The CHWs were mostly women, with percentages of females ranging from 67%–100%.[270,271,277] The majority of CHWs had only completed some secondary level of education,[225,270-274] but some had only primary education.[277-279] or none [41] The CHWs in most studies were working for the government except in Haiti [278] and Mozambique [276] where the CHWs were volunteers in an NGO or paid by government/NGO. Of 11 studies where CHWs worked with the government, CHWs were receiving a salary [225,276,277], received performance-linked incentives [273], more senior cadre (health extension workers [HEWs]) were paid a salary while junior cadres, volunteer Community Health Promoters (vCHPs) [270] and Community Health development Agents (CHDAs) [271] were unpaid, or the status was unreported [41,124,272,275,280].

Table 4. 3: Characteristics of the CHWs

Out come period	Study	CHW nomenclature	% CHW female	CHW age (years)	Pre-employment/ formal education (years)	Years of experience (years)	Paid/unpaid	Employer
Pre- and immediate post training	–Dynes et al 2013 (Ethiopia)	HEWs and vCHPs	98%	*Mean (SD):* 23.5 (3.6)	*Mean (SD)* 11.2 (0.87)	Mean (SD) Region A CHWs: 3.2 (1.4) Region O CHWs: 4.1 (1.2)	HEWs – paid vCHPs - unpaid	Government
	Knettell et al 2017 (Haiti)	CHW	64%	*Mean (range):* 38 (18–75).	*Mean*: 9 completed years	Not reported	Local volunteers	NGO
	Sharma et al 2021 (India)	ASHAs	100%	Percentage aged ≤38: 54%	Percentage >11 years: 57%	*Percentage with experience ≤12 years:* 68%	Unpaid, performance-linked incentives	Government
	Udani 1980 (India)	AWWs	Not reported	*Range*: 20–40 Percentage aged 20-25: 77%	56/97=58% had matric, 41 had up to 8th class education	Not reported	Not reported	Government
	vanRoosmalen et al 1986 (Tanzania)	RMAs, MCHAs, and HAs	Not reported	Not reported	Not reported	Not reported	Not reported	Government
Pre, immediate post, and ≥2 months after	Mantell et al 2022 (South Africa)	CHWs	CHW: 97% OTL: 84%	*Median (range):* CHW: 40 (22–60) OTL: 44 (27–68)	*Some/completed secondary* CHW: 85% OTL:8/31(26%) *Some/completed tertiary* CHW: 9% OTL: 68%	*Percentage with experience ≥6 years* CHW: 81% OTL: 68%	Paid	Government
	Nelson et al 2012 (South Sudan)	Community-based FHWs or community-based providers	Not reported	Not reported	Most were non-literate	Not reported	Not reported	Government
Pre and ≥3 months after	Melo et al 2018 (Brazil)	CHWs (ACSs, in Portuguese)	97%	*Mean (SD):* 45.0 (10.1)	At least primary education	*Mean (SD)* 16.7 (8.1).	Paid by the municipal health authority	Government
	Soremekun et al 2023 (Mozambique)	CHWs (APE)	Not reported	Not reported	Not reported	Not reported	Paid monthly subsidy of $40	Government/ NGO
	Uzochukwu et al 2008 (Nigeria)	CHEWs	Not reported	Not reported	Not reported	*Percentage with experience >2 years:* 78%	Not reported	Government
Immediate post and ≥1years after	Ashwell et al 1995 (Papua New Guinea)	CHWs	67%	*Mean (range):* 22.7 19–26)	Not reported	Not reported	Not reported	Government
	Gobezayehu et al 2014 (Ethiopia)	HEWs + CHDAs	100%	*Mean (SD):* HEWs: 24.5 (2.9) CHDA: 37.8 (8.1)	*Mean*: HEW: 10.1 years CHDAs: 4.3 years	Not reported	HEWs - paid CHDA - unpaid	Government
3 yearly assessments	Kelly et al 2001 (Kenya)	CHWs	Not reported	Not reported	'Standard 7' (equivalent to an elementary school graduate in the USA)[281]	Not reported	Unpaid volunteers	NGO
	Ebbs et al 2023 (Uganda)	CHWs	20%	*Mean age:* 44.2	Grade school	Mean: 7.2	Unpaid	NPO

CHWs, community health workers; HEWs, Health extension workers; vCHPs, volunteer Community Health Promoters; SD, standard deviation; NGO, non-governmental organisation; ASHA, accredited social health activist; AWW, Anganwadi worker; RMAs, rural medical aides; MCHAs, mother and child health aides; HAs, health auxiliaries; OTL, outreach team leader; FHWs, frontline health workers; ACS, Agentes Comunitários de Saúde; APE, Agentes Polivalentes Elementares; CHEW, community health extension worker; CHDAs, Community Health development Agents; NPO, nonprofit organisation

Study design and assessment approach

Nearly all the studies used a pre- and post-study design and their quality assessment were mostly rated as 'weak'; the quality of the two that utilised RCTs was rated as 'moderate.'[276,277] Mobile health (mHealth) technology was used in the training in more recent studies[274,276] including its usage to support monitoring and evaluation.[225]

The post-training assessment outcomes were reported at varying time intervals after the pre-training assessments. As shown in Table 4, five studies reported the comparison outcome measure before and immediately after the training.[270,272,273,275,278] Two reported pre-training, immediate and longer period post-training assessment scores.[41,225] Three compared only the pre- and longer period post-training outcome measures.[276,277,280] Two had no pre-training assessment score but reported immediate and longer period post-training assessment scores.[124,271] One study compared outcomes yearly.[274]

The outcomes of training were measured using various approaches. Some studies observed and scored CHW skills on checklists.[124,270,271,274,279] Written and self-administered[124,225,272,273,277] or verbally administered questionnaires[41,225], multiple choice and true/false questions,[278] and/or objective structured clinical examinations (OSCEs)[41] were also utilised. One adapted an evaluation tool[276] while three utilised a blend of two[279] or more[124] approaches.

Table 4. 4: Description of the study outcome in the included studies

Outcome period	Study	Outcome assessment approach	Outcome measure for each CHW group/cohort
Pre- and immediate post training	Dynes et al 2013 (Ethiopia)	Skills checklist including scenarios on CMNH topics, with points assigned by trainers	Mean knowledge and skill scores
	Knettell et al 2017 (Haiti)	Knowledge scores from 35 multiple choice and true-false questions	Mean knowledge score
	Sharma et al 2021 (India)	Structured questionnaire on knowledge and practices related to life skills and financial literacy.	Mean knowledge and practices scores
	Udani 1980 (India)	Self-completed questionnaire on knowledge of different components of ICDS	Mean knowledge and skill score
	vanRoosmalen et al 1986 (Tanzania)	Knowledge and practice scores on basic elements of MCH with pass mark taken to be a score of 70%	*Proportion of CHWs with ≥70% knowledge and practice score*
Pre, immediate post, and ≥2 months	Mantell et al 2022 (South Africa)	Self-administered knowledge, attitude and practice (KAP) survey questions on curriculum content	Mean KAP survey score
	Nelson et al 2012 (South Sudan)	- Objective structured clinical examinations (OSCEs) on maternal and newborn components - Verbally administered 7-page questionnaire	Mean FHW OSCE score
Pre and ≥3 months after	Melo et al 2018 (Brazil)	Written questionnaire assessing KAP on 8 MNCH domains including open-ended, multiple choice and 5-point Likert scale. The pass mark was taken to be 70%	Mean overall KAP score
	Soremekun et al 2023 (Mozambique)	CHW clinical knowledge instrument adapted from the WHO Health Facility Survey Tool template [282]	*CHW performance, measured as the overall proportion of children with any episode of suspected MDP who received appropriate treatment*
	Uzochukwu et al 2008 (Nigeria)	Correct classification and case management of conditions of children (malaria, pneumonia, diarrhoea with and without blood, upper respiratory tract infection and measles) by CHEWs and the final assessor (resident doctor)	*Overall percentage of children with particular conditions for whom appropriate tasks were performed correctly*
Immediate post and ≥1years after	Ashwell et al 1995 (Papua New Guinea)	- Written test of knowledge of clinical management of patients with signs and symptoms of impetigo, acute otitis media, pneumonia and tuberculosis - Observation instrument completed while observing CHWs managing a systemic illness. - 70% pass mark	Mean knowledge and clinical competency score
	Gobezayehu et al 2014 (Ethiopia)	Skills checklist including scenarios with points assigned by trainers	Mean difference between immediate post-training and 18-month post-training scores
3 yearly assessments	Kelly et al 2001 (Kenya)	- Observation of consultations using a checklist - CHW documentation of the assessment findings, classifications, and treatments for each sick child on a standard form (i.e., the CHW encounter form)	*CHW performance, measured as the proportions of children treated "adequately" (with an antibiotic, antimalarial, oral rehydration solution, or referral, depending on the child's disease severity class*
	Ebbs et al 2023 (Uganda)	1-on-1 skill competency examination using a medical competency skill checklist	Mean skill competency examination score

CMNH, community maternal and newborn health; ICDS, Integrated Child Development Services Scheme; KAP, knowledge, attitude and practice; MNCH, maternal newborn and child health; IMCI, integrated management of childhood illnesses; CHW, community health worker, CHEW, community health extension worker; MDP, malaria, diarrhoea, pneumonia

Changes in the level of the outcome measures

Of the 14 studies, 10 reported the mean outcome scores across CHW groups and the results are shown in Figure 4.2. The remaining four studies reported the outcomes either as the proportions of CHWs who achieved the pass mark of ≥70% [275] or the proportions of 'sick' children who were treated appropriately by CHWs.[276,279,280] The proportions are shown in Figure 4.3. We further subdivided the studies according to the period of outcome report. Within these subdivisions, the studies reporting outcome as means are indicated first, followed by any reporting outcome as proportions.

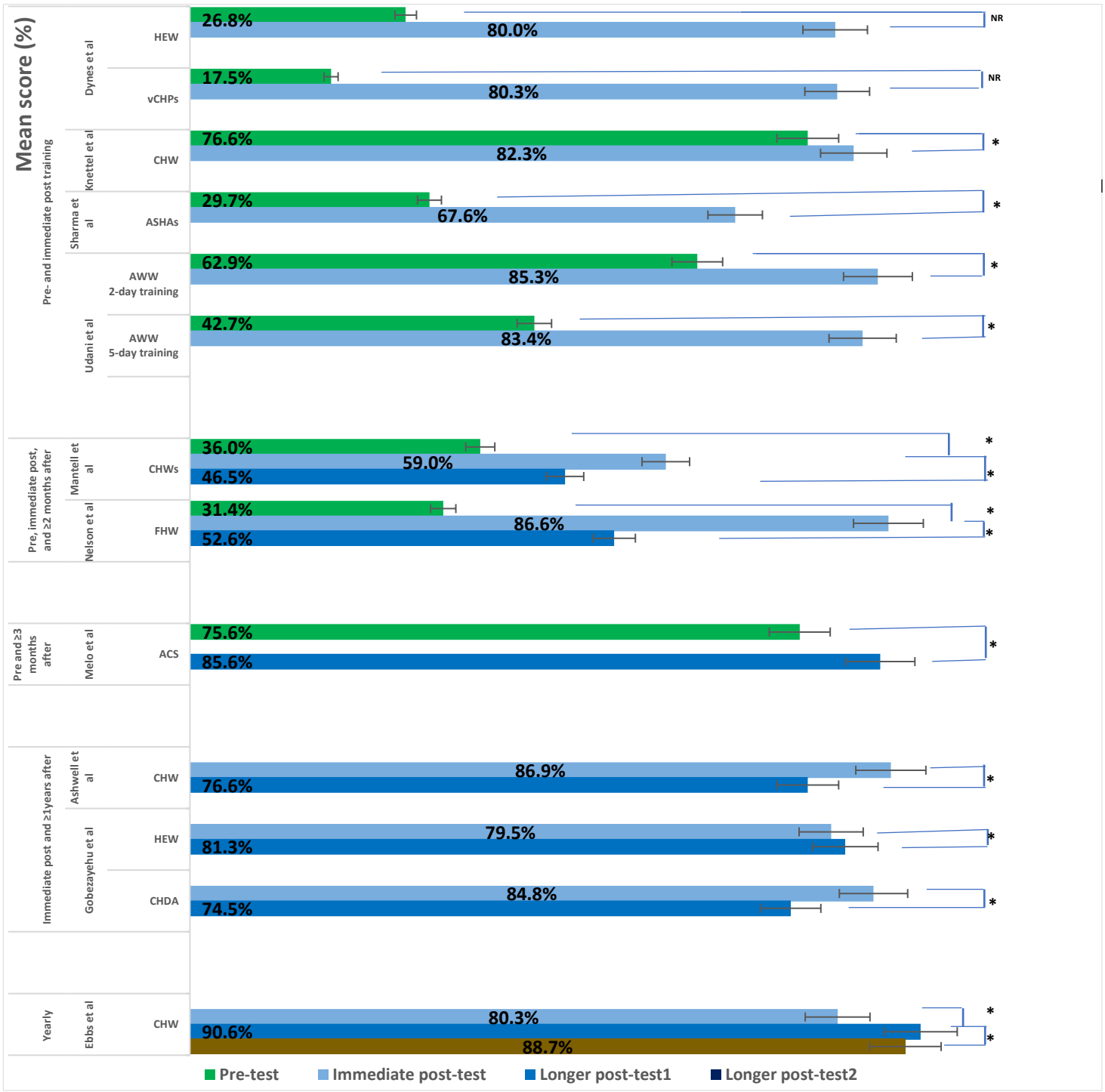


Figure 4. 2: Changes in knowledge and skill scores

P-value key: * Statistically significant difference reported between periods (P<0.05); NR, not reported

HEW, health extension worker; vCHPs, volunteer Community Health Promoters; CHW, community health worker, ASHA, accredited social health activist; AWW, Anganwadi worker; RHW, rural health worker; OTL, outreach team leader; FHW, frontline health worker; ACS, Agentes Comunitários de Saúde; CHEW, community health extension worker; CHDA, ; MDP, malaria, diarrhoea, pneumonia

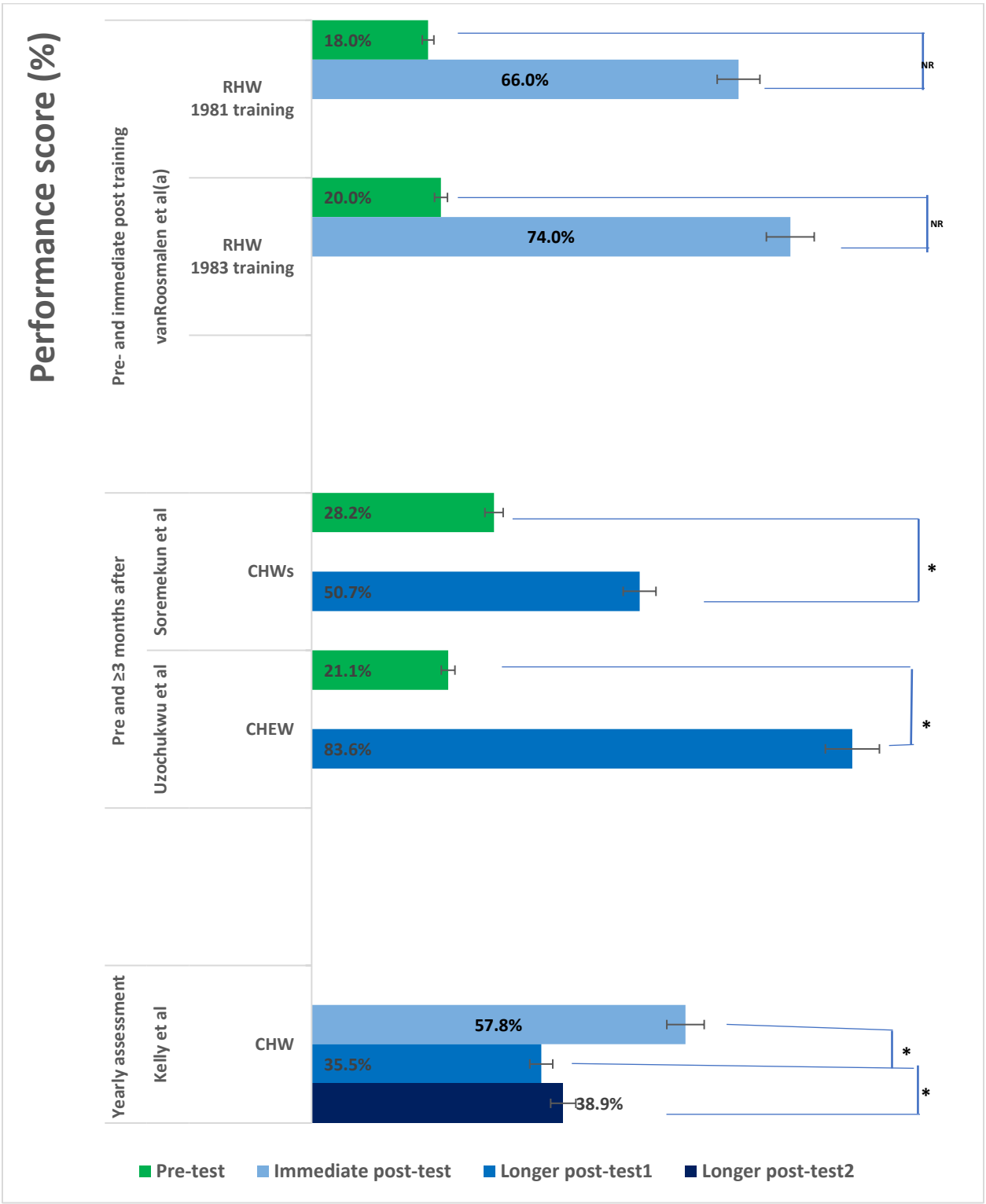


Figure 4. 3:Changes in the proportions of community health workers providing adequate care
P-value key: * Statistically significant difference reported between periods (P<0.05); NR, not reported
(a) vanRoosmalen et al reported the proportions of CHWs who scored ≥70% after training

Period of outcome report: pre- and immediate post-training

Of the five studies that reported a pre- and immediate post-training outcome measure, only one had a strong quality rating [273] while the remaining four had a weak rating. Of these five, four studies with immediate post-training outcomes [270,272,273,278] reported improvements in mean scores ($p<0.05$) from the pre-training assessment, which ranged in magnitude from 5.7 [278] to 62.8 percentage points (pp).[270] Of these four, changes in scores were all statistically significant in three studies.[272,273,278] One study reported a sub-group analysis of training effectiveness by cadre and showed that HEWs whose entry qualifications were higher than those of vCHPs had significantly higher scores (26.8% vs 17.5%, respectively).[270] Another compared two durations of training and found significant improvements of 22.4 vs 40.7 pp after a 2-day and 5-day training on MCH components, respectively.[272] The fifth study whose outcome was the proportion of CHWs with ≥70% score showed improvements ranging from 48.0 to 54.0 pp in two CHW sets trained in 1981 and 1983, respectively. However this study provided no information regarding statistical difference.[275]

Period of outcome report: pre-, immediate and longer post-training

Two studies reported pre, immediate, and longer post-training outcomes and their quality ratings were weak. Both studies initially showed significant improvement ($p<0.05$) from the pre-training assessment of 23.0 pp (from 36.0% to 59.0%) [225] to 55.0 pp (from 31.4% to 86.6%) [41] . However, these decreased significantly by 12.5 pp [225] and 34.0 pp [41] after 2-12 and 2-3 months, respectively. The CHWs with the lowest decrease in pp (12.5) received training on a wider comprehensive care package and had higher levels of background school education (some/completed secondary/tertiary).[225] Those with the highest pp decrease (34.0) were mostly non-literate and received training on a narrower comprehensive care training programme.[41]

Period of outcome report: pre- and longer post-training

Three studies reported pre-and longer post-training outcomes. The one study that reported mean CHW scores showed significant improvement ($p<0.05$) from the pre-training assessment of 10.0 pp (from 75.6% to 85.6%) and had a moderate quality rating.[277] The remaining two studies reported proportions of 'sick' children who received correct management from CHWs.[276,280] They also showed significant improvement ($p<0.05$) from the pre-training assessment of 22.5 pp (from 28.2% to 50.7%) [276] and 62.5 pp (from 21.1% to 83.6%) [280], and their quality was rated as moderate and weak, respectively.

Period of outcome report: immediate and longer post-training

Two studies, including one that reported on two CHW cadres [271], reported immediate and longer post-training scores, but no pre-training scores. The longer post-training scores for HEWs with a higher entry qualification showed a small improvement of 1.8 pp from the immediate-post training assessment.[271] For other cadres, with lower entry qualifications, after 1-4 years [124] and 18 months [271], respectively, the mean scores decreased by 10.3 pp. The quality of the studies was moderate [124] and weak.[271]

Period of outcome report: three yearly assessments

Of the two studies that documented three yearly assessments, one reported the mean score [274] and the other, proportion of 'sick' children treated adequately [279]; both had weak quality ratings. After training provided by local and foreign health professionals in year one, the mean score improved significantly by 10.0 pp in year two.[274] However, in year three, after training provided by "advanced CHWs" who were promoted to instructor level after achieving >80% on skill competence in years one and two, the score decreased significantly by 1.9 pp. In the study reporting proportions of severely sick children treated adequately, after initial training, a significant decrease of 22.3 pp occurred 8-12 months after the first refresher training, then a small but significant increase of 3.4 pp occurred 3-5 months after the second refresher training.[279]

4.1.5 Discussion

Summary of overall findings

The findings of this review suggest that CHWs with limited background education can be trained effectively on a wide range of health-related events and conditions. Despite the decline in the post-training scores reported in some studies, the scores remained above the baseline scores over time. The inclusion of peer CHW trainers in the implementation of CHW training has the potential to improve learning and retention of that learning. Pre-employment education appears to have a bearing on post-training scores with CHWs with lower pre-employment educational levels showing lower performance scores compared to having higher entry qualifications. Most training packages were on MCH and child health. Where training was on a wider comprehensive care package, CHWs who had a higher pre-employment educational level had better post-training scores. At 3 months post-training [280], or one-year and longer [271,274,277], the assessment scores in few studies showed sustained improvement. In contrast, even by 3 months to about 1 year post-training [41,225], or 1 year and longer [124,276,279], most studies reported worsened scores.

The year three scores in one study worsened only somewhat (1.9 pp), perhaps because the trainers changed from health professionals to peer CHWs.[274] Given the differences in contexts across these training programmes, reasons for the differences in effectiveness across training programmes may provide useful information for future strengthening.

Training packages and training duration

This review shows that many LMICs are designing standardised training programmes and curriculum to develop the skills of CHWs towards more comprehensive care.[283] These include the changing diseases and demographic profiles, and even pandemics such as COVID-19 and climate change crises.[18,90] However, even though we considered MCH, MNCH, IMCI and integrated community case management to be comprehensive care packages in this review, separately, they do not cover the actual scope of most CHW programmes. For example, the Ethiopian HEW programme covers 17 integrated packages of care under four areas (family health services e.g., MCH, adolescent and reproductive health; disease prevention and control e.g., HIV/AIDS, TB, malaria; hygiene and environmental sanitation; and health education and communication).[157] However, in the Ethiopian studies included in this review, the focus of the training was community maternal and newborn health.[270,271] If the training was also integrated, better learning outcomes and efficiency of the use of scarce human and financial resources may result. For example, the theoretical training for the wider WBPHCOT programme in South Africa occurred over 7 days, covering health promotive, screening, referrals, contact tracing, psychosocial support, reporting and mentoring content on the most prevalent health issues such as HIV/AIDS.[225] If the training was to have been provided for its separate components, the training period may have to be prolonged. Furthermore, in South Africa, a tool was developed and validated to assess the quality of the wider comprehensive care package.[38,235] When trainings run along distinct/specific programmes, opportunities that such a tool may provide to assess the quality of comprehensive care provided by a national programme may be missed.

Differences in knowledge outcome over time

Based on our definition of comprehensive care in this review, findings showed improved outcomes in the immediate post training period, for all the comprehensive care packages. However, the improvement was mostly not sustained in the longer post training period, nor was the decreases in scores uniform across studies or CHW cadres (e.g., HEWs vs volunteer CHWs). Differences in the contexts in which CHWs perform their roles are important factors that may

help explain the non-uniform decreases in training outcomes. As evidence has shown, CHWs within a programme (recruitment, volunteering, supervision), function within peripheral PHC system (e.g., health posts, dispensary) with different actors (other HCPs, supervisors and managers) and serves as a link with the community systems (e.g., gender norms, culture), through complex interactions.[42,283-287] This complex context including "software elements" such as power, values and norms, and interests of health system actors, influence whether CHWs feel belonging or supported, requires very careful consideration when designing CHW programmes, including training.[90,283,287] To address challenges related to these[121,259,288] more robust training programmes that incorporates ongoing support for trainees, trainers and health system leaders who may be unfamiliar with key components of CHW programmes are recommended.[148,260,289] The use of logic models that involve stepwise descriptions of an intervention (including training intervention), may facilitate identification of barriers and facilitators of effectiveness by programme managers, for improving designs.[37] In an intervention study in South Africa, the CHWs performance only improved considerably after supportive arrangements was made to train CHWs in their local clinics rather than at the district head office which necessitated long distance travels and lodging expenses for the CHWs.[116]

Supportive supervision

There is evidence that most training programmes for CHWs do not explicitly include training for other healthcare workers who are meant to provide support for them.[290] Human resource for health constraints has sometimes meant that available supervising staff may be less experienced than the CHWs themselves.[218] In this review, the lack of adequate evidence on supportive supervision may have implications for the rate of knowledge decline.[107] Supervision and on-going training provide important avenues for enhancing motivation and strengthening the capacity of CHWs for the roles they perform.[218,260,291] A recent review revealed that only six of 29 LMICs with CHW programmes showed evidence of refresher/ongoing training beyond the skills training programme.[90] Goudge et al reported the use of a professional nurse mentor trained in PHC and community nursing who provided supportive supervision for two CHW teams including their mentors who were junior (enrolled) nurses.[218] The focus of the nurse mentor's activities aligned with the definition of supportive supervision[292,293]: *education/training support* to enhance CHW clinical knowledge and skills; m*anagement support* related to ensuring availability of resources (record books, stationeries) and equipment, and; *support function* to facilitate adherence with standards and norms, stakeholder engagement within and external to the

health system.[116,218,219] Peer supervision, where CHWs may be promoted to supervisor level, may become more relevant in view of critical human resource constraints.[294] When supervision occurs between peers including paid vs volunteers, respected CHWs selected by peers vs others, stronger vs weaker, or good performers promoted to be supervisors vs others; evidence suggests a stronger CHW work ethics, better performance, and cost-effectiveness of the CHW programme.[290,295-297]

Evidence of application of digital health intervention

Although evidence on the use of digital technology including mobile phones to facilitate exchange of knowledge and information is limited to more recent studies in this review, increasing evidence exists around the application of digital health intervention to strengthen CHW programme including training and supervision.[298-300] Evidence supports the use of mHealth as a cost-effective approach for facilitating the delivery of training content and medium for facilitating supportive supervision for CHWs.[179,297,301] However, the design, use and evaluation of digital devices need to take educational research and theory into consideration.[302]

Limitations of the primary studies in this systematic review

Our findings in this systematic review should be interpreted with caution, in view of the quality of included studies, with mostly 'weak' ratings, based on the EPHPP tool. This review was unable to show effectiveness of training on the wider comprehensive care packages offered in most LMICs besides that of South Africa and Papua New Guinea. Ongoing evaluations of effectiveness should address wider comprehensive care training programmes. It was not possible to provide adequate reasons as to why the CHW scores on knowledge and skills differed between the training programmes. However, few studies in this review looked at how training influenced performance. The assumption that improved knowledge will improve performance and subsequently health care outcomes cannot be guaranteed.[303] Differences in the methods used to assess outcome may impact the comparability of outcomes between training programmes. Thus, developing and using standardised tools and measures are recommended as part of programme design.[167] The extent of improvement needed by CHWs is also a possible reason to explain outcome differences between studies; if CHWs who are most unlikely to succeed are recruited. In a previous intervention study, most CHW outcomes improved following training support whereas those with rather low level of literacy showed persistent dismal performance.[116] Also the pre- and post- assessment approach may introduce a bias because the pre-test in itself is an

educational intervention for those in an interventional group. Thus, by interacting with the intervention, the test may alter the observed effects, by making the test-takers 'wiser'.[37,304] The Solomon's design attempted to control for this interaction by proposing pre-tested versus not pre-tested subgroups of experimental versus control groups.[304,305] These evaluation models may be useful in addressing differences in outcomes of training between studies in future.

Limitations of this systematic review

Despite adequate attempts at ensuring appropriate inclusion of search terms related to CHW nomenclature in this review, it is possible that some studies could have been missed. Moreover, this study included varying CHW cadres, including volunteers and team leaders such as OTLs. These may have a bearing on the reported findings and the conclusions. However, since the aim of this review is to examine the effectiveness of training for comprehensive care, it is important to consider cadres whose training may influence CHWs performance as well.

4.1.6. Conclusions

This systematic review provides evidence that CHWs can be trained effectively on comprehensive care programmes such as MNH, MCH, IMCI but, there is insufficient evidence regarding effectiveness of training of CHW for a full comprehensive care package in LMICs. Standardized measures across full comprehensive care packages may facilitate timely assessment of effectiveness of training and CHW performance and assist in the revisions of training programmes. Future studies including RCTs and mixed methods design should consider the full packages of comprehensive care in LMICs.

Supplementary Table 4.1: PUBMED search terms

S/N	Search term	Free text words and MeSH headings
1	**Community health worker population**	(((((lay[Text Word] OR voluntary[Text Word] OR volunteer*[Text Word] OR untrained[Text Word] OR unlicensed[Text Word] OR nonprofessional*[Text Word] OR "non professional*"[Text Word] OR non-professional[Text Word]) AND (worker*[Text Word] OR visitor*[Text Word] OR attendant*[Text Word] OR aide[Text Word] OR aides[Text Word] OR support*[Text Word] OR person*[Text Word] OR helper*[Text Word] OR carer*[Text Word] OR caregiver*[Text Word] OR "care giver*"[Text Word] OR consultant*[Text Word] OR assistant*[Text Word] OR staff[Text Word] OR visit*[Text Word] OR "health extension worker*"[Text Word])) OR ((community[Text Word] OR village*[Text Word] OR Barangay[Text Word] OR frontline[Text Word] OR basic[Text Word] OR rural[Text Word] OR auxiliary[Text Word] OR community-based[Text Word] OR lady[Text Word] OR Anganwadi[Text Word] OR outreach[Text Word]) AND ("health worker*"[Text Word] OR "health care worker*"[Text Word] OR "healthcare worker*"[Text Word] OR volunteer*[Text Word] OR worker*[Text Word]))) OR ("Lay volunteer*"[Text Word] OR "Barefoot doctor*"[Text Word] OR "Community health worker*"[Text Word] OR chw[Text Word] OR chws[Text Word])) OR ("community health workers"[MeSH Terms])) OR ("health advisor*"[Text Word] OR "health advocate*"[Text Word] OR "health paraprofessional*"[Text Word] OR "accredited social health activist*"[Text Word] OR "ASHA"[Text Word] OR promotora*[Text Word] OR "community health representative*"[Text Word] OR "village health helper*"[Text Word] OR "community health assistant*"[Text Word] OR "public health aid*"[Text Word] OR "community health agent*"[Text Word] OR "community health volunteer*"[Text Word] OR "female community health volunteer*"[Text Word] OR "community health advocate*"[Text Word] OR "promotoras de salud"[Text Word])
2	**Training**	((((((((((((Curriculum[MeSH Terms]) OR ("Problem-Based Learning"[MeSH Terms])) OR ("Inservice Training"[MeSH Terms])) OR ("Vocational Education"[MeSH Terms])) OR ("Education"[MeSH Terms])) OR ("Education, Public Health Professional"[MeSH Terms])) OR ("Education, Distance"[MeSH Terms])) OR ("Education, Professional, Retraining"[MeSH Terms])) OR ("Education, Professional"[MeSH Terms])) OR ("Education, Nonprofessional"[MeSH Terms])) OR ("Competency-Based Education"[MeSH Terms])) OR ("Area Health Education Centers"[MeSH Terms])) OR ("Educational Measurement"[MeSH Terms])) OR ("Quality Assurance, Health Care"[MeSH Terms])) OR ("Employee Performance Appraisal"[MeSH Terms])
3	**LMICs**	("Low and middle income countries" OR "developing countries" OR BRICS OR BRIC OR Africa OR "north africa" OR "northern Africa" OR "Africa South of the Sahara" OR "Central Africa" OR "east Africa" AND "Eastern Africa" OR "Southern Africa" OR "Western Asia" OR "central Asia" OR "southeastern Asia" OR "Caribbean" OR "West Indies" OR "South America" OR "Latin America" OR "Central America" OR Afghanistan OR Albania OR Algeria OR "American Samoa" OR Angola OR "Antigua and Barbuda" OR Argentina OR Armenia OR Azerbaijan OR Bahrain OR Bangladesh OR Barbados OR Benin OR Belarus OR Belize OR Bhutan OR Bolivia OR Bosnia-Herzegovina OR Botswana OR Brazil OR Bulgaria OR Burkina Faso OR Burundi OR Cambodia OR Cameroon OR "Cape Verde" OR "Central African Republic" OR Chad OR Chile OR China OR Colombia OR Comoros OR Congo OR "Costa Rica" OR "Cote d'Ivoire" OR Croatia OR Cuba OR Cyprus OR Czechoslovakia OR "Czech Republic" OR Slovakia OR Djibouti OR "Democratic Republic of the Congo" OR Dominica OR "Dominican Republic" OR "East Timor" OR Ecuador OR Egypt OR "El Salvador" OR Eritrea OR Estonia OR Ethiopia OR Fiji OR Gabon OR Gambia OR "Georgia (Republic)" OR Ghana OR Greece OR Grenada OR Guatemala OR Guinea OR "Guinea-Bissau" OR Guam OR Guyana OR Haiti OR Honduras OR Hungary OR India OR Indonesia OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Kenya OR Korea OR Kosovo OR Kyrgyzstan OR Laos OR Latvia OR Lebanon OR Lesotho OR Liberia OR Libya OR Lithuania OR Macedonia OR Madagascar OR Malaysia OR Malawi OR Mali OR Malta OR Mauritania OR Mauritius OR Mexico OR Micronesia OR "Middle East" OR Moldova OR Mongolia OR Montenegro OR Morocco OR Mozambique OR Myanmar OR Namibia OR Nepal OR Netherlands Antilles OR "New Caledonia" OR Nicaragua OR Niger OR Nigeria OR Oman OR Pakistan OR Palau OR Panama OR "Papua New Guinea" OR Paraguay OR Peru OR Philippines OR Poland OR Portugal OR "Puerto Rico" OR Romania OR Russia OR Rwanda OR "Saint Kitts and Nevis" OR "Saint Lucia" OR "Saint Vincent and the Grenadines" OR Samoa OR "Saudi Arabia" OR Senegal OR Serbia OR Montenegro OR Seychelles OR "Sierra Leone" OR Slovenia OR Sri Lanka OR Somalia OR "South Africa" OR Sudan OR Suriname OR Swaziland OR Syria OR Tajikistan OR Tanzania OR Thailand OR Togo OR Tonga OR "Trinidad and Tobago" OR Tunisia OR Turkey OR Turkmenistan OR Uganda OR Ukraine OR Uruguay OR USSR OR Uzbekistan OR Vanuatu OR Venezuela OR Vietnam OR Yemen OR Yugoslavia OR Zambia OR Zimbabwe)

CHAPTER 5: PhD PAPER 2

"Examinations are formidable even to the best prepared, for the greatest fool may ask more than the wisest man can answer". —Charles Caleb Colton, English, author, philosopher and eccentric (1780–1832)

This chapter, which is a related systematic review with Paper 1, is in draft form and has the following proposed citation:

Babalola Olukemi, Goudge Jane, Brown Celia, Babalola Joseph, Johnson Samantha, Griffiths Frances. Assessment tools and their utility for evaluating experience and outcomes of community health care worker training for comprehensive care in low- and middle-income countries: A systematic review

5.1 Title: Assessment tools and their utility for evaluating the experience and outcomes of community health care worker training for comprehensive care in low- and middle-income countries: A systematic review of the evidence

5.1.1. Abstract

Background: Despite availability of various tools for assessing community health worker (CHW) performance in low-income and middle-income countries (LMICs) including written or oral tests, direct observation, skills assessment and analysis of administrative data or a combination, they often lack standardised metrics or have no or limited evidence of utility (validity, reliability, and acceptability). Therefore, this study aim to synthesise evidence on the tools that have been used to evaluate gains in CHW knowledge and skills as a result of attending training for comprehensive care and provide evidence of their utility towards identifying characteristics that are scalable.

Methods: This study identified 30 peer-reviewed articles from PubMed/MEDLINE, CINAHL, and Cochrane Library databases searched from 12 September 1978 (Alma Ata) to 31 December 2023. The search followed the PICOS framework: Participants (CHWs), Intervention (training), Comparison (before and after or no training), Outcome (tool for evaluating training outcomes/performance) and Study design (all). A narrative synthesis was performed and the results followed the the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Results: This review included a total of 30 studies from 15 LMICs that have reported any type of tools. Majority of the studies were conducted in the Sustainable Development Goals era (2016-2023; n=15, 50%), reported assessment tools on the narrower range of comprehensive care packages (involving maternal and child health-related programmes; n=24, 80%) and across a spectrum of training interventions (initial and/or refresher and/or supportive supervision; 14, 47%). The most commonly used tools were questionnaire-based (including written, self-completed, interviewer administered or tablet-based; n=19) followed by checklists/observation instruments (n=8). Few others used MCQs/true/false questions/OSCEs, adapted, record/register forms or were semi-structured qualitative instruments. Most commonly assessed outcomes were performance and quality-of-care, while others assessed knowledge and/or skills scores. Of the 30 included studies, less than half (n=13, 43.3%) provided any evidence of utility. Of the 13, IRR (n=9, 69%) was either the only utility type reported (n=4) or along with other validity types (e.g., face, content; n=5). Only one study reported more than two utility types

(face/content/construct/IRR/re-test/reproducibility). Concurrent validity, predictive validity, convergent validity, divergent or discriminant validity were not reported in any study. Furthermore, most studies (n=12, 92%) used objective measures (i.e., not self-reported). Only one of the 13 studies utilised an evaluation model by reporting the Kirkpatrick level of evaluation.

Conclusions: This study identified tools with limited evidence of validity and reliability to evaluate the gains in CHW knowledge and skills following training for comprehensive care mostly on MCH-related programmes. Scarce evidence of incorporation of an evaluation model in assessing the gains in CHW knowledge and skills suggest the need for structured frameworks to facilitate a more systematic and replicable approach to evaluation.

Keywords: Community healthcare worker, comprehensive care, training, assessment tool, evaluation model, validity, reliability, acceptability

5.1.2. Introduction

Assessment is considered pivotal in health professional education particularly because it is important to know if a trainee has a good understand of what has been taught and can move to the next phase of training or if they have achieved sufficient competence for subsequent practice.[306,307] The process of assessment is an "eye opener" for both the trainee and trainer, providing useful information on subsequent steps in the training/learning process, and not just a means towards certification.[307,308] Thus, assessment has been aptly described as the "engine to harness the curriculum"; suggesting the ability of assessment to promote learning, if appropriately designed.[232] This background has led to the ongoing research into the development and designing of methods for assessing learning and competence. According to Baartman et al., if learning only aims for the transfer of knowledge (more common with traditional, more theoretical-based learning), assessment will prioritise memorisation ("rote learning") and knowledge tests.[308] However, as the focus of learning is increasingly favouring competence, the focus of assessment has to involve feedbacks, and formative components, not just summative.[308] Wass et al. further identified key measurement parameters to consider when designing assessments.[232] The purpose (whether summative or formative) must be clear; assessment should align with the learning objectives and learnt competencies and explicitly involve a 'blueprinting' process; a set endpoint standard to determine a pass or fail in a summative assessment; and the methods should be valid (actually measures competence) and reliable (reproducible or consistent test).[232] The assessment methods, including multiple choice questions and Objective Structured Clinical Examination (OSCE), may be assessing changes in knowledge, performance or competence.[307]

Even though most prior evidence focused on higher level health care professionals, the issue of assessment of learning is applicable to lower cadre health care workers such as CHWs as well. According to the WHO, this category of health workers "…. are members of the communities where they work, should be selected by the communities, should be answerable to the communities for their activities, should be supported by the health system….. ".[8] Evidence shows that CHWs continue to be relevant in addressing gaps in access of vulnerable groups to quality healthcare and bridging human resource shortage gaps.[1,4,5] The effectiveness of CHW programmes whose CHWs are adequately-equipped, well-trained, well-supervised, and motivated on a wide range of health conditions and even during disease outbreaks have also been reported.[14,19,20,90]

Thus, CHWs are considered important human resource for health, and their integration into the health system continues to be emphasised. Such acceptance and integration may enhance ongoing research into the design, adoption and effective implementation of training programmes to adequately equip the CHWs. If properly empowered, they can then provide quality care, which as evidence suggests, are capable of. This is even more critical as CHW programmes are becoming comprehensive, addressing increasingly more complex range of health-related services.[16,97]

However, beyond the implementation of well-designed and implemented training programmes is the need for careful planning that involves ongoing assessment of training and what works, in the learning process, and how new evidence can be used to strengthen existing training programmes and curriculums.[18,24,88] Importantly, although diverse, the CHWs roles are context-specific but mainly skills-based, occurring in the community where minimal opportunity for direct support exists, which inform diverse trainings.[20] Moreover, despite the umbrella use of the term "CHW", the CHWs differ widely in what they do and how they are trained and supported, which may explain all the more why the design and application of effective assessment methods are challenging.[309] Furthermore, over the years, recommendations are that training of CHWs are too theoretical, and that classroom-based training is unlikely to provide the type of exposure that these low-level health workers need for adequate skill transfer.[116-118] Therefore, as CHW roles evolve, of importance would be a rethink on the appropriate assessment tools to evaluate CHW learning and competency overtime. The tools should have evidence of utility, including important facets for determining assessment efficacy such as the validity, reliability, and acceptability to be relevant within different contexts within which their roles and services are required.[231] Such tools, with sufficient utility, are needed and may become adaptable across related contexts, to optimise CHW training programmes for comprehensive care.

There is need to be clear about what aspects of training is being evaluated to assess the gains in knowledge and skills after training.[198,199] Meaning that indicators for assessing gains must target specific aspects of training development and processes.[20,198,199] As various evaluation models have suggested, these aspects go beyond just assessing knowledge and skills after implementing the actual training curriculum.[198] Assessment should also target the pre-design phases of training, covering who the trainees and their needs are.[198] Moreover, to further evaluate CHW learning, assessment methods examining behaviour and attitude after training has been considered important, as well as assessment of organisational goals and long-term outcomes.[198] Also, in

assessing CHW competency on comprehensive care services, individual-level and contextual factors that influence knowledge transfer may require consideration.[46]

Various methods have been used to assess CHW performance in LMICs including written or oral tests,[179-181] through directly observing CHW provision of services,[177-179,182,183] vaccine distribution monitoring by use of smartphones,[184], skills assessment[79] and analysis of administrative data to evaluate specific indicators (numbers of household visits conducted, patients attended to or community meetings organised,[185] or a combination.[79,175,179,181] These methods are often limited by the absence of standardised metrics.[167,176] or when available, may only evaluate single disease programmes or the tools have none or limited evidence of utility.[186-191] To bridge this gap, the Community Health Worker Performance Measurement Framework, based on the input-process-output-outcome logic model was developed.[167] Based on this logic model, the framework features four areas (*input*, programmatic *process*, *output* and *outcome*) and seven domains (supportive systems, CHW development, support from community-based groups, CHW competency, CHW well-being, community access and community-centred care), for assessing CHW performance and the health system they are integrated in (Figure 5.1).[167] Each of these seven domains have subdomains and indicators, with 19 subdomains and 46 indicators overall. Among the indicators, those directly related to the performance of CHWs measures the supervision, appraisal of performance, service delivery, quality of services, service usage by the community and referral services. The authors emphasised the relevance of better community-level data collection approaches to enable a strengthened CHW programme. However, these indicators are more programmatic focused, leaving gaps on evidence of assessment tools for evaluating the gains of training and support, particularly for CHWs who provide comprehensive care. Therefore, this study aimed to synthesise evidence on the tools that have been used to evaluate gains in CHW knowledge and skills as a result of attending training for comprehensive care and provide evidence of their utility.

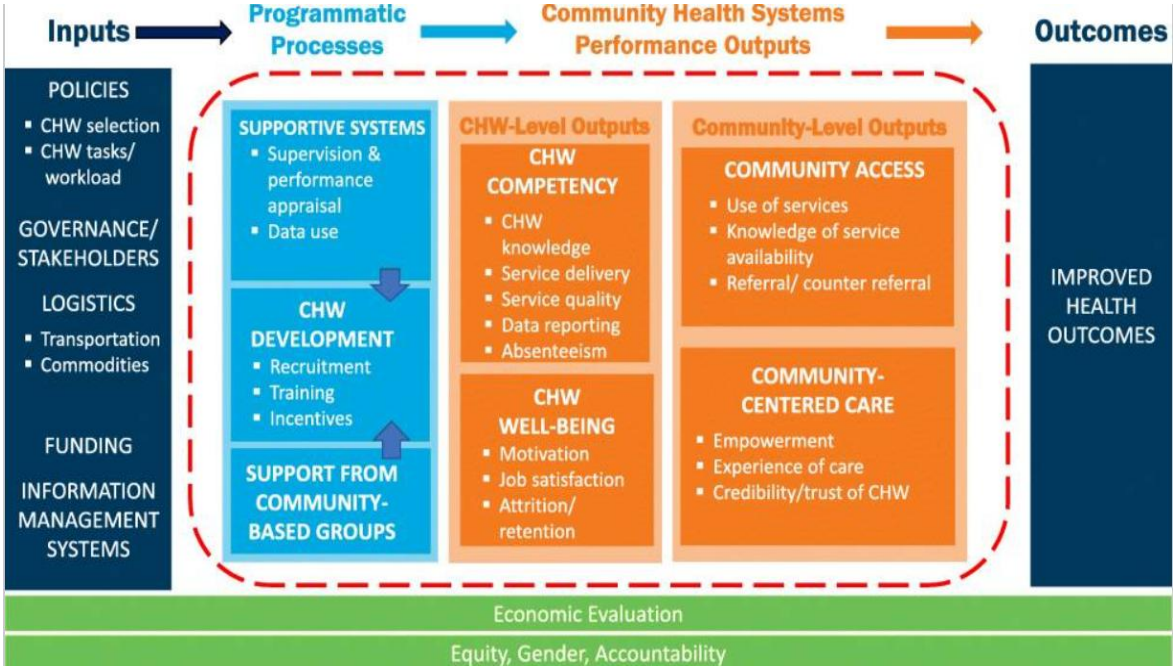


Figure 5. 1: Community Health Worker Performance Measurement Framework

(https://pmc.ncbi.nlm.nih.gov/about/copyright/) Reproduced from[167]

5.1.3 Methods

This systematic evidence review, the second of two related systematic reviews, performed a narrative synthesis. The first systematic review (*under review with Plos One*) was aimed to identify existing LMIC CHW training programmes for comprehensive care and synthesise evidence on their effectiveness. The article selection process, in the two reviews, is as detailed in the article under review. Briefly, since 'comprehensive care' has no explicit definition but has several potential outcomes, consequently, a narrative synthesis approach that does not necessarily need a clear outcome was conducted.[262] As Lisy and Porrit summarised, this narrative synthesis was used to present the main characteristics and differences and similarities between included studies, as well as identify if any relationships exists within the data and the strength of the evidence based on the data.[263] Our systematic review protocol is registered in PROSPERO (registration no: 2020 CRD42020209937). To report the results of the article search and screening, we developed a flow diagram based on the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[264]

The PICOS search strategy approach was used in this study (Table 5.1). Detailed inclusion and exclusion criteria (population, setting and intervention) that we applied in the search and screening (outcome, comparison and study design) phases are shown (Table 5.1).

Table 5. 1: Table showing the PICOS search strategy

PICOS Category	Approach	Examples of search terms
Population/setting	CHWs under various titles including community health worker, community health aides, family planning personnel, and village health workers in LMICs.	Health extension workers, Anganwadi workers, community-based health workers, health assistants Used full list of LMICs, as classified by the 2020 World Bank Group
Intervention – comprehensive care	Existing CHW training programme that are: 3. comprehensive care (combinations of health activities, involving more than one disease or condition using promotive and preventive approaches) 4. national or cover at least an administrative district.	*Applied at the screening phase*
Intervention – training	CHW training programmes.	Training, education, curriculum, and development
Outcomes	At least one tool for evaluating training outcomes or performance whether objective or self-reported (how outcomes were measured, methods of assessment, tools for assessing change in knowledge or skills and type of utility reported)	*Applied at the screening phase*
Comparison	No comparison	*Applied at the screening phase*
Study design	All study designs, qualitative or quantitative were included	*Applied at the screening phase*

Notes: CHW, community health worker; LMIC, low- and middle- income countries

Eligibility criteria

Inclusion criteria

We included available studies relevant to the training of CHWs that met the following criteria:

- The targeted study population was CHWs (including the different country names for CHWs specific for their roles)
- The comprehensive care services provided by the CHWs using promotive and preventive approaches included the following:
    - Any of the following care packages: HIV/TB, MCH, IMCI, and/or
    - Combinations of care packages involving at least two of the following groups: communicable diseases, NCDs, mental health, care of the elderly, care of persons with disability, oral health
- The CHWs were based in any LMICs, using the 2020 World Bank Group classifications (http://databank.worldbank.org/data/download/site-content/CLASS.xls)
- Studies specified the type of training programme and reported the outcome, CHWs knowledge and/or skills.

- The primary study analysed data from either quantitative, qualitative or mixed method designs.
- The full text was available.
- English language studies

Exclusion criteria

During the screening phase, studies were excluded if they were:

- Only focused on other healthcare workers (such as doctors, nurses, or other allied healthcare professionals such as skilled birth attendants or traditional birth attendants), without reporting separately on CHWs.
- Focused on CHW training programme for a single disease.
- Only concerned a high-income country
- Not in English
- Review articles, commentaries, protocols, conference abstracts and letters.
- Qualitative studies reporting perceptions on CHW training
- Studies reporting training conducted prior to September 1978 (Declaration of Alma Ata)

Search strategy

As reported in our previous systematic review, the search strategy for this systematic review was developed under the guidance of one of the co-authors, a medical librarian (SJ). The comprehensive search strategy, implemented from 12 September 1978 (Alma Ata) until 31 December 2023, enabled us to find primary studies on CHW training programmes for comprehensive care. We agreed on the start date of 12 September 1978 when the Alma Ata Declaration was adopted along with the recognition of CHWs relevance for achieving comprehensive PHC.[82] To develop the search terms, those previously utilised in review publications on CHW training implementations in LMICs were adopted.[21,42,82,260,265,266] Our master search string in this review included search terms for 'community health workers' and its abbreviations such as 'CHWs', combined with subject headings on 'training' and its key terms e.g., "Education," "Curriculum," "Problem-Based Learning" and "Staff Development". We included alternative search terms by using the index-linked Medical Subject Headings (MeSH). The included LMICs were according to the 2020 World Bank Group classification (http://databank.worldbank.org/data/download/site-content/CLASS.xls). We combined the search terms by using Boolean operators, 'AND' and 'OR', was well as wildcards.

To ensure efficiency in the use of time and monetary resources, we conducted our search in the following databases: the PubMed, CINAHL, and Cochrane Library.[267,268] We also searched the reference lists of included articles. The Wits Medical Library or authors of included papers enabled us to source for full articles that were difficult to find. OB (the lead author), guided by SJ, FG, CB and JG, performed the article search.

Study screening/and selection

The lead author (OB) and a second co-author (NK) conducted independent screening (title and abstract) using the Covidence software (www.covidence.org). At the screening phase, we included all studies on CHW comprehensive care or "generalist" trainings, based on the criteria for defining comprehensive care, as earlier described. We applied the criteria for the outcome, tool for evaluating training outcomes or performance, during this screening phase. We collated and exported all search results into EndNote X9, where we performed deduplication. Either the lead author (OB) and/or co-author (NK) performed the retrieval and screening of all full texts of potentially relevant studies (guided by JG and FG). Any disagreements at any stage were resolved by consensus. Blinding of reviewers to any portion of any article was not performed.

Data extraction and analysis

Both OB and NK carried out data extraction by using a standardised data extraction template in Microsoft Excel. Besides information on the articles (authors, publication year, study country, study design, study setting); study population (CHWs or CHW client, sample size, gender, age, background education, number of years of experience, remuneration, recruitment criteria and scope of work); characteristics of training (content/curriculum, training duration, trainers, and approach to training); and phase of training (pre-service, on-going and supervision), we also included information on the type of evaluation tool (description/development, availability, utility [validity, IRR, feasibility, impact]). For each tool with any evidence of utility, where available, we also included information on which evaluation model and level was examined. If unavailable, we suggested which Kirkpatrick's level (reaction, learning, job performance (behaviour) and organisational impact, the evaluation corresponded to.

We described the types of tools used in assessing training outcomes and reported the phase of training, type of comprehensive care package and outcome indicators. For studies employing qualitative or mixed methods design, we described all tools used in the study but only reported indicators or outcomes for the quantitative aspect of the study. For all the studies, we only

reported on tools and outcomes for the CHWs/supervisors and excluded any reported at facility/clinic/health post level. We only reported the quality ratings of tools evaluating quantitative outcomes based on any evidence of utility (validity, reliability, feasibility), regardless of use of objective or self-reported measure.[310] The analysis was conducted in Excel Microsoft Office 365 software.

5.1.4 Results

Search results

From a total of 10,673 citations identified by searching the databases, after removing duplicates (n=596), excluding ineligible records during titles and abstracts screening (n=9,923), and during full article review (n=154), the remaining 30 that met our inclusion/exclusion criteria were analysed. The breakdown of the study selection is shown in Figure 5.2.

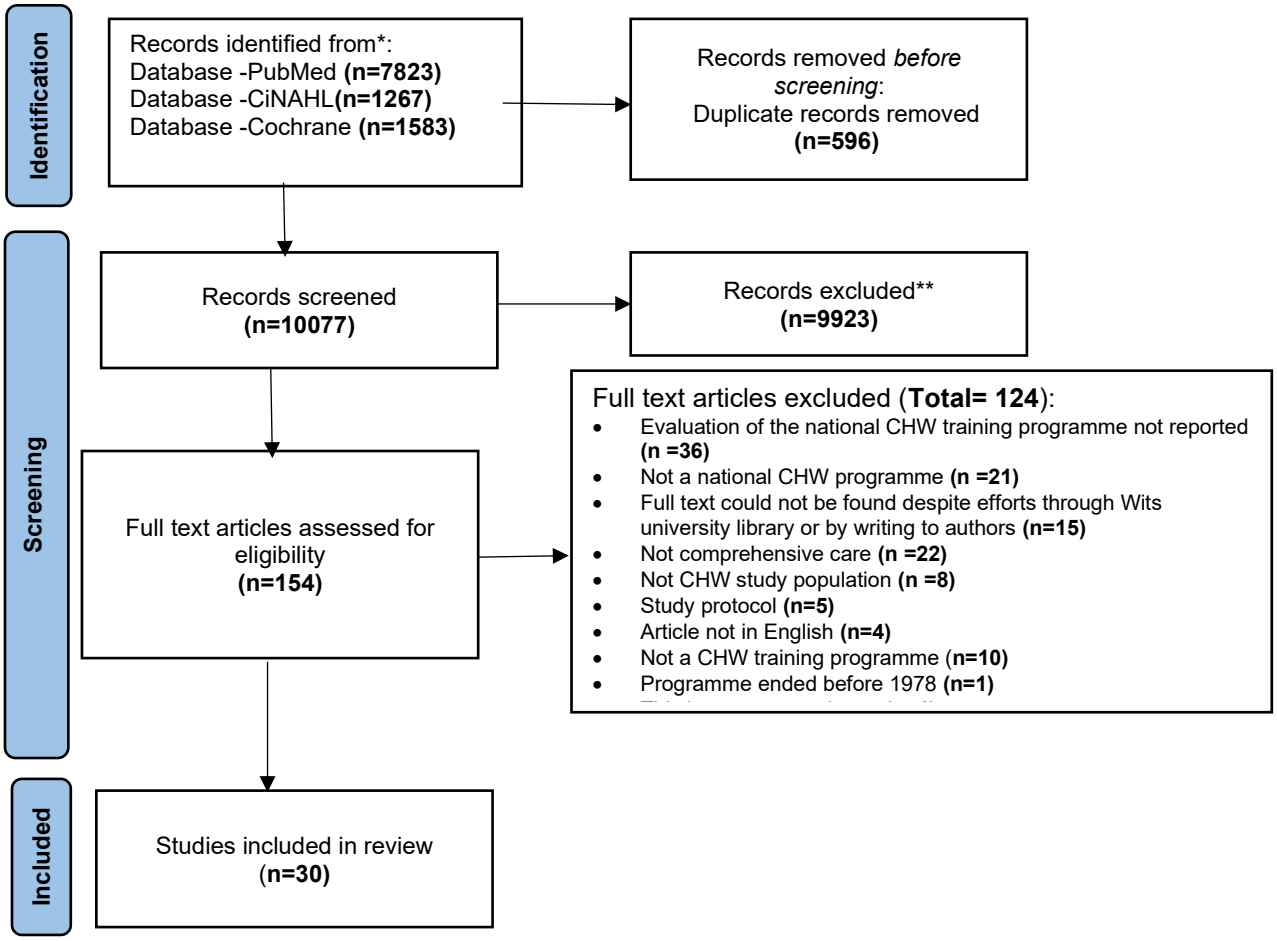


Figure 5. 2: Flow diagram of the study selection

Characteristics of included studies reporting tools for assessing CHW competence or performance on comprehensive care packages

As shown in Table 5.2, the 30 included studies were published between 1980 and 2023 from 15 LMICs, and most studies (n=15, 50%) were conducted in the SDG era (2016 to 2023). The least number of studies (n=2, 6.7%) were published prior to the MDG era (before 2000). The studies spanned 15 LMICs, including six from India,[272,273,311-314] and four each from Kenya[195,279,281,315] and South Africa.[225,305,316,317] Three of the studies were conducted in Ethiopia,[270,271,318] and two each from Bangladesh[319,320] and Uganda.[274,321] One study each was conducted in Brazil,[277] Democratic Republic of Congo,[322] Haiti,[278] Malawi,[323] Pakistan,[324] Papua New Guinea,[124] Rwanda,[84] South Sudan[41] and Tanzania.[325]

Comprehensive care package

Assessment tools were reported on different comprehensive care packages with most studies evaluating the narrower comprehensive care programmes (involving MCH- or child health-related care packages). However, in three of the four South African studies[225,305,317] as well as two other studies,[84,274] the care packages were wider and more comprehensive in scope. Another comprehensive package focused on impetigo, acute otitis media, pneumonia and tuberculosis.[124] (Table 5.2)

Type of training

Of the 30 studies, 14 reported on tools for evaluating gains after the CHWs initial and/or refresher and/or supportive supervision, 10 reported after initial training only[41,225,270,271,273,278,313,317,322,325] and two after supportive supervision only.[318,324] The remaining four conducted ether an educational supportive intervention,[277] workshop,[305] or not stated.[84,321]

Study design

Half of the studies utilised observational study designs including cross-sectional survey (n=11),[195,279,281,312-314,317,318,320,321,323] longitudinal (n=3)[274,315,325] or combination.[84] Five each utilised experimental[273,277,305,316,322] or pre/post design.[41,124,270-272] The remaining used either mixed methods,[225,278,319] qualitative[324] or not stated.[311] The initial training phase mostly utilised pre/post, experimental, longitudinal and cross-sectional study designs.

Types of tools

The most common tools for measuring the outcomes of training involved the use of questionnaires either written/self-completed[124,225,272,273,277,281,316,317,319,320] or verbal/interviewer-administered of mothers/caregivers.[41,84,195,225,312,313,321,323] Tablet-based questionnaire was also utilised.[316] The next most common approach involved the use of checklists/observation instrument by observers for scoring CHW activities.[124,270,271,274,279,314,320,322] Others included the use of MCQs/true/false questions[278] and OSCEs [41] in pre-and post-tests.

In few instances, tools were adapted[318] and other studies used various combinations of tools,[124,279,281,305,318] including diaries.[84] Record review or case/patient register tools were only utilised when the trainings included refresher/supportive supervision[311,315,318] while semi-structured qualitative instruments are applied for in-depth interviews and focus group discussions.[324]

Table 5. 2: Studies that have reported any type of tool for assessing CHW knowledge, skills, competence, quality of care or performance

Study	Study design	CHWs	Comprehensive care package	Training			Assessment*			What was measured i.e. indicators
				Phase	Knowledge and skill content	Duration	Tool	Assessment tool available (Yes/no)	Content of assessment	
Gobezayehu et al 2014 (Ethiopia)	Pre-post study design	201 HEWs and CHDAs (100%, female)	Community Maternal and Newborn Health (CMNH) training	Initial training	• Antenatal care and birth preparedness practices, • Illness recognition, and referral, • Eliminating potentially harmful practices e.g., pre-lacteal feeding, adding oil or butter on cord stump, and bathing the newborn before 24 hours • Conduct CMNH meetings with pregnant women to -Plan for birth -Ensure availability of misoprostol by CHW -Ensure clean environment -Referral plan -Dietary advise • After birth: -Check baby for good colour, breathing, cord care -Placenta delivery -Breastfeeding	Not stated	Skills checklist	No	Pretest checklist: contains similar content detailed in a pictorial "Take Action Cards" with 14 steps for Prevent Problems Before Baby Is Born and 16 steps for Prevent Problems After Baby Is Born. post-test: includes trainees demographics, management activities, and referral	Skills score
Dynes et al 2013 (Ethiopia)	Non-experimental, descriptive design with pre and post training assessments	91 HEWs and CHDAs (98%, female)	CMNH training programme for HEWs and vCHPs	Initial training	Delivery and essential care in postnatal period to prevent maternal and newborn death and disability Mother: • Care at delivery • Postpartum health assessment • Counselling e.g., illness recognition Newborn: • Postnatal health assessment • Counselling e.g., handwashing	Not stated	Skills checklist	No	Checklist was used to score each participant's demonstration and explanation of their response to 14 steps for Prevent Problems before Baby is Born and 16 steps for Prevent Problems after Baby is Born.	Knowledge and skill scores
Miller et al 2016 (Ethiopia)	Cross sectional survey	137 HEWs (137)	ICCM	Supportive supervision using PRCMM	• To assess, classify, and treat childhood pneumonia, diarrhoea, malaria, malnutrition, and measles in children 2–59 months of age • Refer sick children under two months	•Six–day clinical training on ICCM •Bi-annual attendance of HEWs at PRCMM	• Adapted survey tool[282,323]	No	Trained observers observed HEWs' consultations with sick children and recorded details of the HEW's assessment, classification, treatment, referral, and counselling, followed by re-	QoC: proportion of correct management of children with major ICCM illnesses

									examination of the same child	
Rabbani et al 2016 (Pakistan)	Exploratory qualitative inquiry using 14 focus group discussions and 20 in-depth interviews	75 Lady Health Workers (LHW)	MNCH and ICCM	Supportive supervision	• Preventive and basic curative MNCH services: uptake of MCH services, such as family planning and antenatal care, • ICCM of pneumonia and diarrhoea	2 supervisory visits by LHS per month + home visit accompaniment and guidance	Semi-structured guide	Yes (as Table 4 in the paper)	Includes questions to elicit LHWs/LHSs perspectives on how supervision improved their motivation and performance and knowledge and skills on ICCM of pneumonia and diarrhoea.	•LHW/LHS perception on supervision. •Perception on LHW/ LHS ICCM knowledge and skills
Rowe et al 2007 (Kenya -#2782)	Cross-sectional survey (using systematic random sampling)	Volunteer CHWs: 114 (96% female)	CARE Management of the Sick Child (MSC), a modified version of the WHO/UNICEF IMCI	Initial + refresher+ supportive supervision in health facilities and villages	Trained to: Assess children by collecting information on clinical signs and symptoms Diagnose and treat children aged <5 years using the modified IMCI guidelines	• Initial: 10 days lectures + 5 days clinical • Refresher: 6-15 days lectures/role-play/videotape review • Supportive supervision: - clinical: ongoing -group meetings: monthly	• Self-reported standardised questionnaire • Standardised form by trained observers • Standardised interview of child's caretaker •Child re-examination by survey clinician ('gold standard)	No	-Evaluation of initial or refresher training, work experience, supervisory visits, use of job aids and CHW selection -Management of two ill children	Performance: overall or treatment-specific guideline adherence score
Kelly et al 2001 (Kenya)	Three cross-sectional, hospital-based evaluations in 1998 (after initial training), 1999 (after the first refresher), and 2001 (after the second refresher)	The first, second, and third surveys included 100, 108, and 114 CHWs, respectively	A modified version of the WHO's IMCI	Initial + refresher+ supportive supervision	Trained to: •Provide care for children with acute respiratory infections, diarrhoea, and malaria •Refer severely ill children to health facilities •Counsel caregivers on continued care of sick children and on health and disease-related behaviours	•Initial: 21 days •Refresher:7 days of lectures/role-playing/reviewing videotaped consultations and clinical practice •Supportive supervision: ongoing	•Diagnostic algorithm •Checklist for observing consultations •CHW encounter form: to document CHW assessments /diagnoses/ treatments of sick children •Standardized exit interviews with caregivers •Repeat examination of children by a study clinician 6. CHW supervisor evaluation using similar CHW protocol	Yes: a section of the simple algorithm is included as Figure 1 in this article	CHW performance was assessed by conducting evaluations to identify their clinical skills of managing up to four ill children	Performance: sensitivity scores derived from assessment findings of CHWs compared to those of survey clinicians

Rowe et al 2007 (Kenya - #2780)	Longitudinal study	7151 initial consultations by 114 CHWs	CARE Management of the Sick Child (MSC), a modified version of the WHO/UNICEF IMCI	Initial + refresher+ supportive supervision	Trained to: 1. Assess children by collecting information on clinical signs and symptoms 2. Diagnose and treat children aged <5 years using the modified IMCI guidelines	Not stated	CHWs clinical register (i.e. books with prompts in columns for recording specific symptoms, diagnoses and treatments)	No	Clinical register data analysis of initial consultations of ill children aged 0-59 months in the village, who received treatment/referral from 1999-2002	Adherence score: percentage score of guideline-recommended treatments prescribed
Kawakatsu et al 2015 (Kenya)	Three surveys between August and September 2011	1242 volunteer CHWs (81% female)	The Community Health Strategy	Initial training and supportive supervision	Community-based health promotion activities including •door to door canvassing to teach health-related preventive methods •Data collection from households	1. Initial: 10 days 2. Supportive supervision: monthly	•Self-administered semi-structured questionnaires for CHWs/CHEWs • Interviewer administered questionnaire, for mother's health knowledge and on CHW performance (caregiver).	No	CHWs' socio-economic characteristics, working style, job satisfaction and health knowledge. Health knowledge based on responses to questions on immunization schedules, danger signs in pregnant women and neonates and dangerous pregnancy	Performance: •Reporting rate •Health knowledge •Household coverage Level of satisfaction of CHWs with CHEWs' supervision
Nelson et al 2012 (South Sudan)	Pre- and post-training	73 Community-based frontline health workers (FHWs)	Community-based maternal, newborn and child emergency	Initial training	Knowledge on healthy pregnancy, danger signs during labour, bleeding after delivery, newborn care, dehydration & malnutrition, danger signs during pregnancy, preparing for delivery, bleeding after delivery, danger signs in children • Pictorial checklists on identifying danger signs, life-saving care, and early referral. • Use of reusable equipment and commodities	5 days	OSCEs on maternal and newborn components Verbally administered 7-page questionnaire	No	OSCEs on maternal and newborn components	FHW OSCE score
Uwimana et al 2012 (South Africa)	Baseline and ongoing surveys	209 CHWs	TB⁄HIV ⁄PMTCT	Initial training	• Health education on TB/HIV/STIs prevention • TB screening and treatment adherence • STI symptom screening • Home-based HIV counselling and testing • ART treatment adherence and defaulter tracing • PMTCT treatment adherence, infant feeding for HIV + clients, referral and ANC visits	Training: 30 days + another 30 days for clinic placement for practical training on case finding	•Household survey tool •Data collections and reporting tools for routine data	No	•Baseline and ongoing household survey was aimed at assessing the impact of the training programme •Routine monthly data collection	Performance: number of household members served by CHWs
Horwood et al 2017 (South Africa)	•Cluster randomised controlled trial •Baseline/ follow-up surveys	120 CHWs	Continuous quality improvement (CQI) intervention for CHWs on MCH	Initial training on CCM + supportive supervision via CQI Prior training on community	•CCM utilises the treatment algorithms developed IMCI •Support pregnant women •Assess and manage sick infants/children Support PMTCT/ART service delivery	2 weeks training on WHO CCM + 12 month bimonthly CQI mentoring as well as quarterly peer-learning among intervention groups	•Baseline: paper-based questionnaire •Follow-up: tablet-based questionnaire	No	Mothers were asked questions on: care seeking in past 6 months, CHW visits, MNH health knowledge and infant feeding practices	Performance: change in proportion of mothers receiving key health information between time points.

				-based care						
Plowright et al 2018 (South Africa)	Modified Solomon design	64 CHWs	HIV/AIDS, sexually transmitted disease (HAST), TB; and Women's Sexual and Reproductive Health and Rights (WSRHR)	Workshop to strengthen HAST and WRSHR	National government priorities: HIV/AIDS, sexually transmitted disease, TB; and Women's Sexual and Reproductive Health and Rights	2-day training for each topic	•Knowledge questionnaire before/after each training •Self-rated confidence questionnaire •Satisfaction questionnaires •Semi-structured interviews guide •Focus groups	Yes (link to the tool provided)	Questions formatively assessed •Knowledge on HAST and WRRHR separately •CHW confidence to advise clients and their perceptions of the topics	Performance: •Changes in knowledge score •Confidence ratings •Satisfaction with training
Mantell et al 2022 (South Africa)	Mixed-methods evaluation	KAP survey: 191 CHWs (97% female)	WBPHCOT programme	Initial training on a new curriculum Supportive supervision	• Focus on the most prevalent health conditions in the community, including HIV/AIDS. • Classroom skills training on key clinical topics • Field-based training, including on-site practical training	Classroom: 5 days Practical: 9 weeks	•Self-administered knowledge, attitude and practice (KAP) survey questionnaire •Structured observation checklist •Online survey tool for policy/programme stakeholders •Semi-structured interview guides for both KIIs/IDIs	No	•KAP survey questions on curriculum content/ satisfaction with training and supervision •Filed-based observations of CHW activities and facility-based activities of CHWs/OTLs	KAP survey score = proportion of correct answers per participant
Udani 1980 (India)	Pre- and post-training	97 Anganwadi workers (%female: not reported)	Health and ICDS		Antenatal, natal and postnatal care of mothers, family planning • Infant feeding, • Immunization, • Weighing a child, • Hygiene, natal care, colostrum, • Diarrhoea, worm infestation and skin infection, • Nutritious food • Recording of weight, • Plotting the weight chart, • Diagnosing common childhood ailments, • distribution of food supplements	Training + refresher: 2 days versus No prior training: 5 days	Self-completed questionnaire on knowledge of different components of ICDS	No	Recording of weight Knowledge regarding antenatal, natal and postnatal care of mothers Infant feeding Family planning Information regarding immunization Ability to recognise common childhood ailments	Knowledge and skill score *(how the scores were derived was not described in the paper)*

Chaudhary et al 2005 (India)	Not stated	33 AWW -trained in 2002 21 AWW: trained in 2003	IMCI	Initial + refresher + follow-up supervisory visit	•Basic health care to under six children •Providing nutrition and preventive childcare	•Initial: 5 days •Refresher: 1 day •Follow-up supervisory visit: 3 days	•Record review form •Case observation form	No	•Record review of number of sick children seen by each AWW •Case form to examine the sick child by supervisor and AWW separately	Performance: correct treatment of conditions and preventive actions
Shrivastava and Shrivastava 2012 (India)	Cross-sectional study	146 ASHAs	Child health	Previously trained using ASHA training module	•Knowledge of danger signs of diarrhoea, ARI, fever, immunisation that indicate the need for immediate referral •Preventive actions taken for malnutrition and vitamin A deficiency	Not stated	•Pre-tested semi-structured questionnaire administered face-to-face by the researchers	No	•Questions on danger signs of conditions requiring referral and awareness of correct preventive measures for vitamin A deficiency	KAP: proportions of ASHAs with correct knowledge, attitude and practice on child health including referral of a child with danger signs of conditions and correct preventive measures for vitamin A deficiency
Shah et al 2018 (India)	Nested cross-sectional study within a cluster RCT	124 ASHAs	MNCH	Initial	Mobilisation of pregnant women, mothers and children to use health services such as antenatal care, childbirth, home-based care of newborns and immunisation	7 days	Pre-tested, structured questionnaires: •Face-to-face to assess knowledge •By observation to assess skills	No	•Questionnaires to assess knowledge on MNCH care at baseline and endline •Questions related to the skills of ASHA completed in the field by observation.	Level of knowledge and skills: proportions of ASHAs with correct knowledge and skills on MNCH care
Shewade et al 2013 (India)	Cross-sectional study	16 IMNCI trained AWWs/ ANMs and 128 child observations.	IMNCI	•Initial •Refresher	Skill improvement in neonatal and child health issues and appropriate and prompt management	•Initial: duration - not stated •Refresher - 1 day	Observations entered in: •Case record form •Diagnostic skills checklist •Counselling skills checklist.	No	•Assessment of sick children according to IMNCI guidelines. •Assessment of specific diagnostic skills of IMNCI trained workers. •Assessment of their counselling skills	Performance: degree of agreement between physician and trained workers in classifying sick children aged <5 years and level of diagnostic/counselling skills
Sharma et al 2021 (India)	Quasi-experimental, non-RCT with pre-and post-training assessments	171 ASHAs	comprehensive training programme: PACE on life skills and financial literacy.	Initial	Content on improving ASHAs life skills including modules on: • Communication skills, • Problem-solving and decision-making skills • Time and stress management skills, • Financial literacy	6-7 months (theory and practical)	•Trained investigator-administered structured questionnaire	Yes (supplementary file 2 of the published paper)	Questionnaire on life skill scales included: •Communication skills •Self-confidence •Problem-solving and decision-making •Time/stress	Knowledge/ practice scores = aggregate scores of individual questions on the life skills' scales

									management •Financial literacy	
Melo et al 2018 (Brazil)	RCT Pre and post and 1 year post assessments	59 Agentes Comunitários de Saúde – ACSs: (97% female)	CHW training for MCH		• Mother's and infant's health and wellbeing, • Preventive practices and prenatal visits, • Care for labour and delivery, • Common postpartum problems, • Essential newborn care on breastfeeding, nutrition, accident prevention and immunization, • Infant development, • Promoting parent-child interaction, • Assessing family environment, • Identifying socioeconomic and psychosocial problems • Effective communication with parents and family. • Identifying risk factors and warning signs in pregnant women and young infants • ANC care, newborn care, childcare routines and • Child development	4 days	Written questionnaire, including MCQs	Yes (Additional file 1 in the published paper)	Questionnaire assessed KAP on 8 MNCH domains in 4 sections: • Socio-demographic, professional experience, previous training, monthly data of pregnant women/children visited and visit durations • Knowledge assessment • Self-Assessed attitudes • Practices self-assessment	KAP score = percentage of the overall total score obtained for the KAP sections
Puett et al 2012 (Bangladesh)	Cross-sectional survey	338 CHWs	MNCH (2 groups on 2 different workloads: 1= CCM (ARI/ diarrhoea) 2 = 1 + severe acute malnutrition	• Initial • Additional training •Monitoring •Supervision • Refresher	Tasks included nutrition counselling, communication skills, and negotiating feasible practices with caretakers on MNCH	Refresher: 1-day/ monthly	• Adapted QoC checklist[326] • Self-reported questionnaire	No	• Technical competence of CHWs on preventive tasks during routine household visits and curative tasks for case scenarios • Measuring adherence to CCM guideline	•QoC: proportion of correct CHW responses observed during routine consultations at household visits •Adherence score: % of recommended treatments given per case
Billah et al 2018 (Bangladesh)	Mixed method design	131 village doctors	Modified IMCI training	• Initial • Ongoing monitoring •Supportive supervision	• Appropriate management and referral of sick under-five children • Assessment and management of common childhood diseases including ARIs, diarrhoea, fever, malnutrition and ear problems information on age-specific feeding recommendations for healthy and sick children, immunization schedule and when to refer sick children	• Initial: 2 days • Direct monitoring and supervision: quarterly	• Structured, self-administered questionnaire • In-depth interviews of mothers of recently sick children	No	Knowledge on: • pneumonia/severe pneumonia signs • home management of pneumonia and diarrhoea • referral of severely ill child • when to administer first dose of antibiotics	IMCI knowledge score =correct knowledge on conditions and management

Gilroy et al 2013 (Malawi)	Cross-sectional	131 HSAs, 19% Female and 396 sick child observations	CCM	•Initial + CCM training •Follow-up visits •Received initial CCM drug stock	•Assess, classify and treat uncomplicated cases of fever (malaria), cough and fast breathing (pneumonia), diarrhoea and eye infection. •Identify severe illness and refer children with danger signs	•Initial basic training: 10 weeks •CCM training: 6 days •Follow-up visit: within 6 weeks of training	•Sick Child Recording Form (SCRF) •Structured surveyor-administered questionnaire	No	•Management of sick child using SCRF + re-examination by a 'gold-standard' clinician •Assessment of knowledge of case management on a set of case scenarios	QoC = correct case management including assessment, classification, treatment, counselling and referral
Langston et al 2019 (DRC)	A quasi-experimental study	154 Relais communautaires or RECOs (CHWs)	ICCM	Initial	steps of sick child management referral of a child with danger signs Medication for treating children each month	6 days	Checklist	No	Checklist completed while observing RECO's management of sick children on assessment of danger signs, referral, respiratory count and classification of conditions, by direct observation and re-examination	QoC = correct assessment of danger signs/referral decision/respiratory count/classification of conditions
Knettell et al 2017 (Haiti)	Mixed methods	119 (30% female)	Annual volunteer-led training programme for CHWs with a specific focus on MCH	Initial MCH-focused training for CHWs trained on general health	•Reducing illness and mortality among pregnant women, postpartum mothers, and children under five years old. •Prevention of health complications (e.g., nutrition, hygiene, prenatal care) •Recognition of problems •Recommending when to seek for help from health professionals	7 days, yearly	•Pre- and post-course knowledge tests •Pre- and post-course focus group interviews •Post-course satisfaction survey •IDIs with course instructors and administrators	No	•MCQs and true-false questions to test knowledge on the course content •Four MCQs evaluating the effectiveness and applicability of the course •FGDs: to examine participants' expectations, goals, and reactions related to the training •Evaluating details about the programme establishment, changes over time, format and structure, and future plans and goals	•Knowledge score = mean score on knowledge questions on course content

Musoke et al 2019 (Uganda)	Cross-sectional study	201 CHWs (76%, female)	Village Health Team (VHT) strategy or ICCM	Not stated	Provide health information, primary healthcare support and appropriate linkages to health services	Not stated	Structured interviewer-administered questionnaire developed based on previous literature[327]	No (but questions used to derive scoring are included in the article	Questionnaire covered •Socio-demographic characteristics •CHW programme status (recruitment, training, roles and responsibilities, supervision and motivation) •knowledge/practices on malaria and diarrhoea management	Performance = high or low, on score of '0'/'1' for 8 questions, on home visits/health education/use of register/ monthly reports. Scores ≥6 is high
Ebbs et al 2023 (Uganda)	Prospective observational study (2016-2019)	75 CHWs, 20%, female	CHW programme	Initial and annual trainings for 3 years	Knowledge of basic medical skills • Assess respirations • Assess pulse • Manual blood pressure • Haemorrhage control • Rapid trauma evaluation • Record temperature	5 days	Medical competency skill checklist	No	Assesses skill competency 1-on-1 on (respirations, pulse, BP, haemorrhage control, trauma evaluation, temperature)	Skill competency examination score from assessment of 6 skills
Chin-Quee et al 2016 (Rwanda)	Longitudinal and cross-sectional data collection methods	383 vCHWs (85%, female)	• MCH • Wider comprehensive care	Not stated	Community-based IMCI • Growth monitoring of infants and children • Family planning counselling, referral, condom provision • Directly observed treatment of TB • Rapid tests for malaria diagnosis Nutrition counselling • Sanitation and home hygiene counselling • HIV/AIDS prevention and support for people living with HIV/AIDS • Re-supply of oral contraceptive pills and DMPA	Not stated	•Diary for recording daily activities for one month • Interviewer-administered structured instrument -CHWs -Clients	No	•<u>Diaries documented information on:</u> -Number of clients/households attended to, -Time spent with client/household, and services. •<u>Interviews</u>: -CHW perceptions of workload, job satisfaction, and sources of motivation -Clients on any recent service, type and quality of service(s), and overall satisfaction	CHW's perception if service quality = proportion reporting service quality Proportion of clients reporting satisfaction and quality of care
Shelley et al 2018 (Tanzania)	Longitudinal	76 dual role CHWs (50%, female)	MNCH + HIV	Initial training on MNCH + prior: training on HIV home-based services	CHWs received training on visit timing during pregnancy, post-partum, following births until age 5 Health promotion topics: ANC booking, pregnancy danger signs; nutrition; birth preparedness; breastfeeding; newborn care; malaria prevention; HIV/AIDS; family planning; postpartum care; newborn and child danger signs; and growth and development	<u>MNCH</u>: Classroom: 2 weeks Practical: 1 week <u>HIV</u>: 12 days	Monthly summary form	No	Data from monthly summary forms 14 months prior to training to 12 months after training	Client workload = mean numbers of household visits for HIV and MNCH services per month

Ashwell et al 1995 (Papua a New Guinea)	Pre- and post-test assessments	24 CHWs	National CHW programme	Previously trained using ASHA training module	Clinical management of patients presenting with the signs and symptoms of four common clinical case scenarios - impetigo -acute otitis media -pneumonia - tuberculosis • Undertaking comprehensive history-taking and systematic examination for all cases	2 years	• Standardized questionnaire • Written test • Observation instrument .	No	• Questionnaire covers personal/community /facility factors od performance • Test: assesses CHW knowledge of clinical management of impetigo, acute otitis media, pneumonia and TB • Observation instrument for recording CHW management of systemic illness	Knowledge and clinical competency score = achieving ≥70% in correct diagnosis and treatment

*Table includes details of all data collected during assessment

HEWs, health extension workers; IMCI, Integrated Management of Childhood Illness; ICDS, Integrated Child Development Scheme; RMAs, rural medical aides; MCHAs, mother and child health aides; HAs, health auxiliaries; MCH, maternal and child health; IMCI, integrated management of childhood illnesses; iCCM, Integrated Community Case Management; WBPHCOT, Ward-based Primary Health Care Outreach Team; OTL, outreach team leader; inSCALE, Innovations At Scale For Community Access and Lasting Effects; PACE, Personal Advancement and Career Enhancement; CHWs, community health workers; NPOs, nonprofit organisations; CHEWs, Community health extension workers; IMCI, integrated management of childhood illnesses; ARIs, acute respiratory infections; vCHPs, volunteers Community Health Promoter

Utility of tools for assessing CHW competence or performance on comprehensive care packages

As shown in Table 5.3 below, of the 30 articles reporting tools for evaluating gains of training included in this analysis, less than half (n=13, 43.3%) provided any evidence of utility. Overall, the most commonly reported utility, IRR, occurred in nine studies, either as the only utility type,[279,281,318,323] or along with other validity types (e.g., face, content).[270,271,277,314,320] Of the 13 studies, seven had evidence on only one utility type,[279,281,312,313,318,323] five on two utility types[270,271,273,314,320] whereas only one study[277] reported more than two utility types (face/content/construct/IRR/re-test/reproducibility). None of these utility types (concurrent validity, predictive validity, convergent validity, divergent or discriminant validity) were reported in any of the 13 studies.

Nearly all the studies reporting on tools with any evidence of utility were on MCH and child-health related CHW programmes (n=11, 84.6%). The remaining two studies included one that was used to evaluate gain in knowledge and practice following supportive training on comprehensive care (life skills and financial literacy)[273] and another on basic medical skills (including counting of respiration and pulse, measuring temperature, haemorrhage control and emergency trauma care).[274] Despite the related comprehensive care programme evaluated, the outcomes measured varied and even among similar outcomes, the definitions varied. For example, performance was reported as the outcome in three studies. However, performance was measured differently either as the overall or treatment-specific guideline adherence score,[281] sensitivity scores derived from assessment findings of CHWs compared to those of survey clinicians,[279] or degree of agreement between physician and trained workers in classifying sick children aged <5 years (Table 5.3).[314] On the other hand, for studies reporting quality-of-care as the outcome, these seemed to have similar approaches to how the measure was derived. According to Miller et al., Puett et al. and Gilroy et al., quality-of-care was measured as the proportion of correct management of children with major ICCM illnesses; proportion of correct CHW responses observed during routine consultations at household visits and correct case management including assessment, classification, treatment, counselling and referral (Table 5.3).[318,320,323] Importantly, all these three studies were on CHW programmes with child-focused components.

Nearly all the tools (n=12, 92.3%) used to evaluate gains in CHW knowledge and skills following training for comprehensive care that reported any evidence of utility used objective measures. That is, the tools were either trained investigator-administered, or the investigator utilised the tool to record observations of CHWs providing care (i.e., not self-reported). Understandably, the only study that required completion by the CHWs themselves involved written tests.[277]

Table 5. 3: Tools with any evidence of utility

Study	Comprehensive care package	Tools	Tool description	What was measured i.e. indicators	Validity	Reliability
Gobezayehu et al 2014 (Ethiopia)	Community Maternal and Newborn Health (CMNH) training	Skills checklist	Pretest checklist: contains similar content detailed in a pictorial "Take Action Cards" with 14 steps for Prevent Problems Before Baby Is Born and 16 steps for Prevent Problems After Baby Is Born. Post-test: includes trainees demographics, management activities, and referral	Skills score	Content validity Held in-depth discussion about what constitutes a full point score for each step	Inter-rater reliability (IRR) Co-scoring of assessments among specialists until consistent
Dynes 2013 (Ethiopia)	CMNH training programme for HEWs and vCHPs	Skills checklist	Checklist was used to score each participant's demonstration and explanation of their response to 14 steps for Prevent Problems before Baby is Born and 16 steps for Prevent Problems after Baby is Born.	Knowledge and skill scores	Content validity Held in-depth discussion about what constitutes a full point score for each step	IRR Co-scoring until consistency between Master Trainers and across trainers
Miller 2016 (Ethiopia)	ICCM	Adapted survey tool[282,323]	Trained observers recorded details of HEWs' consultations with sick children and including assessment, classification, treatment, referral, and counselling, using the tool, followed by re-examination of the same child by a re-examiner	QoC: proportion of correct management of children with major ICCM illnesses	-	IRR All observers/re–examiners achieved ≥ 90% concordance with the "gold standard clinicians" on three consecutive role play examinations
Rowe et al 2007 (Kenya -#2782)	CARE Management of the Sick Child (MSC), a modified version of the WHO/ UNICEF IMCI	Standardised form by trained observers	Trained observers recorded CHWs management of two ill children using the tool	Performance: overall or treatment-specific guideline adherence score	-	IRR To promote inter-clinician and interobserver agreement, training/ tests were conducted before the study until concordance between clinicians and observers' findings was >90%
Kelly et al 2001 (Kenya)	A modified version of the WHO's IMCI	Checklist for observing consultations	CHW performance was assessed by conducting evaluations to identify their clinical skills of managing up to four ill children	Performance: sensitivity scores derived from assessment findings of CHWs compared to those of survey clinicians	-	IRR Concordance was >95% between observer and survey clinician; >90% between the two clinician evaluators
Shrivastava and Shrivastava 2012 (India)	Child health	Pre-tested semi-structured questionnaire administered face-to-face by the researchers	Questionnaire consists of questions on danger signs of diarrhoea, ARI, fever, immunisation that indicate the need for immediate referral; Awareness of correct preventive measures for malnutrition and vitamin A deficiency	KAP: proportions of ASHAs with correct knowledge, attitude and practice on child health including referral of a child with danger signs of conditions and correct preventive measures for vitamin A deficiency	Validity Pretesting	-
Shah et al 2018 (India)	MNCH	Pre-tested, structured questionnaires: •Face-to-face •By observation	•Questionnaires to assess knowledge on MNCH care at baseline and endline •Questions related to the skills of ASHA in the field	Level of knowledge and skills: proportions of ASHAs with correct knowledge and skills on MNCH care	Validity Pretesting	-
Shewade et al 2013 (India)	IMNCI	•Case record form •Diagnostic skills checklist •Counselling skills checklist.	•Assessment of sick children according to IMNCI guidelines. •Assessment of specific diagnostic skills of IMNCI trained workers. •Assessment of their counselling skills	Performance: degree of agreement between physician and trained workers in classifying sick children aged <5 years and level of diagnostic/counselling skills	Validity Pretesting: conducted to standardize the operational aspects of the skill assessment	IRR The investigator attained a level of agreement [Kappa] of ≥0.9 with an IMNCI master trainer before the study

Sharma et al 2021 (India)	Comprehensive training programme: PACE on life skills and financial literacy.	Investigator administered structured questionnaire	The questionnaire consists of life skill scales for assessing •Communication skills •Self-confidence •Problem-solving and decision-making •Time/stress management •Financial literacy	Knowledge/practice scores = aggregate scores of individual questions on the life skills' scales	Validity Questionnaires were standardized and field-tested before data collection	Internal consistency (Cronbach) Three scales had reliability scores (Cronbach's alpha score) of 0.7, 0.76 and 0.85, respectively
Melo et al 2018 (Brazil)	CHW training on MCH	Written questionnaire	Questionnaire assessed knowledge, attitude and practice on eight MNCH domains under the following four sections: • Socio- demographic, professional experience, previous training, monthly data of pregnant women/children visited and visit durations • Knowledge assessment • Self-assessed attitudes • Practices self-assessment	KAP score = percentage of the overall total score obtained for the KAP sections	Face/content validity To optimize semantic, content and face validity, the draft questionnaire was distributed to researchers in health education, primary care professionals (including CHWs), paediatricians and gynaecologists-obstetricians for a critical appraisal of technical content Construct validity To ensure construct validity and reproducibility, a pilot study was conducted with 20 CHWs who were not participating in this study	IRR Kappa coefficient [inter-rater correlation] was almost perfect in 88% of the analysed questions: moderate in 13% (0.40–0.59), substantial in 38% (0.60–0.79) and almost perfect in 38% (0.80–1.00) Test re-test Same subjects filled the questionnaires two separate times, 1 week apart, to assess reliability. Measurement of agreement between responses (test-retest) was assessed Reliability The comparison of test and retest values (intraclass correlation) showed a high index of concordance between responses in 99.7% of the questionnaire's items.
Puett et al 2012 (Bangladesh)	MNCH	Adapted QoC checklist[326]	Checklist for • Assessing preventive tasks during routine household visits •Measuring adherence to CCM guideline	•QoC: proportion of correct CHW responses observed during routine consultations at household visits •Adherence score: % of recommended treatments given per case	Content validity The tool was reviewed with programme staff and standardized measurement of "quality" was based on a communication tool used in the programme to aid CHW counselling, called the "Promise Sheet".	IRR To ensure accurate observation of routine household visits, consultations and recording, role-plays and interviews were used to determine correct observations as "gold standard"
Gilroy et al 2013 (Malawi)	CCM	Sick Child Recording Form (SCRF)	The SCRF is to assess the management of sick child followed by re-examination by a 'gold-standard' clinician Also, for the assessment of knowledge of case management on a set of case scenarios	QoC: correct case management including assessment, classification, treatment, counselling and referral	-	Yes (achieved 90% between surveyors on direct observation of consultations in role-playing exercises after an initial 7-day training on assessment protocol, methodology and research ethics and a 2-day refresher training halfway through the data collection period)
Ebbs et al 2023 (Uganda)	CHW programme (covers basic medical skills)	Medical competency skill checklist	The checklist is to assess skill competency on respiration count, pulse count, blood pressure measurement, haemorrhage control, trauma evaluation, and temperature measurement	Skill competency examination score from assessment of 6 skills	Content validity Skill competencies were validated by expert consensus on basic medical skills and reviewed by a team of local Uganda physicians to ensure linguistic, cultural, and medical adequacy	-

HEWs, health extension workers; vCHPs, volunteers Community Health Promoters; ICCM, Integrated Community Case Management; IMCI, Integrated Management of Childhood Illness; CHWs, Community health workers; ARI, acute respiratory infections; ASHAs, Accredited Social Health Activists; IMNCI, Integrated Management of Newborn and Childhood Illnesses; MCH, maternal and child health; KAP, knowledge, attitude and practice; QoC, quality of care; CCM, community case management

Assessment tools with any evidence of utility and Kirkpatrick's evaluation models

As Table 5.4 below shows, of all the 13 studies that reported any evidence of utility in this analysis, only one utilised an evaluation model and reported the Kirkpatrick level of evaluation.[277] Therefore, for the remaining 12 studies, Table 5.4 shows possible levels corresponding to the Kirkpatrick's evaluation model. In all the 13 studies, none of the measures corresponded to level 1 ("Reaction" e.g., based on liking, acceptability, usefulness or relevance using rating methods or qualitative design). As shown, in most studies (n=7), the measures corresponded to level 3 ("Behaviour").[274,277,279,281,314,318,320] Measures corresponding to levels 2 and 4 occurred in five[270,271,273,277,313] and two studies,[271,323] respectively. The authors of the only study reporting a Kirkpatrick's model level, reported level two ("learning") only; however, we also added a corresponding level 3 based on the outcome assessment. Level 2 ("learning") was assessed as the extent to which the CHWs' levels of knowledge, attitudes and practice had improved or were sustained pre- and post and 1 year following training.[277] We also assessed the measures of another study to correspond to both levels 2 and 4.[271] Another study that only acknowledged the relevance of specific evaluation models of training but could not incorporate it into their study due to time and financial constraints, had a measure corresponding to level 2.[273]

Table 5. 4: Assessment tools with any evidence of utility, what was measured as the outcome and level of Kirkpatrick's evaluation models

Study	Tools	What was measured i.e. indicators	Where assessment was conducted	Level 2 (*Learning)* – immediate benefits from training, change in attitude/perceptions, change in knowledge/skills	Level 3 (*Behaviour*) Efficiency of training through perception of behavioural change, skill retention, change in workplace behaviour	Level 4 (*Results*) Impact of behavioural change through change in QoC or QoC processes or benefits to patients
Gobezayehu et al 2014	Skills checklist	Skills score	Rural district region (unclear if community/clinic/hospital-based)	Skills was evaluated before and after training		X (degree of knowledge retention 18-month after training)
Dynes 2013 (Ethiopi	Skills checklist	Knowledge and skill scores		Assessment of transfer of knowledge and skills pre- and post-training		
Miller 2016 (Ethiopia)	Adapted survey tool[282,323]	QoC: proportion of correct management of children with major ICCM illnesses	Rural health posts		Able to correctly assess, classify, treat and refer children with pneumonia, diarrhoea, malaria, malnutrition, and measles, about 1 year after training	
Rowe et al 2007 (Kenya - #2782)	Standardised form by trained observers	Performance: overall or treatment-specific guideline adherence score	District hospital outpatient department/CHW work in the village		Percentage of all guideline-recommended assessment, classification and treatment procedures performed correctly for the child aged <5 years	
Kelly et al 2001 (Kenya)	Checklist for observing consultations	Performance: sensitivity scores derived from assessment findings of CHWs compared to those of survey clinicians	District hospital		Assessment occurred 7-13 months after initial training; (8–12 months after the first refresher training) and (3–5 months after the second refresher training)	
Shrivastava and Shrivastava 2012 (India)*	Pre-tested semi-structured questionnaire administered face- to-face by the researchers	KAP: proportions of ASHAs with correct knowledge, attitude and practice on child health including referral of a child with danger signs of conditions and correct preventive measures for vitamin A deficiency	Primary health centres where the ASHAs were working			
Shah et al 2018 (India)	Pre-tested, structured questionnaires: •Face-to-face •By observation	Level of knowledge and skills: proportions of ASHAs with correct knowledge and skills on MNCH care	Questionnaire for knowledge assessment Filed-based: for skills assessment	Assessments occurred on the first day of training and 6 months after.		
Shewade et al 2013 (India)	•Case record form •Diagnostic skills checklist •Counselling skills checklist.	Performance: degree of agreement between physician and trained workers in classifying sick children aged <5 years and level of diagnostic/ counselling skills	Outpatient departments of CHCs/PHCs for skills assessment		Assessment was done 4 years after initial training	

Sharma et al 2021 (India)	Investigator administered structured questionnaire	Knowledge/practice scores = aggregate scores of individual questions on the life skills' scales	-	Assessments occurred at baseline and endline		
Melo et al 2018 (Brazil)**	Written questionnaire	KAP score = percentage of the overall total score obtained for the KAP sections	-	Assessments of intervention CHWs' level of KAP at baseline versus endline	Assessments of CHWs' level of KAP at baseline versus 1 year after training	
Puett et al 2012 (Bangladesh)	Adapted QoC checklist[326]	•QoC: proportion of correct CHW responses observed during routine consultations at household visits •Adherence score: % of recommended treatments given per case	Assessments were conducted during routine household visits and based on curative case scenarios (not direct observation, to simplify the data collection process)		Assessments of QoC was performed 1-3 years after CCM of ARI and diarrhoea training	
Gilroy et al 2013 (Malawi)	Sick Child Recording Form (SCRF)	QoC: correct case management including assessment, classification, treatment, counselling and referral	Assessments were conducted during routine CCM clinics in the community settings where they provide sick childcare			Assessments of QoC was performed about 18 months after the first HSAs underwent CCM training
Ebbs et al 2023 (Uganda)	Medical competency skill checklist	Skill competency examination score from assessment of 6 skills	Health ministry quarters		Exams were conducted after initial training and yearly, thereafter, to assess medical skill competency retention with use of mHealth.	

* Time since training to assessment is unspecified making it difficult to suggest the level of Kirkpatrick evaluation
**Only study reporting Kirkpatrick evaluation model reported for level 2 only but may also have assessed level 3 based on the definitions by Kirkpatric
HEWs, health extension workers; vCHPs, volunteers Community Health Promoters; ICCM, Integrated Community Case Management; IMCI, Integrated Management of Childhood Illness; CHWs, Community health workers; ARI, acute respiratory infections; ASHAs, Accredited Social Health Activists; IMNCI, Integrated Management of Newborn and Childhood Illnesses; MCH, maternal and child health; KAP, knowledge, attitude and practice; QoC, quality of care; CCM, community case management

5.1.5. Discussion

Summary of findings

This systematic review identified and synthesised evidence on 30 studies that reported on tools that have been used to evaluate gains in CHW knowledge and skills following training for comprehensive care mostly on MNCH-related programmes. Most commonly assessed outcomes were performance and quality-of-care, while others assessed knowledge and/or skills scores. Most tools were questionnaires or checklists and were administered mostly by investigators who completed them while observing the comprehensive care of the CHWs while one was written. Overall, the quality of assessment tools are questionable. Even though 13 of the 30 studies provided any evidence of quality assessment or utility of the tools, that is, on their validity and reliability, most only reported one utility, that is, inter-rater reliability, followed by content validity. Although six tools had two or more utility types, only one of the six had more than two.

The tools with evidence of utility were mostly based on quantitative data, while additional tools, including interview guides in qualitative studies, were often needed to cover other training modules, including supportive supervision for CHWs and clients' perspective of care. The evidence of use of an evaluation model such as the Kirkpatrick's model, was by one study only.

Tools for evaluating comprehensive care

As our findings showed, increasingly, more studies are assessing the effectiveness of training programmes to equip CHWs with skills to provide comprehensive care, and they are also attempting to describe the tools used to measure the gains of training. This is important because based on evidence, strategies to improve healthcare quality goes beyond ensuring the availability of *inputs,* that is, not just training, equipment or supplies, but also the measurement of processes of providing care that is influenced by the health provider's behaviour.[174] Thus, what is measured and measurement approaches, matter. For example, in South Africa Horwood et al.[316] seem to ask the mothers about what they know about infant feeding. This is a good measure of impact of the work the CHWs undertake but can be modified by many other factors out of the control of the CHWs. Interpretation of results needs to take this into account. In Ethiopia, Miller et al assessed the CHWs on diagnostic performance. The assessment context within health posts may be very different from the real-world context within community settings where the CHWs would normally perform the assessment. Such approach to measuring performance may overestimate CHW ability to assess sick children accurately. Therefore, in real-world situations, to enable the CHW perform well, other skills may be required (e.g., managing family distress).

In our systematic review, the most common comprehensive care packages for which training were delivered were often MNCH-related and context-specific, covering mostly promotive and preventive practices with limited curative components. The MNCH-related components include facilitating access of pregnant women to care, ensuring post-delivery support, identifying and diagnosing common childhood illnesses, referral services, health education and counselling, nutritional advise, household needs assessment and use of data tools among others. That these comprehensive care packages are more prevalent in this systematic review in LMICs is not surprising. As part of the strategies to ensure adequate health worker capacity, the WHO developed MNCH-related packages including IMCI, ICCM, and on MCH that have been adopted particularly in LMICs.[328,329] At the community level, the role of CHWs in facilitating

access to these comprehensive care packages particularly towards achieving UHC has become the norm by vast LMICs.[1,4,5] Hence the relevance of assessment of various outcome measures to identify strengths and areas requiring improvements as we showed in this systematic review where the CHWs performance, quality-of-care or knowledge/skills scores were mostly assessed. Incorporated into the comprehensive care packages by the WHO are tools, including checklists, questionnaires and case observation forms, developed for assessing competence of trainees by the WHO similar to those reported in our study.[330,331] Our findings are also consistent with that of a review that sought to identify assessment tools for evaluating quality-of-care in children, mapped to a WHO framework of quality-of-care domains.[332]

The availability of tools designed along with MNCH-related programmes may substantiate our findings of some consistency in the approach used to measure quality of care. Indeed, standardised measures are required to enhance reproducibility and replicability, so that similar programmes can benefit from gains of prior studies. In looking at performance outcome in our study however, discrepancy in measurement approach suggests a lack of guide on the design of tools, as though as an afterthought, limiting standardisation. Often, designing of evaluation tools are the product of academic researchers investigations, sometimes as a pilot study, which may limit the design of high-quality tool and adoption of designed tools by governments in LMICs.[273]

To advocate for a more standardised approach to evaluating CHW programmes comprehensively, Agarwal et al proposed a framework structured based on the input-process-output-outcome logic model approach.[167] Although this framework emphasised the relevance of better community-level data collection approaches to enable a strengthened CHW programme, the framework is limited in demonstrating CHW performance, competency, knowledge and/or skills, following training. Thus, as another review recommended, programme designs should consider the goal of assessment as this may influence the tool designed to measure it.[332] To assess the gains of training, identifying low-cost, comprehensive tools focusing more on *processes* may be more relevant to low-cadre CHWs whose outcome is more influenced by ensuring that they know what to do and that they do it well each time, within their given contexts.[332] In our study, as documented in previous reviews, tools to assess the gains of training by documenting the experience of care by clients should be emphasised.[332]

Quality of tools for evaluating comprehensive care

In this systematic review, it remains unclear whether the tools used to assess the gains of training for comprehensive care, in their current states, are suitable or of sufficient quality, given that most tools with any evidence of utility actually had only one utility type. A previous review identified tools used to assess the gains of teaching evidence-based medicine skills to higher-cadre HCPs and the quality of the tools.[310] The authors based their definition of high-quality tools on the evidence of inter-rater reliability, a non-self-reported or objectively measured outcome, and three or more other validity evidence including discriminative validity.[310,333] In our systematic review, none of the studies demonstrated discriminative validity. Hence, based on the previous review criteria of high-quality assessment tool, the tools currently in use for assessing the gains of CHW training for comprehensive care in our systematic review, are unsuitable. However, since this systematic review is focused on lower-cadre CHWs whose roles are becoming increasingly complex, the focus should be on how the CHWs can be enabled to do what they are trained to do and do it well. Thus, consideration may be towards identifying simple, low cost tools that can be used formatively on an ongoing basis to identify gaps or areas of deficiency in CHW competence as recommended even for higher-cadre HCPs.[334-338] This approach may facilitate a more strengthened training and support to most effectively and efficiently achieve sustained gains following training. However, with increasing demand for professionalisation and certification of the CHWs, summative tools with high quality utility may increasingly become more relevant and need further explorations.[339] In addition, the need for ongoing monitoring and evaluation system, for which evaluation models built into the design of CHW programmes for comprehensive care, would also become crucial.[88]

Evaluation models

In this systematic review, there is rather scanty evidence of the incorporation and reporting of use of evaluation models in studies that have evaluated the gains of training of CHWs on comprehensive care packages. The use of evaluation models incorporated into the design of training is considered important to ensure effective, ongoing monitoring and evaluation, and can help early identify what may be missing or requiring strengthening in training design. The only study that reported the use of an evaluation model, the Kirkpatrick's four level model, was also the only study to report more than two utility types, and was the closest to being described reporting a high-quality tool.[277] That this study incorporated an evaluation model in its design may have fostered a more thorough approach to evaluating the gains of training as well as a more

rigorous assessment of the tool utility. Although evidence exists of the commonly used Kirkpatrick's evaluation model in evaluating the real-world evaluation of CHW training, most were either reported in higher-income countries,[148,149] were focused on disease programmes that we did not consider as comprehensive,[200,226,340] or both.[341]

In this systematic review, most studies assessed level 3 of the Kirkpatrick's four level model. This is inconsistent with previous systematic review findings which suggest that the most commonly reported levels of the Kirkpatrick's four level model are the first two (the '*reaction*' and '*learning*' levels).[310] These two levels commonly evaluate trainees level of satisfaction with training process, content or environment (*reaction*) and transfer of knowledge and skills (*learning*).[149] The level 3 of Kirkpatrick's four level model ('*behaviour*'), a measure of changes in participants' '*behaviour'* or daily activities, is often assessed at work locations, and measured long-term (usually 6-12 months after training).[148,200] However, it is unclear whether these studies in our systematic review would have actually regarded their measures as corresponding to level 3, if they had utilised an evaluation model It has been suggested that complex interactions between the training processes and other programmatic inputs which are at play at levels 3 and 4 tend to imply difficulty in measuring at these levels.(Kumaravel et al 2020) .

In our systematic review, the only study that employed the evaluation model described it as the basis for the study design and utilised a controlled RCT to evaluate the '*learning*' following an educational intervention pre-, post-, and at one-year. Another study reported the Kirkpatrick's model as the basis for the creation of the tools they used to evaluate the gains of training.[148] These discrepancies in the use of the evaluation model has been suggested as a limitation of the model itself related to its oversimplification and the ways by which the model is applied in actual practice.[43,204,227,342] A careful consideration of the limitations of evaluation models is necessary to ensure the designing of more appropriate methods and tools if the evaluation model is to provide advantage.[342]

Originally, evaluation models were designed to evaluate how well an educational intervention aligned to its goal when it was designed.[43] This suggests that the use of evaluation models should predate the study design and tool development phases. Over the years, attempts are being made to provide easier understanding of how best to obtain more meaningful results following the use of an evaluation model.[342] For example, it has been said that 'learning' continues beyond the

delivery of packaged training to learnings occurring within work locations, making the level 3 'behaviour' a more reflective measure of learning.[342] However, despite these limitations, for CHWs who are lower-cadre HCPs, the renewed interest in a scaled-up CHW programme for comprehensive care calls for an iterative evaluation approach that the use of evaluation models such as the Kirkpatrick's may be able to bridge. In future, it is recommended that programme planners consider incorporating evaluation models into programme design with links between training objectives and organisational goals.[342] Also more rigorous and multiple study designs and data sources are recommended to evaluate all the different levels in the Kirkpatrick's evaluation model. Another consideration is adequate budget to evaluate the higher levels in the evaluation model.

Study limitations

Previous studies

Limited studies have reported on tools for much wider comprehensive care packages, limiting our understanding of the CHW scope, content and outcomes assessed by evaluation tools. Programme designers and implementers as well as the academic community are encouraged to consider adequate description of tools for evaluating the gains of training for much wider comprehensive care,

Current systematic review

No criteria were set for defining tools that could be considered of sufficient quality, limiting the applicability of current findings to exploratory only, and future study with a require more rigorous approach is recommended to identify measures for defining tools of sufficient quality. Also, in this systematic review, we have only included studies published in English in peer-reviewed journals, suggesting the possibility of language and publication biases.

5.1.6 Conclusion

This study identified tools with limited evidence of validity and reliability to evaluate the gains in CHW knowledge and skills following training for comprehensive care mostly on MNCH-related programmes with hardly any on more integrated wider scope of comprehensive care. Scarce evidence of incorporation of an evaluation model in assessing the gains in CHW knowledge and skills suggest the need for structured frameworks to identify appropriate points of assessment of training programme effectiveness. This may facilitate a more systematic and

replicable approach to evaluation. As packages of care provided by the CHWs are becoming more integrated, towards more comprehensive care, standardized measures and tools with evidence of high-quality utility, are needed. Availability of evidence-based high-quality tools may facilitate timeous assessment of effectiveness of CHW training and performance within related CHW programmes and assist in training programme revisions and optimisation.

CHAPTER 6: PhD PAPER 3

This chapter, which has been published in *Frontiers in Public Health*, has the following citation:

Babalola Olukemi, Goudge Jane, Levin Jonathan, Brown Celia, Griffiths Frances. Assessing the utility of a quality-of-care assessment tool used in assessing comprehensive care services provided by community health workers in South Africa. *Front Public Health* 2022;10:868252. https://doi.org/10.3389/fpubh.2022.868252

6.1. **Title:** Assessing the utility of a quality-of-care assessment tool used in assessing comprehensive care services provided by community health workers in South Africa

6.1.1. Abstract

Background

Few studies exist on the tools for assessing quality-of-care of community health worker (CHW) who provide comprehensive care, and for available tools, evidence on the utility is scanty. We aimed to assess the utility components of a previously reported quality-of-care assessment tool developed for summative assessment in South Africa.

Methods

In two provinces, we used ratings by 21 CHWs and three team leaders in two primary health care facilities per province regarding whether the tool covered everything that happens during their household visits and whether they were happy to be assessed using the tool (acceptability and face validity), to derive agreement index (≥85%, otherwise the tool had to be revised). A panel of six experts quantitatively validated 11 items of the tool (content validity). Content validity index (CVI), of individual items (I-CVI) or entire scale (S-CVI), should be >80% (excellent). For the inter-rater reliability (IRR), we determined agreement between paired observers' assigned quality-of-care messages and communication scores during 18 CHW household visits (nine households per site). Bland and Altman plots and multilevel model analysis, for clustered data, were used to assess IRR.

Results

In all four CHW and team leader sites, agreement index was ≥85%, except for whether they were happy to be assessed using the tool, where it was <85% in one facility. The I-CVI of the 11 items in the tool ranged between 0.83 and 1.00. For the S-CVI, all six experts agreed on relevancy (universal agreement) in eight of 11 items (0.72) whereas the average of I-CVIs, was 0.95. The Bland-Altman plot limit of agreements between paired observes were −0.18 to 0.44 and −0.30 to 0.44 (messages score); and −0.22 to 0.45 and −0.28 to 0.40 (communication score). Multilevel modelling revealed an estimated reliability of 0.77 (messages score) and 0.14 (communication score).

Conclusion

The quality-of-care assessment tool has a high face and content validity. IRR was substantial for quality-of-care messages but not for communication score. This suggests that the tool may only be useful in the formative assessment of CHWs. Such assessment can provide the basis for reflection and discussion on CHW performance and lead to change.

Keyword: community health workers, quality-of-care assessment tool, utility, validity, reliability, comprehensive care

6.1.2. Introduction

Community health workers (CHWs) are recruited from the community they serve, and after limited training, they provide community-based services.[9-11,14,15,84,247] Many CHWs programmes engaged in disease-specific interventions focusing on single diseases and conditions (family planning, antenatal care, and immunization services).[5,25] Increasing evidence are suggesting that CHW programmes are training CHWs to become generalists, providing more comprehensive healthcare.[16,17] These include maternal and child health, childhood immunization and breastfeeding, and diagnosis and treatment of illnesses.[25] What is included as comprehensive services of CHW differ between countries and CHW programmes.[8,16,17,21,25,66,242,244] In South Africa, CHWs provide comprehensive promotive and preventive healthcare services, but do not treat illness.[8,21,66,244] To enable effective implementation of CHW programmes, we need to be able to assess the quality of comprehensive care provided by CHWs.[52,192]

There is a lack of validated tools, indicators, and standardized metrics to monitor CHW programmes.[25,173,176,192] To guide the development of standardized measures of CHW performance, Agarwal, Sripad et al. proposed the "Community Health Worker Performance Measurement Framework".[167] This framework identifies "CHW knowledge", "service delivery," "service quality" and "data reporting" as indicators of CHW performance. Evidence from existing literature assessing CHW performance, shows that few of existing tools used are explicitly validated (see Table 2.2) for existing literature categorized by the Agarwal Sripad et al. indicators). Several of these assessment methods target single diseases or conditions, or only assessed limited services, which is of limited use for assessing the quality-of-care of CHWs who provide comprehensive care. Laurenzi et al. piloted an assessment tool with some similarity to the tool we have assessed in our study. This Home Visit Communication Skills Inventory, a 21-item checklist, assessed only the communication skills (including domains on active listening, active delivery, and active connecting) of CHWs who provide comprehensive care, in South Africa.[186] The Inventory scored audio-recorded and transcribed communication between the CHW and householder(s) during home visits. However, it does not assess CHW skills overall. Furthermore, global rating scales[187,188,343-347] used to assess a performance or skills[348] and which tend to be briefer than checklists[349] are also limited, because of concerns around inter-rater reliability (IRR).[189,190]We previously reported how we developed the quality-of-care assessment

tool within a 3-year (2016–2019) intervention study (Batlhokomedi project), aimed to improve CHW quality-of-care in a South African district.[235,236] We designed the tool to undertake a summative assessment of CHW quality-of-care delivered during household visits.[219,350,351] The tool was designed for an intervention study focused on the continuing assessment of CHWs during household visits taking into consideration the independent care provided by CHWs in the community and the several outcomes that are involved in comprehensive care.[235,236] Briefly, before setting out, just before and on entry, and during household visit, we assessed the various components of the CHW working day while on a household visit, with the tool structured according to the flow (Table 6.1).[235] Items in our quality-of-care assessment tool require a categorical response (e.g., yes/no; present/absent, scored as 1/0). The data scores obtained by direct observations are aggregated and through further calculations, are used to derive message and communication scores (separately) per household. The proportion of expected messages given, and actions undertaken per household, as well as the proportion of items with positive outcome while assessing communication are reported as the household message or communication score, respectively. By these methods, our tool can be used to derive easy-to-understand scores of performance domains. Finally, the CHW bag content and the conditions for which the CHW provides advice/messages and actions for the householders, are based on the South Africa national CHW training manual.[352] Therefore, these are context specific. Trained non-clinical fieldworkers complete the tool while shadowing CHWs during household visits, guided by a fieldwork manual.[235] It should be noted that in our tool, we only included items that the fieldworkers can easily grade and observe. Our tool could be used to measure the indicator subdomains ("CHW knowledge," "service delivery," "service quality" and "data reporting") under the "community health systems performance output-CHW level" domain in the Agarwal, Sripad et al. performance framework.[167]

Table 6. 1: The quality-of-care assessment tool structure

Tool sections (point at which recorded)	Components of the tool
Before setting out	Contents of CHW bag including the list of equipment available for use during the household visit
Just before and on entry to a household (CHW seeks for permission for the fieldworker to observe the visit)	Visit planning
	CHW communication skills including attention to confidentiality
During household visit	Householder conditions and messages and actions expected of CHW
	CHW communication skills including attention to confidentiality
After leaving the household	Factors that could prevent a CHW delivering good quality care
	CHW communication skills including attention to confidentiality

CHW, community health worker.

Our study aimed to assess the utility (face and content validity, acceptability, and inter-rater reliability) of the quality-of-care assessment tool developed to assess the quality of care of CHWs who perform comprehensive care during household visits. We sought to answer the question: Is the quality-of-care assessment tool valid or useful for assessing the quality of comprehensive care provided by CHWs during household visits?

6.1.3. Methods

Assessment tools with high utility (reliability [whether an assessment result can be replicated assuming the same or similar conditions], validity [whether the items in an instrument of interest measure what it is intended to], educational impact [the extent to which desired educational goal expected of the learner and communicated through assessments are being achieved], cost and feasibility [evaluation of the balance between cost and benefit of implementing an instrument, and whether it is capable of being carried out successfully using available resources] and acceptability [extent to which relevant stakeholders consider the instrument acceptable as an assessment tool), are essential, to consider an assessment as 'fair'.[353] The extent to which these utility components are relevant depends on whether the assessment is formative, or summative.[353] In this current study, we provide data on the utility (validity, acceptability, and inter-rater reliability) of an inventory, which covers communication, content and factors (CHW and household characteristics) likely to influence the ability of the CHW to provide good quality care.[235,236] Table 6.2 shows the study design, data collection methods and participants' selection criteria for each utility type.

Table 6. 2: Type of utility, study design, data collection method, participants and data collected

Type of utility	Study design	Data collection method	Type of data	Number of participants	Selection criteria	Data collected
Face validity and acceptability	Cross-sectional study using purposive sampling technique	Workshop, followed by self-completed questionnaire (Appendix 6.1)	Primary	6–10 per facility (four facilities)	Who could read fairly easily or were proficient or confident in the use of English. –Provided consent	-CHW and OTL years of experience –Ward-based Outreach Team Phases one and two examinations passed –Degree to which CHWs agree that the tool covers everything that happens during a household visit–Views of CHWs on the content of the tool –Degree to which CHWs agree that they will be happy for their home visits to be assessed using the tool. –Views of CHWs on why they would be happy for the tool to be used in assessing their performance
Content validity	Cross-sectional study using convenience sampling technique	Expert validation questionnaire (Appendix 6.2)	Primary	six	–At least a master's degree –Had worked on CHW issue for at least 3 years –Have at least three relevant publications or reports related to CHW performance within the South African context.	Experts' provided scores on 11 items in the tool
Inter-rater reliability	Primary data for this secondary data analysis were collected using mixed methods (including a cross-sectional observational study).	Direct observation by paired observers using the quality-of-care assessment tool (Appendix 3.1)	Secondary	three (household observations, n=18)	Trained observers	- Observers' quality-of-care communication scores based on how the CHW engaged with the household -Observers' quality-of-care messages scores based on the health conditions identified and messages given by CHWs

CHW, community health worker; OTL, outreach team leader.

Acceptability and face validity

For the acceptability and face validity, the CHWs and their team leaders (known as outreach team leaders [OTLs]), provided answers on the extent to which our tool covers everything that happens on household visits and how happy they were for their home visits to be assessed using the tool?"[354] That is, the CHWs who would be impacted by the assessment tool needed to express how they felt regarding the tool. Face validity can ensure acceptance of the tool and

cooperation of the impacted clients and policy makers toward its use when non-professionals whose care will be assessed by the tool provide ratings on the tool wholly or its items[355] with or without further explanations regarding the ratings.[356] The recommended face validity rating is on a five-point scale, from one "*the test is unsuitable for that purpose*" to five "*the test is extremely suitable for that purpose*".

Study design, study setting, and participant selection

Using a cross-sectional study design and purposive sampling technique, we collected primary data from CHWs and OTLs in two PHC facilities each from Mpumalanga and Gauteng Provinces. To select each participant, in each facility, we asked the OTLs to (1) identify CHWs who met our selection criteria (see Table 6.2), and (2) who agreed to participate.

Data collection approaches

Workshop

Participants were asked to describe typical household visit day activities. Then, we checked whether the tool was describing these and discussed differences. We audio-recorded the workshop.

Self-completed questionnaire (Appendix 6.1)

We asked the participants to provide a score on a scale of one (*strongly disagree*) to five (*strongly agree*), for the following: (1) "*This quality-of-care assessment tool covers everything that happens on household visits*" and (2) "*I would be happy for my home visits to be assessed using this tool*". We also asked the participants to provide qualitative comments regarding their views on the content of the tool and why they would be happy for the tool to be used in assessing their performance.

Data analysis

From the CHWs/OTLs ratings, we calculated separately for the CHWs and OTLs the agreement index as the mean scores of ratings of the extent to which CHWs/OTLs agreed that the tool covers everything that happens on household visits (agreed) and how many were happy to be assessed using the tool (happy). The agreement index should be ≥85%[357] otherwise, the tool should be revised if the index is <85%.

Content validation

The content validity study requires that content experts determine the extent to which items in a tool are relevant or representative of intended constructs.[358,359] This a posteriori attempt to evaluate the relevance of the content of a scale, requires about 3–10 experts.[233] A content validity index (CVI), which expresses the proportion of agreement on the assigned rating for relevancy of each item on a scale of zero and one, is calculated.[233,360] On a 4-point scale, experts' ratings of three or four is assigned '1' and one or two is assigned '0'.[233] CVI assesses the relevancy of individual items (I-CVI) or the scale (S-CVI, i.e., for the tool as a whole).[233] As reported in previous studies[361,362] we computed both the I-CVI as well as S-CVI (S-CVI/universal agreement [UA] and S-CVI/averages [Ave]).

Study design and participant selection criteria

Using a cross-sectional study design and convenience sampling technique, we considered 26 content experts, identified by colleagues or via online search and sent an introductory email to each of the 13 who met the inclusion criteria (minimum of 3 years of productive work involving the CHWs, master's degree, and at least three relevant CHW performance-related publications within the South African context).

Data collection/pilot testing

Via email, we sent the following: the quality-of-care assessment tool (Appendix 3.1a-c), the fieldwork manual guiding the use of the tool (Appendix 3.2) and the participants' information sheet (Appendix 3.7). We developed a validation questionnaire (Appendix 6.2) including questions on various items in the tool (with a series of ratings on a Likert scale). We provided space for additional comments including missing items from the tool or any other comments. Each expert reviewer worked independently and anonymously. We also offered the experts the option of a meeting (virtually) to complete the questionnaire. We collected data between 15 July 2020 and 28 August 2020.

We had the questionnaire piloted by three researchers to assess clarity, flow, comprehension, and grammar. We used their comments and suggestions to strengthen the questionnaire.

Data analysis

We computed the CVI by asking experts to rate each item relevance on a scale of five (1=*strongly disagree*; 2= *somewhat disagree*; 3= *neither agree nor disagree*; 4= *somewhat agree*; and 5= *strongly agree*). Then we categorized ratings of 4 or 5 as '1=relevant' and one–

three as ‘0 =not relevant'. To calculate the I-CVI, if there are five or fewer experts, all must agree (that is all must have assigned a score of either four or five with an overall I-CVI of 1.0). For six or more experts, calculated I-CVI must be ≥0.83 for the item to be content valid, that is, not all the experts need to agree.[233] The I-CVI is further categorized as follows: <70% (to be eliminated), 70–79% (needing revision), and >79% (appropriate).[361] Therefore, based on the ratings of this study's six experts, we calculated I-CVI for each item by dividing the number of experts whose scores were categorized as ‘1' by the number of experts who provided a score at all for each item.

To calculate S-CVI, two methods are used: (1) S-CVI/UA assesses in how many items in the tool, overall, was there universal agreement (UA) based on the experts' scores, or (2) S-CVI/Ave which assesses the average (Ave) of all individual item index (I-CVIs) derived from experts' scores.[363] To calculate S-CVI/UA, we derived the proportion of items for which the experts scored as ‘1', divided by the total number of items in the tool. In the S-CVI/Ave approach, we summed up the I-CVIs for all the items and divided that by the total number of items in the tool.[234,364] As in previous study, to establish the relevancy of the overall items of our new tool, for both methods, the index had to be ≥80% (excellent).[365]

Thematic analysis was performed for qualitative data (experts' comments), driven by questions posed to the experts. The findings were summarized across all the experts to identify what was common or different, that are thought to improve the tool.

Inter-rater reliability

For the IRR, we used the following methods: (i) Bland and Altman[366] recommend a widely-used method that takes into account sources of variations between measures to determine the degree of agreement, which should be predetermined by the researchers[367-369]; (ii) For the analysis of clustered data (i.e., clustering of patients grouped within households and by site), we performed the multilevel model analysis, which considers correlations among responses of observed units within clusters[370] to obtain statistically efficient estimates of the regression coefficients of quality-of-care messages or communication scores on observer and site.

Study design

This study used the secondary data collected during the evaluation phase (endline) of a 3-year (2016–2019) intervention study (Batlhokomedi project).[235,236] Details of the primary data

collection and study design have been reported elsewhere.[236] Briefly, a mixed method design was used, which included a cross-sectional observational study of randomly selected CHWs analysed in this study.

Data collection

Briefly, in the primary study, data were obtained from 110 households in Area A and 106 households in Area B of Gauteng Province, South Africa. Furthermore, in 21 household visits where two observers observed the same CHW and scored the visits using the quality-of-care assessment tool, we obtained complete data from 18 (9 per area) households. All data were received in Excel spreadsheet.

Data analysis

To determine the degree of agreement, the difference in the mean data were plotted against the mean and an equality line on which all the points would lie if the measures were the same reading each time was drawn (Bland-Altman plot). The degree of agreement, or the lack was then determined by calculating the bias (limit of agreement) from the mean difference (*d*) and the standard deviation (SD) of the differences (s), assuming that the difference is normally distributed. That is:

$$\textbf{Limits of agreement (LOA)} = \textbf{mean difference} \pm \textbf{1.96 x (SD of differences)}$$

For the Bland Altman analysis, we included all paired observer data (21 household records [area a, n=11; area b, n=10]). We derived the quality-of-care messages or communication scores as earlier described. After excluding households with missing quality-of-care messages or communication scores, we included nine pairs of household observations per site in the analyses. The dependent variables were quality-of-care messages or communication score. In this analysis, we considered observer and site as fixed effects (that is, the levels of these factors are selected by a non-random process or consist of the entire population of possible levels; for example, "area" [1=a, 2=b] is fixed since there are only two possible values, both of which are included in our model). We also performed a fixed effect multilevel modelling including 'area' and 'observer' to calculate the proportion of the total variance that is between observers (or due to observers) as:

$$\rho = \sigma u2/\sigma u2 + \sigma e2$$

where ρ refers to the reliability or the intra-class correlation that measures the closeness of scores assigned by the same observer relative to the closeness of scores by a different observer.

Ethics approval and consent to participate

This study was approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (approval number M190933). For the face validity, we also obtained ethical approval from Ehlanzeni (MP-2020001-002) and Tshwane Districts (GP-202001-012). We obtained written informed consents from all face validity participants. For the experts, completion of the validation questionnaire was synonymous with consent.

6.1.4. Results

Face validity

In this study, we included data of participants from facilities A and B in Mpumalanga Province and C and D in Gauteng Province. From facilities A, B, C and D; 5, 6, 5, and 5 CHWs; and 1, 2, 0, and 3 OTLs, respectively, provided ratings on our tool (Table 6.3).

Table 6. 3: Percentage agreement of ratings by CHWs, OTLs, province and overall.

Variable	Extent of agreement on content (tool covers everything done during household visits)		Extent of agreement on acceptability (happy to be assessed using the tool)	
	Mean score	**Agreement index (%)**	**Mean score**	**Agreement index**
CHWs				
Facility				
A (*n*=5)	5.00	100.00	5.00	100.00
B (*n*=6)	4.80	96.00	4.80	96.00
C (*n*=5)	4.40	88.00	3.20	64.00
D (*n*=5)	5.00	100.00	4.40	88.00
Province				
MP (*n*=11)	4.90	98.00	4.90	100.00
Gau (*n*=10)	4.70	94.00	3.80	76.00
Total (*n*=21)	4.80	96.00	4.35	87.00
OTLs				
Facility				
A (*n*=1)	5.00	100.00	5.00	100.00
B (*n*=2)	4.50	90.00	4.00	80.00
C (*n*=0)	0.00	0.00	0.00	0.00
D (*n*=3)	4.67	93.30	4.67	93.30
Province				
MP (*n*=3)	4.75	95.00	4.50	90.00
Gau (*n*=3)	4.67	93.30	4.67	93.30
Total (*n*=6)	4.71	94.20	4.59	91.70

CHWs, Community health workers; OTLs, Outreach team leaders; MP, Mpumalanga (Facility A and B); Gau, Gauteng (Facility C and D).

The mean years of experience were 15.0, 8.1, 9.0, and 9.7 years for CHWs and 2.4, 2.5, no data, and 4.5 years for OTLs, respectively. Among CHWs, only those in facility B had passed the

Ward-based Outreach Team Phases one and two examinations. Only one CHW in facility A passed the Phase one examination.

All the CHWs and their leaders agreed that the assessment tool covered everything that happens during their household visits (with overall mean scores and agreement index of 4.8 vs. 4.7 corresponding to 96.0 vs. 94.2% agreement index, respectively) (Table 6.3). Although they also agreed that they were happy to be assessed using the tool overall (4.35 vs. 4.59 corresponding to 87.0 vs. 91.7%, respectively), the mean score and index for CHWs in facility C was 3.2 and 64.0%, respectively. In facility C, of the five respondents, only one gave a rating of four, regarding whether they were happy to be assessed using the tool. Qualitatively, one OTL indicated that the fieldworker rating (global rating) for the CHWs should be objective.

Content validation

Of the 13 eligible experts invited to this study, six (response rate, 46%) agreed to participate and provided both qualitative and quantitative judgements on the tool items.

The I-CVI of the 11 items ranged between 0.83 and 1.00. For three items ("assessment of quality of communication," "assessment of messages and activities," and "global rating") fewer than six experts assigned a score of four or five. However, the I-CVI proportion was above 0.8 for each of these three items. Therefore, having all the 11 items in the tool is appropriate.

For the S-CVI/UA, the six experts assigned a score of 4 (quite relevant) or 5 (very relevant) for 8 of 11 items. Therefore, the S-CVI/UA was 0.72. With S-CVI/Ave, the average of the proportions (or I-CVIs) where all the experts had rated the items as relevant was 0.95.

For *item 7*, checklist aggregate score (that is, the quality-of-care messages score)' *and eight* 'global ratings,' only one of six experts rated that a CHW with high scores would not be a genuinely high-performing CHW (or vice versa). However, on *item 7*, three experts commented as follows:

"There is a limit to the extent to which a score can capture the relational nature of communication during a visit"–Expert 1"Collaboration and cooperation need attention"–Expert 2"Data must be triangulated from observation, the CHWs documentation, performance reviews, and/or household member experience"–Expert 3

On *item 8*, three experts commented that the global ratings (*item 8*), are subjective. Even the remaining three suggested the need for triangulation with other aspects of data (CHW documentation or household member experience) for appropriate interpretations. Three of four experts who provided comments on communication (*item 2*) suggested that other aspects of communication including listening skill (i.e., body language, respect and empathy, rapport, and rapport-related skills such as praise and affirmation), be added to this tool. On notetaking, two of three experts considered the relevance of electronic forms of notetaking, while another suggested the need to also consider post-visit notes.

Inter-rater reliability

Table 6.4 shows the mean SD of quality-of-care messages and communication scores per paired observers, by site, and households. The mean messages scores differed between observers by household and site.

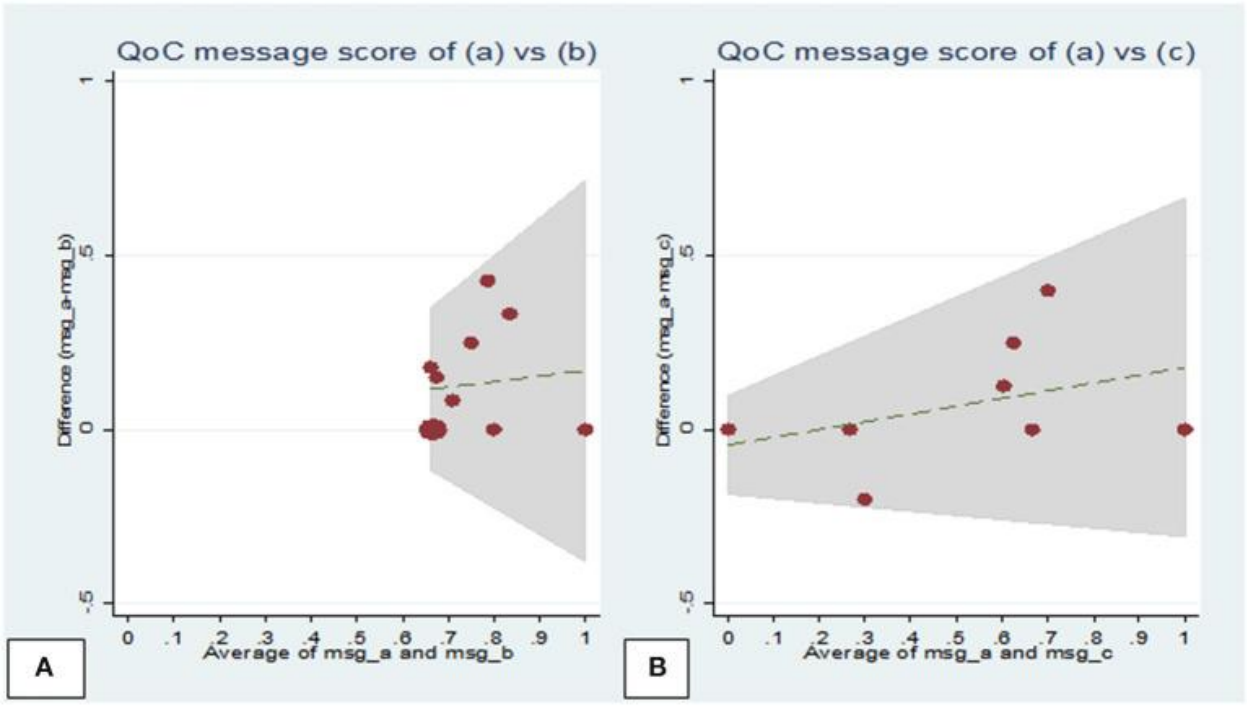
Table 6. 4: Quality-of-care mean messages and communication scores difference by paired observers by site.

	Mean score difference between observers			
	Site a		**Site b**	
	Observer (a) vs. (b)	**Observer (a) vs. (c)**	**Observer (a) vs. (b)**	**Observer (a) vs. (c)**
N households per observer	**5**	**4**	**8**	**1**
Quality-of-care assessment tool messages score (household level)[a]	0.17 (range, 0.72–0.89)[b]	0.05 (range, 0.53–0.58)[b]	0.11 (range, 0.66–0.77)[b]	0.26 (range, 0.52–0.78)[b]
Quality-of-care assessment tool communication score (household level)[a]	0.00 (range, 1.00–1.00)	0.07 (range, 0.93–1.00)	0.11 (range, 0.89–1.00)	0.50 (range, 0.50–1.00)

[a] *Observer a consistently had the highest scores across all the paired categories*
[b]*Range shows the scores per paired observers*.

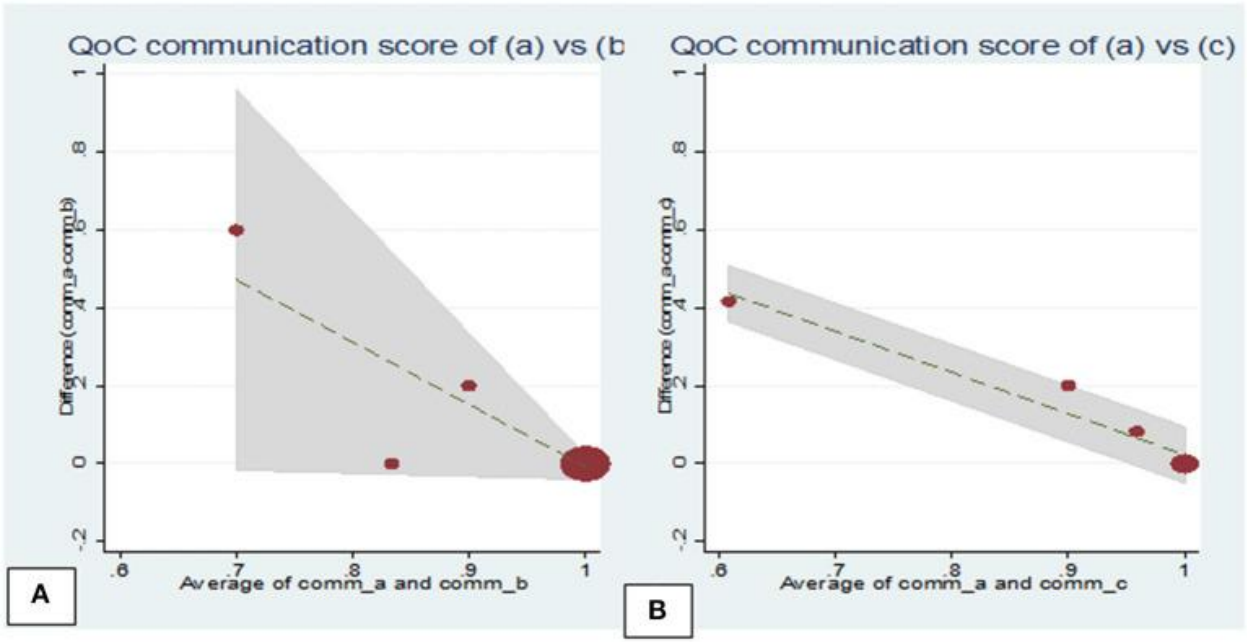
The Bland-Altman plot for the quality-of-care messages scores revealed that the LOA ranged from −0.18 to 0.44 [between observers (a) and (b) (Figure 6.1A)] and from −0.30 to 0.44 [observers (a) and (c) (Figure 6.1B)]; while for the quality-of-care communication scores, these ranged from −0.22 to 0.45 [observers 1 and 2 (Figure 6.2A)] and from −0.28 to 0.40 [observers 1 and 3 (Figure 6.2B)]

Figure 6.1.



Bland-Altman plots of the mean difference against the mean quality-of-care messages scores assigned by observers during household visits. **(A)** Plot showing observers (a) and (b) scores. Mean difference = 0.14, standard deviation (SD) = 0.20 (limits of agreement = mean−2 × SD to mean+2 × SD) = −0.18 to 0.44; **(B)** Plot showing observers (a) and (c) scores. Mean difference =0.07, SD = 0.18 (limits of agreement = mean−2 × SD to mean+2 × SD) = −0.30 to 0.44. QoC, quality-of-care; msg, message.

Figure 6.2.



Bland-Altman plots of the mean difference against the mean communication scores assigned by observers during household visits**. (A)** Plot showing observers (a) and (b) scores, mean diff = 0.07, standard deviation (SD) = 0.19 (limits of agreement = mean−2 × SD to mean+2 × SD) = −0.31 to 0.44; **(B)** Plot showing observers (a) and (c) scores, mean diff = 0.14, SD = 0.20 (limits of agreement = mean−2 × SD to mean+2 × SD) = −0.25 to 0.54.

The multilevel modelling revealed an estimated reliability of 0.77 for observations between different observers in the same household compared to observations on different households for the quality-of-care messages scores, and 0.14 for the quality-of-care communication scores (Table 6.5).

Table 6. 5: Estimated inter-rater reliability in multilevel modelling analysis.

	Reliability between raters in the assigned quality-of-care messages scores	**Reliability between raters in the assigned quality-of-care communication scores**
Sigma u (σu)	0.21	0.05
Sigma e (σe)	0.12	0.12
Rho (ρ) $= \sigma u^2/\sigma u^2 + \sigma e^2$ =inter-rater reliability	$= 0.21^2/(0.21^2 + 0.12^2)$ =0.77	$=0.05^2/(0.05^2 + 0.12^2)$ =0.14

6.1.5. Discussion

The results of this study suggest that the quality-of-care assessment tool has a high face and content validity, and the IRR was substantial for quality-of-care messages but poor for communication scores. The low IRR of 14% for quality-of-care communication scores suggest that observer differences were important. Discrepancies in scores have been related to personal bias in the scoring process and skill deficiencies especially among newly trained observers.[371,372] The communication items also, may be more subjective than the messages scores that are in line with the South African CHW training manual.[353] This is because communication could be affected by stress, emotion and workload and may require additional training of the observers on speech recognition.[373] These results suggest that the quality-of-care messages score may be useful summative assessment, but this would provide a partial assessment. The communication scores, and perhaps the whole tool, may be best used to assess CHW activities only formatively.

That is, the assessment may only provide the basis for reflecting and discussing about CHW performance in order that these might lead to change.

From a theoretical perspective, formative assessment provides an interphase between social interaction (teacher-learner) and cognition (learning) through which learners' thinking and learning processes are supported.[374] Through our quality-of-care score, CHW independent work during household visits can be assessed on an ongoing basis, with timely reflective information and feedbacks on learning gaps to help improve independent CHW care and comprehensive care outcomes.[375] The CHWs learning process as well as mentorship/supervision approaches can be enhanced through feedbacks, self-reflection, and dialogue.[376] Abundance evidence exists on the relevance of formative assessment in the learning process of healthcare trainees including undergraduate, postgraduate, and nursing education globally, for required skills.[334,335,337,338]

In low-and-middle-income countries, formative assessment approaches have been examined in healthcare workers. In Malawi, the effect of a formative assessment framework among nursing studies in the teaching and learning of essential nursing skills resulted in improved competencies in the skills laboratory.[336] Intensive care skills training of intensive care unit nurses including a formative assessment component, was effective in improving participants' knowledge on assessment and management of patients.[377] To become a CHW, the required educational qualification is minimal.[66] However, despite this limited educational background, CHWs are required to work within complex inter-relating environments of community and health sector within which are multiple layers of actors whose actions have effect on CHW performance.[378] Therefore, as Agarwal et al. suggested, a formative assessment approach, measured routinely, built into supervisory activities, using a checklist, may provide opportunity for immediate and comprehensive feedback.[192] Such practices when carried out in an environment that nurtures the development of CHW learning, by providing allowance for making mistakes and rectifying them without compromising patients care, would be appropriate for CHWs. Our tool can be applied in CHWs work environment, before and after regimented training, and on an ongoing basis, with non-judgmental feedbacks on activities requiring strengthening, by healthcare system actors including OTLs, managers, and supervisors to enhance CHW skills.

Recently, focus is shifting to peer formative assessment as another approach to enhance student engagement with learning[379] improve teamwork skills[380] and provides multiple opportunities for

assessment of competence by peers.[381] In an intervention study of lady health workers in Pakistan, CHWs who received additional 4-day clinical and supervisory training provided supportive supervision to their peers during household visits.[382] A component of the intervention required the peer supervisors to provide written feedback to their peers. The group who received this feedback showed better improvement. This underscores the relevance of a formative assessment tool not only for supervisors and team leaders, but also peers.

Strength and limitation

We developed a tool that might be applicable for formative assessment in programmes where the CHWs provide comprehensive care, to strengthen individual CHW learning through reflective feedback. However, the study has a few limitations. (1) A low face validity was reported in one of four facilities included in the face validity study. This was the only facility where the researcher, instead of the OTL, was left to approach and secure individual CHW buy-in. Challenges with inexperienced OTL, considered in this instance, include poor communication and problems with managing team members. On the other hand, the self-selected CHWs may be a more representative sample than a possible 'preselected-to-provide-positive-feedback' group. However, despite this facility's low validity, the comments section of CHWs ratings by those who would not be happy to be assessed using this tool offered no information on why they would not be happy. (2) Assessments and comments by experts may have emphasized their specialty more, as implied by lower ratings on some items. Thus, few experts whose most dominant expertise was on curriculum development and communication required further clarifications before being able to provide a rating on items in their less-dominant areas, with the tendency for more cautious ratings on such items. (3) Our IRR assessment data had a small sample size due to logistic issue. A larger multi-country study could provide findings to enhance generalizability across wider national CHW programmes.

6.1.6. Conclusion

We provide a simple tool to facilitate the provision of feedback to strengthen individual CHW activities with a view to progressive improvement in the levels of competence. In our future study, we hope to explore the integration of our tool with continuing education and supportive supervision for CHW work. The use of our tool can be encouraged by policy makers and actors

within the healthcare system to improve CHW practice, especially for comprehensive care, and within national CHW programmes.

CHAPTER 7: PhD PAPER 4

This chapter, which has been published in *Frontiers in Public Health*, has the following citation:

Babalola O, Levin J, Goudge J, Griffiths F. Community health workers' quality of comprehensive care: a cross-sectional observational study across three districts in South Africa. Frontiers in Public Health. 2023 Dec 14;11:1180663.
https://doi.org/10.3389/fpubh.2023.1180663

7.1. **Title:** Community health workers' quality of comprehensive care: a cross-sectional observational study across three districts in South Africa

7.1.1. Abstract

Background: Community healthcare worker (CHWs) training programmes are becoming increasingly comprehensive (an expanded range of diseases). However, the CHWs that the programme relies on have limited training. Since the CHWs activities occur largely during household visits, which often go unsupervised and unassessed, long-term, on-going assessment is needed to identify gaps in CHW competency for further strengthening. We observed CHWs during household visits and gave scores according to what proportion of health messages/activities provided for the health conditions encountered in the households. We aimed to determine 1) messages/activities scores derived from the proportion of health messages given in the households by CHWs who provide comprehensive care in South Africa, and 2) the associated factors.

Methods: In three districts (from two provinces), we trained five fieldworkers to score the messages provided by, and activities of, 34 CHWs that we randomly selected, during 376 household visits in 2018 and 2020 using a cross-sectional study design. Multilevel models were fitted to identify factors associated with the messages/activities score, adjusted for the clustering of observations within CHWs. The models were adjusted for fieldworkers and study facilities (n=5, respectively) as fixed effects. CHW-related (age, education level, and phase of CHW training attended/passed) and household-related factors (household size [number of persons per household], number of conditions per household, and number of persons with a condition (hypertension, diabetes, HIV, tuberculosis [TB], and cough) were investigated.

Results: In the final model, messages/activities score increased with each extra 5-minute increase in visit duration. Messages/activities scores were lower for households with either children/babies, hypertension, diabetes, increasing household size, increasing number of household conditions and members with either TB or cough. The messages/activities scores were not associated with any CHW characteristics, including education and training.

Conclusions: This study identified important factors related to the messages provided by, and activities of CHWs, across CHW teams. Increasing efforts are needed to ensure that CHWs who

provide comprehensive care are supported given the wider range of conditions they provide messages/activities for, especially in households with hypertension, diabetes, TB/cough, and those with children and babies.

Keywords: community health workers, comprehensive care, messages/activities score, household visits, competence, associated factors

7.1.2. Introduction

Community healthcare workers (CHWs), with limited training, are the focus in many low and middle-income countries (LMICs) of attempts to accomplish the goal of UHC of providing accessible, acceptable, and affordable health care services to vulnerable groups.[25,383,384] CHWs programmes have historically focused on single diseases and conditions (mostly around maternal and child health, MCH).[25,259] However, increasingly, they are now focusing on more expanded range of diseases and people (including subpopulations with communicable and non-communicable diseases), towards more comprehensive care.[17,18,25,90,98,259,385,386] CHW programmes in LMICs focusing on comprehensive care include the Ethiopia's HEW programme (HEP), India's ASHAs, Pakistan's Lady Health Worker Programme (PLHW), Malawi's HSA, government-employed CHEWs in Kenya, CHWs in Rwanda, and the CHAs in Zambia.[9-15] Although there is no specific definition for what constitutes 'comprehensive care', programmes where a single CHW provides a "full range of services" including preventive, promotive and/or some curative care at the most peripheral level of the primary healthcare (PHC) system, may be considered 'comprehensive,' as discussed in a recent review.[18] For example, Ethiopia's 16 HEP healthcare packages cover family health, disease prevention/control and hygiene, and environmental sanitation.[387] The ASHAs comprehensive care package include diagnosis of health conditions (e.g., malaria, tuberculosis, diarrhoea); provision of drugs and referrals; reproductive, maternal and newborn care; and nutritional counselling and health education.[388] PLHW programme provides care to rural and urban slum communities on MCH (maternal antenatal care, birth record keeping, child development, family planning); promotive and preventive educational services (checking blood pressure, body temperature); treatment of minor diseases (childhood diarrhoea, respiratory infections); and health education/promotion/referrals.[389,390] However, since these comprehensive CHWs programmes rely on a healthcare worker cadre with limited training, there has to be long-term or on-going assessment, to identify gaps in CHW competency, within their routine work environment.[383]

South Africa has had a unifying national CHW programme framework since 2011 that is prioritized in the South African National Department of Health (NDoH) re-engineering of PHC.[391] Alongside other healthcare providers, CHWs constitute the national Ward-based Primary Healthcare Outreach Team (WBPHCOT), in a largely comprehensive programme, with

CHWs serving a 'generalist' role.[392] The activities of WBPHCOT include "health promotion, primary prevention of disease, healthy behaviour counselling, treatment adherence counselling, and secondary disease prevention through basic screening".[29] The team are required to provide "appropriate referral and basic therapeutic, rehabilitative and palliative care services". The CHWs undergo two 10-day phase 1 curriculum-based training courses followed by a practicum, and a 5-day phase 2 skills-based training course, with a practical skill component.[29,261] However, implementation of the WBPHCOT programme is uneven across districts and provinces, with variability in CHW service delivery.[222,393] Differences across provinces and districts in CHW activities occur regarding whether or not the CHWs 'checked in' at healthcare facilities before and after household visits, hours of work, required number of households to visit daily, whether or not routine weekly supportive training occurs, and whether oversight supervision functions occur.[222] These differences underscore the need to assess CHW competency, across districts, in South Africa.

There are increasing literature on essential and standardized metrics and validated indicators for assessing CHW competency; however, evidence suggests difficulty with assessing them within comprehensive care.[38,167,168] Assessing CHW performance based on all subcomponents of a comprehensive care package is challenging.[168,174] This is because both structural (linkage with health system/community, assessment of available supplies and resources) and process measures (communication competency, compliance with standards of care and procedures, and activities related to care) would be needed, as proposed by Donabedian [52,284,394].

CHW competency is assessed using several methods and tools. These include direct observation checklists either by supervisors, trained experts, or field investigators; use of self-administered questionnaire; and administrative data.[179,193,395,396] Their applications have mostly focused on subcomponents of comprehensive care packages. For example, Madagascar's community health volunteers (CHVs)' comprehensive care package included child and maternal health, case management of children <5 years, and reproductive health counselling and family planning (RH/FP).[193] However, using expert observers and gold standard evaluators, the CHVs were assessed on either case management of children <5 years or RH/FP. In South Africa, assessment of CHWs knowledge and confidence using a self-administered questionnaire showed adequate confidence of CHWs in several activities (giving prescribed medications and managing clients

with diabetes) and low knowledge and confidence levels in managing clients with hypertension.[396] However, the findings were limited because of lack of validated tool. Another South African study that used a validated checklist based on audio recordings revealed on average good communication practices (active listening and active delivery) during home visits.[186] However, only communication scores were reported, leaving out other skills of CHWs.

*S*tudies assessing factors influencing the performance of comprehensive care provided by CHWs within the household settings are also few. Kawakatsu et al. reported that performance was associated with CHWs' individual-level (marital status and educational level), supervisor-level (number of supervisions received), and community-level factors (household size).[195] Sociodemographic factors (including age, gender and education) also influence CHW performance.[18,196] Recently, in Kenya, Njororai et al. investigated the demographic and environmental factors affecting CHW performance.[197] Using self-reported, questionnaire-based survey among 309 mixed cadre CHWs (volunteers, CHEWs who supervise CHWs, and retired CHWs), having a secondary education and poor communication skills influenced performance. In these previous studies, Kawakatsu et al. assessed performance using previous 6-month submitted CHW reports to their supervisors, whereas Njororai et al.'s performance (categorized as poor/better) assessment was based on contextual information including whether the CHWs were available, participated, or were responsive to their work.[195,197]

Therefore, there is need for an assessment of factors influencing CHW performance related to their work during household visits, using a validated tool. We developed an observational checklist, the quality-of-care assessment tool for CHW summative assessment in South Africa, within a previous study.[39,235] As previously reported, we developed the tool to account for the work of South African CHWs, on a daily basis (before they leave the healthcare facility, on entry into a household and during the household visit) **(Table 6.1)**.[38] A fieldworker utilizes our tool to record observed activities/messages and communication items, to compute an aggregate score for each. Our evaluation of this tool suggests good utility, high validity (face and content) for both quality of messages and communication, and good interrater reliability for messages, but not for communication scores.[38] In this study, using this validated tool, we sought to answer the question: What factors are associated with the messages/activities scores of CHWs who provide comprehensive care in South African districts? Our study aimed to determine the performance

(messages/activities) score of CHWs who provide comprehensive care and determine what factors explain the score. In this paper we focus on CHW household visits. This is important because activities of CHWs during household visits often go unsupervised and unassessed.

7.1.3. Methods

Study setting

The study was undertaken in two districts of Gauteng Province and one district of Mpumalanga Province, South Africa. Sedibeng District has approximately 1,039,908 people in 330,326 households, 12.3% live in informal households in plastic and corrugated iron-made shacks while others live in brick houses, mainly provided by the government.[240] About half (50.7%) of the population are unemployed, live in poverty (48.5%) and depend on the government for social grants.[240] Our two study facilities are located approximately 30 km from the district centre. Tshwane District has approximately 3,555,741 people in 1,136,876 households, 22.6% are unemployed, 29.6% live in poverty, and 16.4% live in informal households.[241] Our study facility is located approximately 32 km from the district centre. Ehlanzeni District, in Mpumalanga Province, has approximately 1,856,753 people in 514,000 households, nearly half (47.8%) do not have any schooling at all and 5.6% live in informal households.[242] About 43.4% of the population are unemployed while 67.8% live in poverty.[242] Our two study facilities are located approximately 138 and 126 km, respectively from the district centre.

Study design

The study formed part of a programme of research reported elsewhere.[39,218] We undertook two cross sectional surveys and combined the data for this study:

1. We collected data in 2017 in two facilities (A and B) in Sedibeng District.
2. We collected data in 2020 in two facilities (C and D) in Ehlanzeni District, Mpumalanga Province and one facility (E) in Tshwane District, Gauteng Province.

The COVID-2019 pandemic limited the CHW observation to one facility in Tshwane District. We complied with the necessary COVID-19 prevention protocol during the study.

The CHW teams and their OTLs

The OTLs for the CHW teams included two enrolled nurses (ENs, with 2-year completed nursing course) (one per facility in Sedibeng District), four professional nurses (PNs, trained in PHC and

community nursing) (two per facility in Ehlanzeni District), and two PNs + one EN (Tshwane District). Their average nursing years of experience ranged from 2.4 to 4.5 years. Most of the OTLs were from the local communities and had undergone the WHBPCOT training. However, the PN OTLs are also tasked with providing PHC services in the clinic, limiting opportunities for supportive supervision. In one of the districts, an OTL who was an EN was not local. This OTL lacked confidence in providing supervisory support.[218] Further, facility E, including the WHBPCOTs, was designated a National Health Insurance pilot site in 2012 and underwent health system strengthening interventions focused at the PHC level.[397]

Sampling methods

This study included all CHWs in the WHBPCOT programme who worked in the three districts. Inclusion criteria were all the CHWs in each facility who were available for two full weeks of household visits to provide comprehensive care and were willing to participate. In any of the facilities, if any CHW was not available for part, or all of the two weeks of household visits or if the CHW was providing home-based care only (i.e., providing bed bath, wound dressing and cleaning support largely to sick and non-sick elderly), such were not considered eligible for the study. Random sampling was used to select each CHW for observation. We negotiated with the OTLs to ensure that the randomly selected CHWs focused on home visits. Three CHWs were randomly selected for each 2-weekly observation per cycle of observations for a total of four cycles (facilities A and B) and two cycles (facilities C, D and E). Households were not selected, rather, the normal schedules of CHW pairs under the guidance of their OTLs was used to determine the household where observation took place.

Quality-of-care tool

During household visits, to guide fieldworkers with non-clinical experience who were trained on the use of our quality-of-care tool in completing the tool, we developed a fieldwork manual.[235] The fieldworkers assign scores of '0' or '1' for messages/activities performed while observing CHWs during household visits using the tool. During household visits, the CHWs may perform messages/activities for adults, the elderly (sick and non-sick), pregnant women, and children and babies with a need. The CHWs may also attend to children and babies in their absence, by obtaining information regarding their immunization, nutrition, and HIV exposure status from caregivers/parents. **Appendix 3.1d** shows how the tool is used to derive performance

(messages/activities) scores for a hypothetical 'Household 1' with hypertension, diabetes and HIV.

Data collection

We have previously reported the data collection for our study facilities in Sedibeng District.[39,218] Briefly, in facilities A and B, in 2017, three trained fieldworkers utilized the paper-based form of our assessment tool to score the messages/activities and communication items of 12 and 10 randomly selected CHWs during 147 and 124 household visits, respectively. For facilities C, D, and E, in 2020, two trained fieldworkers utilized our tool to score the messages/activities of 2, 4, and 6 randomly selected CHWs during 40, 51, and 14 household visits, respectively.

For each randomly selected CHW (and partner), a brief interview was first used to obtain written consent, demographic details, content of CHW bags, and plans for the day. Within the households, the rest of data collection was by observation. The data collected while observing an overall 34 CHWs who provided services to 526 clients were captured separately by two fieldworkers in REDCap (https://redcap.core.wits.ac.za/) to minimize errors. Author OB then verified agreements between the two captured data. All the discrepancies were resolved by rechecking the data on the completed hard copy of the tool. The finalized data were then exported into Stata 17 (Stata Statistical Software: Release 17. College Station, TX: StataCorp LP) and merged for data cleaning and analysis. We had no details on three CHWs who were ineligible during random selection (because they had been on leave at selection time), but after their resumption, they had paired with an eligible CHW (we had no control over the pairing) and led in providing services in 36 household visits. Therefore, these data were excluded from the final analysis.

Outcome:

Our dependent variable, quality-of-care messages/activities score (hereafter messages/activities score), was derived as an aggregate score and defined as follows:

Messages/activities score: this is the number of observed messages given and actions undertaken divided by the number of expected messages. The messages/activities score was calculated for each condition (e.g., hypertension, diabetes, or HIV) and aggregated by household (see Appendix 3.1d).

Explanatory variables:

- CHW-related characteristics: age, education level, and phases of CHW training attended and/or passed
- CHW activities: duration of visit (in minutes), normal frequency of visits, when CHW last visited the household, planned activities for this visit
- Household-related factors**:** household size (number of people per household), and number of people with either hypertension, diabetes, HIV, TB or cough, and presence of infant/young child, and presence of pregnant person in the household
- Other contextual visit factors: whether there were 'disruptions' during the visit that could potentially affect CHW competency during the visit that was beyond the control of the CHW e.g., baby crying, television noise, presence of visitors

Statistical analysis

Descriptive statistics are expressed as mean ± standard deviation (SD) for continuous variables and frequency and percentages for categorical variables. We performed one-way analysis of variance to compare messages/activities scores by district, CHW-related characteristics, CHW activities, household related factors and other contextual factors. Multilevel models were fitted to identify factors associated with messages/activities score, adjusting for the clustering of observations within CHWs. In the models, both fieldworker and facility were included as fixed effect, due to the small number of each (there were only five fieldworkers and five facilities). CHW-related variables, and contextual and household-related factors were investigated. In building the model, we used a backward elimination approach whereby after we included all the variables in one model, we then removed each variable from the model one by one, starting with the least significant, then each model was refitted until all the variables that were significant at $p<0.1$ level were retained.[398] To select the best model for predicting messages/activities score, we evaluated the prediction errors using the principle of Akaike information criterion (AIC) minimization. In each model fitted, AIC imposes a penalty of 2p (where p is the number of predictors in the model) against the model deviance (- 2* log-likelihood), for each additional variable. We selected the model that minimized AIC as the best prediction model. In each model, we retained 'facility' as a variable, regardless of the level of significance. We reported the mean messages/activities scores and their 95% confidence intervals (95% CI). $P<0.05$ was considered to be significant.

Ethical consideration

The Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (approval number M190933), the respective ethics committee of participating Ehlanzeni (MP-2020001-002) and Tshwane Districts Research Committees (GP-202001-012) approved this study protocol. The participants provided their written informed consent to participate in this study and each CHW sought and obtained verbal consent from each head of household before the fieldworker is allowed to enter to perform observations.

7.1.4. Results

Characteristics of households and household members included in this study

The characteristics of 376 households and 526 household members who engaged with the CHWs are shown in Table 7.1. The mean number (standard deviation [SD]) of household members per visit was 1.8 (SD, 0.98), the CHWs mostly engaged with females (n=369, 72.4%), individuals aged over 60/retired elderly (n=253, 48.1%), and those living in brick houses (n=284, 75.5%).

Table 7. 1: Description of household members who engaged with the CHW (or, for children, engagement can be by their carer only)

Characteristics	Total		Facility A		Facility B		Facility C		Facility D		Facility E	
Number of household members who engaged with CHWs (n, %)	526	100.0	184	35.0	195	37.1	63	12.0	66	12.6	18	3.4
Number of households (n, %)	376	100.0	147	39.1	124	32.8	40	10.6	51	13.6	14	3.7
Mean (standard deviation) and range of household size per CHW visit	1.77 (0.98)	1-5	1.49 (0.74)	1-4	2.02 (1.05)	1-5	2.17 (1.31)	1-5	1.55 (0.79)	1-4	1.44 (0.51)	1-2
Gender (n, %)												
Male	145	27.6	51	27.7	63	32.3	13	20.6	14	21.2	4	22.2
Female	381	72.4	133	72.3	132	67.7	50	79.4	52	78.8	14	77.8
Age category (n, %)												
Baby under 6 months	21	4.0	4	2.2	9	4.6	7	11.1	0	0.0	1	5.6
Pre-school child	44	8.4	9	4.9	20	10.3	12	19.1	3	4.5	0	0.0
School age child/adolescent	11	2.1	2	1.1	7	3.6	0	0.0	2	3.0	0	0.0
Adult <60	197	37.4	47	25.5	90	46.2	28	44.4	30	45.5	2	11.1
Over 60 / retired/ elderly	253	48.1	122	66.3	69	35.4	16	25.4	31	47.0	15	83.3
Type of housing (n=376)												
Informal (shacks)	92	24.5	20	13.6	72	58.1	0	0.0	0	0.0	0	0.0
Formal (brick)	284	75.5	127	86.4	52	41.9	40	100.0	51	100.0	14	100.0

CHW, community health worker

The description of the conditions of household members who engaged with the CHW (or, for children, engagement can be by their caregivers/parents only) are shown in Table 7.2. In all the facilities, the CHWs mostly encountered hypertension (n=218, 41.4%). Across districts, most CHWs encountered only one condition per household (n=263, 50.0%).

Table 7. 2: Description and burden of conditions of household members who engaged with the CHW (or, for children, engagement can be by their carer only)

Characteristics	Total		Facility A		Facility B		Facility C		Facility D		Facility E	
Number of household members who engaged with CHWs (n, %)	526	100.0	184	35.0	195	37.1	63	12.0	66	12.6	18	3.4
Number of households (n, %)	376	100.0	147	39.1	124	32.8	40	10.6	51	13.6	14	3.7
Condition (n, %)[a]												
Hypertension	218	41.4	124	67.4	48	24.6	16	25.4	19	28.8	11	61.1
Diabetes	73	13.9	31	16.9	21	10.8	8	12.7	8	12.1	5	27.8
HIV	72	13.7	16	8.7	26	13.3	15	23.8	15	22.7	0	0.0
Tuberculosis	17	3.2	5	2.7	8	4.1	0	0.0	4	6.1	0	0.0
Other chronic	42	8.0	16	8.7	9	4.6	9	14.3	7	10.6	1	5.6
Persistent cough	29	5.5	22	12.0	7	3.6	0	0.0	0	0.0	0	0.0
Child less than 6 months	21	4.0	4	2.2	9	4.6	7	11.1	0	0.0	1	5.6
Child 6 months to 5 years	44	8.4	9	4.9	20	10.3	12	19.1	3	4.6	0	0.0
Pregnant	13	2.5	1	0.5	6	3.1	5	7.9	1	1.5	0	0.0
Home-based care	6	1.1	6	3.3	0	0.0	0	0.0	0	0.0	0	0.0
Other illness[a]	115	21.9	39	21.2	42	21.5	17	27.0	13	19.7	4	22.2
Number of conditions per household												
0[b]	90	17.1	17	9.2	51	26.2	4	6.4	15	22.7	3	16.7
1	263	50.0	82	44.6	101	51.8	37	58.7	34	51.5	9	50.0
2	132	25.1	64	34.8	34	17.4	14	22.2	15	22.7	5	27.8
3	41	7.8	21	11.4	9	4.6	8	12.7	2	3.0	1	5.6

CHW, community health worker

[a]Refers to any illness that is talked about but not listed as a specific condition or 'other chronic' in the tool, and include an illness that a patient has or has the fear or are at risk of getting, or one that the fieldworker is unclear about when the CHW/client are discussing about it.

[b]When the response to a routine health question "Are you sick?" was 'no' and no other health need was identified

Characteristics of the CHWs included in this study

The characteristics of the CHWs who were observed by trained fieldworkers during household visits are shown in Table 7.3. Overall, 34 CHWs were observed. The overall mean age (standard deviation [SD]) was 42.0 (9.9) years and ranged from 26 to 61 years. Facility C (50.5 [2.1] years) and D (50.5 [7.6] years) had the oldest CHWs while facility B (35.3 [11.6] years) had the youngest. Only about a third (n=11, 32%) of the 34 CHWs had completed secondary education ("matric" and above), and the overall mean [SD] length of CHW service was 7.65 (4.18) years (range, 1-17 years). Although most (n=25, 73.6%) had attended the prescribed phase 1 WBPHCOT training, only 4 (5.9%) had passed, and of the four, only two had passed both phases 1 and 2.

Table 7. 3: The characteristics of the CHWs

Characteristics	Overall		Facility A		Facility B		Facility C		Facility D		Facility E	
Number of CHWs observed n (%)	34		12		10		2		4		6	
Age (years)												
Mean (SD)	42.00	9.93	45.75	6.55	35.30	11.59	50.50	2.12	50.50	7.55	37.17	6.43
Range	26-61		32-55		26-59		49-52		43-61		30-48	
Education, n (%)												
Some secondary	23	67.7	7	58.3	8	80.0	0	0.0	3	75.0	5	83.3
Completed secondary education (matric and above)	11	32.3	5	41.7	2	20.0	2	100.0	1	25.0	1	16.7
Length of service as CHW (years)												
Mean (SD)	7.65	4.18	11.33	3.85	6.90	2.38	7.00	0.00	1.00	0.00	6.17	0.75
Range	1-17		7-17		3-10		7-7		1-1		5-7	
WBPHCOT training passed												
None attended	9	26.5	1	8.3	0	0.0	0	0.0	3	75.0	5	83.3
Phase 1 attended not passed	21	61.8	11	91.7	10	100.0	0	0.0	0	0.0	0	0.0
Phase 1 attended & passed	2	5.9	0	0.0	0	0.0	1	50.0	1	25.0	0	0.0
Phase 1 & 2 passed	2	5.9	0	0.0	0	0.0	1	50.0	0	0.0	1	16.7

CHW, community health worker; SD, standard deviation; WBPHCOT, Ward-based Primary Healthcare Outreach Team

Characteristics of the CHW visits (planned activities) to households

As shown in Table 7.4, duration of visit varied widely between CHWs but was similar across districts with an overall mean of 13.5 (9.8; range 1-84) minutes. In all the facilities except facility C (19.1%), the CHWs mostly (65%, 72%, 65% and 78% for facilities A, B, D, and E, respectively) indicated 'last week' as their last visit to the households. For planned activities during the current visit, the most common plan, follow-up of chronic patients/medication delivery, was similar across facilities. On the other hand, the CHWs visit the households much less to conduct household registration or check pregnant women.

Table 7. 4: CHWs activities

Characteristics	Overall		Facility A		Facility B		Facility C		Facility D		Facility E	
Number of CHW observed n (%)	34		12		10		2		4		6	
Number of household (n, %)	376	100.0	147	39.1	124	32.8	40	10.6	51	13.6	14	3.7
Visit duration (minutes)												
Mean (SD)	13.54	9.80	11.22	8.62	11.49	9.34	20.10	8.86	19.00	10.55	17.36	9.04
Range	1-84		1-84		1-75		2-50		6-56		5-41	
When CHW last visited this household, n (%)												
Never	55	10.5	15	8.2	24	12.3	1	1.6	14	21.2	1	5.6
Last week	328	62.4	119	64.7	140	71.8	12	19.1	43	65.2	14	77.8
Last month	116	22.1	37	20.1	29	14.9	39	61.9	9	13.6	2	11.1
Within last 3 months to 1 year	27	5.1	13	7.1	2	1.0	11	17.5	0	0.0	1	5.6
Planned activities for this visit, n (%)												
Household registration	38	10.1	20	13.6	14	11.3	2	5.0	0	0.0	2	14.3
Follow-up of chronic patients/medication delivery	255	67.8	117	79.6	75	60.5	22	55.0	29	56.9	12	85.7
Check children/babies	34	9.0	10	6.8	12	9.7	12	30.0	0	0.0	0	0.0
Check pregnant women	10	2.7	2	1.4	1	0.8	7	17.5	0	0.0	0	0.0
Others[a]	71	18.9	12	8.2	23	18.6	8	20.0	27	52.9	1	7.1

CHW, community health worker; SD, standard deviation; WBPHCOT, Ward-based Primary Healthcare Outreach Team

[a]Other activities include defaulter tracing, non-sick elderly, referral follow-up, visiting the bedridden, providing health education, adherence support, and TB dotting

Messages/activities scores of CHW visits by selected household and CHW characteristics

In Table 7.5, the overall mean messages/activities scores differed across facilities but was highest in facility E at 51.6% (SD, 28.0%) and least in facility C at 36.4% (SD, 24.2%). The SDs of the scores across all the facilities were wide (from 23.4% in facility A to 30.2% in facility B). CHWs who had completed secondary education ('matric' and above) had higher overall mean messages/activities score of 51.8% (SD, 27.5%) compared to those with some secondary education (44.2% [SD, 26.5%]). CHWs messages/activities score was highest when CHWs had attended and passed phases 1 and 2 of the WBPHCOT trainings (n=2, 100%) compared to when they had attended phase 1 and passed (48.3%, SD [25.9%]) or attended phase 1 and failed (40.6%, SD [21.3%]). The mean messages/activities scores were <50.0% for all the planned activities (including household registration, follow-up of chronic patients/medication delivery, as well as checking children, babies, and pregnant women). The scores were also <50% when this was the first visit (last visit=never), or when last visit occurred either one week ago (last week) or longer than one week. The scores were also <50% for all conditions except when visiting a pregnant person (53.3% [28.7%]).

Table 7. 5: Messages/activities scores of CHW visits by selected household and CHW characteristics

Characteristics	Overall		Facility A		Facility B		Facility C		Facility D		Facility E	
	Mean score (%)	SD	Mean score (%)	SD	Mean score (%)	SD	Mean score (%)	SD	Mean score (%)	SD	Mean score (%)	SD
Overall score	43.94	27.00	42.13	23.42	51.18	30.16	36.39	24.16	34.86	26.56	51.64	27.95
CHW education												
Some secondary	44.2	26.50	50.02	29.27	37.92	18.03	-	-	17.78	16.78	66.25	26.89
Completed secondary education (matric and above)	51.85	29.21	45.83	8.33	20.00	0.00	65.00	49.50	33.33	0.00	100.00	0.00
WBPHCOT training passed												
None attended	43.54	31.55	30.00	0.00	-	-	-	-	17.78	16.78	66.25	26.89
Phase 1 attended not passed	40.59	21.30	49.72	21.59	30.55	16.62	-	-	-	-	-	-
Phase 1 attended & passed	48.33	25.92	-	-	-	-	66.67	0.00	30.00	0.00	-	-
Phase 1 & 2 passed	100.00	0.00	-	-	-	-	100.00	0.00	-	-	100.00	0.00
When CHW last visited this household, n (%)												
Never	37.93	33.35	19.26	18.61	72.48	27.64	25.00	0.00	43.33	39.70	-	-
Last week	46.40	25.62	44.94	22.73	51.76	27.78	36.31	26.33	36.86	25.03	53.96	26.19
Last month	37.91	27.11	50.14	21.47	33.63	37.21	32.07	24.37	18.48	16.18	25.00	0.00
Within last 3 months to 1 year	43.82	32.21	36.92	30.07	100.00	0.00	43.65	30.51	-	-	-	-
Planned activities for this visit, n (%)												
Household registration	42.46	25.62	37.71	15.69	55.71	36.90	32.11	29.93	-	-	28.57	0.00
Follow-up of chronic patients/medication delivery	44.22	25.25	45.35	23.51	48.59	27.12	32.86	21.34	34.57	23.52	53.29	28.24
Check children/babies	39.15	23.50	35.74	21.78	46.47	29.01	37.43	21.33	-	-	-	-
Check pregnant women	44.13	26.55	35.83	12.06	-	-	48.27	31.41	-	-	-	-
Others[a]	40.57	34.58	27.50	21.55	62.18	38.21	31.99	30.29	31.52	31.81	28.57	0.00
Household conditions												
Hypertension	41.77	22.98	42.41	20.44	47.69	27.41	25.59	18.89	34.37	22.47	45.10	25.23
Diabetes	29.92	15.10	27.97	10.22	35.67	15.65	22.24	12.31	20.52	8.42	45.21	30.23
HIV	44.18	28.53	44.64	22.30	49.45	34.74	39.20	26.37	39.56	25.40	-	-
Tuberculosis	23.26	26.99	34.00	38.76	20.89	23.43	-	-	14.58	17.18	-	-
Other chronic	33.39	25.53	26.78	26.02	50.93	22.90	25.74	10.45	26.28	21.32	100.00	0.00
Persistent cough	22.18	15.61	25.85	14.17	10.66	15.18	-	-	-	-	-	-
Child less than 6 months	49.11	20.36	46.43	27.04	51.09	18.67	51.02	21.60	-	-	28.57	0.00
Child 6 months to 5 years	33.86	18.21	38.15	15.71	37.92	16.83	28.61	20.58	15.00	13.23	-	-
Pregnant	53.30	28.74	50.00	0.00	62.50	34.46	48.57	25.20	25.00	0.00	-	-
Home-based care	41.85	9.73	41.85	9.73	-	-	-	-	-	-	-	-
Other illness	37.78	28.96	32.97	19.52	51.12	33.32	24.38	22.64	28.53	33.71	31.52	18.83
Routine check	43.95	38.89	45.70	23.82	50.05	31.83	36.39	24.16	51.64	27.95	34.18	26.74
Number of conditions per household												
1	53.95	28.97	54.32	26.16	60.10	30.62	45.06	25.21	41.76	29.51	64.29	27.98
2	30.25	12.78	32.44	12.00	32.03	12.53	24.47	15.21	19.73	8.68	38.00	7.58
3	20.70	8.82	24.09	7.12	19.12	11.88	17.18	5.94	13.64	6.43	6.06	0.00
Household size												
1	44.77	27.02	44.56	23.93	51.89	30.01	35.97	27.96	36.72	28.26	51.88	24.04
2	43.86	27.03	38.13	22.22	51.90	30.63	40.49	20.70	34.12	23.96	51.38	33.89
3	41.76	29.77	35.60	23.39	46.88	34.21	36.90	26.81	-	-	-	-
4	40.47	23.70	33.75	9.17	52.01	24.26	39.95	19.07	8.33	14.43	-	-
5	25.34	22.08	-	-	34.29	30.90	19.97	16.71	-	-	-	-

CHW, community health worker; SD, standard deviation; WBPHCOT, Ward-based Primary Healthcare Outreach Team

[a]Other activities include defaulter tracing, non-sick elderly, referral follow-up, visiting the bedridden, providing health education, adherence support, and TB dotting

Multilevel model results of factors associated with the messages/activities scores

As shown in Table 7.6, the factors that are associated with the messages/activities score included CHWs activity-related factors (visit duration and when the activity planned by CHW for that house on that day was checking on children and babies) and household-related factors (household size,

number of conditions in a household, and the type of condition for which the CHW provided services).

Table 7. 6:Results of fitting multilevel models for factors associated with the messages/activities scores

Variables	Estimated coefficients	SE	z	Confidence interval		P-value
				Lower	Upper	
CHW activity-related factors						
Visit duration (5-minute change)	1.52	0.51	2.96	0.51	2.53	**0.003****
Checking on children and babies	-10.11	3.12	-3.24	-16.22	-4.00	**0.001****
Checking on pregnant women	11.43	6.17	1.85	-0.65	23.52	0.064
Household-related factors						
Household size (each extra person)	-3.63	1.05	-3.46	-5.69	-1.58	**0.001****
Number of conditions in a household (each extra condition)	-21.65	1.77	-12.23	-25.12	-18.18	**0.001****
Conditions for which the CHW provided services						
Hypertension	-5.14	2.50	-2.05	-10.04	0.23	**0.040***
Diabetes	-15.52	2.88	-5.40	-21.16	-9.89	**<0.001*****
HIV	4.80	2.62	1.83	-0.33	9.93	0.067
Tuberculosis (TB) and cough						
TB alone no cough	-13.41	5.06	-2.65	-23.33	-3.49	**0.008****
Cough alone no TB	-17.49	4.38	-4.38	-25.32	-9.66	**<0.001*****
Both TB and cough	9.39	18.25	0.51	-26.38	45.16	0.607

We selected the model that minimized Akaike information criterion (AIC) as the best prediction model. SE, standard error; CHW, community health worker

With each extra 5-minutes spent in the household and each additional message provided by the CHW, the messages/activities score increased by 1.5% (95% CI, 0.5 to 2.5, p=0.003) and 9.2% (95% CI, 7.8 to 10.6, p<0.001), respectively. For each extra person with HIV or when checking on pregnant women, the scores increased marginally by 4.8% (p=0.067) and 11.4% (p=0.064), respectively. However, for each extra person and condition in the household, the score decreased by 3.6% (95% CI, 1.6 to 5.7, p=0.001) and 21.7% (95% CI, 18.2 to 25.1, p<0.001), respectively. For each household where a member had hypertension, diabetes, TB alone, cough alone, or when the CHWs planned to check on children and babies, the score also decreased by 5.1% (95% CI, 0.2 to 10.0, p<0.040), 15.5% (95% CI, 9.9 to 21.2, p<0.001), 13.4% (95% CI, 3.5 to 23.3, p=0.008), 17.5% (95% CI, 9.7 to 25.3, p<0.001) and 10.1% (95% CI, 4.0 to 16.2, p=0.001), respectively. In multilevel modelling, no CHW-related characteristics were associated with the messages/activities score.

7.1.5. Discussion

We found evidence of very high frequencies of visits (twice a week and weekly) by CHWs to households, with >64.0% having occurred the previous week in most facilities. The planned activities were many, covering MCH, communicable and non-communicable diseases, although the most common was to follow-up chronic patients/deliver medications. It is possible that the high frequency or regularity of CHWs visits may be to prevent loss of skills.[311] In our previous study that reported on facilities A and B, frequent visits were because it was easier to go to households they knew. Furthermore, delivery of medications, one of their activities, required at least two monthly visits (to collect the household member's card and deliver their medications).[218] Yet, after a "nurse mentor" (a qualified PN) had provided training and mentoring for CHWs and OTLs for over a year, fewer repeat visits were subsequently reported, and CHWs still managed to provide more comprehensive care.[218]

Having completed secondary education ('matric' or above) pre-employment educational level and passing the WBPHCOT trainings seem to have some relevance with the messages/activities scores. Indeed, previous studies have reported a better performance of CHW work for those with a secondary education.[197,399] CHW background education is an important pre-selection criterion, and training, including relevant content to the CHW scope of work is crucial, if CHWs are to be effective in providing quality care.[19,63,90,400,401] In this study, of concern is how many CHWs were yet to pass the WBPHCOT trainings. In South Africa, several challenges have affected the successful implementation of the WBPHCOT training programmes, including poor fit between training content and CHW skill gaps, lack or shortages of learning materials, inconducive timing of training, unconducive learning environment, and lack of budgeting.[392] Thus, even when the CHWs have attended the training, most are yet to pass. Besides, newer CHWs who have no related experience have been employed, within the same programmatic constraints as previous CHWs.[402] Furthermore, framework to guide ongoing mentorship/supervision by CHW team leaders are reported to be underdeveloped.[292] However, in this study, in the final multilevel model, the messages/activities scores no longer showed association with either education or CHW training.

In the multilevel models, messages/activities score increased with each extra 5 minutes spent in the household. For each extra person, extra condition, and each household where a member had

diabetes, TB alone, cough alone, or when the CHWs planned to check on children and babies, the messages/activities score decreased. These findings may suggest a challenge in the balance between the number of conditions that a CHW may be required to address in a household and available time. While increasing the array of health topics covered by CHW is a tempting strategic approach to cover public health priorities, the present study shows that additional topics and less time are linked to decreased message scores. Beyond quality care, there is only so much a CHW can do when the number of conditions is high, and time is short. Therefore, quantity of time is key and may be an important consideration as an associated cost of CHW programmes.[228]

Other studies have also suggested better performance with longer time spent during visits. According to Goudge et al., in a South African district, during household registrations where a CHW was to have asked nine questions to elicit any health needs in a household, on average, CHWs were observed to have asked only four to five questions.[39] Although the length of time spent was not reported in this previous study, it is assumed that the CHWs would have had to spend a longer time to have asked all the relevant questions. In a qualitative study of household members, Konlan et al. reported that 57% of participants (household members) had indicated that the time spent by the CHWs was either too short or wished that the CHWs had stayed longer, which corroborated the findings of an older study.[403,404] Further study is suggested in view of the scanty evidence regarding the influence of time spent and performance.

Evidence is lacking concerning the influence of household size on CHW performance, with existing evidence reporting the number of households covered by CHWs only.[195] In our study, we found that an increasing household size as well as increasing number of conditions during visits have a negative influence on messages/activities scores. It stands to reason to consider that it may be easy for a CHW to forget to give all the messages needed to everyone with a condition in large households. To address this challenge within comprehensive care, individual CHW performance assessment on an on-going basis is recommended, to identify and strengthen individual-CHW-level issues (knowledge gap and challenges with adherence to stipulated guidelines).[168,284]

In our study, the evidence suggested by the declining messages/activities scores for conditions, including diabetes, TB, cough, and children/babies are important. In LMIC, CHWs are effective in providing promotive and preventive care for different conditions in MCH, as well as TB,

hypertension, and diabetes.[25] However, when CHWs must provide services for increasingly complex number of activities, it could result in poor performance.[18] In South Africa, CHWs showed adequate confidence in giving prescribed medications and managing clients withdiabetes but had low knowledge and confidence levels in managing clients with hypertension.[396] Another previous study in six provinces of South Africa revealed that CHWs expressed the need for more training especially on testing blood pressure and supporting diabetes, despite initial training.[222] These findings emphasize the role of supportive supervision.[290,405,406] The preference for comprehensive care by increasing number of LMICs also suggests the need for programme planners to utilize available evidence to inform approach to adding unto the wide array of tasks that CHWs perform.

Strength and limitation

We provided detailed quality of messages/activities scores and associated factors on several comprehensive care services of CHWs using a validated tool designed to investigate the process measures (compliance with standards of care) during household visits. The study also identified, with the use of the tool, variations in CHW competencies across settings and CHW teams. However, since the study did not examine community and health systems factors, interpretations of the findings are mostly limited to individual-level CHW characteristics and household factors. The influence of the additional burden due to the COVID-19 pandemic could not be considered in this study since the development and validation of the tool used in data collection pre-dated the pandemic. Finally, the small sample size in some facilities and conditions occasioned by the on-going pandemic may have affected the robustness of the findings. Generalization of the results is limited to CHW programme providing comprehensive care particularly in LMICs.

7.1.6. Conclusion

In this study, additional time spent in the household increased the messages/activities score. Increasing household size, increasing number of conditions, and the presence of diabetes, TB alone, cough alone, or plan to check on children and babies decreased the messages/activities score. Our findings identified important characteristics that could form the focus of training and supportive supervision, specific to these CHWs but replicable with adjustment of the tool to local contexts. The findings also support the relevance of ongoing assessments of CHW competency during household visits.

CHAPTER 8: INTEGRATED DISCUSSION

describe the key findings from this study reported in the papers presented in Chapters 4-7 (2 published, 1 under review and 1 in draft) in Table 8.1. This is followed by my proposed recommendations for operationalising productive CHW training assessment processes and for supporting CHWs whose performance can achieve acceptable health outcomes.

8.1. Key findings

The key findings emanating from this PhD study, are discussed, aligned with its four research objectives. In this PhD research, to discuss the findings, I proposed definitions of what could be considered as 'comprehensive care' since no previous studies have attempted to proffer a definition for it. I defined 'comprehensive care' provided by CHWs not as a single disease entity or condition but that it involves promotive, preventive and/or curative services for combinations of diseases or conditions. Such combinations of diseases and conditions should comprise at least two from communicable diseases, NCDs, mental health, care of older adults, persons with disability or cancers, sexual and reproductive health, and oral health. Moreover, I also based the definition of comprehensive care on established integrated care packages such as HIV/TB, MCH, MNCH, CMNH, IMCI, and CCM programmes, which are now further considered to be of "narrower comprehensive care scopes " or those that have integrated some of these and additional packages, now considered to be of "wider comprehensive care scopes".

Table 8. 1: Emerging findings

Chapter and paper number	Objective	High level findings
Chapter 4 (Paper 1)	To identify existing LMIC CHW training programmes for comprehensive care and synthesise evidence on their effectiveness and outcome measures	• This systematic review synthesised evidence which showed that CHWs with limited pre-employment education can be trained effectively on comprehensive care packages including MCH-related programmes. • Most of the studies reported a decline in post-training scores over time; however, the scores did not decline below the pre-training scores. • Over time, the contents of CHW training are including more skill and competency-based components and less didactic classroom-based components. • Limited evidence suggest that by integrating CHW training packages beyond a 'narrow comprehensive care scope", the training duration may be reduced, resulting in efficiency of the use of scarce human and financial resources. • Also, that more extensive time can then be preserved during which CHWs can practice and hone their skills and competency. • However, regardless of the effectiveness of a CHW training programme for comprehensive care, they do better with ongoing intensive support which can be by peer CHWs who may be higher cadre CHWs or those who qualify to be promoted to supervisory positions, or more commonly, nurses or clinicians. • Programme that has designed training curriculum to support supervisors and managers though minimal, alongside CHWs, showed sustained improvements in CHW knowledge and skills, even when a wider comprehensive care scope is involved.
Chapter 5 (Paper 2, (early draft)	To synthesise evidence on the tools used to evaluate experience and outcomes of training of CHW and the utility of such tools	• In this related systematic review, preliminary analysis showed that tools are often developed or adapted to evaluate CHWs training experiences and outcomes within comprehensive care programmes in LMICs. • The utility of such tools are often limited to some validity and/or reliability evidence (1-2 types). • Only one tool was found to have been developed on a wider comprehensive care scope (across communicable and non-communicable diseases or health-related events) which demonstrated multiple types of established utility. • The available evidence of the use of evaluation models, such as the Kirkpatrick four-level model, to evaluate CHW experience and outcomes of training on comprehensive is rather limited. Most studies do not utilise any evaluation model, leaving a gap in the use of a systematic approach to evaluating the training programmes.
Chapter 6 (Paper 3)	To assess the utility (i.e. validity and reliability) of a tool for assessing the quality of CHWs comprehensive care in South Africa	The results from the utility assessment of the quality-of-care assessment tool developed within the previous Batlhokomedi study that I evaluated in this PhD show that the items in this tool measure what they are intended to. This finding is based on the following:

		All the CHWs and their team leaders agreed that the assessment tool covered everything that is meant to take place during a household visit with an agreement index of >90%, respectively; and that they were happy if their activities were scored using the tool (agreement index >85%), implying a high acceptability and face validity Also, the results of six eligible experts who assessed the tool items both quantitatively and qualitatively confirmed a high content validity and agreed that all the 11 items in the tool are appropriate with an individual-item content validity index (I-CVI) of ≥83% (appropriate). At the scale-level, the S-CVI based on average of the proportions was 95% (≥80% = excellent). For the interrater reliability, which measures the extent to which the results obtained by two independent observers using the tool are similar, given the same or similar conditions, the result was high for quality-of-care messages scores of the care provided through messages by the CHWs during their home visits (77%). However, for the quality-of-care communication scores, the interrater reliability was low (14%). Based on these results, I make the case that the quality-of-care assessment tool may only be useful in the formative assessment of CHWs.
Chapter 7 (Paper 4)	To determine the factors associated with the quality of comprehensive care in three districts from two South African provinces.	The assessment tool was used to score messages provided by CHWs during household visits and the data were analysed to identify factors across household-level, condition and CHW activities influencing CHW performance (quality of messages/activities provided). Messages/activities score increased with each extra 5-minute increase in visit duration and for having a household member with HIV. Messages/activities scores were lower for households with either children/babies, diabetes, increasing household size, increasing number of household conditions and members with either TB or cough. These findings imply the need for increasing efforts to ensure that CHWs who provide comprehensive care are supported given the wider range of conditions they provide messages/activities for, especially in households with diabetes, TB/cough, and those with children and babies.

8.2. Emerging findings

The emerging findings from this PhD study and the relevant literature are: 1) effective training programmes exists on comprehensive care in LMICs; 2) supportive supervision; 3) assessing CHW performance, factors of performance and evaluation models

8.2.1. Effective training programmes for CHW exists on comprehensive care in LMICs

In LMICs, over the years, I showed that training packages have been developed, implemented and their effectiveness have been identified. However, these packages are mostly of ofnarrower scope than comprehensive care, mainly MCH-related and IMCI programmes. The emergence of these narrower training packages results from the WHO's development of strategies to equip healthcare workers and strengthen health service delivery and quality of care that can be adopted by countries, particularly LMICs.[328,329] Indeed, they are attempts to move away from single condition approaches towards more comprehensive care so that services can be provided for multiple conditions in an integrated and holistic manner.[407] With this increasing move towards comprehensive care in LMICs, evidence from this PhD study shows that training packages for enhancing the capacity of CHWs are becoming more integrated overtime. However, with the broadening of the scope of practice of CHWsfurther integrationof comprehensive training packages is crucial.[24,90,148] Integrated training packages with streamlining of the overlapping components of piecemeal curricula , is likely to result in more streamlined combinations of complex CHW activities and tasks.[122,408] Such streamlining of training processes may improve training and curriculum design, prevent training duplications, facilitate better learning , and enable CHWs to combine activities and tasks to facilitate household visit efficiency. However, CHW programme planners may not always add on new activities and tasks in a planned manner, or new activities may be warranted, urgently, such as during the COVID-19 pandemic, requiring immediate action and little pre-planning.[103,407] Thus, in expanding CHW tasks and activities, even within single-cadre CHW programmes, like that of South Africa reported in this PhD study, a selective approach whereby "more empowered" CHWs are tasked more, but with appropriate remuneration for the additional responsibilities, may be needed.[409]

As this PhD study demonstrated, there is clear evidence that regardless of the CHWs pre-employment educational level, effective training programmes exist on these comprehensive care packages in LMICs. However, despite this obvious evidence, effectiveness of CHW training

programmes is often short-lived, suggesting rather complex terrain around training of CHWs for comprehensive care. Among issues impacting training effectiveness are that with the increasing CHW scope of work and tasks, there are challenges with ongoing support and availability of equipment. CHWs are only at their best when they have received adequate training, ongoing support and motivation through regular incentives and availability of equipment and materials for their work.[19,410,411]

As my findings showed and based on evidence, training is necessary for CHWs to develop competence for the tasks they are to perform and it enables them to gain confidence and mastery of such tasks.[11] Indeed, my findings provide evidence that effective training packages exist and that CHWs are able to acquire and retain knowledge after receiving various trainings addressing their comprehensive scope of work. This fact has remained consistent overtime regardless of the approaches to training. Therefore, the lack of persistence of knowledge and skills over variable times following training may require understanding of more nuanced issues.[24,90,412] Looking at training alone, my findings agree with evidence from LMIC that how training is designed, frequency of training and competence of both those who are tasked to deliver training and their trainers are crucial.[24,90,412] Newly gained knowledge and skills also give the CHWs the edge to seeing themselves as serving important roles in the community.[11] Therefore, training is critical to CHWs feeling empowered, demonstrate efficacy, and provide quality comprehensive care.[11] For these CHWs with rather low pre-employment education level tasked with increasing comprehensive care service delivery, the expectation of performance is really about their skills. That is, that they should be able to undertake the specific tasks that are required of them.[24,413,414] Thus, beyond training, this PhD study found several other factors could be influencing how consistently well CHWs perform their comprehensive care. These factors can include how the training curriculum are designed or its contents, whether ongoing training and/or supportive supervision are occuring and how effectively implemented.

Training curriculum

Even though my findings suggest that training curriculum contents are becoming more practical, and incorporating skills-based components, the curriculum still need careful balance to ensure that CHWs acquire the skills they need and maintain them. Indeed, CHWs require some theoretical knowledge to understand the basic principles related to their roles as well as of

prevalent health needs of the population they are to provide care for.[19,24] However, since most CHW services provided in the communities mostly occur away from immediate support, hands-on practical experience, to offer more competency-based sessions that can translate to quality field-based performance are needed.[19,24,305] Thus, a move away from largely theoretical, classroom based training towards more competency-based training, will provide more opportunities for CHWs to practice their skills, and promote experience and proficiency. To fully support the CHWs in their widening roles, they should learn more by "doing" what they are required to do than undergo more theoretical classroom-based learning.[414]

Ongoing training

As I showed in this study, with the evidence that CHW roles are becoming increasingly comprehensive and government of nations are recognising their relevance even in emergency situations such as pandemics, ongoing training is crucial, after training, to sustain and harness CHW performance.[415] In this study, I provide evidence on support options being implemented by various CHW programmes in LMICs. Although I showed that CHW training programmes tend to include one or more ongoing support options including ongoing refresher/in-service trainings and supportive supervision, these have not consistently optimized CHW performance long-term. A previous review has also suggested similar findings.[108]

One of the major challenges relates to issues of infrequent occurrence or non-functioning ongoing training/refresher programmes. This can explain why in this study, I showed variable decline in CHWs knowledge and skills following training, despite refresher trainings, because they would have started to forget whatever skills they have managed to acquire or develop during the training. I consider that to plan and implement these largely formal training sessions would require extensive logistic and financial inputs, similar to that for the primary training that LMICs' governments may not wish to prioritise. Additionally, refresher/in-service trainings may not strategically focus on areas of CHW deficiencies since in the initial CHW training, CHW skills are not usually uniformly developed across all activities within modules regardless of how adequately the pre-employment training was. Moreover, challenges including low completion rates of refresher training and insufficient practical sessions have been reported in LMICs.[416] Importantly, even with quality pre- and in-service training, individual CHWs differ in the extent to which each acquire knowledge and skills across activities and tasks, limiting individual's

skills to limited range of services despite training on comprehensive care package.[51] Thus, support through the refresher/in-service training platform appear unsuitable in the way it is currently being implemented, to optimise CHW skills long-term.

Another issue involves the fact that CHWs are recruited at different times, as my study showed, and sometimes, CHWs may not have received any training or receive only an abridged training occurring over fewer than usual number of days or on incomplete modules before deployment.[411] Also, as first line responders, CHWs are increasingly being tasked with undertaking emergency services on an ad-hoc basis that often fall outside their formal training for comprehensive care services, which are primarily geared toward health promotion and preventive care.[82,105,109] Such emergency roles include their redeployment for COVID-19 prevention and control activities, necessitating urgent surveillance activities, community health awareness, education and support during crises while attempting to maintain non-COVID-19 services.[103,105,254,256,417-420] However, although such emergency situations require rapid skill acquisition and adaptation by CHWs, they frequently provide such services without formal preparatory training in emergency protocols or structured supervision and experience heavier workload due to the add-on roles.[103,105,421] These can compromise CHW effectiveness and well-being and underscore the critical need for clearer role definitions on emergency tasks and flexible, on-demand targeted emergency-care training modalities.[105,418-420] In addition, adaptable supportive supervision systems that can rapidly upskill CHWs, provide real-time guidance and support during emergencies, facilitate mental health/psychosocial support and enhance mechanisms for safe referral, are crucial.[420] Ballard et al. refers to a concept of 'labour exploitation', including excessive and complex workload, which may not be unrelated to the burden of providing comprehensive care, especially during add-on emergency adhoc services, and often are uncompensated.[27,422,423] These factors may not just affect the effectiveness of care of CHWs following training but to what extent they are able to acquire and retain knowledge and skills.[27,422] Among factors influencing learning and extent of knowledge retention after learning, those related to the psychological and emotional state are considered influential to the brain's absorption and retention capabilities.[424] Indeed, previous evidence from LMICs including Ethiopia and South Africa, suggests experience of psychological and financial distress linked to their demanding work environments and often precarious employment conditions.[27,418,425]

Thus, I consider both ongoing and on-demand training approaches where CHWs receive regular, strategic and adhoc trainings as necessary to address their unique task-/skill-related challenges.[19,296] However, to learn more and achieve optimal performance, this PhD findings underscore that these CHWs require multiple layers of support to perform effectively and sustainably. These supports operate at several levels beyond the already discussed individual-level trainings, skills development, and psychosocial support to cope with the emotional demands of their work.[19,296] They also need organizational support, including fair remuneration, clear role definitions, and regular, supportive supervision, which areequally important for sustaining motivation and accountability.[222] To function as effective intermediaries between households and the formal health system, CHWs need recognition and trust from the communities they serve; thus, community engagement and involvement in CHW programme design, planning and implementation is essential.[19] At the policy and health system levels, consistent financing, integration into health structures, and career development opportunities are essential for ensuring that CHWs are not undervalued or marginalized within the broader healthcare workforce. Previous studies highlight that weaknesses in any one layer, including lack of supervision or community recognition, can undermine CHW performance even when other forms of support are present.[82]

8.3.2. Supportive supervision

The necessity of supportive supervision of CHWs for optimal performance is another important finding of this PhD study. Although few studies evaluating effectiveness of CHW training for comprehensive care reported on the supportive component, its relevance is consistently emphasised. This PhD study uncovered some terms commonly used with supervision in general, including community-based supervision, peer supervision, group supervision, technology assisted supervision and supportive supervison. These are consistent with terms used by Westgate et al. regarding supervision approach categories reported as external (i.e., by district or PHC personnel), community (i.e. community-based committees or groups), group (i.e. combined CHW teams coming together and supported by their supervisors), peer (CHWs learning form each other) and dedicated supervision (CHW leaders' full and exclusive role is devoted to supervising their teams).[294] Supervision may be facility-based, community-based or both, and may be ongoing or occur infrequently, especially when facility-based. I identified various supervision approaches operating uniquely or in combination, in different LMICs. For example,

in Ethiopia, a dedicated community-based supervision model is implemented whereby the HEWs provide frequent, on-the-job support to frontline workers during household visits that take place in the community. Kenyan Ministry of Health blended approach offers a multi-layered supervision system to address capacity gaps, fostering a collaborative environment, and improving adherence to clinical protocols and data reporting accuracy. South Africa leans more towards the dedicated supportive supervison approach where dedicated team leaders (OTLs) and facility managers provide layered support facilitating relationships and linkage between CHW and PHC facilities and between CHW and the community.[116,218,225,426]

The goal of supervision is to guide, monitor, support and coach the CHWs to optimise their performance through direct observations or by higher level professionals, such as nurses or other senior member of the health team, auditing their activities.[296,427] This explains the various characteristics that have been described for supportive supervision, including "*education/training support"* for optimising CHWs clinical knowledge and skills; m*anagement support* to ensure resource and equipment availability (record books, stationeries) and *support function* towards ensuring adherence with standards and norms, and facilitating stakeholder engagements.[218] To be more appropriate in improving CHW performance more broadly, supportive supervison should 'promote quality at all levels of the health system by strengthening relationships within the system, focusing on the identification and resolution of problems, and helping to optimize the allocation of resources promoting high standards, teamwork, and better two-way communication'.[428] Indeed, supervision that is of adequate quality is considered more effective than how regularly it is carried out.[296]

Recent but limited evidence from this PhD is suggesting the need for novel alternative supportive supervison models to better support the CHW performance including blended learning approach. In this PhD systematic review, Mozambique, implemented a technology-based (mHealth) intervention package, 'inSCALE', developed to support iCCM programmes which demonstrated improved CHW performance in the short-term (3 months). Other more recent evidence include a digitally enabled supportive supervision model for the Ethiopian's HEP programme, which combines digital tools with traditional supervisory structures, and is being used to enhance CHW performance and motivation.[429] Central to this approach is the electronic Community Health Information System (eCHIS), which enables real-time data collection, tracking, and analysis of

CHW activities and health outcomes.[429,430] Supervisors use an enhanced eCHIS application suite featuring dashboards, automated supervision alerts, and digital target setting to monitor performance and tailor mentorship during supervisory visits.[429] This digital integration improves communication between CHWs and supervisors, streamlines data-driven decision-making, and enables timely feedback loops essential for continuous quality improvement. Complementing these technological tools, the program incorporates performance-based incentives, fostering motivation and accountability at both individual and team levels. Ethiopia and Malawi are also addressing the challenges of inconsistent access to quality training and supervision of CHWs by implementing an offiline mobile application.[431] These alternative digitai health-enabled supervision models may potentially address the gap of limited or insufficient supervision and training of CHWs and may be more cost-effective solution for supporting CHWs' deployment in emergency situations such as during the COVID-19 pandemic and Ebola outbreak.[296,432]

Evidence of other alternative supportive supervision models suggest the need to identify what works within specific CHW training programme for comprehensive care that can be scaled up. Goudge et al. designed a nurse mentor supportive supervision model employinga dedicated qualified professional nurse to support CHWs teams from two PHC facilities and their immediate supervisors (lower cadre nurses who tends to be less experienced, sometimes than the CHWs) in South Africa.[218] By employing role plays, debriefing sessions, community supervision and prompt feedback, CHWs could then perform more complex comprehensive care activities than before, with improved CHWs programme embeddedness with the community and integration with the health system.[116,218] In another South African context, a supportive supervision cluster RCT examined CHW effectiveness for the narrower comprehensive care package (MCH) by comparing an enhanced, accountable supervision by an NGO to standard government (district-led) supportive supervision.[433,434] Enhanced, accountable supervision entailed more frequent monitoring, accountability, and supportive mentorship. Accountability measures involved the use of paper-based or phone-based logging of every home visit, monitored by supervisors who hold the CHW accountable for non-performance.[433,434] Their findings showed that with enhanced, accountable supervision, CHWs achieved better performance in over 80% (11 out of 13) of measured indicators.[433] Thus, there has to be new thinking around how supportive supervision is implemented related to specific CHW comprehensive care programmes, particularly considering approach or combination of approaches, who is best able

to provide most optimum and cost-effective support, and how best to motivate the supervisors in their supervisory role.

To be effective, those tasked with providing supportive supervision, regardless of their cadre (peers, nurses or clinicians), require well-defined training that should be incorporated into training curriculums of CHW programmes. However, in this PhD study, I identified a concerning issue regarding supportive supervision with limited information regarding how those providing support for the CHWs are being supported. Adequate support for the supervisors can equip them on clinical, administrative, and supportive skills, to enable them facilitate access of CHWs to key health system support, including tools, materials, and supplementary training to improve CHW performance.[294] Although few, in this PhD study, CHW teams whose programme includes dedicated training for CHW supervision showed longer-term sustanance of effectiveness within larger comprehensive care packages than those without. Examples of LMICs with such documented evidence of a training programme specifically for CHW team supervisors include Ethiopia, Kenya and South Africa. To enhance CHW performance, the focus of the dedicated training programmes for these supervisors differ within LMICs. While Ethiopia's focus on HEW supervisor ongoing in-service training is combined with mentorship to oversee frontline workers, in Kenya, supervisory cadres receive structured training on data use, supportive supervision techniques, and problem-solving. These training programmes are typically a blend of theoretical components on leadership and management with practical modules on conducting field visits, providing feedback, and using digital tools for supervision.[108] In South Africa, supervisory training models are designed to equip nursing staff and senior CHWs with skills to mentor, monitor, and support frontline CHWs effectively.[225] These are positive developments that should be replicated in more LMICs. This is because CHWs supported within such programmes are often better motivated, perform broader tasks and are better integrated into the health system.[219] This is also encouraging since earlier reports often document poor CHW management and supervision in general in LMICs.[435] Knowing that LMICs including South Africa are tending more towards national comprehensive care CHW programmes, it is critical for supervisors to be empowered considering how crucial they are to effective CHW performance and quality care.

8.2.2. Assessing CHW performance on comprehensive care, factors of performance and evaluation models

As my study revealed, things are changing, and in recent years and with the renewed interest in national CHW programmes, more integrated services are becoming the norm. Despite these changes, studies evaluating the effectiveness of training packages for equipping CHWs for such 'wider comprehensive care scope' are rather scanty. To assess effectiveness of training on comprehensive care or CHW performance, tools with sufficient utility are needed. The evidence from this PhD study indicate the availability of limited evidence of validated tools, mostly checklists, mostly lacking in rigorous utility assessments are being used to assess the gains of CHW performance in LMIC. Further, this PhD also shows evidence that a tool that the Batlhokomedi team developed to evaluate the performance of CHWs in South Africa and which I validated in this PhD study shows potential for use in the formative assessment of CHW tasks within the community, and could be utilized to rate the performance of CHWs by trained non-medical observers. I also provide evidence that this simple tool, has utility to facilitate ongoing feedback to support individual CHWs towards improved levels of competence.

By using the tool validated in this PhD study, I identified challenging factors influencing the CHW performance. Such include household factors where the CHWs perform their comprehensive care services, clients' conditions encountered and time spent providing care. Larger household size and complexity, including the presence of multiple health conditions among household members, and specific health conditions in the household, such as hypertension, diabetes, TB, and respiratory symptoms (cough), negatively influenced the quality of care messages delivered by CHWs. Furthermore, my PhD study also found evidence to suggest that adequate time spent in the household is crucial for CHWs to perform effectively. This suggests that CHWs who provide comprehensive care face challenges in effectively delivering comprehensive care in more complex and larger households. Indeed, often, pressure may occur that can hinder the CHWs' ability to address all health needs adequately, emphasising the need for context-specific CHW comprehensive care programme design and evaluation.

Although the major focus around CHW research has been the concern around their lower education and training, these emerging factors seem to be more about the household itself.

Indeed, the household environment is considered complex and can be challenging for CHW practices. On one hand, if CHWs are accepted and trusted, they can navigate providing care in the home environment more easily, on the other hand, when client expectations do not align with what the CHWs can offer, it can put pressure on the CHWs, compromising effective care.[436-438] CHWs who undertake heavy workload (necessitated by comprehensive care) and experience inconsistent and sub-standard trainings may not know enough to meet the health needs of the clients, and may likely then spend less time during visits. Even when they know sufficiently, there is only so much that they can fit into one home visit with more complex issues.[218] In particular, for certain conditions such as TB or coughing, it makes sense that CHWs may spend less time in a household because both conditions carry a degree of stigma/concern of disease spread.[439] Performance may also be affected if clients fail to disclose their TB status or symptoms, limiting opportunity to provide quality care.[440,441] As part of the "soft skills" training that CHWs receive, stigma may be an important area to consider.

In addition, I reported particular decreases in performance during visits involving vulnerable groups such as babies, children and pregnant women. Indeed, babies and children in households may naturally cause a degree of disruption or distraction, limiting effective care.[442] Thus, in South Africa, specific age-based trainings—or creative strategies—have been advocated for CHWs when delivering messages for babies and children during home visits. A recommendation is for pictorial job aids covering diverse age-based topics on child health, nutrition, developmental milestones and simple but engaging activities to stimulate learning and capture children's attention during home visits have been advocated to complement CHW home-visit interventions.[442] However, even the solution increases the CHW workload, highlighting that the difficulty CHWs face in managing households with multiple or complex health needs, may go beyond diverse skills to wider health system considerations to addressing increasing CHW worload.

By evaluating the quality of comprehensive care by CHW teams within the South African context using the validated quality-of-care tool, which took into account the details of their work on a daily basis, it was possible to identify health conditions or events that individual CHWs had difficulty with. Thus, the tool has potential for ongoing use if integrated within continuing education and support for strengthening CHW work. Its use within the healthcare system may

improve CHW practice, especially for comprehensive care, and within national CHW programmes.

To optimise CHW programme, data collection particularly if digitised and deployed at the point of CHW service delivery, can unearth CHW areas of weaknesses for ongoing support by supervisors.[19] Inherently, once CHWs' knowledge and skills are supported adequately, improved health outcomes following CHW services can be inferred.[19] Indeed technological innovations and job aids transform CHW programmes by addressing critical challenges of scale, cost, and quality in training, supervision, and service delivery—challenges that are particularly acute in overburdened health systems like South Africa's. Digital health platforms facilittes flexible, interactive training that extends beyond traditional in-person workshops, allowing CHWs to refresh and update their knowledge asynchronously, often overcoming barriers related to geographic isolation and limited human resources. Examples of such mobile applications include the Smart Health app and upSCALE which provide CHWs with clinical decision support, standardized protocols, and patient management tools adapted to local health priorities and languages, improving consistency and effectiveness of care.[430] The tool validated in this PhD may provide a cost-effective approach to strenghten CHW performance and facilitate supportive supervision efforts if data collection was digitalised. Further, the data generated through the use of this tool could be analysed using AI learning algorithms to generate tailored recommendations for individual or group CHW training needs, or to identify those at high-risk of underperformance and supervisory focus areas. However, lower-technology approaches, using simpler if-then algorithms combined with SMS messaging could be used to provide CHWs with reminders and feedback messages based on data, to reinforce specific CHW skills immediately and address gaps in knowledge. Further work is still needed in this area that I plan to explore through future research.To further strengthen large-scale CHW programmes, a strong monitoring and evaluation system to facilitate on-going consideration of emerging issues for prompt corrections is required.[88] When training packages include evaluation models at the point of design, this may facilitate effective monitoring and early identification of aspects of training design requiring additional focus or review. In these study, despite the availability of several evaluation models already in use in educational training of higher cadre HCPs, I found limited evidence of their incorporation.

8.2.3. Implications of the study findings for CHW training programmes in LMICs

This PhD has provided ample evidence that CHWs can be effectively trained to provide comprehensive care on mostly narrower scope of comprehensive care services and also provides limited evidence suggesting that training on wider comprehensive care scope may also be effective. The knowledge and skills of CHWs improve after training and are sustained for variable length of time especially with ongoing support.

The lack of more harmonised training curriculum on the wider comprehensive care scope as evidenced by rather limited studies evaluating the effectiveness of wider CHW comprehensive care training package makes it challenging to address the difficulties of accessing training by these lower cadre staff with minimal level of background education. In this study, training on much narrower scope of comprehensive care meant focusing on several subcomponents of care, requiring logistical inputs and longer hours of training in the long run, which may adversely affect the extent of knowledge and skill transfer.

The lack of a clearly consistent positive impact of ongoing/refresher training on training outcomes as evidenced by variable decline in knowledge and skills despite these ongoing trainings overtime, may suggest the option of dedicated supportive supervision as a more attractive support option. This is considering that the logistical and financial inputs for ongoing/refresher trainings may be harder for governments in LMICs to prioritise. However, different contexts of LMICs may mean different approaches to ongoing support for CHWs on comprehensive care overtime.

Since supportive supervision is also not without its challenges, particularly with HRH shortages and limited funding, alternative models can be explored by governments. These models should consider a non-hierarchical supervision support by more experienced or senior CHW peers; more experienced/senior nurses mentoring CHW teams and their supervisors; community engagement/involvement to enhance community trust, recognition and feedback; and by utilising digital technology to offer ongoing support. For effective supportive supervision, adequate training of senior nurses/mentors of lower cadre supervisors is also necessary using well-documented training curriculum. Thus, using alternative models concurrently, multiple layers of effective support can be created around CHWs particularly those providing the much wider comprehensive care services.

Assessment of CHW performance should occur both in the real world as well as in controlled settings, for every CHW programme. A dual approach will be particularly beneficial in LMICs because varying contextual factors, health system maturity, and community expectations influence CHW success. As my study shows, assessments often occur in either and not in both settings. Each has its advantages, for example, the real world assessments provides additional information regarding how the CHW copes with complexly interacting factors in their social and health system contexts, taking into account factors like resource limitations, diverse client populations, and integrated health systems. In real world, measures such as timely service delivery, community coverage, usage rates, client satisfaction, and CHW retention shiould be tracked via regular data collection systems and qualitative feedback from communities and supervisors. Real-world measurement reveals operational barriers and facilitators that affect sustained performance and scalability. In controlled settings, such as pilot programs or research trials, performance measurement can be used to monitor standardized metrics. Thus, CHW knowledge, task proficiency, and adherence to clinical protocols can be assessed through direct observation, simulated client interactions, or competency assessments as demonstrated in this PhD study. Measures in controlled environments thus allow for a thorough assessment of service quality, the accuracy of interventions, and the development of skills without being influenced by external factors. These measures can enable the establishment of baseline effectiveness and the identification of training or process improvements. Thus, a single framework including such validated tools as reported in this PhD study can be used for assessing performance, competency and task completion rates on a regular basis, in conjuction with continuous mionitoring of routine data collection on CHW activities, supervision reports and community and client feedback. Competency assessments and real-world performance data can then be used to identify gaps in training, resource allocation, and systemic barriers. Data dashboards can be automated digitally to provide timely feedback to CHWs, supervisors, and programme managers to enable adaptive management.

It is also evident from this PhD study that measures based on validated tools are needed to facilitate timely assessment of effectiveness of CHW training programmes on wider comprehensive care packages, particularly to assess competence and on-the-job performance. Although I provided a tool with a high face and content validity, it has limited interrater reliability on the communications component. However, I consider its use as a formative tool to

be important for sustaining competence particularly at household level where the CHWs provide most of their services. However, despite the usefulness of a formative tool for these lower-cadre workers, a reliable summative assessment tool also has important usefulness within different CHW contexts, judging from the increasing interest in certification and professionalisation of the CHWs.

8.2.4 Implications of the study findings for CHW training programmes in South Africa

The South African CHW programme is comprehensive, yet, there are challenges in matching training content with CHWs' skill gaps and resources and budgetary constraints. Despite initial training efforts, many CHWs do not pass required phases of training.

The quality of CHW care (measured by messages/activities delivered) is influenced by household characteristics and conditions rather than CHWs' education or training per se, indicating possible gaps in training implementation and support. Therefore, support and adaptation of training programmes are needed to enhance comprehensive care delivery, especially for households with chronic conditions such as hypertension, diabetes, TB, and children/babies.

Furthermore, there is an underdeveloped framework for ongoing mentorship and supervision. Although my PhD identified recent effort of government at introducing structured training to enhance CHW team leaders's skills on supportive supervision, the national programme was donor-funded, suggesting limitations with sustanability.

Given that variations exist in how CHE programmes are being implemented in South Africa due to variations in district resources, community dynamics, and burden of disease which differentially influence CHW performance and measurement approaches, there may be need to adapt the validated tool reported in this PhD to local languages and consider differences in cultural norms to ensure relevance and acceptability.

Positioning these findings within South Africa's evolving national health system landscape, particularly the country's National Health Insurance (NHI) scheme, underscores the critical but complex role of CHWs in the country's health transformation.[426] The South African NHI plans to ensure that the populace have access to equitable and quality health care by pooling resources

and shifting care more from hospitals to the PHC-level, as the foundation of UHC.[426,443] Under NHI, CHWs are envisioned as pivotal actors bridging communities with formal health services, extending preventive, promotive, and basic curative care.[426] This shift presents opportunities for professionalizing and integrating CHWs more systematically, potentially enhancing training standards, supervision modalities, and career pathways, which aligns with the recommended multi-layered support. However, the evolving policy environment also raises challenges around resource allocation and role clarity.[426,443] While NHI promises increased financing for PHC, there are pressing competing priorities such as infrastructure, workforce expansion, and tertiary care needs.[444] The shifting burden of disease towards chronic, multimorbid conditions demands CHWs acquire broader competencies on chronic disease management and social determinants engagement, necessitating ongoing revisions of existing training and supervision frameworks that should be evidence-based.

Overall, the findings indicate the need for tailored, context-specific training approaches that extend beyond basic skill transmission for CHWs in the South African health system. Effective ongoing mentorship and leadership development are crucial to improving health system effectiveness and quality of care locally.

CHAPTER 9: RECOMMENDATIONS

In this chapter, I highlight the ways by which the findings of this study can be applied beyond considering CHW training and assessment of effectiveness and performance in ways similar to those of higher cadre health professionals like nurses. Rather, this section is targeted at multiple stakeholders including policy makers, programme developers and implementers as well as the research community in presenting these recommendations. The concluding part of this chapter emphasises the importance of the CHWs themselves in the discourse of their training programme, particularly in LMICs.

9.1. Recommendations

9.1.1. Recommendations for health system and policy in LMICs and South Africa

1. As emphasised by the WHO in the 2018 *Guideline on health policy and system support to optimise community health worker programmes,* training programmes must have well developed curriculum for the scope of work of CHWs, and such should ensure a balance between theoretical knowledge and practical skills. Therefore, LMICs including South Africa need to develop standardised training curricula that reflects the evolving health priorities including emerging diseases and emergency responses. It is recommended that training packages be regularly reviewed and adapted to match the changing disease patterns and CHW roles.
2. There is need for more sustainable financing mechanisms by governments in LMICs as the recent US cuts in funding on several health programmes such as HIV/TB that rely on the CHWs emphasise the need for less donor dependency. Thus governments should aim to secure stable and adequate funding to ensure fair remuneration and improved allocation for implementing CHW programme. The planned NHI in South Africa can potentially ensure stable and adequate funding with early deliberations on how this can be achieved through collaborative stakeholder engagements.
3. Since the roles of CHWs are expanding and not in any organised manner, it is necessary for governments of countries to make the call for further harmonisation of narrower scopes of comprehensive care packages by convening national stakeholders including the academia, CHWs and communities. This can be along the lines of those developed by the WHO and

United Nations on MCH services. An example is a mapping review commissioned by the United Nations and partners in 2012 to develop integrated training curriculum for STIs, reproductive tract infections, and HIV along with maternal health, child health and newborn care components that had previously been addressed as separate components.[122]

4. Furthermore, the call for CHW certification after pre-employment training needs further support at this level.

9.1.2. Recommendations for national CHW training programme developers and implementers in LMICs including South Africa

1. Despite evidence of competency-focused training for enhancing and sustaining CHW, there is limited evidence of utilisation of the approach in LMICs. Thus, there is need to establish clear roles and competencies to tailor the design of training curriculum, particularly within the context of comprehensive care, for addressing specific community health needs and social contexts in LMICs.
2. There is a need to aim for a comprehensive curriculum to further integrate the different components within the wider scope of comprehensive care to take advantage of components that are required across various distinct packages, such as the soft skills of communication and administration.
5. Training of CHWs should support ongoing and quality supportive supervision including the training of supervisors and other supportive structures, to facilitate a well-developed "multiple layers of support" around the CHWs which should include collaborations at various levels of government, as well as community and health facility stakeholders. Multi-level support is needed including enhancing clear role definitions and psychosocial support to optimize CHW performance.
3.
4. There should be ongoing investment into the monitoring and evaluation of CHW training programmes to identify areas requiring further strengthening to achieve training goals.
5. There is need to foster community recognition and trust to empower CHWs as effective intermediaries in health systems as well as improve CHW integration into formal health system structure with clear career progression pathways.

6. Participatory approaches involving CHWs and communities in programme design and evaluation should be encouraged.

9.1.3. Recommendations to strengthen research and use of evidence

There is a vital role for a diverse set of stakeholders including the CHWs themselves, Ministries of Health and academic community to strengthen research and use of evidence to improve CHW programmes.

1. The academic community need to provide methodological expertise to explore CHW programme effectiveness, cost-effectiveness and best practices; they should also provide expertise in analysing data for generating findings to inform evidence-based decision making by policy decision makers and programme planners.
2. In addition, CHWs as frontline workers should be encouraged and facilitated to provide practical insights to shape research relevance around CHW programme implementation.
3. Government health departments and policymakers should ensure that CHW programmes align with national health strategies and use findings of research to inform policy dialogue, resource allocation and health system strengthening.
4. Collaboration with community organisations and faith-based groups should be encouraged to foster local engagement, trust, and culturally appropriate intervention design that is evidenced-based.

9.2. Strength and limitations

The main strength of this PhD study is its comprehensive, multi-level examination of CHW training programmes and evaluation of performance that integrates evidence from various LMIC settings with primary data findings on individual CHWs. The study's use of data from these diverse settings enhances the validity and applicability of its findings for LMICs including South Africa. Additionally, by actively engaging CHWs and stakeholders in the evaluation process of the validated assessment tool enriches the study's relevance and ensures that recommendations are grounded in operational realities, thereby increasing the potential for effective translation into policy and practice. The evidence allows nuanced insights into factors affecting CHW training programmes and evaluation methods.

The study encountered some limitations. In the systematic reviews conducted to investigate training effectiveness and tools for assessing gains of training, adequate attempts were made to include all applicable search terms on CHWs, training and LMICs; however, some studies may have been missed, potentially limiting the generalisability of the findings. Furthermore, since the studies included were on various cadres of CHWs, and some even reported on the team leaders and facility managers, this may have influenced the reported findings and conclusions. Also, the number of studies reporting tools on the wider comprehensive care packages were few; thus, our understanding of the CHW scope, content and outcomes assessed by evaluation tools remains limited.

The primary data collections relied largely on observations by trained observers. Such approach to data collection runs the risk of 'Hawthorne effect' whereby the CHWs modify how they behave while being observed by increasing their work output. Thus, to prevent the potential of observation bias, the data collected in the first three days of recordings were discarded, to ensure that the findings reflect real-world activities of CHWs. Primary data collection in some facilities was limited by small sample sizes, potentially limiting the robustness of our findings and preventing further explorations of associated factors of messages/activities score disaggregated by CHW teams. Moreover, the study on the associated factors of messages/activities score did not explore community and health systems factors, limiting the findings to individual-level CHW characteristics and household factors only. This study's validation component also pre-dated the COVID-19 pandemic; thus, I failed to capture the effect of how the add-on tasks related to COVID-19 could have influenced the findings.

9.3. Areas for further research

The body of research on the training of CHWs to address their expanding scope of work has been increasing and more so within the context of UHC. As part of this PhD study, I have identified important areas that can be addressed in future studies. Additionally:

1. The outcome measures used to assess the gains following training vary (performance, quality of care, knowledge and skills etc.). Even when the same measure is mentioned, how measurements are conducted or what is actually measured often differ. There is need for

further exploration into process measures and indicators to uniquely map the competencies needed for the CHWs to perform their tasks successfully and to keeping achieving the success.

2. Using well-known evaluation models, longitudinal studies are needed to evaluate the long-term impact of how different phases of CHW training for comprehensive care influence performance or competence sustainability.
3. Also, although there is increasing demand for CHW professionalisation and certification, in LMICs, there is need for evidence on the effect of certification on CHW effectiveness to further substantiate and encourage government buy-in.
4. Further exploration into the development and use of digital tools and mHealth, particularly for resource-constraint settings for facilitating and optimising CHW training, support and assessment are crucial in future.
5. CHWs' preparedness and response to emergencies, including epidemics, natural disasters, and other crises, represents a promising area for future research. Investigating how CHWs contribute to early warning systems, risk communication, community mobilization, and continuity of essential health services during emergencies using both qualitative and quantitative methods can provide critical insights into strengthening health system resilience. This line of inquiry could explore the training needs, resource requirements, and supportive supervision necessary to optimize CHW effectiveness in emergency contexts. Additionally, studying the integration of CHWs within broader emergency response frameworks and their impact on vulnerable populations during crises can inform policy and programmatic adaptations essential for comprehensive, community-centred care.

CHAPTER 10: CONCLUSIONS

- To conduct a systematic review to synthesise evidence on national or large-scale CHW training programmes for comprehensive care in LMICs to:
  - ✓ Identify existing CHW training programmes for comprehensive care and synthesise evidence on their effectiveness.
  - ✓ Identify the tools that have been used to evaluate gains in CHW knowledge and skills as a result of attending the training and provide evidence for their utility.

In conclusion, the objectives based on the two-related systematic reviews conducted in this PhD demonstrates effectiveness of training for a lower cadre health worker a category with low background education, on comprehensive care of varying scope. Summarily, implementing pre-employment training that is context specific, tailored to the roles of CHWs, convincingly leads to improved knowledge and skills for a limited period. Beyond this, levels of skills begin to decline if no other quality support is provided. The type of support that will be considered effective in maintaining and sustaining knowledge, skills and performance of CHWs has to avoid the limitations of most refresher/ongoing training that provides little or no difference to improving knowledge and skills long-term, following pre-employment training. Thus, an approach where regular and strategic support are provided close to where the CHWs provide services is necessary. This form of support, commonly considered as dedicated supportive supervision, may be by health workers in the nursing profession or peer CHWs who meet the criteria as supervisors. However, it is important that both CHWs and immediate supervisors have other forms of support to keep them both motivated. Thus, beyond the immediate supervisor, other "layers of support" including at the level of health facility within which CHWs are integrated, the community within which they are embedded or district-level where training is implemented, stakeholders committed to CHW may be identified to complement this multi-layer support structure. For the entire support structure, some form of training either via online digital platform or by use of video workshop or more interesting and novel approach, the entire 'layer' is motivated to keep maintaining and sustaining CHW competence.

- To assess the usefulness (i.e., validity, reliability etc.,) of a tool developed to assess the quality of care provided by CHWs after attending the South African national training programme.

- To apply the validated quality of care assessment tool for determining the CHW quality of comprehensive care during household visits and associated factors:
  - ✓ Determine the messages/activities scores derived from the proportion of health messages given in the households by CHWs who provide comprehensive care in South Africa, and
  - ✓ Identify the associated factors

For the third and fourth objectives, in conclusion, I showed that critical to the success of training for comprehensive care is the use of quality tools and measures to monitor and evaluate how effective the training programme is and what are the outcomes of training among the trained CHWs. The tool I validated in this PhD can be used to generate data on CHWs to identify gaps in performance, which can be bridged through supportive supervision. The tool can also be used to track change in performance, in response to supportive supervision solutions, particularly when deployed using the digital technology platforms.

Finally, empowered and consistently competent CHWs can provide quality health services that can translate to UHC and improve health outcomes.

REFERENCES

1 Crigler, L., Hill, K., Furth, R. & Bjerregaard, D. *Community Health Worker Assessment and Improvement Matrix (CHW AIM): A Toolkit for Improving Community Health Worker Programs and Services*. (USAID Health Care Improvement Project, 2011).

2 Kok, M. C. *Performance of Community Health Workers: Optimizing the benefits of their unique position between communities and the health sector*, VRIJE UNIVERSITEIT, (2015).

3 World Health Organization. *Increasing access to health workers in remote and rural areas through improved retention: global policy recommendations*. (World Health Organization, 2010).

4 Jaskiewicz, W. & Tulenko, K. Increasing community health worker productivity and effectiveness: a review of the influence of the work environment. *Human Resources for Health* **10**, 38 (2012). https://doi.org/10.1186/1478-4491-10-38

5 Tulenko, K. *et al.* Community health workers for universal health-care coverage: from fragmentation to synergy. *Bulletin of the World Health Organization* **91**, 847-852 (2013).

6 Scott, K. *et al.* What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. *Human Resources for Health* **16**, 1-7 (2018). https://doi.org/10.1186/s12960-018-0304-x

7 Hoemeke, L. Vol. 22 July 2018 (ed CHW Central) (Initiatives Inc., Boston, MA 02116, 2018).

8 World Health Organization. *Strengthening the performance of community health workers in primary health care: report of a WHO Study Group [meeting held in Geneva from 2 to 9 December 1987]*. (World Health Organization, 1989).

9 De Koning, K. *et al.* A common analytical framework on factors influencing performance of close-to-community providers. *KIT Royal Tropical Institute*, 78 (2014).

10 Angwenyi, V. *et al.* Moving to a strong(er) community health system: analysing the role of community health volunteers in the new national community health strategy in Malawi. *BMJ Global Health* **3**, e000996 (2018). https://doi.org/10.1136/bmjgh-2018-000996

11 Kane, S. *et al.* Limits and opportunities to community health worker empowerment: A multi-country comparative study. *Social Science & Medicine* **164**, 27-34 (2016). https://doi.org/https://doi.org/10.1016/j.socscimed.2016.07.019

12 Taegtmeyer, M. *et al.* Exploring perceptions of community health policy in Kenya and identifying implications for policy change. *Health Policy Plan* **31**, 10-20 (2015). https://doi.org/10.1093/heapol/czv007

13 Chin-Quee, D. *et al.* Balancing workload, motivation and job satisfaction in Rwanda: assessing the effect of adding family planning service provision to community health worker duties. *Reproductive Health* **13**, 2 (2016). https://doi.org/10.1186/s12978-015-0110-z

14 Bhutta, Z., Lassi, Z., Pariyo, G. & Huicho, L. *Global experience of community health workers for delivery of health related Millennium Development Goals: a systematic review, country case studies, and recommendation for integration into national health systems*. (World Health Organization, Global Health Workforce Alliance, 2010).

15 Liu, A., Sullivan, S., Khan, M., Sachs, S. & Singh, P. Community health workers in global health: scale and scalability. *Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine* **78**, 419-435 (2011).

16 Schneider, H., Schaay, N., Dudley, L., Goliath, C. & Qukula, T. The challenges of reshaping disease specific and care oriented community based services towards comprehensive goals: a situation appraisal in the Western Cape Province, South Africa. *BMC health services research* **15**, 436 (2015).

17 Schneider, H., English, R., Tabana, H., Padayachee, T. & Orgill, M. Whole-system change: case study of factors facilitating early implementation of a primary health care reform in a South African province. *BMC Health Services Research* **14**, 1-11 (2014).

18 Glenton, C., Javadi, D. & Perry, H. B. Community health workers at the dawn of a new era: 5. Roles and tasks. *Health Research Policy and Systems* **19**, 1-16 (2021).

19 World Health Organization. *WHO guideline on health policy and system support to optimize community health worker programmes*, <https://www.who.int/publications/i/item/9789241550369> (2018).

20 Taylor, C. *et al.* Determining whether Community Health Workers are 'Deployment Ready'Using Standard Setting. *Annals of Global Health* **84** (2018).

21 Olaniran, A., Smith, H., Unkels, R., Bar-Zeev, S. & van den Broek, N. Who is a community health worker?–a systematic review of definitions. *Global health action* **10**, 1272223 (2017).

22 O'Donovan, J., O'Donovan, C., Kuhn, I., Sachs, S. E. & Winters, N. Ongoing training of community health workers in low-income andmiddle-income countries: a systematic scoping review of the literature. *BMJ open* **8**, e021467 (2018).

23 van Rensburg, H. C. South Africa's protracted struggle for equal distribution and equitable access – still not there. *Human Resources for Health* **12**, 26 (2014). https://doi.org/10.1186/1478-4491-12-26

24 Aitken, I., Perry, H. & Crigler, L. Training community health workers for large-scale community-based health care programs. *Developing and strengthening community health worker programs at scale: a reference guide and case studies for program managers and policymakers. Baltimore: Jhpiego*, 9-1 (2014).

25 Perry, H. B., Zulliger, R. & Rogers, M. M. Community health workers in low-, middle-, and high-income countries: an overview of their history, recent evolution, and current effectiveness. *Annual Review of Public Health* **35**, 399-421 (2014).

26 Zulliger, R. *Ethiopian community health worker programs*, <https://chwcentral.org/ethiopian-community-health-worker-programs/> (2018).

27 Ballard, M. *et al.* Labour conditions in dual-cadre community health worker programmes: a systematic review. *The Lancet Global Health* **11**, e1598-e1608 (2023). https://doi.org/10.1016/S2214-109X(23)00357-1

28 Kenyan Ministry of Health. *Kenya Community Health Strategy 2020 - 2025*, <https://chwcentral.org/wp-content/uploads/2021/07/Kenya_Nat'l_Community_Health_Strategy_2020-2025.pdf> (2020).

29 South African Department of Health. *Policy framework and strategy for ward-based primary health care outreach teams 2018/19 – 2023/24*, <https://rhap.org.za/wp-content/uploads/2018/04/Policy-WBPHCOT-4-April-2018-1.pdf> (2018).

30 Scott, K., George, A. S. & Ved, R. R. Taking stock of 10 years of published research on the ASHA programme: examining India's national community health worker programme from a health systems perspective. *Health research policy and systems* **17**, 29 (2019).

31 Roy, S. *et al.* Beyond Institutionalization: planning for sustained investments in training, supervision, and support of community health worker programs in Bangladesh. *Global Health: Science and Practice* **9**, 765-776 (2021).

32 Lohr, K. N. & Schroeder, S. A. A Strategy for Quality Assurance in Medicare. *New England Journal of Medicine* **322**, 707-712 (1990). https://doi.org/10.1056/nejm199003083221031

33 Lawrence, M. & Olesen, F. Indicators of quality in health care. *The European journal of general practice* **3**, 103-108 (1997).

34 Prytherch, H. *et al.* The challenges of developing an instrument to assess health provider motivation at primary care level in rural Burkina Faso, Ghana and Tanzania. *Glob Health Action* **5**, 1-18 (2012). https://doi.org/10.3402/gha.v5i0.19120

35 Kak, N., Burkhalter, B. & Cooper, M.-A. *Measuring the competence of healthcare providers*, 2001).

36 Sipsma, H. L., Curry, L. A., Kakoma, J.-B., Linnander, E. L. & Bradley, E. H. Identifying characteristics associated with performing recommended practices in maternal and newborn care among health facilities in Rwanda: a cross-sectional study. *Human Resources for Health* **10**, 1-8 (2012).

37 Brown, C. in *Training for community health: Bridging the global health care gap* (eds Anne Geniets, James O'Donovan, Laura Hakimi, & Niall Winters) Ch. 10, (Oxford University Press, 2021).

38 Babalola, O., Goudge, J., Levin, J., Brown, C. & Griffiths, F. Assessing the Utility of a Quality-of-Care Assessment Tool Used in Assessing Comprehensive Care Services Provided by Community Health Workers in South Africa. *Frontiers in Public Health* **10** (2022).

39 Goudge, J. *et al.* Household coverage, quality and costs of care provided by community health worker teams and the determining factors: findings from a mixed methods study in South Africa. *BMJ open* **10**, e035578 (2020).

40 Rowe, A. K. *et al.* A multifaceted intervention to improve health worker adherence to integrated management of childhood illness guidelines in Benin. *American journal of public health* **99**, 837-846 (2009).

41 Nelson, B. D. *et al.* Evaluation of a novel training package among frontline maternal, newborn, and child health workers in South Sudan. *International Journal of Gynecology & Obstetrics* **119**, 130-135 (2012).

42 Abdel-All, M., Putica, B., Praveen, D., Abimbola, S. & Joshi, R. Effectiveness of community health worker training programmes for cardiovascular disease management in low-income and middle-income countries: a systematic review. *BMJ open* **7**, e015529 (2017).

43 Bates, R. A critical analysis of evaluation practice: the Kirkpatrick model and the principle of beneficence. *Evaluation and program planning* **27**, 341-347 (2004).

44 Kaufman, R. & Keller, J. M. Levels of evaluation: Beyond Kirkpatrick. *Human Resource Development Quarterly* **5** (1994).

45 Kirkpatrick, D. & Kirkpatrick, J. *Evaluating training programs: The four levels*. (Berrett-Koehler Publishers, 2006).

46 Ambu-Saidi, B., Fung, C., Turner, K. & Lim, A. A Critical Review on Training Evaluation Models: A Search for Future Agenda. *Journal of Cognitive Sciences and Human Development* **10**, 142-170 (2024).

47 Organization, W. H. *WHO guideline on health policy and system support to optimize community health worker programmes*. (World Health Organization, 2018).

48 Scott, K. *et al.* What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. *Human Resources for Health* **16**, 39 (2018). https://doi.org/10.1186/s12960-018-0304-x

49 Cometto, G. *et al.* Health policy and system support to optimise community health worker programmes: an abridged WHO guideline. *The Lancet Global Health* (2018).

50 South African Department of Health. *Policy Framework and Strategy for Ward-based Primary Healthcare Outreach Teams 2018/19 - 2023/24*, <https://rhap.org.za/wp-content/uploads/2018/04/Policy-WBPHCOT-4-April-2018-1.pdf> (2017).

51 Tesema, A. G. *et al.* Community health extension workers' training and supervision in Ethiopia: Exploring impact and implementation challenges for non-communicable disease service delivery. *PLOS Global Public Health* **2**, e0001160 (2022).

52 Donabedian, A. The quality of care: how can it be assessed? *Jama* **260**, 1743-1748 (1988).

53 Taylor, C. A., Lilford, R. J., Wroe, E., Griffiths, F. & Ngechu, R. The predictive validity of the Living Goods selection tools for community health workers in Kenya: cohort study. *BMC Health Services Research* **18**, 803 (2018). https://doi.org/10.1186/s12913-018-3620-x

54 Lehmann, U. & Gilson, L. Actor interfaces and practices of power in a community health worker programme: a South African study of unintended policy outcomes. *Health Policy Plan* **28** (2013).

55 Kinkel, H.-F., Marcus, T., Bam, N., Hugo, J. & Memon, S. Community oriented primary care in Tshwane District, South Africa: Assessing the first phase of implementation. *African Journal of Primary Health Care and Family Medicine* **5**, 1-9 (2013).

56 Taylor, D. C. & Taylor, C. E. in *Just and lasting change: When communities own their futures Historical Demonstrations* (eds Daniel C Taylor & Carl E Taylor) Ch. 7, 111-124 (John Hopkins Uiversity Press, 2016).

57 Newell, K. W. & World Health Organization. *Health by the people*. (World Health Organization, 1975).

58 Kirch, W. *Encyclopedia of Public Health: Volume 1: A-H Volume 2: I-Z*. (Springer Science & Business Media, 2008).

59 Hu, D. *et al.* Development of village doctors in China: financial compensation and health system support. *International Journal for Equity in Health* **16**, 1-7 (2017).

60 Sidel, V. W. The barefoot doctors of the People's Republic of China. *New England journal of medicine* **286**, 1292-1300 (1972).

61 King, M. *Medical Care in Developing Countries.* . (Oxford University Press, 1966).

62 Newell, K. W. *Helping people help themselves*. (World Health Organization, 1975).

63 Perry, H., Crigler, L. & Hodgins, S. Developing and strengthening community health worker programs at scale: a reference guide for program managers and policy makers. *Dhaka, Bangladesh: University Press Ltd* (2013).

64 van Ginneken, N., Lewin, S. & Berridge, V. The emergence of community health worker programmes in the late apartheid era in South Africa: An historical analysis. *Social Science & Medicine* **71**, 1110-1118 (2010).

65 Chopra, M., Munro, S., Lavis, J. N., Vist, G. & Bennett, S. Effects of policy options for human resources for health: an analysis of systematic reviews. *The Lancet* **371**, 668-674 (2008).

66 Lewin, S. *et al.* Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane database of systematic reviews* (2010).

67 Folz, R. & Ali, M. Task sharing in health workforce: an overview of community health worker programmes in Afghanistan. *Special issue on scaling up health workforce in the Eastern Mediterranean Region; Eastern Mediterranean Health Journal* **24** (2018). https://doi.org/ https://doi.org/10.26719/2018.24.9.940

68 UN Millennium Project. *Who's Got the Power? Transforming Health Systems for Women and Children. Task Force on Child Health and Maternal Health.*, (Earthscan; United Nations Development Programme, 2005).

69 World Health Organization. *Task shifting: rational redistribution of tasks among health workforce teams: global recommendations and guidelines*, <https://iris.who.int/bitstream/handle/10665/43821/9789241596312_eng.pdf> (2007).

70 World Health Organization. Task shifting to tackle health worker shortages. *Geneva: WHO* (2007).

71 Mundeva, H., Snyder, J., Ngilangwa, D. P. & Kaida, A. Ethics of task shifting in the health workforce: exploring the role of community health workers in HIV service delivery in low- and middle-income countries. *BMC Medical Ethics* **19**, 71 (2018). https://doi.org/10.1186/s12910-018-0312-3

72 World Health Organization. Declaration of alma-ata. (World Health Organization. Regional Office for Europe, 1978).

73 United Nations. *Transforming our World: The 2030 Agenda for Sustainable Development*, <https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981> (2015).

74 Schneider, H. & Lehmann, U. From Community Health Workers to Community Health Systems: Time to Widen the Horizon? *Health Systems & Reform* **2**, 112-118 (2016). https://doi.org/10.1080/23288604.2016.1166307

75 Perry, H. & Zulliger, R. (Johns Hopkins Bloomberg School of Public Health, Baltimore, 2012).

76 World Health Assembly. *Community health workers delivering primary health care: opportunities and challenges.*, <http://apps.who.int/gb/ebwha/pdf_files/WHA72/A72_R3-en.pdf.> (2019).

77 Campbell, J., Admasu, K., Soucat, A. & Tlou, S. Maximizing the impact of community-based practitioners in the quest for universal health coverage. *Bulletin of the World Health Organization* **93**, 590-590A (2015).

78 World Health Organization. (World Health Organization; Licence: CC BY-NC-SA 3.0 IGO, Geneva, 2018).

79 Crigler, L., Hill, K., Furth, R. & Bjerregaard, D. *Community Health Worker Assessment and Improvement Matrix (CHW AIM): a toolkit for improving CHW programs and services*. (University Research Corporation, 2011).

80 Campbell, J. *et al.* Universal truth: no health without a workforce. Forum Report, Third Global Forum on Human Resources for Health. (Global Health Workforce Alliance and World Health Organization, Recife, Brazil. Geneva 2013).

81 Rifkin, S. B. *Community health workers*. (Academic Press, 2008).

82 Lehmann, U. & Sanders, D. Community health workers: What do we know about them? The state of the evidence on programmes, activities, costs and impact on health outcomes of using community health workers. *Evidence and Information for Policy* **2** (2007).

83 Taylor, B., Mathers, J. & Parry, J. Who are community health workers and what do they do? Development of an empirically derived reporting taxonomy. *Journal of Public Health* **40**, 199-209 (2018).

84 Chin-Quee, D. *et al.* Balancing workload, motivation and job satisfaction in Rwanda: assessing the effect of adding family planning service provision to community health worker duties. *Reproductive Health* **13**, 2 (2015). https://doi.org/10.1186/s12978-015-0110-z

85 Olaniran, A., Smith, H., Unkels, R., Bar-Zeev, S. & van den Broek, N. Who is a community health worker? – a systematic review of definitions. *Global Health Action* **10**, 1272223 (2017). https://doi.org/10.1080/16549716.2017.1272223

86 International Labour Organisation. *International Standard Classification of Occupations (ISCO-08): structure, group definitions and correspondence tables.* , <http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf> (2012).

87 Lewin *et al.* Lay health workers in primary and community health care: A systematic review of trials. (2006).

88 Perry, H. (Maternal and Child Survival Program, 2020).

89 Hodgins, S. *et al.* Community health workers at the dawn of a new era: 1. Introduction: tensions confronting large-scale CHW programmes. *Health Research Policy and Systems* **19**, 1-21 (2021).

90 Schleiff, M. J., Aitken, I., Alam, M. A., Damtew, Z. A. & Perry, H. B. Community health workers at the dawn of a new era: 6. Recruitment, training, and continuing education. *Health Research Policy and Systems* **19**, 1-28 (2021).

91 Kardanmoghadam, V. *et al.* Determining patients' satisfaction level with hospital emergency rooms in Iran: a meta-analysis. *Global journal of health science* **7**, 260 (2014).

92 Nekoei Moghadam, M. *et al.* A qualitative study on human resources for primary health care in Iran. *The International journal of health planning and management* **33**, e38-e48 (2018).

93 Christopher, J. B., Le May, A., Lewin, S. & Ross, D. A. Thirty years after Alma-Ata: a systematic review of the impact of community health workers delivering curative interventions against malaria, pneumonia and diarrhoea on child mortality and morbidity in sub-Saharan Africa. *Human resources for health* **9**, 1-11 (2011).

94 Fortune, N., Madden, R., Riley, T. & Short, S. The International Classification of Health Interventions: an 'epistemic hub'for use in public health. *Health promotion international* **36**, 1753-1764 (2021).

95 Suri, A., Gan, K. & Carpenter, S. Voices from the field: perspectives from community health workers on health care delivery in rural KwaZulu-Natal, South Africa. *J Infect Dis* **196** (2007).

96 Perry, H., Zulliger, R. & Rogers, M. Community health workers in low-, middle- and high-income countries: an overview of their history, recent evolution, and current

effectiveness. *Annu Rev Public Health* **35** (2014). https://doi.org/10.1146/annurev-publhealth-032013-182354

97 Schneider, H., English, R., Tabana, H., Padayachee, T. & Orgill, M. Whole-system change: case study of factors facilitating early implementation of a primary health care reform in a South African province. *BMC Health Services Research* **14**, 609 (2014). https://doi.org/10.1186/s12913-014-0609-y

98 Mishra, S. R., Neupane, D., Preen, D., Kallestrup, P. & Perry, H. B. Mitigation of non-communicable diseases in developing countries with community health workers. *Globalization and Health* **11**, 1-5 (2015).

99 Neupane, D. *et al.* Effectiveness of a lifestyle intervention led by female community health volunteers versus usual care in blood pressure reduction (COBIN): an open-label, cluster-randomised trial. *The Lancet Global Health* **6**, e66-e73 (2018).

100 Gyawali, B. *et al.* Effectiveness of a female community health volunteer–delivered intervention in reducing blood glucose among adults with type 2 diabetes: An open-label, cluster randomized clinical trial. *JAMA network open* **4**, e2035799-e2035799 (2021).

101 Roland, K. B. *et al.* Use of community health workers and patient navigators to improve cancer outcomes among patients served by federally qualified health centers: a systematic literature review. *Health equity* **1**, 61-76 (2017).

102 van Ginneken, N. *et al.* Primary-level worker interventions for the care of people living with mental disorders and distress in low-and middle-income countries. *Cochrane database of systematic reviews* (2021).

103 Bhaumik, S., Moola, S., Tyagi, J., Nambiar, D. & Kakoti, M. Community health workers for pandemic response: a rapid evidence synthesis. *BMJ Glob Health* **5** (2020). https://doi.org/10.1136/bmjgh-2020-002769

104 Kaseje, N., Ranganathan, M., Magadi, M., Oria, K. & Haines, A. The effectiveness of rural community health workers in improving health outcomes during the COVID-19 pandemic: a systematic review. *Global health action* **17**, 2292385 (2024).

105 Zulu, J. M. *et al.* A scoping review of the roles, challenges, and strategies for enhancing the performance of community health workers in the response against COVID-19 in low- and middle-income countries. *BMC Primary Care* **26**, 163 (2025). https://doi.org/10.1186/s12875-025-02853-7

106 Chagula, W. & Tarimo, E. in *Health by the people* (ed KW Newell) (World Health Organization, 1975).

107 Cometto, G. *et al.* Health policy and system support to optimise community health worker programmes: an abridged WHO guideline. *The Lancet Global Health* **6**, e1397-e1404 (2018).

108 O'Donovan, J., O'Donovan, C., Kuhn, I., Sachs, S. E. & Winters, N. Ongoing training of community health workers in low-income and middle-income countries: a systematic scoping review of the literature. *BMJ open* **8** (2018).

109 Schneider, H., Besada, D., Daviaud, E., Sanders, D. & Rohde, S. Ward-based primary health care outreach teams in South Africa: developments, challenges and future directions. *South African Health Review* **2018**, 59-65 (2018).

110 Schneider, H., Hlophe, H. & van Rensburg, D. Community health workers and the response to HIV/AIDS in South Africa: tensions and prospects. *Health policy and Planning* **23**, 179-187 (2008).

111 Clarke, G. Non-governmental organizations (NGOs) and politics in the developing world. *Political studies* **46**, 36-52 (1998).

112 Gilson, L., Sen, P. D., Mohammed, S. & Mujinja, P. The potential of health sector non-governmental organizations: policy options. *Health policy and planning* **9**, 14-24 (1994).

113 Javanparast, S. *et al.* A policy review of the community health worker programme in Iran. *Journal of public health policy* **32**, 263-276 (2011).

114 Walker, P. R., Downey, S., Crigler, L. & LeBan, K. CHW "Principles of Practice". *Guiding principles for non-governmental organizations and their partners for coordinated national scale-up of community health worker programs* **21** (2013).

115 Redick, C. & Dini, H. *The current state of CHW training programs in SubSaharan Africa and South Asia: What we know what we dont know and what we need to do*, <http://1millionhealthworkers.org/files/2013/01/1mCHW_mPowering_LitReview_Formatted.compressed.pdf> (2014).

116 Malatji, H., Griffiths, F. & Goudge, J. Supportive supervision from a roving nurse mentor in a community health worker programme: a process evaluation in South Africa. *BMC Health Services Research* **22**, 1-12 (2022).

117 Gilson, L. *et al.* National community health worker programs: how can they be strengthened? *Journal of Public Health Policy* **10**, 518-532 (1989).

118 UNICEF/World Health Organization. *Management of sick children by community health workers: intervention models and programme examples*, <https://iris.who.int/bitstream/handle/10665/44226/9789280639858_eng.pdf> (2006).

119 Joubert, A. & Reid, M. Knowledge, skills, and training of community health workers to contribute to interprofessional education: a scoping review. *Journal of Interprofessional Care* **38**, 308-318 (2024).

120 Perry, H. & Zulliger, R. *How effective are community health workers? An overview of current evidence with recommendations for strengthening community health worker programs to accelerate progress in achieving the health-related Millennium Development Goals*. (Johns Hopkins Bloomberg School of Public Health, 2012).

121 Afzal, M. M., Pariyo, G. W., Lassi, Z. S. & Perry, H. B. Community health workers at the dawn of a new era: 2. Planning, coordination, and partnerships. *Health Research Policy and Systems* **19**, 1-17 (2021).

122 Tran, N. T., Portela, A., de Bernis, L. & Beek, K. Developing capacities of community health workers in sexual and reproductive, maternal, newborn, child, and adolescent health: a mapping and review of training resources. *PLoS One* **9**, e94948 (2014).

123 O'Brien, M. J., Squires, A. P., Bixby, R. A. & Larson, S. C. Role development of community health workers: an examination of selection and training processes in the intervention literature. *American journal of preventive medicine* **37**, S262-S269 (2009).

124 Ashwell, H. & Freeman, P. The clinical competency of community health workers in the eastern highlands province of Papua New Guinea. *Papua and New Guinea medical journal* **38**, 198-207 (1995).

125 Ande, O., Oladepo, O. & Brieger, W. R. Comparison of knowledge on diarrheal disease management between two types of community-based distributors in Oyo State, Nigeria. *Health education research* **19**, 110-113 (2004).

126 Tan, J.-P. & Nam, Y.-J. J. in *The Right Skills for the Job?: Rethinking Training Policies for Workers* (eds Rita Almeida, Jere Behrman, & David Robalino) 67 (World Bank, 2012).

127 Nam, Y. J. J. *Pre-employment skills development strategies in the OECD*. (World Bank, 2009).

128 Skills for Health. *Pre-Employment Best Practice in the Health Sector - A Framework for Employers*, <https://www.skillsforhealth.org.uk/images/resource-section/getting-good-people-into-hard-to-fill-entry-level-posts/pre-employment-best-practice-a.pdf> (

129 Urch, G. E. 503-505 (JSTOR, 1988).

130 World Health Organization. *Training for mid-level managers (MLM): module 4: supportive supervision*, <https://iris.who.int/bitstream/handle/10665/337056/9789240015692-eng.pdf> (2020).

131 Stellenberg, E., Van Zyl, M. & Eygelaar, J. Knowledge of community care workers about key family practices in a rural community in South Africa. *African Journal of Primary Health Care & Family Medicine* **7**, 1-7 (2015).

132 Wanduru, P. *et al.* The performance of community health workers in the management of multiple childhood infectious diseases in Lira, northern Uganda–a mixed methods cross-sectional study. *Global health action* **9**, 33194 (2016).

133 Sheikh, S. *et al.* Health care provider knowledge and routine management of pre-eclampsia in Pakistan. *Reproductive Health* **13**, 107-113 (2016).

134 Blacklock, C. *et al.* Impact of contextual factors on the effect of interventions to improve health worker performance in sub-Saharan Africa: review of randomised clinical trials. *PloS One* **11**, e0145206 (2016).

135 Leslie, H. H., Gage, A., Nsona, H., Hirschhorn, L. R. & Kruk, M. E. Training and supervision did not meaningfully improve quality of care for pregnant women or sick children in sub-Saharan Africa. *Health Affairs* **35**, 1716-1724 (2016).

136 WHO UNICEF. *WHO/UNICEF joint study on alternative approaches to meeting basic health needs of populations in developing countries*, <https://thedocs.worldbank.org/en/doc/720971630566653143-0560011975/original/WorldBankGroupArchivesFolder1649963.pdf> (1975).

137 Phommanivong, V., Thongkham, K., Deyer, G., Rene, J. P. & Barennes, H. An assessment of early diagnosis and treatment of malaria by village health volunteers in the Lao PDR. *Malaria Journal* **9**, 347 (2010). https://doi.org/10.1186/1475-2875-9-347

138 O'Donovan, J. *et al.* Costs and cost-effectiveness of community health worker programs focussed on HIV, TB and malaria infectious diseases in low- and middle-income countries (2015–2024): A scoping literature review. *PLOS Global Public Health* **5**, e0004596 (2025). https://doi.org/10.1371/journal.pgph.0004596

139 Shrestha, P. *et al.* Strengthening primary health care through community health workers in South Asia. *The Lancet Regional Health - Southeast Asia* **28**, 100463 (2024). https://doi.org/https://doi.org/10.1016/j.lansea.2024.100463

140 Bangladesh Ministry of Health and Welfare. *Bangladesh National strategy for Community Health workers (2019-2030)*, <https://www.healthynewbornnetwork.org/hnn-content/uploads/Bangladesh__Community-Health-Workers.pdf> (2019).

141 Buse, K. & Hawkes, S. Health in the sustainable development goals: ready for a paradigm shift? *Globalization and health* **11**, 1-8 (2015).

142 Mokwena, K., Mokgatle-Nthabu, M., Madiba, S., Lewis, H. & Ntuli-Ngcobo, B. Training of public health workforce at the National School of Public Health: meeting Africa's needs. *Bulletin of the World Health Organization* **85**, 949-954 (2007).

143 Schneider, H., Okello, D. & Lehmann, U. The global pendulum swing towards community health workers in low- and middle-income countries: a scoping review of trends, geographical distribution and programmatic orientations, 2005 to 2014. *Hum Resour Health* **14**, 65 (2016). https://doi.org/10.1186/s12960-016-0163-2

144 WHO UNICEF. *Caring for the newborn at home, a training course for community health workers*, <https://www.who.int/publications/i/item/9789241549295> (2012).

145 WHO UNICEF. *Caring for the sick child in the community*, <https://www.who.int/publications/i/item/9789241548045> (2011).

146 WHO. *Packages of interventions for family planning, safe abortion care, maternal, newborn and child health*, <https://www.who.int/publications/i/item/WHO-FCH-10.06> (2010).

147 The Partnership for Maternal, N. a. C. H., ,. *Essential interventions, commodities and guidelines for reproductive, maternal, newborn and child health*, <https://www.who.int/publications/i/item/essential-interventions-commodities-and-guidelines-for-reproductive-maternal-newborn-and-child-health> (2011).

148 Lee, L. K. *et al.* Workforce readiness training: a comprehensive training model that equips community health workers to work at the top of their practice and profession. *Frontiers in public health* **9**, 673208 (2021).

149 Holcomb, J., Ferguson, G. M., Thornton, L. & Highfield, L. Development of training curriculum to improve patient communication skills and social support among community health workers. *HLRP: Health Literacy Research and Practice* **6**, e142-e150 (2022).

150 Lehmann, U. & Sanders, D. in *Evidence and Information for Policy* (ed D. o H. R. f Health) (World Health Organization, 2007).

151 Teklehaimanot, H. D. & Teklehaimanot, A. Human resource development for a community-based health extension program: a case study from Ethiopia. *Human Resources for Health* **11**, 39 (2013). https://doi.org/10.1186/1478-4491-11-39

152 Karim, A. M., Admassu, K. & Schellenberg, J. Effect of Ethiopia's health extension program on maternal and newborn health care practices in 101 rural districts: a dose–response study. *PLoS One* **8** (2013). https://doi.org/10.1371/journal.pone.0065160

153 Karim, A. M., Tamire, A., Medhanyie, A. A. & Betemariam, W. Changes in equity of maternal, newborn, and child health care practices in 115 districts of rural Ethiopia: implications for the health extension program. *BMC Pregnancy Childbirth* **15**, 238 (2015). https://doi.org/10.1186/s12884-015-0668-z

154 Ameha, A. *et al.* Effectiveness of supportive supervision on the consistency of integrated community cases management skills of the health extension workers in 113 districts of Ethiopia. *Ethiopian medical journal* **52 Suppl 3**, 65-71 (2014).

155 Kitaw, Y., Ye-Ebiyo, Y., Said, A., Desta, H. & Teklehaimanot, A. Assessment of the training of the first intake of health extension workers. *Ethiop J Health Dev* **21** (2007).

156 Teklehaimanot, H. D. & Teklehaimanot, A. Human resource development for a community-based health extension program: a case study from Ethiopia. *Hum. Resour. Health* **11** (2013). https://doi.org/10.1186/1478-4491-11-39

157 Assefa, Y., Gelaw, Y. A., Hill, P. S., Taye, B. W. & Van Damme, W. Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. *Globalization and health* **15**, 1-11 (2019).

158 Daka, D. W., Wordofa, M. A., Woldie, M., Persson, L. Å. & Berhanu, D. Quality of clinical assessment and management of sick children by Health Extension Workers in four regions of Ethiopia: A cross-sectional survey. *PLoS One* **15**, e0239361 (2020).

159 Getachew, T., Mekonnen, S., Yitayal, M., Persson, L. A. & Berhanu, D. Health Extension Workers' diagnostic accuracy for common childhood illnesses in four regions of Ethiopia: a cross-sectional study. *Acta Paediatrica* **108**, 2100-2106 (2019).

160 Getahun, T. *et al.* Management of bacterial infections in young infants in Ethiopia: Facility preparedness, health workers' knowledge and quality of care. *Acta Paediatrica* **111**, 2178-2187 (2022).

161 Medhanyie, A., Spigt, M., Dinant, G. & Blanco, R. Knowledge and performance of the Ethiopian health extension workers on antenatal and delivery care: a cross-sectional study. *Human resources for health* **10**, 1-8 (2012).

162 Wang, H., Tesfaye, R., Ramana, G. N. & Chekagn, C. T. *Ethiopia health extension program: an institutionalized community approach for universal health coverage*. (World Bank Publications, 2016).

163 Karim, A. M. *et al.* Effect of Ethiopia's health extension program on maternal and newborn health care practices in 101 rural districts: a dose-response study. *PloS one* **8**, e65160 (2013).

164 Karim, A. M., Tamire, A., Medhanyie, A. A. & Betemariam, W. Changes in equity of maternal, newborn, and child health care practices in 115 districts of rural Ethiopia: implications for the health extension program. *BMC pregnancy and childbirth* **15**, 1-11 (2015).

165 Ameha, A. *et al.* Effectiveness of supportive supervision on the consistency of integrated community cases management skills of the health extension workers in 113 districts of Ethiopia. *Measurements* **52**, 65-71 (2013).

166 Campbell, S. M., Roland, M. O. & Buetow, S. A. Defining quality of care. *Social Science & Medicine* **51**, 1611-1625 (2000). https://doi.org/https://doi.org/10.1016/S0277-9536(00)00057-5

167 Agarwal, S. *et al.* A conceptual framework for measuring community health workforce performance within primary health care systems. *Human Resources for Health* **17**, 1-20 (2019).

168 Kok, M. *et al.* Community health workers at the dawn of a new era: 10. Programme performance and its assessment. *Health Research Policy and Systems* **19**, 1-14 (2021).

169 Donabedian, A. The quality of care. *Archives of pathology & laboratory medicine* **121**, 11 (1997).

170 Kok, M. C. *et al.* Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. *Health Policy and Planning* **30**, 1207-1227 (2015). https://doi.org/10.1093/heapol/czu126

171 Mainz, J. Defining and classifying clinical indicators for quality improvement. *International journal for quality in health care* **15**, 523-530 (2003).

172 Nemcek, M. A. & Sabatier, R. State of Evaluation: Community Health Workers. *Public Health Nursing* **20**, 260-270 (2003). https://doi.org/10.1046/j.1525-1446.2003.20403.x

173 Bosch–Capblanch, X. & Marceau, C. Training, supervision and quality of care in selected integrated community case management (iCCM) programmes: a scoping review of programmatic evidence. *Journal of global health* **4** (2014).

174 Hanefeld, J., Powell-Jackson, T. & Balabanova, D. Understanding and measuring quality of care: dealing with complexity. *Bulletin of the World Health Organization* **95**, 368 (2017).

175 Taylor, C. A., Lilford, R. J., Wroe, E., Griffiths, F. & Ngechu, R. The predictive validity of the Living Goods selection tools for community health workers in Kenya: cohort study. *BMC Health Serv Res* **18**, 803 (2018). https://doi.org/10.1186/s12913-018-3620-x

176 Ballard, M. & Montgomery, P. Systematic review of interventions for improving the performance of community health workers in low-income and middle-income countries. *BMJ Open* **7**, e014216 (2017). https://doi.org/10.1136/bmjopen-2016-014216

177 Smith, S. *et al.* Community health volunteer program functionality and performance in Madagascar: a synthesis of qualitative and quantitative assessments. (2013).

178 Agarwal, A., Gallo, M. & Finlay, A. *Evaluation of the Quality of Community Based Integrated Management of Childhood Illness and Reproductive Health Programs in Madagascar*, <https://www.urc-chs.com/sites/default/files/Madagascar_Eval_qual_comm_IMCI_CDC_Feb2013.pdf> (2013).

179 Gautham, M., Iyengar, M. S. & Johnson, C. W. Mobile phone–based clinical guidance for rural health providers in India. *Health informatics journal* **21**, 253-266 (2015).

180 Bailey, J. E. & Coombs, D. W. Effectiveness of an Indonesian model for rapid training of Guatemalan health workers in diarrhea case management. *J Community Health* **21**, 269-276 (1996). https://doi.org/10.1007/bf01794877

181 Winch, P. J. *et al.* Increases in correct administration of chloroquine in the home and referral of sick children to health facilities through a community-based intervention in Bougouni District, Mali. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **97**, 481-490 (2003).

182 Ayele, F., Desta, A. & Larson, C. The functional status of community health agents: a trial of refresher courses and regular supervision. *Health policy and planning* **8**, 379-384 (1993).

183 Carrón, J., Melian, M. & Leon, F. Final report of an operations research project:" Developing Tools of Low-Cost Use to Improve the Quality of Care of Rural CBD in Paraguay". (Subcontract CI91. 96A January 1 1992-July 31 1994. Participating agencies: Centro Paraguayo de Estudios de Poblacion (CEPEP) the Population Council/INOPAL II., 1994).

184 Andreoni, J., Callen, M., Khan, Y., Jaffar, K. & Sprenger, C. Using preference estimates to customize incentives: An application to polio vaccination drives in pakistan. Report No. 0898-2937, (National Bureau of Economic Research, 2016).

185 Ashraf, N., Bandiera, O. & Lee, S. S. *Do-gooders and go-getters: career incentives, selection, and performance in public service delivery*. (Citeseer, 2014).

186 Laurenzi, C. A. *et al.* The home visit communication skills inventory: Piloting a tool to measure community health worker fidelity to training in rural South Africa. *Research in Nursing & Health* **43**, 122-133 (2020).

187 Doyle, J. D., Webber, E. M. & Sidhu, R. S. A universal global rating scale for the evaluation of technical skills in the operating room. *The American Journal of Surgery* **193**, 551-555 (2007). https://doi.org/https://doi.org/10.1016/j.amjsurg.2007.02.003

188 Niitsu, H. *et al.* Using the Objective Structured Assessment of Technical Skills (OSATS) global rating scale to evaluate the skills of surgical trainees in the operating room. *Surgery Today* **43**, 271-275 (2013). https://doi.org/10.1007/s00595-012-0313-7

189 Adler, M. D. *et al.* Comparison of checklist and anchored global rating instruments for performance rating of simulated pediatric emergencies. *Simulation in Healthcare* **6**, 18-24 (2011).

190 Ilgen, J. S., Ma, I. W., Hatala, R. & Cook, D. A. A systematic review of validity evidence for checklists versus global rating scales in simulation-based assessment. *Med Educ* **49**, 161-173 (2015). https://doi.org/10.1111/medu.12621

191 Cardemil, C. V., Gilroy, K. E., Callaghan-Koru, J. A., Nsona, H. & Bryce, J. Comparison of methods for assessing quality of care for community case management of sick children: an application with community health workers in Malawi. *The American Journal of Tropical Medicine and Hygiene* **87**, 127 (2012).

192 Agarwal, S. *et al.* Setting the global research agenda for community health systems: literature and consultative review. *Human resources for health* **17**, 1-8 (2019).

193 Agarwal, A., Gallo, M. & Finlay, A. Evaluation of the quality of community based integrated management of childhood illness and reproductive health programs in Madagascar: Prepared for the United States Agency for International Development through the President's Malaria Initiative. *Published for CDC by the USAID Health Care Improvement Project. Chevy Chase, MD: University Research Co., LLC* (2013).

194 Bossuroy, T., Delavallade, C. & Pons, V. Fighting tuberculosis through community based counsellors: a randomized evaluation of performance based incentives in India. *New Delhi: International Initiative for Impact Evaluation* (2016).

195 Kawakatsu, Y. *et al.* Individual and contextual factors associated with community health workers' performance in Nyanza Province, Kenya: a multilevel analysis. *BMC Health Services Research* **15**, 1-10 (2015).

196 Kelkar, S. & Mahapatro, M. Community health worker: a tool for community empowerment. *Health Popul Perspect Issues* **37**, 57-65 (2014).

197 Njororai, F., Ganu, D., Nyaranga, K. C. & Wilberforce, C. Role of Socio-Demographic and Environmental Determinants on Performance of Community Health Workers in Western Kenya. *International Journal of Environmental Research and Public Health* **18**, 11707 (2021).

198 Topno, H. Evaluation of training and development: An analysis of various models. *Journal of Business and Management* **5**, 16-22 (2012).

199 Alvarez, K., Salas, E. & Garofano, C. M. An integrated model of training evaluation and effectiveness. *Human Resource Development Review* **3**, 385-416 (2004).

200 Seneviratne, S. *et al.* Characteristics and outcomes of community health worker training to improve the prevention and control of cardiometabolic diseases in low and middle-income countries: A systematic review. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing* **59**, 00469580221112834 (2022).

201 Chaya, P. & Urassa, D. Integration of community health workers into a formal health system of Tanzania-measuring satisfaction on the training program using Kirk Patrick Model. *Global Journal of Human-Social Science* **18**, 1-7 (2018).

202 Chaya, P. S. *Satisfaction of community health worker-students with the training program at Kahama and Shirati Health Institutes in Tanzania* Master's thesis, Muhimbili University of Health and Allied Sciences, (2017).

203 Zaman, S. B. *et al.* Development and evaluation of a training program on non-communicable diseases to empower community health workers in rural India. *PEC Innovation*, 100305 (2024).

204 Alliger, G. M. & Janak, E. A. Kirkpatrick's levels of training criteria: Thirty years later. *Personnel psychology* **42**, 331-342 (1989).

205 Alliger, G. M., Tannenbaum, S. I., Bennett Jr, W., Traver, H. & Shotland, A. A meta-analysis of the relations among training criteria. *Personnel psychology* **50**, 341-358 (1997).

206 Holton III, E. F. The flawed four-level evaluation model. *Human Resource Development Quarterly* **7**, 5-21 (1996).

207 Brinkerhoff, R. O. An integrated evaluation model for HRD. *Training & Development Journal* **42**, 66-69 (1988).

208 Brewer, T. *Use of Phillips' Five Level Training Evaluation and Return on Investment Framework in the US Non-profit Sector* Doctoral thesis, University of North Texas, (2007).

209 Coovadia, H., Jewkes, R., Barron, P., Sanders, D. & McIntyre, D. The health and health system of South Africa: historical roots of current public health challenges. *Lancet* **374** (2009). https://doi.org/10.1016/s0140-6736(09)60951-x

210 National Department of Health. *National Strategic Plan 2010/11-2012/13.*, <https://www.mm3admin.co.za/documents/docmanager/2D5ED792-878C-4371-9575-8281A96BBB26/00023294.pdf> (2010).

211 Orgill, M. *et al.* A qualitative study of the dissemination and diffusion of innovations: bottom up experiences of senior managers in three health districts in South Africa. *International journal for equity in health* **18**, 1-15 (2019).

212 Byleveld, S., Haynes, R., Bhana, R., Dudley, L. & Barron, P. District management study: a review of structures, competences and training interventions to strengthen district management in the national health system of South Africa. *Durban: Health Systems Trust* (2009).

213 Nxumalo, N., Goudge, J. & Thomas, L. Outreach services to improve access to health care in South Africa: lessons from three community health worker programmes. *Global health action* **6**, 19283 (2013).

214 Gray, A. & Vawda, Y. *Health Legislation and Policy.* . (Health Systems Trust, 2018).

215 Mungazi, D. A. & Walker, L. K. *Educational reform and the transformation of Southern Africa*. (Greenwood Publishing Group, 1997).

216 Mpanza, M. N. *A case study of teachers' implementation of the grade four natural sciences curriculum* MASTER OF EDUCATION DEGREE thesis, University of KwaZulu-Natal, (2014).

217 Stevenson, S. *Community health workers: A Spotlight in-depth feature*, <https://www.spotlightnsp.co.za/2016/11/30/community-health-workers-spotlight-depth-feature/> (2015).

218 Goudge, J. *et al.* The effect of a roving nurse mentor on household coverage and quality of care provided by community health worker teams in South Africa: a longitudinal study with a before, after and 6 months post design. *BMC Health Services Research* **23**, 1-11 (2023).

219 Tseng, Y.-h. *et al.* Integrating community health workers into the formal health system to improve performance: a qualitative study on the role of on-site supervision in the South African programme. *BMJ Open* **9**, e022186 (2019).

220 Cleary, K. *Health Department to improve salaries for community health workers*, <https://www.grocotts.co.za/2019/03/07/health-department-to-improve-salaries-for-community-health-workers/> (2019).

221 Mutandiro, K. *Community health workers blockade Gauteng Department of Health*, <https://www.groundup.org.za/article/health-care-workers-disrupt-gauteng-department-health/> (2019).

222 Murphy, J. P. *et al.* Community health worker models in South Africa: a qualitative study on policy implementation of the 2018/19 revised framework. *Health Policy and Planning* **36**, 384-396 (2021).

223 South Africa National Department of Health. *2024 Community Health Worker (CHW) Training Materials for Foundation Phase*, <https://knowledgehub.health.gov.za/elibrary/2024-community-health-worker-chw-training-materials-foundation-phase> (2024).

224 I-TECH. *I-TECH Launches In-Service Skills Development Program for Health Workers in South Africa*, <https://www.go2itech.org/2019/06/i-tech-launches-in-service-skills-development-program-for-health-workers-in-south-africa/> (2019).

225 Mantell, J. E. *et al.* " They are our eyes outside there in the community": Implementing enhanced training, management and monitoring of South Africa's ward-based primary healthcare outreach teams. *Plos one* **17**, e0266445 (2022).

226 Abdel-All, M. *et al.* Evaluation of a training program of hypertension for accredited social health activists (ASHA) in rural India. *BMC health services research* **18**, 1-11 (2018).

227 Reio Jr, T. G., Rocco, T. S., Smith, D. H. & Chang, E. A critique of Kirkpatrick's evaluation model. *New Horizons in Adult Education and Human Resource Development* **29**, 35-53 (2017).

228 Masis, L., Gichaga, A., Zerayacob, T., Lu, C. & Perry, H. B. Community health workers at the dawn of a new era: 4. Programme financing. *Health Research Policy and Systems* **19**, 107 (2021). https://doi.org/10.1186/s12961-021-00751-9

229 Admon, A. J. *et al.* Assessing and improving data quality from community health workers: a successful intervention in Neno, Malawi. *Public Health Action* **3**, 56-59 (2013). https://doi.org/10.5588/pha.12.0071

230 Eseryel, D. Approaches to evaluation of training: Theory & practice. *Journal of Educational Technology & Society* **5**, 93-98 (2002).

231 Van Der Vleuten, C. P. The assessment of professional competence: developments, research and practical implications. *Advances in Health Sciences Education* **1**, 41-67 (1996).

232 Wass, V., Van der Vleuten, C., Shatzer, J. & Jones, R. Assessment of clinical competence. *The lancet* **357**, 945-949 (2001).

233 Lynn, M. R. Determination and quantification of content validity. *Nursing research* (1986).

234 Polit, D. F. & Beck, C. T. The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health* **29**, 489-497 (2006).

235 Griffiths, F. *et al.* Development of a tool for assessing quality of comprehensive care provided by community health workers in a community-based care programme in South Africa. *BMJ Open* **9**, e030677 (2019).

236 Goudge, J. *et al.* Household coverage, quality and costs of care provided by community health worker teams and the determining factors: findings from a mixed methods study in South Africa. *BMJ Open* **10**, e035578 (2020). https://doi.org/10.1136/bmjopen-2019-035578

237 Munn, Z. *et al.* Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology* **18**, 143 (2018). https://doi.org/10.1186/s12874-018-0611-x

238 National Department of Health. (Government printers Pretoria, 2020).

239 National Planning Commission. *National Development Plan 2030: our future–make it work*, <https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf> (2012).

240 *Sedibeng District Profile and Analysis. District development model*, <https://www.cogta.gov.za/ddm/wp-content/uploads/2020/11/Sedibeng-October-2020.pdf> (

241 *Tshwane District Profile and Analysis. District development model*, <https://www.cogta.gov.za/ddm/wp-content/uploads/2020/08/2nd-Take_Final_DistrictProfile_TSHWANE2306-1-002> (

242 *Ehlanzeni District Profile and Analysis. District development model*, <https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf> (

243 Seekings, J. *Social stratification and inequality in South Africa at the end of apartheid* <https://open.uct.ac.za/server/api/core/bitstreams/a7c4bdf6-3fff-44bb-86fe-5f36ca4e54ab/content> (2003).

244 Medcalf, A. & Nunes, J. Visualising primary health care: World Health Organization representations of community health workers, 1970–89. *Medical history* **62**, 401-424 (2018).

245 De Koning, K. *et al.* A common analytical framework on factors influencing performance of close-to-community providers. *KIT Royal Tropical Institute* **78** (2014).

246 Kane, S. *et al.* Limits and opportunities to community health worker empowerment: a multi-country comparative study. *Social Science & Medicine* **164**, 27-34 (2016).

247 McCollum, R. *et al.* Exploring perceptions of community health policy in Kenya and identifying implications for policy change. *Health policy and planning* **31**, 10-20 (2016).

248 Bhutta, Z. A., Lassi, Z. S., Pariyo, G. & Huicho, L. Global experience of community health workers for delivery of health related millennium development goals: a systematic review, country case studies, and recommendations for integration into national health systems. *Global health workforce Alliance* **1**, 61 (2010).

249 Angwenyi, V. *et al.* Moving to a strong (er) community health system: analysing the role of community health volunteers in the new national community health strategy in Malawi. *BMJ global health* **3**, e000996 (2018).

250 Chin-Quee, D. *et al.* Balancing workload, motivation and job satisfaction in Rwanda: assessing the effect of adding family planning service provision to community health worker duties. *Reproductive health* **13**, 1-7 (2015).

251 Schneider, H., Schaay, N., Dudley, L., Goliath, C. & Qukula, T. The challenges of reshaping disease specific and care oriented community based services towards

comprehensive goals: a situation appraisal in the Western Cape Province, South Africa. *BMC health services research* **15**, 1-11 (2015).

252 Najafizada, S. A. M., Labonté, R. & Bourgeault, I. L. Community health workers of Afghanistan: a qualitative study of a national program. *Conflict and health* **8**, 1-16 (2014).

253 South African Department of Health. *Coronavirus lockdown: Healthcare sector regulations fact sheet*, <https://www.gov.za/sites/default/files/gcis_documents/20200418_Regulations%20on%20the%20Healthcare%20Sector%20Fact%20Sheet.pdf> (2020).

254 World Health Organization. *Community-based health care, including outreach and campaigns, in the context of the COVID-19 pandemic: interim guidance*, <Community-based health care, including outreach and campaigns, in the context of the COVID-19 pandemic (who.int)> (2020).

255 Jha, N. *India's first line of defense against the coronavirus is an army of 900,000 women without masks or hand sanitizer*, <https://www.buzzfeednews.com/article/nishitajha/india-coronaviruscases-ashas > (2020).

256 Salve, S. *et al.* Community health workers and Covid-19: Cross-country evidence on their roles, experiences, challenges and adaptive strategies. *PLOS Global Public Health* **3**, e0001447 (2023).

257 Hodges, M., Butler, D., Spaulding, A. & Litzelman, D. K. The role of community health workers in the health and well-being of vulnerable older adults during the COVID pandemic. *International Journal of Environmental Research and Public Health* **20**, 2766 (2023).

258 Mabunda, D. *et al.* Perceptions of Community Health Workers (CHW) on barriers and enablers to care for people with psychosis in rural Mozambique: findings of a focus group discussion study using the Capability, Opportunity, Motivation and Behaviour framework (COM-B framework). *Human Resources for Health* **20**, 44 (2022).

259 Scott, K. *et al.* What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. *Human resources for health* **16**, 1-17 (2018).

260 O'Donovan, J., O'Donovan, C., Kuhn, I., Sachs, S. E. & Winters, N. Ongoing training of community health workers in low-income and middle-income countries: a systematic scoping review of the literature. *BMJ open* **8**, e021467 (2018).

261 Vawda, Y. & Gray, A. (eds L Rispel & A Padarath) (Health Systems Trust, 2018).

262 Popay, J. *et al.* Guidance on the conduct of narrative synthesis in systematic reviews. *A product from the ESRC methods programme Version* **1**, b92 (2006).

263 Lisy, K. & Porritt, K. Narrative synthesis: considerations and challenges. *JBI Evidence Implementation* **14**, 201 (2016).

264 Page, M. J. *et al.* The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Bmj* **372** (2021).

265 Lariosa, T. The role of community health workers in malaria control in the Philippines. *The Southeast Asian journal of tropical medicine and public health* **23**, 30-35 (1992).

266 Sharma, R., Webster, P. & Bhattacharyya, S. Factors affecting the performance of community health workers in India: a multi-stakeholder perspective. *Global Health Action* **7**, 25352 (2014).

267 Ewald, H. *et al.* Searching two or more databases decreased the risk of missing relevant studies: a metaresearch study. *Journal of clinical epidemiology* **149**, 154-164 (2022).

268 Higgins, J. *et al.* Cochrane handbook for systematic reviews of onterventions version 6.4 (updated August 2023). Cochrane, 2023. *Available from www. training. cochrane. org/handbook* (2023).

269 Thomas, H., Ciliska, D., Micucci, S., Wilson-ABra, J. & Dobbins, M. *Effective public health practice project (EPHPP)*, <https://merst.healthsci.mcmaster.ca/wp-content/uploads/2022/08/quality-assessment-tool_2010.pdf> (1999).

270 Dynes, M. *et al.* Strengthening maternal and newborn health in rural Ethiopia: early results from frontline health worker community maternal and newborn health training. *Midwifery* **29**, 251-259 (2013).

271 Gobezayehu, A. G. *et al.* Knowledge and skills retention among frontline health workers: community maternal and newborn health training in rural Ethiopia. *Journal of Midwifery & Women's Health* **59**, S21-S31 (2014).

272 Udani, R. H., Chothani, S., Arora, S. & Kulkarni, C. Evaluation of knowledge and efficiency of anganwadi workers. *The Indian Journal of Pediatrics* **47**, 289-292 (1980).

273 Sharma, S. *et al.* Evaluation of a training program for life skills education and financial literacy to community health workers in India: a quasi-experimental study. *BMC Health Services Research* **21**, 1-10 (2021).

274 Ebbs, D., Benson, O., Jasicki, S., McCollum, S. & Cappello, M. The Laro Kwo Project: A train the trainer model combined with mobile health technology for community health workers in Northern Uganda. *PLOS Global Public Health* **3**, e0001290 (2023).

275 Van Roosmalen, J. & van Roosmalen-Wiebenga, M. Effectiveness of seminars in training rural health workers. *Tropical doctor* **16**, 90-92 (1986).

276 Soremekun, S. *et al.* Improving outcomes for children with malaria, diarrhoea and pneumonia in Mozambique: A cluster randomised controlled trial of the inSCALE technology innovation. *PLOS digital health* **2**, e0000235 (2023).

277 Melo e Lima, T. R. d., Maia, P. F. C. d. M. D., Valente, E. P., Vezzini, F. & Tamburlini, G. Effectiveness of an action-oriented educational intervention in ensuring long term improvement of knowledge, attitudes and practices of community health workers in maternal and infant health: a randomized controlled study. *BMC medical education* **18**, 1-13 (2018).

278 Knettel, B. A., Slifko, S. E., Inman, A. G. & Silova, I. Training community health workers: an evaluation of effectiveness, sustainable continuity, and cultural humility in an educational program in rural Haiti. *International Journal of Health Promotion and Education* **55**, 177-188 (2017).

279 Kelly, J. M. *et al.* Community health worker performance in the management of multiple childhood illnesses: Siaya District, Kenya, 1997–2001. *American journal of public health* **91**, 1617-1624 (2001).

280 Uzochukwu, B. *et al.* Integrated management of childhood illness in Nigeria: Does short-term training of health workers improve their performance? *Public Health* **122**, 367 (2008).

281 Rowe, S. Y. *et al.* Effect of multiple interventions on community health workers' adherence to clinical guidelines in Siaya district, Kenya. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **101**, 188-202 (2007).

282 World Health Organization. *Health facility survey: tool to evaluate the quality of care delivered to sick children attending outpatient facilities*, <https://iris.who.int/bitstream/handle/10665/42643> (2003).

283 Hodgins, S. *et al.* Community health workers at the dawn of a new era: 1. Introduction: tensions confronting large-scale CHW programmes. *Health Research Policy and Systems* **19**, 109 (2021). https://doi.org/10.1186/s12961-021-00752-8

284 Kok, M. C. *et al.* Which intervention design factors influence performance of community health workers in low-and middle-income countries? A systematic review. *Health Policy and Planning* **30**, 1207-1227 (2015). https://doi.org/10.1093/heapol/czu126

285 Kok, M. C. *et al.* How does context influence performance of community health workers in low-and middle-income countries? Evidence from the literature. *Health research policy and systems* **13**, 1-14 (2015).

286 LeBan, K., Kok, M. & Perry, H. B. Community health workers at the dawn of a new era: 9. CHWs' relationships with the health system and communities. *Health Research Policy and Systems* **19**, 1-19 (2021).

287 Kok, M. C. *et al.* Performance of community health workers: situating their intermediary position within complex adaptive health systems. *Human Resources for Health* **15**, 59 (2017). https://doi.org/10.1186/s12960-017-0234-z

288 Colvin, C. J., Hodgins, S. & Perry, H. B. Community health workers at the dawn of a new era: 8. Incentives and remuneration. *Health Research Policy and Systems* **19**, 1-25 (2021).

289 Lee, L., Montgomery, S., Gamboa-Maldonado, T., Nelson, A. & Belliard, J. C. Perceptions of organizational readiness for training and implementation of clinic-based community health workers. *Journal of health organization and management* **33**, 478-487 (2019).

290 Kok, M. C. *et al.* Does supportive supervision enhance community health worker motivation? A mixed-methods study in four African countries. *Health Policy and Planning* **33**, 988-998 (2018).

291 Nkomazana, O., Mash, R., Wojczewski, S., Kutalek, R. & Phaladze, N. How to create more supportive supervision for primary healthcare: lessons from Ngamiland district of Botswana: co-operative inquiry group. *Global health action* **9**, 31263 (2016).

292 Assegaai, T. & Schneider, H. National guidance and district-level practices in the supervision of community health workers in South Africa: a qualitative study. *Human Resources for Health* **17**, 1-10 (2019).

293 Peach, J. & Horner, N. (SAGE Publications, 2007).

294 Westgate, C., Musoke, D., Crigler, L. & Perry, H. B. Community health workers at the dawn of a new era: 7. Recent advances in supervision. *Health Research Policy and Systems* **19**, 1-18 (2021).

295 Nakibaala, G. *et al.* An evaluation of a peer supervision pilot project among community health workers in rural Uganda. *African Health Sciences* **22**, 647-656 (2022). https://doi.org/10.4314/ahs.v22i2.74

296 Hill, Z. *et al.* Supervising community health workers in low-income countries–a review of impact and implementation issues. *Global health action* **7**, 24085 (2014).

297 Henry, J. V. in *Training for community health: Bridging the global health care gap* (eds Anne Geniets, James O'Donovan, Laura Hakimi, & Niall Winters) (Oxford University Press, 2021).

298 Early, J., Gonzalez, C., Gordon-Dseagu, V. & Robles-Calderon, L. Use of mobile health (mHealth) technologies and interventions among community health workers globally: a scoping review. *Health promotion practice* **20**, 805-817 (2019).

299 Mahmood, H. *et al.* Community health worker-based mobile health (mHealth) approaches for improving management and caregiver knowledge of common childhood infections: a systematic review. *Journal of global health* **10** (2020).

300 Ebbs, D., Hirschbaum, J. H., Mika, A., Matsushita, S. C. & Lewis, J. H. Expanding medical education for local health promoters among remote communities of the Peruvian Amazon: An exploratory study of an innovative program model. *Advances in Medical Education and Practice*, 215-223 (2020).

301 Agarwal, S. *et al.* Mobile technology in support of frontline health workers. *John Hopkins Univ Glob mHealth Initiat* **2016**, 86 (2016).

302 Winters, N., Langer, L. & Geniets, A. Scoping review assessing the evidence used to support the adoption of mobile health (mHealth) technologies for the education and training of community health workers (CHWs) in low-income and middle-income countries. *BMJ open* **8**, e019827 (2018).

303 Kruk, M. E. *et al.* High-quality health systems in the Sustainable Development Goals era: time for a revolution. *The Lancet global health* **6**, e1196-e1252 (2018).

304 McCambridge, J., Butor-Bhavsar, K., Witton, J. & Elbourne, D. Can research assessments themselves cause bias in behaviour change trials? A systematic review of evidence from Solomon 4-group studies. *PLoS One* **6**, e25223 (2011).

305 Plowright, A. *et al.* Formative evaluation of a training intervention for community health workers in South Africa: A before and after study. *PloS one* **13**, e0202817 (2018).

306 Yudkowsky, R., Park, Y. S. & Downing, S. M. *Assessment in health professions education*. (Routledge New York, 2019).

307 Nundy, S., Kakar, A. & Bhutta, Z. A. in *How to Practice Academic Medicine and Publish from Developing Countries? A Practical Guide* (eds Samiran Nundy, Atul Kakar, & Zulfiqar A. Bhutta) 393-404 (Springer Nature Singapore, 2022).

308 Baartman, L. K., Bastiaens, T. J., Kirschner, P. A. & Van der Vleuten, C. P. The wheel of competency assessment: Presenting quality criteria for competency assessment programs. *Studies in educational evaluation* **32**, 153-170 (2006).

309 Hodgins, S. *et al.* Comparing apples with apples: A proposed taxonomy for "Community Health Workers" and other front-line health workers for international comparisons. *PLOS Glob Public Health* **5**, e0004156 (2025). https://doi.org/10.1371/journal.pgph.0004156

310 Kumaravel, B. *et al.* A systematic review and taxonomy of tools for evaluating evidence-based medicine teaching in medical education. *Systematic reviews* **9**, 1-12 (2020).

311 Chaudhary, N., Mohanty, P. & Sharma, M. Integrated management of childhood illness (IMCI) follow-up of basic health workers. *The Indian Journal of Pediatrics* **72**, 735-739 (2005).

312 Shrivastava, S. R. & Shrivastava, P. S. Evaluation of trained Accredited Social Health Activist (ASHA) workers regarding their knowledge, attitude and practices about child health. *Rural and remote health* **12**, 1-7 (2012).

313 Shah, S. *et al.* The role of an mH ealth intervention in improving knowledge and skills of accredited social health activists in tribal areas of Gujarat, India: a nested study within an implementation research trial. *Acta Paediatrica* **107**, 72-79 (2018).

314 Shewade, H. D., Aggarwal, A. K. & Bharti, B. Integrated Management of Neonatal and Childhood Illness (IMNCI): skill assessment of health and Integrated Child Development

Scheme (ICDS) workers to classify sick under-five children. *The Indian Journal of Pediatrics* **80**, 448-454 (2013).

315 Rowe, S. *et al.* Longitudinal analysis of community health workers' adherence to treatment guidelines, Siaya, Kenya, 1997–2002. *Tropical Medicine & International Health* **12**, 651-663 (2007).

316 Horwood, C. *et al.* A continuous quality improvement intervention to improve the effectiveness of community health workers providing care to mothers and children: a cluster randomised controlled trial in South Africa. *Human resources for health* **15**, 1-11 (2017).

317 Uwimana, J., Zarowsky, C., Hausler, H. & Jackson, D. Training community care workers to provide comprehensive TB/HIV/PMTCT integrated care in KwaZulu-Natal: lessons learnt. *Tropical medicine & international health* **17**, 488-496 (2012).

318 Miller, N. P. *et al.* Assessment of the impact of quality improvement interventions on the quality of sick child care provided by Health Extension Workers in Ethiopia. *Journal of global health* **6** (2016).

319 Billah, S. M. *et al.* Feasibility of engaging "Village Doctors" in the Community-based Integrated Management of Childhood Illness (C-IMCI): experience from rural Bangladesh. *Journal of Global Health* **8** (2018).

320 Puett, C., Coates, J., Alderman, H., Sadruddin, S. & Sadler, K. Does greater workload lead to reduced quality of preventive and curative care among community health workers in Bangladesh? *Food and Nutrition Bulletin* **33**, 273-287 (2012).

321 Musoke, D. *et al.* Performance of community health workers and associated factors in a rural community in Wakiso district, Uganda. *African Health Sciences* **19**, 2784-2797 (2019).

322 Langston, A. *et al.* Testing a simplified tool and training package to improve integrated Community Case Management in Tanganyika Province, Democratic Republic of Congo: a quasi-experimental study. *Journal of Global Health* **9** (2019).

323 Gilroy, K. E. *et al.* Quality of sick child care delivered by Health Surveillance Assistants in Malawi. *Health policy and planning* **28**, 573-585 (2013).

324 Rabbani, F. *et al.* Health workers' perspectives, knowledge and skills regarding community case management of childhood diarrhoea and pneumonia: a qualitative

inquiry for an implementation research project “Nigraan” in District Badin, Sindh, Pakistan. *BMC health services research* **16**, 1-10 (2016).

325 Shelley, K. D. *et al.* Can volunteer community health workers manage multiple roles? An interrupted time-series analysis of combined HIV and maternal and child health promotion in Iringa, Tanzania. *Health policy and planning* **33**, 1096-1106 (2018).

326 Marsh, D., Guenther, T., Sadruddin, S., Vijayrhagavan, J. & Koepsell, J. Tools to introduce community case management (CCM) of serious childhood infection. *Washington: Save the Children* (2011).

327 Bhattacharyya, K., Winch, P., LeBan, K. & Tien, M. *Community health worker incentives and disincentives: how they affect motivation, retention, and sustainability*. (BASICS II Arlington, VA, 2001).

328 Irfan, O., Khan, A. M. & Bhutta, Z. A. in *Manson's Tropical Diseases (Twenty-Fourth Edition)* (eds Jeremy Farrar *et al.*) 1205-1220 (Elsevier, 2024).

329 McGready, R., Mola, G., Rijken, M. J., Nosten, F. H. & Mutabingwa, T. in *Manson's Tropical Diseases (Twenty-Fourth Edition)* (eds Jeremy Farrar *et al.*) 1188-1204 (Elsevier, 2024).

330 Madaj, B., Smith, H., Mathai, M., Roos, N. & Van Den Broek, N. Developing global indicators for quality of maternal and newborn care: a feasibility assessment. *Bulletin of the World Health Organization* **95**, 445 (2017).

331 World Health Organization. *Consultation on improving measurement of the quality of maternal, newborn and child care in health facilities*. iv, 38 p. (World Health Organization, 2014).

332 Quach, A. *et al.* Assessing the quality of care for children attending health facilities: a systematic review of assessment tools. *BMJ Global Health* **6**, e006804 (2021).

333 Shaneyfelt, T. *et al.* Instruments for evaluating education in evidence-based practice: a systematic review. *Jama* **296**, 1116-1127 (2006).

334 Koh, L. C. Refocusing formative feedback to enhance learning in pre-registration nurse education. *Nurse Education in Practice* **8**, 223-230 (2008).

335 Koh, L. C. Academic staff perspectives of formative assessment in nurse education. *Nurse education in practice* **10**, 205-209 (2010).

336 Msosa, A., Bruce, J. & Crouch, R. Effect of a formative assessment intervention on nursing skills laboratory learning in a resource-constrained country. *Nurse Education Today* **97**, 104677 (2021).

337 O'Shaughnessy, S. M. & Joyce, P. Summative and Formative Assessment in Medicine: The Experience of an Anaesthesia Trainee. *International Journal of Higher Education* **4**, 198-206 (2015).

338 Shahedi, F. *et al.* A new method of "student-centered formative assessment" and improving students' performance: An effort in the health promotion of community. *Journal of Education and Health Promotion* **9**, 136 (2020).

339 Miranda, A. V. *et al.* Professionalisation of Community Health Workers: Time for a Formal Contract. *The International Journal of Health Planning and Management* (2025).

340 Naal, H. *et al.* Evaluating a capacity building program on women's health for displaced community health workers in fragile settings in Lebanon. *Human Resources for Health* **19**, 1-16 (2021).

341 Josiah Willock, R., Mayberry, R. M., Yan, F. & Daniels, P. Peer training of community health workers to improve heart health among African American women. *Health promotion practice* **16**, 63-71 (2015).

342 Cahapay, M. Kirkpatrick model: Its limitations as used in higher education evaluation. *International Journal of Assessment Tools in Education* **8**, 135-144 (2021).

343 Regehr, G., MacRae, H., Reznick, R. & Szalay, D. Comparing the psychometric properties of checklists and global rating scales for assessing performance on an OSCE-format examination. *Academic Medicine* **73**, 993-997 (1998).

344 Ma, I. W. *et al.* Comparing the use of global rating scale with checklists for the assessment of central venous catheterization skills using simulation. *Advances in health sciences education* **17**, 457-470 (2012).

345 Seo, S., Thomas, A. & Uspal, N. G. A Global Rating Scale and Checklist Instrument for Pediatric Laceration Repair. *MedEdPORTAL* **15** (2019).

346 Brouwers, M. C. *et al.* The Global Rating Scale complements the AGREE II in advancing the quality of practice guidelines. *Journal of Clinical Epidemiology* **65**, 526-534 (2012). https://doi.org/https://doi.org/10.1016/j.jclinepi.2011.10.008

347 Tavares, W., Boet, S., Theriault, R., Mallette, T. & Eva, K. W. Global Rating Scale for the Assessment of Paramedic Clinical Competence. *Prehospital Emergency Care* **17**, 57-67 (2013). https://doi.org/10.3109/10903127.2012.702194

348 Gerard, J. M. *et al.* Validation of global rating scale and checklist instruments for the infant lumbar puncture procedure. *Simulation in Healthcare* **8**, 148-154 (2013).

349 MacRae, H. M. *et al.* Comparing checklists and databases with physicians' ratings as measures of students' history and physical-examination skills. *Academic Medicine* (1995).

350 Parchman, M. L., Romero, R. L. & Pugh, J. A. Encounters by patients with type 2 diabetes—complex and demanding: an observational study. *The Annals of Family Medicine* **4**, 40-45 (2006).

351 Crabtree, B. F., MILLER, W. L. & Stange, K. C. Understanding practice from the ground up. *Journal of Family Practice* **50**, 881-881 (2001).

352 Department of Health, R. o. S. A. CHW Training Manual Phase 1. (Department of Health, Republic of South AFrica, 2012).

353 Mirbahai, L. & Adie, J. Applying the utility index to review single best answer questions in medical education assessment. *Archives of Epidemiology and Public Health* **1**, 1-5 (2020).

354 Alderson, J., Clapham, C. & Wall, D. *Language test construction and evaluation*. (Ernst Klett Sprachen).

355 Nevo, B. Face validity revisited. *Journal of Educational Measurement* **22**, 287-293 (1985).

356 Gaber, J. & Gaber, S. L. Using face validity to recognize empirical community observations. *Evaluation and Program Planning* **33**, 138-146 (2010). https://doi.org/https://doi.org/10.1016/j.evalprogplan.2009.08.001

357 Paulisso, D. C. *et al.* Cross-Cultural Adaptation and Face Validity of the Functional Mobility Assessment into Brazilian Portuguese. *Occupational Therapy International* **2020** (2020).

358 Sireci, S. & Faulkner-Bond, M. Validity evidence based on test content. *Psicothema* **26**, 100-107 (2014). https://doi.org/10.7334/psicothema2013.256

359 Sireci, S. G. The construct of content validity. *Social indicators research* **45**, 83-117 (1998).

360 Grant, J. S. & Davis, L. L. Selection and use of content experts for instrument development. *Research in nursing & health* **20**, 269-274 (1997).

361 Zamanzadeh, V. *et al.* Design and implementation content validity study: development of an instrument for measuring patient-centered communication. *Journal of caring sciences* **4**, 165 (2015).

362 Wynd, C. A. & Schaefer, M. A. The osteoporosis risk assessment tool: Establishing content validity through a panel of experts. *Applied Nursing Research* **15**, 184-188 (2002).

363 Beck, C. T. & Gable, R. K. Ensuring content validity: An illustration of the process. *Journal of Nursing Measurement* **9**, 201-215 (2001).

364 Polit, D. F., Beck, C. T. & Owen, S. V. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in nursing & health* **30**, 459-467 (2007).

365 Davis, L. L. Instrument review: Getting the most from a panel of experts. *Applied nursing research* **5**, 194-197 (1992).

366 Bland, J. M. & Altman, D. Statistical methods for assessing agreement between two methods of clinical measurement. *The lancet* **327**, 307-310 (1986).

367 Flegal, K. M., Graubard, B. & Ioannidis, J. P. Use and reporting of Bland–Altman analyses in studies of self-reported versus measured weight and height. *International Journal of Obesity* **44**, 1311-1318 (2020).

368 Gerke, O. Reporting standards for a Bland–Altman agreement analysis: A review of methodological reviews. *Diagnostics* **10**, 334 (2020).

369 Zaki, R., Bulgiba, A., Ismail, R. & Ismail, N. A. Statistical methods used to test for agreement of medical instruments measuring continuous variables in method comparison studies: a systematic review. *PloS one* **7**, e37908 (2012).

370 Rabe-Hesketh, S. & Skrondal, A. *Multilevel and longitudinal modeling using Stata*. (STATA press, 2008).

371 Kazdin, A. E. Artifact, bias, and complexity of assessment: The ABCs of reliability. *Journal of applied behavior analysis* **10**, 141-150 (1977).

372 Rolider, N. U., Iwata, B. A. & Bullock, C. E. Influences of response rate and distribution on the calculation of interobserver reliability scores. *Journal of Applied Behavior Analysis* **45**, 753-762 (2012).

373 Granåsen, D. Towards automated assessment of team performance by mimicking expert observers' ratings. *Cognition, Technology & Work* **21**, 253-274 (2019).

374 Clark, I. Formative assessment:'There is nothing so practical as a good theory'. *Australian Journal of Education* **54**, 341-352 (2010).

375 Prashanti, E. & Ramnarayan, K. Ten maxims of formative assessment. *Advances in physiology education* **43**, 99-102 (2019).

376 Clark, I. Formative assessment: Assessment is for self-regulated learning. *Educational psychology review* **24**, 205-249 (2012).

377 De Silva, A. P. *et al.* Nursing intensive care skills training: a nurse led, short, structured, and practical training program, developed and tested in a resource-limited setting. *Journal of critical care* **30**, 438. e437-438. e411 (2015).

378 Kok, M. C. *et al.* Performance of community health workers: situating their intermediary position within complex adaptive health systems. *Human resources for health* **15**, 1-7 (2017).

379 Casey, D. *et al.* Use of peer assessment as a student engagement strategy in nurse education. *Nursing & health sciences* **13**, 514-520 (2011).

380 Hastie, C., Fahy, K. & Parratt, J. The development of a rubric for peer assessment of individual teamwork skills in undergraduate midwifery students. *Women and Birth* **27**, 220-226 (2014).

381 Dannefer, E. F. *et al.* Peer assessment of professional competence. *Medical education* **39**, 713-722 (2005).

382 Aftab, W. *et al.* Improving community health worker performance through supportive supervision: a randomised controlled implementation trial in Pakistan. *Acta Paediatrica* **107**, 63-71 (2018).

383 Perry, H. B. *et al.* Community health workers at the dawn of a new era: 11. CHWs leading the way to "Health for All". *Health Research Policy and Systems* **19**, 1-21 (2021).

384 Perry, H. & Zulliger, R. (Johns Hopkins Bloomberg School of Public Health, Baltimore, 2012).

385 Freeman, P. A. *et al.* Comprehensive review of the evidence regarding the effectiveness of community–based primary health care in improving maternal, neonatal and child health: 4. child health findings. *Journal of global health* **7** (2017).

386 Thomas, L. S., Buch, E. & Pillay, Y. An analysis of the services provided by community health workers within an urban district in South Africa: a key contribution towards universal access to care. *Human Resources for Health* **19**, 1-11 (2021).

387 Teklehaimanot, H. D. & Teklehaimanot, A. Human resource development for a community-based health extension program: a case study from Ethiopia. *Human resources for health* **11**, 1-12 (2013).

388 Gopalan, S. S., Mohanty, S. & Das, A. Assessing community health workers' performance motivation: a mixed-methods approach on India's Accredited Social Health Activists (ASHA) programme. *BMJ open* **2**, e001557 (2012).

389 Soofi, S. *et al.* Effect of provision of home-based curative health services by public sector health-care providers on neonatal survival: a community-based cluster-randomised trial in rural Pakistan. *The Lancet Global Health* **5**, e796-e806 (2017). https://doi.org/https://doi.org/10.1016/S2214-109X(17)30248-6

390 Hafeez, A., Mohamud, B. K., Shiekh, M. R., Shah, S. A. I. & Jooma, R. Lady health workers programme in Pakistan: challenges, achievements and the way forward. *JPMA. The Journal of the Pakistan Medical Association* **61**, 210 (2011).

391 National Department of Health of South Africa 2011. *Provincial guidelines for the implementation of the three streams of PHC Re-engineering*, <http://www.jphcf.co.za/wp-content/uploads/2014/06/guidelines-for-the-implementation-of-the-three-streams-of-phc-4-Sept-2.pdf,> (

392 Jinabhai, C., Marcus, T. & Chaponda, A. *Rapid appraisal of ward based outreach teams*, <https://www.up.ac.za/media/shared/62/COPC/COPC%20Reports%20Publications/wbot-report-epub-lr-2.zp86437.pdf> (2015).

393 Schneider, H., Sanders, D., Besada, D., Daviaud, E. & Rohde, S. Ward-based primary health care outreach teams in South Africa: developments, challenges and future directions. *South African health review* **2018**, 59-65 (2018).

394 Yourkavitch, J., Zalisk, K., Prosnitz, D., Luhanga, M. & Nsona, H. How do we know? An assessment of integrated community case management data quality in four districts of Malawi. *Health Policy and Planning* **31**, 1162-1171 (2016).

395 Ashraf, N., Bandiera, O. & Lee, S. S. Do-gooders and go-getters: career incentives, selection, and performance in public service delivery. *Harvard Business School*, 1-60 (2015).

396 Moetlo, G. J., Pengpid, S. & Peltzer, K. An evaluation of the implementation of integrated community home-based care services in Vhembe District, South Africa. *Indian Journal of Palliative Care* **17**, 137 (2011).

397 National Department of Health. *National Department of Health Annual Report 2017/2018*, <https://www.gov.za/sites/default/files/gcis_document/201810/doh-annual-report-2018.pdf> (2019).

398 Royston, P., Ambler, G. & Sauerbrei, W. The use of fractional polynomials to model continuous risk variables in epidemiology. *International journal of epidemiology* **28**, 964-974 (1999).

399 Crispin, N. *et al.* Effects of selected socio-demographic characteristics of community health workers on performance of home visits during pregnancy: a cross-sectional study in Busia District, Kenya. *Global Journal of Health Science* **4**, 78 (2012).

400 World Health Organization. *Handbook for national quality policy and strategy: a practical approach for developing policy and strategy to improve quality of care.* , <http://apps.who.int/iris/bitstream/handle/10665/272357/9789241565561-eng.pdf?ua=1> (2018).

401 World Health Organization. *Delivering quality health services: a global imperative for universal health coverage*, <https://apps.who.int/iris/bitstream/handle/10665/272465/9789241513906-eng.pdf> (2018).

402 Nyalunga, S., Ndimande, J., Ogunbanjo, G., Masango-Makgobela, A. & Bogongo, T. Perceptions of community health workers on their training, teamwork and practice: a cross-sectional study in Tshwane district, Gauteng, South Africa. *South African Family Practice* **61**, 144-149 (2019).

403 Diema Konlan, K. *et al.* The practice of home visiting by community health nurses as a primary healthcare intervention in a low-income rural setting: a descriptive cross-sectional study in the Adaklu District of the Volta region, Ghana. *The Scientific World Journal* **2021** (2021).

404 Amonoo-Lartson, R. & De Vries, J. Patient care evaluation in a primary health care programme: The use of tracer conditions as a simple and appropriate technology in health care delivery∗. *Social Science & Medicine. Part A: Medical Psychology & Medical Sociology* **15**, 735-741 (1981).

405 Madede, T. *et al.* The impact of a supportive supervision intervention on health workers in Niassa, Mozambique: a cluster-controlled trial. *Human Resources for Health* **15**, 1-11 (2017).

406 Singh, D., Negin, J., Orach, C. G. & Cumming, R. Supportive supervision for volunteers to deliver reproductive health education: a cluster randomized trial. *Reproductive Health* **13**, 1-10 (2016).

407 Brooks, B. *et al. Building a community health worker program: The key to better care, better outcomes, & lower costs*, <https://www.aha.org/system/files/2018-10/chw-program-manual-2018-toolkit-final.pdf> (2014, 2018).

408 Jaskiewicz, W. & Tulenko, K. Increasing community health worker productivity and effectiveness: a review of the influence of the work environment. *Human resources for health* **10**, 1-9 (2012).

409 Smithwick, J., Nance, J., Covington-Kolb, S., Rodriguez, A. & Young, M. "Community health workers bring value and deserve to be valued too:" Key considerations in improving CHW career advancement opportunities. *Front Public Health* **11**, 1036481 (2023). https://doi.org/10.3389/fpubh.2023.1036481

410 UNAIDS. *2 million African community health workers: Harnessing the demographic dividend, ending AIDS and ensuring sustainable health for all in Africa*, <https://www.unaids.org/sites/default/files/media_asset/African2mCHW_en.pdf> (2017).

411 Thio, S. *et al.* 'First of all, I need training': a qualitative study evaluating the Fiji community health worker training program. *BMC Primary Care* **25**, 228 (2024). https://doi.org/10.1186/s12875-024-02480-8

412 National Planning Commission of Namibia. *Evaluation of the Namibian Health Workers Programme*, <https://www.nafsan.org/wp-content/uploads/2020/05/2017-Nam_HEP_Eval_Report_Dec4.pdf> (2017).

413 Naimoli, J. F., Frymus, D. E., Wuliji, T., Franco, L. M. & Newsome, M. H. A Community Health Worker "logic model": towards a theory of enhanced performance in low- and middle-income countries. *Human Resources for Health* **12**, 56 (2014). https://doi.org/10.1186/1478-4491-12-56

414 Palazuelos, D. & Gadi, S. in *Training for community health: Bridging the global health care gap* (eds Anne Geniets, James O'Donovan, Laura Hakimi, & Niall Winters) Ch. 3, (Oxford University Press, 2021).

415 Crigler, L., Fort, A. L., De Diez, O., Gearon, S. & Gyuzalyan, H. Training alone is not enough. *Performance Improvement Quarterly* **19**, 99-116 (2006).

416 Mariam, D. H., Wondimagegn, D. & Conteh, L. *Optimizing the Ethiopian Health Extension Programme: Strategies to address workforce challenges*, <https://iris.who.int/bitstream/handle/10665/369533/9789290234951-eng.pdf?sequence=1> (2023).

417 Kallon, L. H., Raven, J., Wurie, H. R. & Mansour, W. From policy to practice: a qualitive study exploring the role of community health workers during the COVID-19 response in Sierra Leone. *BMC Health Serv Res* **23**, 1228 (2023). https://doi.org/10.1186/s12913-023-10272-6

418 Ndulue, O. I., Chukka, A. & Naslund, J. A. Burnout and mental distress among community health workers in low- and middle-income countries: a scoping review of studies during the COVID-19 pandemic. *Global Health Journal* **8**, 162-171 (2024). https://doi.org/https://doi.org/10.1016/j.glohj.2024.11.007

419 Okafor, U. B., Obasanjo, I. & Goon, D. T. "…considered 'essential workers', so we report to work and serve the community": experiences of community health workers during COVID-19 pandemic in the Eastern Cape, South Africa. *BMC Health Services Research* **24**, 1310 (2024). https://doi.org/10.1186/s12913-024-11756-9

420 Namuhani, N. *et al.* Leveraging community health workers for COVID-19 response in Democratic Republic of Congo, Nigeria, Senegal, and Uganda: roles, barriers, and

facilitators. *BMC Primary Care* **25**, 269 (2024). https://doi.org/10.1186/s12875-024-02531-0

421 World Health Organisation. *Learning 4 Impact: strengthening frontline and community-focused learning for health emergencies*, <https://www.who.int/news/item/24-04-2025-learning-4-impact--strengthening-frontline-and-community-focused-learning-for-health-emergencies?utm_source=chatgpt.com> (2025).

422 Ballard, M. *et al. Are dual cadre CHW programmes exploitation by another name?*, <https://apolitical.co/solution-articles/en/are-dual-cadre-chw-programmes-exploitation-another-name> (2021).

423 Sullivan, J., Aranda, Z., Adusumilli, M., Martens, A. & Jiménez, A. Perceptions around occupational mental well-being of community health workers and an intervention package for its promotion: A mixed-methods study in rural Chiapas, Mexico. *SSM - Mental Health* **6**, 100360 (2024). https://doi.org/https://doi.org/10.1016/j.ssmmh.2024.100360

424 Ritter, F. E. *Factors affecting learning and retention: A unified list* <https://acs.ist.psu.edu/reports/ritter21d.pdf> (2021).

425 Maes, K., Closser, S., Tesfaye, Y. & Abesha, R. Psychosocial distress among unpaid community health workers in rural Ethiopia: Comparing leaders in Ethiopia's Women's Development Army to their peers. *Social Science & Medicine* **230**, 138-146 (2019). https://doi.org/https://doi.org/10.1016/j.socscimed.2019.04.005

426 van Vuuren, C. J., Lowe, Z. & Bodenstein, K. Moving Towards a South African NHI System of Excellence: Recommendations Based on the Insider Perspectives of CHWs as Key Role-Players. *Int J Environ Res Public Health* **22** (2025). https://doi.org/10.3390/ijerph22050807

427 Vasan, A., Mabey, D. C., Chaudhri, S., Brown Epstein, H.-A. & Lawn, S. D. Support and performance improvement for primary health care workers in low- and middle-income countries: a scoping review of intervention design and methods. *Health Policy and Planning* **32**, 437-452 (2016). https://doi.org/10.1093/heapol/czw144

428 Marquez, L. R. & Kean, L. C. Making supervision supportive and sustainable: new approaches to old problems. *Supplement to Population Reports* **XXX** (2002).

429 Mirkuzie, A. H. *et al.* What does it take to design digitally enabled performance management and incentive interventions for community health programs: Lessons from Ethiopia. *PLOS Digit Health* **4**, e0000914 (2025). https://doi.org/10.1371/journal.pdig.0000914

430 : Percept Actuaries & Consultants. *Digitally empowering community healthcare workers in Africa: Lessons and insights from the Living Goods (Smart Health app) and upSCALE experiences*, <https://percept.co.za/wp-content/uploads/2021/05/Brief-2-CHW.pdf> (2021).

431 Last Mile Health. *Three digital health innovations helping community health workers deliver quality care*, <https://lastmilehealth.org/2024/11/01/three-digital-health-innovations-helping-community-health-workers-deliver-quality-care/> (2024).

432 Rodrigues, S. M. *et al.* Digital Health-Enabled Community-Centered Care: Scalable Model to Empower Future Community Health Workers Using Human-in-the-Loop Artificial Intelligence. *JMIR Form Res* **6**, e29535 (2022). https://doi.org/10.2196/29535

433 Rotheram-Borus, M. J. *et al.* The effect of supervision on community health workers' effectiveness with households in rural South Africa: A cluster randomized controlled trial. *PLoS medicine* **20**, e1004170 (2023).

434 Tomlinson, M. *et al.* Relationship of perinatal outcomes to the competence and quantity of contact with community health workers. *Journal of Global Health* **15**, 04094 (2025).

435 Pallas, S. W. *et al.* Community health workers in low- and middle-income countries: what do we know about scaling up and sustainability? *Am J Public Health* **103**, e74-82 (2013). https://doi.org/10.2105/ajph.2012.301102

436 Breakthrough ACTION. *Factors influencing community health worker behaviors: Literature review and synthesis*, <https://breakthroughactionandresearch.org/resource-library/factors-influencing-community-health-worker-behaviors/> (2024).

437 Kambarami, R. A. *et al.* Factors Associated With Community Health Worker Performance Differ by Task in a Multi-Tasked Setting in Rural Zimbabwe. *Glob Health Sci Pract* **4**, 238-250 (2016). https://doi.org/10.9745/ghsp-d-16-00003

438 Pandya, S. *et al.* Understanding Factors That Support Community Health Worker Motivation, Job Satisfaction, and Performance in Three Ugandan Districts: Opportunities

for Strengthening Uganda's Community Health Worker Program. *Int J Health Policy Manag* **11**, 2886-2894 (2022). https://doi.org/10.34172/ijhpm.2022.6219

439 Aron, M. B. *et al.* A time-motion study of community health workers delivering community-based primary health care in Neno District, Malawi. *Hum Resour Health* **21**, 51 (2023). https://doi.org/10.1186/s12960-023-00839-z

440 Heunis, C., Wouters, E., Kigozi, G., Janse van Rensburg-Bonthuyzen, E. & Jacobs, N. TB/HIV-related training, knowledge and attitudes of community health workers in the Free State province, South Africa. *African Journal of AIDS Research* **12**, 113-119 (2013).

441 Foster, I. *et al.* "This is an illness. No one is supposed to be treated badly": Community-based stigma assessments in South Africa to inform TB stigma intervention design. *Res Sq* (2023). https://doi.org/10.21203/rs.3.rs-3716733/v1

442 Rockers, P. C. *et al.* Evaluation of a community health worker home visit intervention to improve child development in South Africa: A cluster-randomized controlled trial. *PLOS Medicine* **20**, e1004222 (2023). https://doi.org/10.1371/journal.pmed.1004222

443 Mkhwanazi, T. Assessing the National Health Insurance (NHI) in South Africa: Policy Formulation, Stakeholder engagement and Implementation Challenges. *European Journal of Medical and Health Research* **2**, 198-215 (2024).

444 Malakoane, B., Heunis, J., Chikobvu, P., Kigozi, N. & Kruger, W. Public health system challenges in the Free State, South Africa: A situation appraisal to inform health system strengthening. *BMC health services research* **20**, 58 (2020).

APPENDICES

Appendix 3. 1: The quality-of-care assessment tool

Appendix 3.1a: Household visit entry component

HOUSEHOLD ENTRY FORM V5: Monday 14th August 2017

Date: …… FW Name……Day ID……CHW Initials:…… CHW code …… HH visit ID…… RECORD ID……

	QUESTION	CODE		ANS
1	Site	1, Usizolwethu ; 2, Vicshkuli		
2	**ASK CHW:** When did you last visit or attempt to visit this household?	1, never 2, in the last week 3, in the last month	4, in the last 3 months 5, in the last year, 6, more than a year ago	
3	**ASK CHW:** How often do you normally visit this household?	1= more than once a month 2= once a month 3=once 3 months	4=once a year 5=or less than once a year	
4	**ASK CHW:** What is your plan for the visit? **Multiple choice** Note: Tick 2 and 3 if doing both	1, household registration, 2, follow up chronic disease patient 3, medication delivery 4, checking on children & babies 5, checking on pregnant woman 6, checking on the elderly person who is not otherwise sick 7, hospital discharge for clinic 8, defaulter tracing for clinic 9, Check due to referral from the community 10, Check whether anybody needs care 11, other, please specify		
5	**FOR FW:** Which of the following best describes the MAIN dwelling that this family occupies? **Single choice**	1, House on a separate stand/plot made of brick or concrete 2, House on a separate stand / plot made of traditional materials 3, Flat or apartment in a block of flats 4, Cluster house in a complex / Town house 5, Semi-detached house 6, House/flat/room in back yard room or flatlet on a property 7, servant's quarters or granny flat 8, Shack in back yard 9, Shack in an informal settlement/squatter settlement 10, Other		
6	Has the household given permission for you to observe the CHW do her work?	00=No; 01= Yes; Note: only ask if a person over 18 years is present.		
7	Reason given for refusal	1, None given, 2, No person over 18 years present; 3, Nobody at home	4, No time (person leaving, visitors) 5, other	
	IF OTHER, please describe			
8	GPS co-ordinates	Send location via Whatsapp		
9	Start time of visit	HH: MM		
10	Where did the consultation take place	1= In the appropriate place (either in the household or in the yard) 2=at the gate or the door step		
11	Reason given for not going inside	Text		
12	**IF THIS IS THE FIRST VISIT TO THE HOUSEHOLD**, did the CHW do any of the following in introduction? **Multiple choice**	1=introduce themselves 2=explain their job as a CHW 3=explain why they have come today	4=ask permission to ask some questions about health / or to speak to a specific person; 5=didn't observe entry process as waiting outside.	
13	**IF THIS IS NOT THE FIRST VISIT,** Did the CHW ask about the household / patient's wellbeing based on their prior knowledge?	0=No 1=Yes	2=patient started talking first 3=Not observed	
14	Did the CHW encourage the main patient to explain how they are/ how have been?		0=No; 1=Yes	
15	Did the main patient talk about themselves ?		0=No; 1=Yes	
16	**IF YES**, does the CHW interrupt the main patient when the patient first starts to talk about themselves?		0=No; 1=Yes	

Appendix 3.1b: Patient conditions, messages and action component

V5: Monday 14th August 2017

CONDITIONS FORM Date:..... FW Name :..... Day ID..... .. CHW Initials:..... CHW code ..... HH visit ID ..... Patient ID ..... Record ID .....

QUESTION		ANSWER
Name / identifying features		
Gender	1=Female; 2=Male *(Ask if not clear)*	
Age	1=baby under 6mths 2=pre-school child 3=school age child / adolescent 4=adult 5=over 60 / retired/ elderly	

REFERRAL CODES

1 = casual 'you should go to the clinic' with little conviction that it will happen

2 = reminder to go for medication review

3= give specific instructions to go to the clinic / hospital

4 = given a referral letter

5 = offer of referral was refused

6 = invitation to a support group

7 = Invitation to Khategopele

CHW PLAN CODES

1= Come back for another visit (eg to see the baby)

2= Bring medication including regular medication delivery

3= Speak to relative or friend to organise help (eg care or transport)

4= Facilitating access to care at clinic (e.g. finding file, speak to nurse, wait for patient at clinic, gives money for transport)

5=Speak to other NGOs (e.g. about food parcels)

6=Facilitate access to state agencies (e.g. home affairs)

7= Bring / ask Nurse

8= Calling for official transport (i.e. ambulance)

9= CHW gives number so patient can call if needs help

10=Other

Write code and details of plan (incl. organisation / role of person) in rows below.

Did patient engage with plans? 0=No 1=Yes

CONDITION/PATIENT TYPE		ADVICE / MESSAGES							REFERRALS	WHAT DID THE CHW PLAN TO DO?	
Hypertension		Life style advice/ grant	Taking medication (adherence, side effects, if forget)	Measuring BP	Access to medication / going to the clinic / checking card						
Diabetes		Life style advice	Taking medication	Measuring BP	Access to medication	Measuring glucose	Foot care				
HIV		Life style advice / grant	Taking medication (adherence, side effects, if forget)	Access to medication / going to the clinic / checking appt card							
TB		Life style advice / grant	Taking medication (adherence, side effects, if forget)	Access to medication / going to the clinic / checking appt card							
Other / unnamed chronic		Life style advice/ grant	Taking medication (adherence, side effects, if forget)	Access to medication / going to the clinic / checking appt card							
Has persistent cough		Screen for TB									
Under 6 months		Mother's health	Caring for baby	HIV related	Feeding / grant	RTH card	Attending clinic	Looking at baby			
6 mths-5 years		RTC card	Feeding / diet / grant	Attending clinic	HIV status	Looking at /examining child					
Pregnant woman		Life style advice / grant	Knowing HIV status	Attending clinic / danger signs	Preparation for birth / baby						
Routine check to identify need		Family planning	HIV Status	Pap smear	Cough	Home-based care	Social grants	Are you sick?			
		Pregnant	Delivery in last 6 weeks?	Under 5	Daily medication	Checking known elderly person					
Other illness or potential illness		Providing advice									

Appendix 3.1c: Household visit exit and FW assessment component

EXIT AND FW ASSESSMENT FORM V4 : Monday 14th August 2017

Date:……FW Name :…… Day ID…… CHW Initials:…… CHW code …… HH visit ID …… Record ID……

	QUESTION		CODE	ANS
17	End time of visit		HH: MM	
18	Was there any physical, cognitive or language difficulty in communication between CHW and any patients present?		0=No 1=Yes	
19	**IF YES**, Please explain			
20	Was the CHW sufficiently sensitive to privacy for all the patients?	0=No; 1=Yes; 2=Best given circumstances		
21	**IF NO,** or 'best given circumstance's, please explain:			
22	Did the CHW make any notes of the visit?	0=No; 1=wrote readings on piece of paper or notebook; 2= wrote other notes about visit in notebook		
23	Was there any problem with this consultation, or any unresolved barriers to ensuring the patient gets access to care?		0=No; 1=Yes	
24	**IF YES,** what was the problem ? **Multiple choice**	<u>Household</u> 1=general uncooperative attitude from the patient or other household members; 2=negative attitude towards the CHW because she has failed to help in the past; 3=general disruptions (e.g. crying baby or visitors) 4=appears not to want to engage at this visit (e.g. due to presence of FW); 5= Patient going out as CHW arrived 6=Not allowed entry as new born child 7=Wants an older CHW <u>Health system problems</u> 8=Patient doesn't go to clinic due attitude of nurses / no medication / stigma 9=Transport problems 10= Delays in getting access to lab results 11=other		
25	**IF OTHER**, please describe:			
26	Please rate the CHW's performance for this visit on a scale of 1-5 (where 1 is very poor, and 5 is very good)		1-5	
27	Please explain rating:			
28	**FOR CHW:** How happy are you with how this visit went on a scale of 1-5, if 1 is very unhappy and 5 is very happy ?		1-5	
29	**FOR CHW:** Please explain your answer			

Appendix 3.1d: Deriving the messages/activities score for a hypothetical 'Household 1'

Household 1									
Conditions	**Present (Yes=1/ No=0)**	**Messages/activities per condition**							**Aggregate score**
Hypertension		Lifestyle advice	Taking medication	Measuring BP	Access to medication				
	1	**1**	**1**	**0**	**1**				¾=75.0
Diabetes		Lifestyle advice	Taking medication	Measuring BP	Access to medication		Glucose	Foot care	
	1	**0**	**1**	**0**	**1**		**0**	**0**	3/6=50.0%
Under 5		Road To Health Card	Feeding/diet	Attending clinic	Looking at child				
Under 6 months		Mothers' health	Caring for the baby	HIV-related	Feeding	RTC	Attending the clinic	Looking / examining baby	
HIV	**1**	Lifestyle advice	Taking medication	Access to medication / going to clinic					
		1	**1**	**1**					3/3=100.0
Persistent cough		Screen for TB							
TB		Lifestyle advice	Taking medication	Access to medication /going to the clinic					
		Lifestyle advice	HIV status	Attending clinic / danger signs	Preparation of birth/baby				
Pregnant women									
		Advice							
Other illness or potential illness									
		Check up							
Total number of conditions in household	3								75% + 50% + 100%=225/3
Household message score = (observed/expected hypertension messages) + (observed/expected diabetes messages) / total number of conditions in household									75.0%

BP, blood pressure; RTC, road-to-health card; TB, tuberculosis

Appendix 3. 2: Fieldwork manual for completing the quality-of-care assessment tools

Identifying people at household visit, who to include on your sheet and how to score them

1. At the household visits, in order to be recorded on the patient sheet, the person must be
    a. A family member
    b. Present during the visit.
2. In addition, in order to be recorded, the person will fall into one of the following categories
    a. An existing patient, or a new patient registered or found in the current visit, that falls in one of our patient conditions/types
    >> the FW should list the person and mark appropriate condition/type of patient and numbers given for any advice or actions given
    b. A person does not fall into one of our patient conditions/types, but who is sick (or potentially sick) and asks the CHW for health advice
    >> person is listed and record under illness or potential illness and record messages or actions given.
    c. A person does not fall into one of our patient conditions/types, and is not sick, but health message is given (e.g., advice on smoking/alcohol/family planning/pap smear) or check done (e.g., checking frail old man)
    >> FW should list person on tool, record person as routine check and give number for message as a routine check (whether the person is present or not)
3. Do NOT include the CHW's engagement with the following people
    a. A family member who is not present, but whom the CHW may discuss with the household members present
    b. A person who seems to fit our list of categories, but nobody asks for advice, and the CHW does not offer advice
    c. A neighbour or visitor asks for advice (see below)
4. If someone is present at the visit but is not part of the household / family the FW should ignore any interaction with CHW.
    a. If it is unclear whether the person is a visitor or not during the visit, FW should assume they are part of household and record the relevant information.
    b. If it becomes clear later that they are not part of the household, the FW crosses through the name on the sheet and writes a note as to why it is crossed through. The entry should remain legible so the cross through should be a single line.

    e.g., neighbour or visitor,
    e.g., children who are attending a crèche at the household are not recorded;
    e.g., children who spend day with granny should be recorded;
5. Survey will stop if you are not given permission to do observation

Completing the patient conditions and messages/actions questionnaire

6. Recording both the patient's condition as well as the messages/ actions is important for the scoring system. The scoring system allows us to assess whether the appropriate advice was given or not. We have categorised patients by their conditions and types of patients that need care. The ones that need discussing are listed below:
7. If the gender of the baby is not clear – ask.
8. Do not make assumption about what the condition is. If the diagnosis becomes clear in the conversation, then use this information. If it does not become clear then:

    a. If you feel the conversation is free, and there is no stigma, then ask "Are you happy to tell me your condition
    b. If the CHW tells the FW 'this patient has HIV" on the way to the house, she is indicating that either the patient thinks the CHW does not know, or that this is a sensitive issue. So, in these

circumstances- do not ask if the patient is happy to explain her / condition – rather record as an unnamed condition.

c. CHW are asked to trace defaulting TB and HIV patients, but they are not told the diagnosis, so the CHW's assessment of the condition may not be correct.

9. The conditions / categories include
   a) Hypertension = high blood pressure
   b) Diabetes
   c) HIV
   d) TB
   e) Other/unnamed chronic
      i. unnamed by patient or CHW OR
      ii. other chronic illness not on our list e.g., epilepsy or asthma.
      iii. It is NOT an acute illness such as flu. This would be recorded under other illness or potential illness.
   f) Persistent cough=cough for longer than two weeks.
   g) Pregnant woman – any stage of pregnancy
   h) Other illness or potential illness
      i. any illness that is talked about that is not on our list and is not an 'other chronic'.
      ii. It may be an illness a patient has or an illness the fear or are at risk of getting.
      iii. It may be that as FW you do not know what the illness is they are talking about
   i) A person in need of home-based care
   j) An otherwise well person who is asked a" routine health check" question (see below)

10. The message options for each condition / category include

Hypertension	Lifestyle advice (also grant)	Taking medication (adherence, side effects, if forget)		Measuring BP	Access to medication / going to the clinic		
Diabetes	Lifestyle advice	Taking medication	Measuring BP	Access to medication	Glucose	Foot care	
HIV	**Lifestyle advice**	Taking medication	**Access to medication / going to the clinic**				
TB	Lifestyle advice	Taking medication	Access to medication / going to the clinic				
Other / unnamed chronic	Lifestyle advice	Taking medication	Access to medication / going to the clinic				
Has persistent cough	Screen for TB						
Child under 6 months	Mother's health	Caring for baby	HIV related	Feeding / grant	RTC	Attending the clinic	Looking at /examining baby
Child between 6 mths-5 years	RTC	Feeding / diet / grant	Attending clinic		Looking at /examining child		
Pregnant woman	Lifestyle advice	Knowing HIV status	Attending clinic / danger signs		Preparation for birth / baby		
Routine check	Routine check (where CHW asks for example about family planning, whether had HIV test, pap smear, whether has persistent cough, or visits the elderly						
Needing home-based care	Provided HBC						
Other illness or potential illness	Providing advice						

11. <u>Please note that the following categories include a range of issues</u>

Lifestyle advice
Taking exercise

Healthy eating	
Access to food or grants	
Taking medication, includes discussing the following	
Adherence	
What to do if you forget to take your medication	
Side effects	
Should the CHW get a tick for asking for the clinic card? No because unless it is TB, there is not information about whether the pills are being taken or not	
Access to medication	
Medication delivery	
Advice to go to clinic	
Any discussion of how patient gets medication, even if they are failing	
Feeding / diet for under 5 or under 6 months	
Breastfeeding	
Access to food/child grant	
Type of food	
How to care for the baby	
Asking about general health	
Advice about washing, keeping warm	
Looking at or examining the child / baby or measuring MUAC	
Does not include asking if child is fine	
Road to health card	
Does this include asking about immunisations? Yes	
HIV status/ testing for babies and pregnant women	
Asking about status	
Asking about PMTCT	
Routine check e.g.,	
Ask about family planning	asking about Pap smear
Visiting elderly	asking whether a person has a cough / persistent cough
Asking whether has had an HIV test	asking if has recently had BP measured

12. Please note that message /actions gets a tick if:
    a. If the CHW talks about the issue, even if patient is not managing to do it e.g., a visit to the clinic which patient says they are unable to do.
    b. if the patient volunteers the information and the CHW does not take the conversation further because there is nothing else to say e.g., patient volunteers that they went to the clinic yesterday.
    c. If the patient tells the CHW If BP/glucose measured recently (under 1 month) at a visit to the clinic, and as a result the CHW does not measure then it, give a tick for measurement.

13. The message or action DOESN'T get a tick if:

a. CHW does not have equipment to measure BP / glucose, or equipment does not work

14. A routine check is when a CHW offers health promotion advice or checks on an otherwise well person. Examples are:
    - checking on elderly man
    - asking woman if she has had a pap smear test
    - or asking if using family planning
    - or asking if have HIV test recently
    - or asking whether a cough has lasted for more than two weeks.

    Please note the following about routine checks:
    a) Enter name of patient, mark condition/type of patient as a "routine check" AND ticks the routine check message box. THIS IS IMPORTANT FOR SCORING SYSTEM
    b) As a result, the scoring of routine check gives the CHW an extra 100% score for that person because they have offered health promotion advice.
    c) We are not penalising CHW for not offering advice when they could have done. The FW will not record missed opportunities where the CHW could have given health advice but did not.

15. If the routine question is asked of a several people at once, would this be recorded for each person individually or once?
    Example: there are several members of the household present and the CHW asks whether they know their HIV status, or whether they have been tested for TB, whether they have had a pap smear
    a) Enter the score for all individuals who qualify as a household member that is present as if each individual is being addressed separately i.e. the score will be included for each individual
    b) However, this CHW would not score well in terms of privacy

16. If the routine checks discover a problem or leads to the identification of person who falls into our categories, then mark patient as follows:

    a. PREGNANT / UNDER 5 / UNDER 6 MONTHS – mark in these categories and score the CHW accordingly
    b. If the patient or CHW thinks the patient has TB/HIV/Cancer / Diabetes or any other condition – record on OTHER ILLNESS OR POTENTIAL ILLNESS because the patient has not been given a diagnosis yet. **This is the case even if the CHW measures the BP or glucose of the patient, as neither of these can confirm a diagnosis.**
    c. If the patient says they have A PERSISTENT COUGH, also record under persistent cough.

    Some examples of how the scoring system works:
    d. If the CHW discovers a problem (e.g., pregnancy) the person will be recorded twice - once under routine check to discover the pregnancy, and once under pregnant woman, perhaps noting the advice given to go to the clinic;
    e. If the CHW discovers the pregnancy but does not give any advice, the presence of the pregnant woman would be recorded, but there would be no messages or action.
    f. If patient is asked about cough, and answer that they have a cough and it has been present for more than two weeks, then also record patient as having persistent cough (NOT other illness or potential illness) and any messages or actions given. So, if the CHW discovers a persistent cough the person will be recorded twice - once under routine check to discover the cough, and once under persistent cough.

FW assessment of visit tool

For first visit we are wanting data on how the CHW negotiates entry to the house. For second visits, the question focuses on how the CHW is building relationship with the household.

17. If this is the first visit, for the question on how the CHW introduces themselves there are multiple possible answers. Further explanation of some of them follows:
    a. introduce themselves = name
    b. explain why they have come today =
        i. explain that they have come to visit the household to understand about the household and if the CHWs can help; OR
        ii. we have come to see a specific person (this could be contact tracing, defaulter tracing, following hospital discharge but may not be stated at this point unless CHW is already talking to the relevant person)

18. If this is not the first visit, did the CHW ask about the household / patient's wellbeing based on prior knowledge?
    - FW has to judge whether the CHW based their question, to the household, on prior knowledge based on the content of the question.
        i. How are you? – this does not suggest prior knowledge.
    - The following are examples of questions that suggest prior knowledge
        ii. How have you been since your operation?
        iii. How is your son?
        iv. Has your daughter been to visit recently?
    - If the above might have happened but the fieldworker was not present as they had not yet been invited into the household, mark as "not observed"
    - If the CHW does not ask about the patient, because there is another person present, but allows the patient to decide what to say, then the CHW would score as "patient started talking first" on this question.

19. Did the CHW encourage the patient to explain how they are/how they have been? The CHW would ideally ask open questions, such as how have you been? How are you feeling?
    a. However, sometimes encouragement is apparent even if wording of question is closed e.g., are you feeling better? FW needs to judge encouragement based on effort of CHW and response of patient.
    b. If patient does not talk, yet the CHW has asked open questions and appears to be encouraging the patient to talk (e.g., leaving time for response, looking at patient) then answer is "YES", even though patient did not respond.

20. Does the CHW interrupt the patient when the patient first starts to talk about themselves?
    - This is only about the main patient (or main household respondent for household registrations). If there are two patients/respondents, then only assess the first one the CHW speaks to.
    - Interruption can be a verbal interruption, or it can be turning away, i.e., indicating that the CHW is not listening.

21. Is there any physical, cognitive or language difficulty in communication?
    - Common physical problems include deafness, common cognitive problems, (e.g., mental impairment/illness, or elderly person with memory loss (dementia), or person with learning disability).
    - If a person speak quietly that just requires the CHW to move closer - this is not a communication problem because it can be solved.

22. Privacy
    a. Privacy should be regarded as 'yes' if:

i. The CHW asks first to speak with the patient privately or clarify the role of another (when there is another person present that is not needed to provide support with the consultation i.e. friend/relation of elderly people; friend/relation of a deaf/blind person).
ii. The CHW asks if the patient is comfortable with discussing his/her condition in the presence of another.
iii. CHW speaking about a child <5 years in the presence of the parent should be considered as 'yes' for privacy.

b. Privacy should be regarded as 'no' if:
   i. The CHW discusses the patients' condition in the presence of another without asking first to speak with the patient privately.
   ii. The CHW discusses the patients' condition in the presence of another without asking if the patient is comfortable with discussing his/her condition in the presence of another.
   iii. CHW speaking first about a child <5 years in the presence of another other than the parent should be considered as 'no' for privacy

c. Privacy should be regarded as 'best given circumstances' if:
   i. If the patient mentions a health issue in front of other people that gives the CHW permission to continue to talk about that particular health issue in front of the other people. However, any issues not raised by the patient in front of other people should only be talked about in private.
   ii. If the consultation takes place on the doorstep of a shack because there is nowhere else, both parties use low voices, and other people cannot hear, the answer chosen should be 'best given circumstances'
   iii. Parent mentions a health issue about a child <5 years in the presence of another other than the parents should be considered as 'best given circumstances' for privacy

23. Were any referrals made?
    a. Person who is being referred can be present or not.

24. If the CHW said she would do something
    a. Facilitating access to the clinic could include: e.g., finding file, or speaking to nurse, or wait for patient at clinic;
    b. We want to judge change in engagement with community organisations; so, it is important to write down as much information as possible for this question. Ensure you get the name of the NGO.

25. Did the CHW encourage the main patient to engage with any plans being made or the referral? (Alternatively did the CHW engage with relatives /carer about the plans?) Please see following examples:

    e.g., CHW says patient needs to go to clinic. Patient responds with how she will get there, or why she cannot get there, or agrees the plan is fine with her – these would be recorded as a "yes". If CHW tells patient what to do and does not encourage/allow engagement of the patient with planning, then mark as "no".

    e.g., If patient is not well enough to engage, does the CHW make a plan to contact someone who can engage with the plan?

26. Did the CHW make notes during the visit? These notes should be in the CHW's own notebook / paper that they keep as a record of their household visits. This does not include the tick sheet for statistics.

27. Were there any problems with this consultation?
    a. Mark the best answer or if you really cannot fit the problem into one of the categories, then mark other and describe.
    b. The option "appears not to want to engage at this visit" = person is not negative to the CHW but is indicating that this is not a good time for them to engage. (Sometimes it will be a bad time for the householder to be interrupted, other times it might be they say this because of the presence of the FW – we cannot disentangle these)
    c. We are including here about household level problems, and health system problems.

28. Please rate this visit on a scale of 1-5 (very good, good, neutral, poor, very poor)
    - Answer 5 / very good if the CHW did all s/he could do, given the circumstances
    - Answer 1 /very poor if you believe the CHW could have done much better.
    - Your best judgement on this question is just fine.

Example of a good visit:
In a Sicelo observation, the CHW suggested that the patient ask for a referral from Meyerton to Sicelo … the CHW said the problem is that Sicelo often does not have drugs. The conversation shifted .. schools, clinics .. by the end of which the patient said she would transfer…
the CHW is being patient .. and gently encourages the patient to transfer.

Post –observation questions for CHW

29. Ask this question as soon as possible after leaving the household and before entry to the next household even if you have to ask the CHW to pause for a moment.

Appendix 3. 3: PROSPERO Registration message

From: CRD-REGISTER <irss505@york.ac.uk>
Sent: Tuesday, 03 November 2020 11:07
To: Olukemi Babalola <olukemi.babalola1@wits.ac.za>
Subject: PROSPERO Registration message [209937]

Dear Dr Babalola,

Thank you for submitting details of your systematic review "Community health worker training programmes for comprehensive care in low and middle income countries, their effectiveness and outcome assessment: a systematic review" to the PROSPERO register. We are pleased to confirm that the record will be published on our website within the next hour.

Your registration number is: CRD42020209937

You are free to update the record at any time, all submitted changes will be displayed as the latest version with previous versions available to public view. Please also give brief details of the key changes in the Revision notes facility and remember to update your record when your review is published. You can log in to PROSPERO and access your records at https://www.crd.york.ac.uk/PROSPERO.

Comments and feedback on your experience of registering with PROSPERO are welcome at crd-register@york.ac.uk

Best wishes for the successful completion of your review.

Yours sincerely,

Georgina MacKenzie
PROSPERO Administrator
Centre for Reviews and Dissemination
University of York
York YO10 5DD
t: +44 (0) 1904 321049
e: CRD-register@york.ac.uk
www.york.ac.uk/inst/crd

PROSPERO is funded by the National Institute for Health Research and produced by CRD, which is an academic department of the University of York.

Email disclaimer: https://www.york.ac.uk/docs/disclaimer/email.htm

Appendix 3. 4: Ethics and Institutional Approvals

Appendix 3.4a: Wits HREC (Medical) clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Dr Olukemi Solabomi Babalola

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M190933

NAME: (Principal Investigator)	Dr Olukemi Solabomi Babalola
DEPARTMENT:	Centre for Health Policy Gauteng Province (Tshwane District) Mpumalanga Province (Enhlanzeni District)
PROJECT TITLE:	Implementation and assessment methods of community health worker training programmes
DATE CONSIDERED:	27/09/2019
DECISION:	Approved unconditionally
CONDITIONS:	Approval issued to conduct study in Tshwane Metropolitan Municipality Offices, Phedisong 6 Clinic, Stanza Bopape Clinic and Enhlanzeni District
SUPERVISOR:	Prof Jane Goudge and Prof Frances Griffiths
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	06/05/2020

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 on the Third Floor, Faculty of Health Sciences, Phillip 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 in **September** and will therefore be due in the month of **September** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

05 May 2020
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 3.4b: Batlhokomedi Project ethical clearance certificate

R14/49 Prof Jane Goudge et al

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M160354

NAME: **(Principal Investigator)**	Prof Jane Goudge et al
DEPARTMENT:	Centre for Health Policy Sedibeng Health District University of the Witwatersrand and University of Warwick
PROJECT TITLE:	Implementing Comprehensive, Integrated, Community-Based Health Care for Under-Served, Vulnerable Communities in South Africa: A Practical, Evidence-Informed Model
DATE CONSIDERED:	01/04/2016
DECISION:	Approved
	Written permission to conduct the study must be submitted prior to study commencement for each study site.
CONDITIONS:	
SUPERVISOR:	
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	29/08/2016

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 10004, 10th floor, Senate House/2nd Floor, Phillip Tobias Building, Parktown, 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 t/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 in **March** and will therefore be due in the month of **March** each year.

5 September 2016

Principal investigator Signature

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 3.4c: Tshwane District Health Authority approval letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Enquiries: Dr. Mpho Moshime-Shabangu
Tel: +27 12 451 9036
E-mail: Mpho.Moshime@gauteng.gov.za

TSHWANE RESEARCH COMMITTEE: CLEARANCE CERTIFICATE

DATE ISSUED: 31/08/2020
PROJECT NUMBER: 34/2020
NHRD REFERENCE NUMBER: GP_202001_012

TOPIC: Implementation and Assessment Methods of Community Health Worker Training Programmes

Name of the Researcher:	Dr Olukemi Babalola
Name of the Supervisor:	Prof Jane Goudge Prof Frances Griffiths
Facilities:	Phedisong 6 Clinic Stanza Bopape CHC
Name of the Department:	University of the Witwatersrand

NB: THIS OFFICE REQUEST A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE AND

NOTE THAT RESUBMISSION OF THE PROTOCOL BY RESEARCHER(S) IS REQUIRED IF THERE IS DEPARTURE FROM THE PROTOCOL PROCEDURES AS APPROVED BY THE COMMITTEE.

DECISION OF THE COMMITTEE: APPROVED

.....
Dr. Mpho Moshime-Shabangu
Deputy Chairperson: Tshwane Research Committee
Date.....

.....
Mr. Mothomone Pitsi
Chief Director: Tshwane District Health
Date: .....

Annexure 1

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DECLARATION OF INTENT FROM THE PHC MANAGER FOR TSHWANE PROVINCIAL CLINICS

I give preliminary permission to **Dr Olukemi Babalola** to do his or her research on **"Implementation and Assessment Methods of Community Health Worker Training Programmes."** in

Phedisong 6 Clinic
Stanza Bopape CHC

I know that the final approval will be from the Tshwane Regional Research Ethics Committee and that this is only to indicate that the clinic/hospital is willing to assist.

Other comments or conditions prescribed by the PHC Manager to the Researcher are

The researcher to have an entry meeting with potential facilities before starting with the data collection.

Mr M. Makhudu
Primary Health Care: Tshwane
Date: 19/2/2020

Appendix 3.4d: Ehlanzeni District Health Authority approval letter

health
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

Indwe Building, Government Boulevard, Riverside Park, Ext. 2, Mbombela, 1200, Mpumalanga Province
Private Bag X11285, Mbombela, 1200, Mpumalanga Province
Tel I: +27 (13) 766 3429, Fax: +27 (13) 766 3458

Litiko Letemphilo | Departement van Gesondheid | UmNyango WezeMaphilo

Enq: 013 766 3766/3511
Ref: MP_2020001_002

Provincial Research Approval Letter

Dr Olukemi Babalola
School of Public Health, Room 313,
Centre for Health Policy,
Private Bag X3,
Wits, 2050

TITLE: **APPLICATION FOR RESEARCH APPROVAL: IMPLEMENTATION AND ASSESSMENT METHODS OF COMMUNITY HEALTH WORKER TRAINING PROGRAMMES**

Dear Dr Babalola

The Provincial Department of Health Research Committee has approved your research proposal in the latest format you sent.

- Approval Reference Number: MP_2020001_002.
- Data Collection Period: 15/07/2020 to 15/11/2021.
- Approved Data Collection Facilities: Ehlanzeni District; Arthurseat Clinic; and Shatale Clinic.

Kindly ensure that the study is conducted with minimal disruption and impact on our staff, and also ensure that you provide us with a soft or hard copy of the report once your research project has been completed.

NB: Please note that due to the Covid-19 pandemic, face to face interviews may not be permitted during lockdown levels 3, 4 & 5.

Kind regards

DR C NELSON
MPUMALANGA PHRC CHAIRPERSON
DATE: **2 July 2020**

MPUMALANGA
THE PLACE OF THE RISING SUN

Appendix 3. 5: Information sheet for face validity/acceptability of the quality-of-care assessment tool

Formal Title: Implementation and assessment methods of community health worker training programme

My name is Olukemi Babalola. I am a PhD student at the School of Public Health, Centre for Health Policy at the University of the Witwatersrand.

Thank you for reading this Study Information Sheet.

What is my PhD study about?

I am conducting this study to find out about the experience of people who are involved in the training of community health workers who provide a wide range of services to people in the community and how these workers are assessed after they have been trained.

Why have I asked you for an interview?

We know that community health workers are performing a wider range of services when they go to the households. To be able to assess the quality of the work that they do, we need to know more about how their training is being carried out.

In one of our previous studies, we have developed a tool (Quality of Care Assessment Tool; QoCAT), to assess the quality of the services that CHW provide after they have been trained. I am asking for your permission to assess this tool to see how useful it is.

What is involved for you?

If you agree, I will be giving you the paper version of the tool (QoCAT) and another paper questionnaire that you will need to complete by providing a mark (score) for your answer. I will also be asking for any explanation for what you think we have not included in the tool. The assessment interview will last up to 60 minutes. With your permission, I will audio-record the interview and make notes during the interview.

What will happen to the interview data?

I will transcribe the audio-recording. I will remove any identifiers such as names and locations. I will analyse all the data for this study and write a paper for publication. The paper is likely to include anonymised quotes from interviews.

Is my participation voluntary?

It is up to you to decide whether you want to participate in this research. If you agree to help with this research, and later change your mind, you are free to end the interview at any time, without any consequences.

Are there any risks associated with the participation?

There are no risks associated with the participation in this study. Please note confidentiality section below

Is my participation and data kept confidential?

The information obtained from the questionnaire will be used for research purposes only. No one other than the research team members will be allowed to see the information. We will not disclose your identity

or use your name in any reports of this work. The knowledge gained from this research will be shared in summary form, without revealing individuals' identities. Only grouped results, not of individual, will be shared.

Anonymity will be protected by assigning codes, e.g., A or B, to respondents (used in transcripts), and data presentation will avoid specific individuals or groups of people being identified. Participant codes will be kept in a locked filing cabinet under my care for the duration of the data collection and analysis and will be destroyed once analysis is complete. The audio recording will be stored on a secure university computer server and destroyed at the end of 2 years if there is a publication and 6 years if there is none. Your name, consent form and interview transcript, will be stored on a password protected University computer for 10 years in-line with university research data policy.

Approval for and benefits of this work

The study has been approved by the ethics committee of University of the Witwatersrand, Mpumalanga and Gauteng Provinces. We hope the study will contribute new ideas and insights regarding the quality of the community health worker services.

If you agree to participate, we would also like you to complete the consent form.

Can I see a copy of the study report?

I will be pleased to show the final report of this study on request.

What if I have any questions?

You are free to ask me any question about this research. You may contact me on 078 855 5594/olukemi.babalola1@wits.ac.za You can also contact my supervisors, Professor Jane Goudge on 011 717 3425/ jane.goudge@gmail.com, or Professor Frances Griffiths at +44 (0)24765 22534/ f.e.griffiths@warwick.ac.uk

Who has reviewed and approved the study?

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Appendix 3. 6: Information sheet for observing the quality of CHW services

Formal Title: Implementation and assessment methods of community health worker training programme.

My name is Olukemi Babalola. I am a PhD student at the School of Public Health, Centre for Health Policy at the University of the Witwatersrand.

Thank you for reading this Study Information Sheet.

What is my PhD study about?

I am conducting this study to find out about the quality of service that community health workers, who visit people at home, provide to people in the community. We are visiting households to observe the services and the type of messages that you, community health worker, offer to members of the household. I would like to invite you to participate.

If you agree to participate, I will be observing the services that you, the community health worker, offer to members of households. All information obtained will be kept confidential.

Is my participation voluntary?

It is up to you to decide whether you want to participate in this research. If you agree to help with this research, and later change your mind, you are free to end the interview at any time, without any consequences.

Are there any risks associated with the participation?

There are no risks associated with the participation in this study. Please note confidentiality section below

Is my participation and data kept confidential?

The information will be used for research purposes only, and nobody outside of the research team will see your answers you give. Your name will not be stored together with your answers. We will not disclose your identity or use your name in any reports of this work. The knowledge gained from this research will be shared in summary form, without revealing individuals' identities. Only grouped results, not of individual, will be shared.

Anonymity will be protected by assigning codes, e.g., A or B, to respondents (used in transcripts), and data presentation will avoid specific individuals or groups of people being identified. Participant codes will be kept in a locked filing cabinet under my care for the duration of the data collection and analysis and will be destroyed once analysis is complete. Your name, consent form and observation checklist, will be stored on a password protected University computer for 10 years in-line with university research data policy.

Approval for and benefits of this work

The study has been approved by the ethics committee of University of the Witwatersrand, Mpumalanga and Gauteng Provinces. We hope the study will contribute new ideas and insights regarding the quality of the community health worker services.

If you agree to participate, we would also like you to complete the consent form.

Can I see a copy of the study report?

I will be pleased to show the final report of this study on request.

What if I have any questions?

You are free to ask me any question about this research. You may contact me on 078 855 5594/olukemi.babalola1@wits.ac.za You can also contact my supervisors, Professor Jane Goudge on 011 717 3425/ jane.goudge@gmail.com, or Professor Frances Griffiths at +44 (0)24765 22534/ f.e.griffiths@warwick.ac.uk

Who has reviewed and approved the study?

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Appendix 3. 7: Information sheet for experts on content validity of the quality-of-care assessment tool

Formal Title: Assessing the utility of the post-training assessment tool (QoCAT) used in assessing the services provided by trained community health workers

Dear Prof/Dr/Mr/Ms_____

Hello and thank you for your time today.

My name is Olukemi Babalola. I am a PhD student at the School of Public Health, Centre for Health Policy at the University of the Witwatersrand.

What is my PhD study about?

In South Africa, since the adoption of the national community health worker programme in 2011,[3] we know that community health workers have been performing a wider range of services when they go to the households. We have developed a tool (Quality of Care Assessment Tool; QoCAT)[4] to assess the quality of the services that community health workers provide after they have been trained. I am conducting this study to find out about the usefulness (content validity) of the tool in assessing the quality of care of community health workers who perform comprehensive care.

Benefits of this work

We hope the study will contribute to understanding how to assess the quality of community health worker services.

The QoCAT

The QoCAT is used to collect data during household visits by a trained non-clinical fieldworker. It is structured to fit with the flow of activities when a community health worker is conducting household visits. Data is collected just before entry, during the household visit and, after leaving the household.

QoCAT fieldwork manual

Fieldworkers are trained to collect the data as documented in a fieldwork manual.

What is involved for you?

I invite you as an expert to evaluate the relevance of the QoCAT components that directly assess the quality of care provided by trained community health workers. If you agree, I will send you the tool (QoCAT – Document B), the fieldwork manual (Document C, for reference only), and a questionnaire to complete (Document D). The questionnaire (Document D) includes questions with a series of ratings on a Likert

[3] Schneider H, Besada D, Daviaud E, Sanders D, Rohde S. Ward-based primary health care outreach teams in South Africa: developments, challenges and future directions. South African Health Review. 2018;2018(1):59-65.

[4] Griffiths F, Babalola O, Brown C, de Kadt J, Malatji H, Thorogood M, Tseng YH, Goudge J. Development of a tool for assessing quality of comprehensive care provided by community health workers in a community-based care programme in South Africa. BMJ open. 2019 Sep 1;9(9):e030677. doi: 10.1136/bmjopen-2019-030677.

scale and questions about what is missing from the tool and opportunity for your further comments. If you prefer, I can meet you (virtually) to complete the questionnaire.

Why are we approaching you?

For at least 3 years you have worked on the issue of community health workers, you have at least a master's degree, and at least three relevant publications or reports related to community health workers' performance within the South African context.

What will happen to the data?

I will analyse all the data and write a paper for publication.

Is my participation voluntary?

Your participation in this research is voluntary.

Is my participation confidential?

Each expert reviewer will work independently, and the identity of each reviewer will not be revealed to any other reviewer. Should you agree, we will identify the expert reviewers in the acknowledgment section of the final report of this study. If you do not agree your contribution will remain confidential to myself and my PhD supervisors.

How do I know the results of this work?

I will send you the final report of this study on request.

What if I have any questions?

You are free to ask me any question about this research. You may contact me on 078 855 5594/olukemi.babalola1@wits.ac.za You can also contact my supervisors, Professor Jane Goudge on 011 717 3425/ jane.goudge@gmail.com, or Professor Frances Griffiths at +44 (0)24765 22534/ f.e.griffiths@warwick.ac.uk

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Appendix 3. 8: Consent form for the face validity of the quality of care assessment tool

PLEASE COMPLETE ONE FORM FOR EACH PARTICIPANT

PLEASE COMPLETE THE IDs IN THE SPACES BELOW

_____	_____	_____
DATE	**LOCATION CODE**	**PARTICIPANT CODE**

Title of project: Implementation and assessment methods of community health worker training programme

Name of researcher: Olukemi Babalola

I …… agree to participate in this research project. I have read the information sheet and the research has been explained to me and I understand what my participation will involve.

I agree to participate in completing the questionnaire YES NO (please circle)

I agree that the researcher may use quotes
in her research report that do not identify me YES NO

…… (signature)
…… (name of participant)
…… (date)

PERSON PROVDING CONSENT

I certify that s/he apparently understood the nature and the purpose of the study and consents to the participation in the study. S/he has been given opportunity to ask questions which have been answered satisfactorily.

Signature: _____ **Date:** _____

Designee/investigator's name _____ **Time:** _____
(please print name)

Appendix 3. 9: Consent form for the audio recording of the CHW questionnaire workshop on face validity/acceptability of the quality-of-care assessment tool

DATE	LOCATION CODE	PARTICIPANT CODE

Title of project: Implementation and assessment methods of community health worker training programme

Name of researcher: Olukemi Babalola

I agree to participate in this research project. The research has been explained to me and I understand what my participation will involve.	YES	NO
I agree that the workshop may be audio recorded	YES	NO

…… (signature)

…… (name of participant)

…… (date)

PERSON PROVIDING CONSENT

I certify that s/he apparently understood the nature and the purpose of the study and consents to the participation in the study. S/he has been given opportunity to ask questions which have been answered.

Signature: _____ **Date** _____

Designee/investigator's Name _____ **Time:** _____
(please print name)

Appendix 3. 10: Consent form for observing the quality of CHW services

PLEASE COMPLETE ONE FORM FOR EACH OF THE CHW

PLEASE COMPLETE THE IDs IN THE SPACES BELOW

_____	_____	_____	_____
DATE	**SITE**	**CHW INITIALS**	**CHW CODE**

I have had the study explained to me. I have understood all that has been read and had my questions answered satisfactorily.

☐ **Yes** *please tick* **I agree to be observed**

I understand that I can change my mind at any stage, and it will not affect me in any way.

Signature: _____ **Date:** _____

Participant Name: _____ **Time:** _____
Name ***(please print name)***

I certify that S/he apparently understood the nature and the purpose of the study and consents to the participation in the study. S/he has been given opportunity to ask questions which have been answered satisfactorily.

Signature: _____ **Date:** _____

Designee/investigator's name _____ **Time:** _____
(please print name)

Appendix 3. 11: Revised Batlhokomedi information sheet for observing the quality of CHW services

INTRODUCTION / INFORMATION SHEET

Formal Title: Implementing comprehensive, integrated, community-based health care for under-served, vulnerable communities in South Africa: A practical, evidence-informed model.

Hello. My name is _____. I work for the Centre for Health Policy at the University of the Witwatersrand.

We are conducting a study to find out about the quality of service that community health workers, who visit people at home, provide to people in the community. We are visiting households to observe the services and the type of messages that you, community health worker, offer to members of the household. I would like to invite you to participate.

If you agree to participate, I will be observing the services that you, the community health worker, offer to members of households. All information obtained will be kept confidential.

Voluntary participation

Participation in this study is voluntary. You are free to withdraw at any time, without any consequences.

Risks

There are no risks associated with participating in the research.

Confidentiality

The information will be used for research purposes only, and nobody outside of the research team will see your answers you give. Your name will not be stored together with your answers. We will not disclose your identity or use your name in any reports of this work. The knowledge gained from this research will be shared in summary form, without revealing individuals' identities.

Anonymous use of your information in future

The information you provide may also be used in future by other researchers for research purposes only if you agree. All information that could be used to identify you would have been removed before they are allowed to have such information. Therefore, they will not be able to disclose your identity or use your name in any reports of their work. The knowledge gained from this research will be shared in summary form.

Approval for and benefits of this work

The study has been approved by the ethics committee of University of the Witwatersrand, and Gauteng Provincial Department of Health. The study will contribute new ideas and insights regarding the provision of Community Health Worker services.

What if I have any questions?

You are free to ask me any question about this research. You can also contact Kemi Babalola on olukemi.babalola1@wits.ac.za or 078-855-5594 or (011) 717-3434

If you are concerned about anything to do with the study in general, or wish to make a complaint, you can contact the chair of the ethics committee at the University of the Witwatersrand, who is Professor Clement Penny at telephone number: (011) 717-2301.

Appendix 3. 12: Revised Batlhokomedi consent form for observing the quality of CHW services

PLEASE COMPLETE THE IDs IN THE SPACES BELOW

Title of project: Implementing comprehensive, integrated, community-based health care for under-served, vulnerable communities in South Africa: A practical, evidence-informed model.

Name of researcher:

_____	_____	_____	_____
DATE	**SITE**	**CHW INITIALS**	**CHW CODE**

I have had the study explained to me. I have understood all that has been read and had my questions answered satisfactorily.
please tick

I agree to be interviewed	YES □	NO □
I agree that the information I provide may be used anonymously by other researchers following this study	YES □	NO □

I understand that I can change my mind at any stage, and it will not affect me in any way.

Signature: _____ **Date:** _____

Participant Name: _____ **Time:** _____
Name ***(please print name)***

I certify that she apparently understood the nature and the purpose of the study and consents to the participation in the study. She has been given opportunity to ask questions which have been answered satisfactorily.

Signature: _____ **Date:** _____

Designee/investigator's name _____ **Time:** _____
(please print name)

Appendix 3. 13: Letter of Batlhokomedi data release

The Centre for Health Policy

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

14 January, 2020

Dear Prof Clement Penny,

Batlhokomedi Project Data for PhD Research Work

This is to certify that Dr Olukemi Babalola, a PhD student at the Centre for Health Policy, School of Public Health, Wits University is conducting a research entitled "Implementation and Assessment Methods of Community Health Worker Training Programmes" under the supervision of Prof Jane Goudge of the Centre for Health Policy. By this letter, she is being granted approval to utilise the de-identified Batlhokomedi Project data collected between 2017 to 2019 in her secondary data analysis.

The Batlhokomedi Project entitled "Implementing Comprehensive, Integrated, Community-based Health care for Underserved, Vulnerable Communities in South Africa: A Practical, Evidence-informed Model" was approved by the Human Research Ethics Committee (Medical), with Clearance Certificate No. M160354. Kemi will also be required to comply with appropriate ethical processes in the use of the data.

Please do not hesitate to contact me if you require any further details regarding this letter, or on the Batlhokomedi study more generally. I can be reached at jane.goudge@gmail.com, or on 011 717 3425

Yours sincerely,

Prof Jane Goudge
The Director
Centre for Health Policy
School of Public Health

Health Policy and Systems Research

3rd Floor, New School of Public Health Building, Wits Education Campus, 27 St Andrews Rd Parktown
Private Bag X3 Wits 2050 · Tel: 27 (0) 11 717 3420 · Fax: +27 (0) 86 568 9144 · www.wits.ac.za/chp

Appendix 6. 1: Questionnaire for face validity of the quality-of-care assessment tool

Title of project: Implementation and assessment methods of community health worker training programme

Name of researcher: Olukemi Babalola

_____	_____	_____
DATE	**LOCATION CODE**	**PARTICIPANT CODE**

Please tell me a bit about yourself

How many years have you worked as a CHW in total? _____Months _____Years

Please tick the CHW training you have attended:

Phase 1 ☐

Phase 2 ☐

Other – please specify ☐

Please list any training you are currently undertaking

_____

Please tick the CHW training you have passed:

Phase 1 ☐

Phase 2 ☐

Other – please specify ☐

Please indicate how much you agree or disagree with each of the following statements:

	Strongly disagree =1	**Somewhat disagree =2**	**Neither agree nor disagree =3**	**Somewhat agree =4**	**Strongly agree =5**
1. This tool (QoCAT) covers everything that happens on household visits					

Please provide explanation for your answer in (1) above

_____

_____

	Strongly disagree =1	Somewhat disagree =2	Neither agree nor disagree =3	Somewhat agree =4	Strongly agree =5
2. I would be happy for my home visits to be assessed using this tool					

Please provide explanation for your answer in (2) above

_____

_____

_____

Appendix 6. 2: Expert questionnaire for content validity of the quality-of-care assessment tool

Title: Assessing the Utility of the Post-Training Quality of Care Assessment Tool (QoCat) Used in Assessing the Services Provided by Trained Community Health Workers (CHWs)

Thank you for agreeing to complete this expert review content validity evaluation questionnaire (henceforth, '*questionnaire*')**:**

In order to complete the *questionnaire*, I suggest you read through the Participants Information Sheet (Document A) and view Document B (Quality of Care Assessment Tool, QoCAT), and Document C (fieldwork manual). Then, familiarise yourself with this document that covers how we developed the QoCAT in pages 2-3 below; and the *questionnaire*, pages 4-6 below.

The attached QoCAT (Document B), is a three-page document with the following sections:

a. Household entry form (numbered serially from 1 - 16)
b. Patients form (Condition/patient type and advice/messages)
c. Exit and fieldworker assessment form (numbered serially from 17 - 30)

The attached fieldwork manual (Document C), is a seven-page document with the guidelines on how to complete the QoCAT

The *questionnaire* for you to complete is on page 4 in this Document D. It includes questions with the numbers corresponding to the component of QoCAT being assessed. Please

i. Check the QoCAT component being assessed in Document B using the corresponding numbers and examples/explanations in Document C (fieldwork manual).
ii. Provide a rating (1-5) for each question here in Document D, pages 4-6
iii. Write your comments in the spaces provided after each question.

You will notice that the *questionnaire* (pages 4-6, Document D) does not ask you to assess the content of the CHW bag or the actions/messages provided by the CHWs in the QoCAT Patients form (Document B), which includes questions on the conditions of householders for which the CHW provides advice/messages and actions during household visits). These items are based on the national CHW training manual and on the expectations of stakeholders at Sedibeng District (where the primary study was conducted). Since these items are based on the specific context of this district, others using this tool will need to edit these sections based on the expectation of their CHWs.

Thank you very much for your participation.

A. Quality of care assessment tool (QoCAT)[5]

QoCAT was developed as an observation tool for use by non-clinician fieldworkers shadowing community health workers (CHWs) on their household visits. A fieldwork manual was developed to guide the completion of the tool by the fieldworkers.

Tool development
QoCAT was developed within a 3-year intervention study that aimed to improve the quality of care of CHWs in Sedibeng District through improved supervision and training. The tool was used to assess CHW quality of care before and after the intervention. Tool content was derived from literature review, the CHW training manual and a qualitative observation study of CHWs[6]

Why observation by fieldworkers?
QoCAT is designed to assess CHW quality of care delivered during household visits. We considered several approaches to the assessment. Formal tests assess what CHWs could do and not what they actually do. A nurse as observer is expensive and could affect data because CHWs defer to nurses and householders would expect care from nurses during visits if a CHW was unable to provide needed care. Our earlier observation study indicated that CHWs accepted non-clinical fieldworkers' observation of their activities. Therefore, we used the approach of non-clinical fieldworkers' observation of CHW activities to complete QoCAT.

Development of manual for fieldworkers
From our research data, we identified various CHW household visits scenarios and content that informed what was included in a fieldwork manual developed to guide the fieldworkers in completing QoCAT. For example, what to do when a visitor with a health need is present during CHW household visit (not rated by FW because the visitors are not members of that household), or when a household member is not present but is well, or not present but should have received care (no patient form is completed for that patient). To assess whether the CHW was sufficiently sensitive to the privacy of all the patients, the fieldworker was required to provide a Yes/No/Best given circumstances options. For best given circumstances, the patient may have given a go-ahead for consultation in the presence of another person. Whether the CHW was sufficiently sensitive to privacy could be difficult to rate for a fieldworker in such an instance.

Training of the fieldworkers
The non-clinical fieldworkers (with degree in social work and public health) underwent training on the CHW training manual, CHWs scope of practice, QoCAT and fieldwork manual. Fieldworkers used observations from previously undertaken household visits to undertake role plays, to simulate various household visit scenarios. Based on the observations, the fieldworkers completed the QoCAT independently. Changes were made to the tool format to make recording as easy as possible (for fieldworkers recording while standing and confined to a small space). QoCAT was piloted for its feasibility.

[5] Griffiths F, Babalola O, Brown C, de Kadt J, Malatji H, Thorogood M, Tseng YH, Goudge J. Development of a tool for assessing quality of comprehensive care provided by community health workers in a community-based care programme in South Africa. BMJ open. 2019 Sep 1;9(9):e030677. doi: 10.1136/bmjopen-2019-030677.

[6] Tseng YH, Griffiths F, de Kadt J, Nxumalo N, Rwafa T, Malatji H, Goudge J. Integrating community health workers into the formal health system to improve performance: a qualitative study on the role of on-site supervision in the South African programme. BMJ open. 2019 Feb 1;9(2):e022186. doi: 10.1136/bmjopen-2018-022186.

QoCAT structure

QoCAT was structured in line with the flow of the CHW working day during household visits (Table1).

Table 1 QoCAT structure

Tool sections (point at which recorded)	Components of the tool	To be assessed for content validity in this study
Before setting out	Contents of CHW bag	No
Just before and on entry to a household	Visit planning	Yes
	CHW communication skills including attention to confidentiality	
During household visit	Householder conditions and messages and actions expected of CHW	No
	CHW communication skills including attention to confidentiality	Yes
After leaving the household	Factors that would prevent a CHW delivering good quality care	Yes
	CHW communication skills including attention to confidentiality	

How QoCAT is scored

The items in QoCAT require a categorical response (e.g., yes/no; present/absent, scored as 1/0). The data scores were aggregated and, through further calculations, were used to derive message and communication scores (separately) per household. The proportion of expected messages given and actions undertaken for each household, as well as the proportion of items with positive outcome while assessing communication were reported as the household message or communication score, respectively.

B. ***The questionnaire***

Please indicate how much you agree or disagree with each of the following statements:

	Strongly disagree =1	**Somewhat disagree =2**	**Neither agree nor disagree =3**	**Somewhat agree =4**	**Strongly agree =5**
1. <u>Approach to data collection by observation</u> **We performed data collection by direct observations of CHW activities by trained non-clinical fieldworkers.** **To what extent do you agree with the following approach:**					
a. Data collection via observation for assessing the quality of care delivered by CHWs during household visits					
b. Data collection by trained non-clinical fieldworkers for assessing the quality of care delivered by CHWs during household visits					
c. What other approaches might be better?					

	Strongly disagree =1	**Somewhat disagree =2**	**Neither agree nor disagree =3**	**Somewhat agree =4**	**Strongly agree =5**
2. In order to assess the quality of communication, please refer Document B questions 10-16 and Document C, numbers 17-21: **a.** To what extent do you agree that these communication questions are sufficient to evaluate the quality of CHW communication in the household?					X
b. Are there additional communication issues that you wish we had considered?					

	Strongly disagree =1	**Somewhat disagree =2**	**Neither agree nor disagree =3**	**Somewhat agree =4**	**Strongly agree =5**
3. To assess whether the CHW was sufficiently sensitive to the privacy of the householder, the fieldworker records 'No,' 'Yes,' or 'best given circumstance' for QoCAT questions 20-21 (refer Document B) depending on examples in the fieldwork manual (refer Document C, number 22). a. To what extent do you agree that the examples in the fieldwork manual for assessing privacy is right when the rating is:					
No					
Yes					
Best given circumstance					

b. What would you consider that a CHW needs to do, that we might not have considered, in order to score a yes rather than a no?

	Strongly disagree =1	Somewhat disagree =2	Neither agree nor disagree =3	Somewhat agree =4	Strongly agree =5
4. To assess the quality of communication of CHW, we took note of the fact that about a third of the planned visits by CHWs are for medication delivery, which involves visiting the same household 1-2 times per month. These visits might not involve a lot of communication. **With this in mind, we asked whether the CHW has had prior engagement with that household or not and what the CHW plan is for this visit (refer Document B question 2 (response "=Never") and question 4):** a. To what extent do you agree that these are necessary in assessing the quality of communication?					

b. Are there other issues that we should consider that could affect how we interpret the quality of communication of CHW?

	Strongly disagree =1	Somewhat disagree =2	Neither agree nor disagree =3	Somewhat agree =4	Strongly agree =5
5. To interpret the quality of care provided by the CHWs, we considered household-level or health system-level problems where the householder is not negative to the CHW but which could constitute unresolved barriers to ensuring the patient gets access to care (refer Document B questions 23-24 and Document C number 27). For example, a crying baby might limit the time for the CHW to deliver care and a negative experience of the householder with the health system could reduce trust in anyone representing the health system a. To what extent do you agree that documenting these are necessary in assessing the quality of care?					

b. Are there other issues that we should consider that could affect how we interpret the quality of care of CHW?

	Strongly disagree =1	Somewhat disagree =2	Neither agree nor disagree =3	Somewhat agree =4	Strongly agree =5

6. We asked whether the CHWs took note during the consultation in QoCAT question 22 (Document B): **a.** To what extent do you agree that note taking by CHWs is an aspect of care quality?					
b. Are there additional questions that we should add about maintain records of CHW work?					
	Strongly disagree =1	**Somewhat disagree =2**	**Neither agree nor disagree =3**	**Somewhat agree =4**	**Strongly agree =5**
7. A CHW who scores highly on the checklist part of this tool (QoCAT) page 2, Document B (Patients Form) would be a genuinely high-performing CHW (and vice versa) **a.** To what extent do you agree with the above statement?					
b. Please explain your answer?					
	Strongly disagree =1	**Somewhat disagree =2**	**Neither agree nor disagree =3**	**Somewhat agree =4**	**Strongly agree =5**
8. A CHW who scores highly on the global rating part of this tool as rated by the fieldworker (refer Document B, question 26 and Document C, number 28) would be a genuinely high-performing CHW (and vice versa) **a.** To what extent do you agree with the above statement bearing in mind your knowledge of global ratings?					
b. Please explain your answer?					
9. Kindly provide here any other comments that you may have on the tool in general					

Appendix Turnitin 1

669557, Olukemi Solabomi Babalola, PhD Thesis.docx

ORIGINALITY REPORT

4%	3%	3%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	wiredspace.wits.ac.za Internet Source	1%
2	bmjopen.bmj.com Internet Source	1%
3	Ras, Reuben Charles. "Can Petroleum Jelly be Used to Obtain Satisfactory Renal Ultrasound Imaging?", University of the Witwatersrand, Johannesburg (South Africa), 2025 Publication	1%
4	wrap.warwick.ac.uk Internet Source	<1%
5	www.frontiersin.org Internet Source	<1%
6	Martin Vinæs Larsen, Gabriel Lenz, Anna Mikkelborg. "Migration and the Persistence of Violence", Open Science Framework, 2023 Publication	<1%
7	www.ncbi.nlm.nih.gov Internet Source	<1%
8	health-policy-systems.biomedcentral.com	