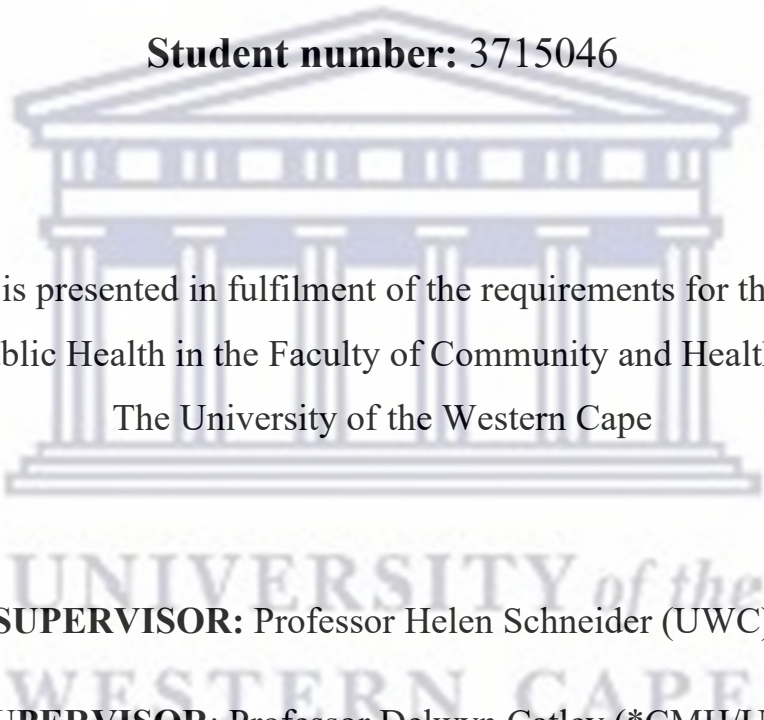


**Evaluating Community Health Workers' Capacity to Deliver
'Lifestyle Africa' in Cape Town, South Africa: Adaptation of the
Diabetes Prevention Programme for a Middle-Income Country**

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Student number: 3715046



This thesis is presented in fulfilment of the requirements for the degree of
Master of Public Health in the Faculty of Community and Health Sciences at
The University of the Western Cape

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KEYWORDS

Community Health Workers

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Health promotion

Group facilitation

Programme delivery

CHW training and supervision

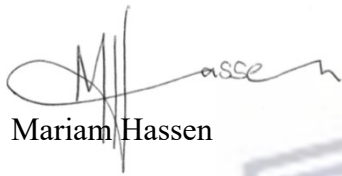
Low and Middle Income Countries

Lifestyle interventions for chronic disease management



DECLARATION

In submitting this thesis, I declare that the entirety of the work contained herein is my own original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), and that this work has not been submitted for any other degree at any other institution.


Mariam Hassen

November 2023



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ABSTRACT

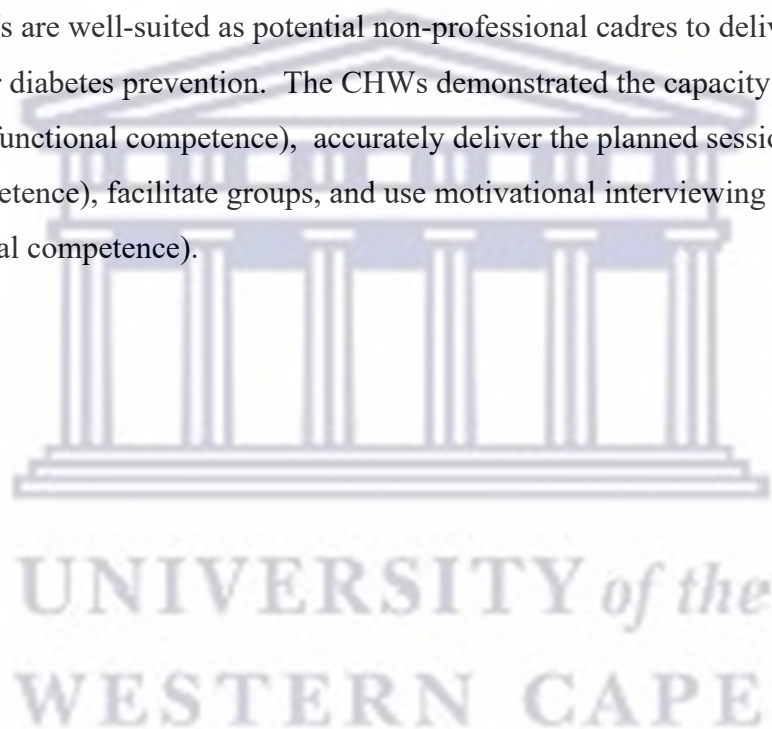
Background and rationale: There is a growing burden of Non-Communicable Diseases (NCDs), such as Type 2 Diabetes, globally and in particular in low- and middle-income countries (LMICs). LMICs face the added challenge of curbing the syndemics of NCDs and infectious diseases, such as HIV and TB, and more recently COVID-19. These diseases pose a growing threat to health systems, communities, and development, which will ultimately affect the goal of reaching Universal Health Coverage and Sustainable Development Goals (SDGs). These challenges require new and comprehensive models of service delivery and more efficient resource use. Task shifting to community health workers (CHW) is a strategy promoted in LMICs to ease burdens on human resources for health. However, there is limited evidence in the literature on the impacts and sustainability of holistic NCD management in LMICs with a need for contextually adapted and “socially valid” strategies to match the resources and existing capacity of health and other sectoral systems. This thesis examines the roles and capacity of CHWs in the prevention and management of Type 2 Diabetes.

Study aim: To evaluate the capacity of CHWs to effectively deliver an adaptation of a Diabetes Prevention Programme (Lifestyle Africa) to chronic disease club participants in an urban community setting in Cape Town.

Methods: A descriptive study was conducted, drawing on data collected through observations of CHW (n=18) practice and delivery, and surveys of patients (n=134) from 11 community clubs participating in a two-arm parallel cluster randomised control trial. The Lifestyle Africa trial intervention consisted of 17 health promotion sessions based on group motivational interviewing techniques and was delivered over 8 months by trained CHWs. Trial outcome measures included weight loss and improved glycaemic control. Using validated instruments for assessing Motivational Interviewing (MI) and Group Facilitation (GF), independent observers using Likert scales (1-7), rated a total of 133 group sessions delivered by CHWs. CHWs were also rated on delivery of session-specific content, and completion of set-up procedures. Summary MI and GF scores were computed and aggregated to assess CHW performance, factors associated with this performance, and the association between performance and study outcomes. The study protocol was approved by the University of the Western Cape BMREC and Higher degrees (Ethics Ref no.BM17/8/22)

Results: In their delivery of Lifestyle Africa, the CHWs reached the completion standard of 80% for the majority of the set-up procedures. They showed similar good levels of performance (as a percentage of maximum possible scores) in the delivery of session-specific content tasks of $89.7\% \pm 18.7$ (56.0-100%); in group facilitation of $77.2\% \pm 6.2$ (70.2-88.3%); and in motivational interviewing techniques of $75.5\% \pm 7.4$ (66.2-88.6%). The trend was for CHW performance to improve over time. Performance was also positively shaped by club characteristics such as mean education levels and age. Positive correlations were seen between mean club MI scores and percentage improvement in glycemetic control.

Conclusions. When provided with appropriate training, supportive supervision, and resources, CHWs are well-suited as potential non-professional cadres to deliver lifestyle interventions for diabetes prevention. The CHWs demonstrated the capacity to adhere to set-up procedures (functional competence), accurately deliver the planned session content (cognitive competence), facilitate groups, and use motivational interviewing techniques effectively (social competence).



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LIST OF ABBREVIATIONS

ANOVA: Analysis of Variance

ART: Antiretroviral Therapy

BMI: Body Mass Index

BoD: Burden of Disease

CDC: Centre for Disease Control

CDoH: Commercial Determinants of Health

CHW: Community Health Worker

DMB: Data Management Board

DPP: Diabetes Prevention Programme

ECD: Early Childhood Development

GF: Group Facilitation

HbA_{1c}: Glycated Haemoglobin

IDF: International Diabetes Federation

LMICs: Low- and Middle-Income Countries

MENA: Middle East and North Africa

MI: Motivational Interviewing

MICs: Middle-Income Countries

NCDs: Non-Communicable Diseases

NGO: Non-Government Organisation

NPOs: Non-Profit Organisations

O: Overall

RCT: Random Control Trial

SANHANES: South African National Health and Nutrition Examination Survey

SD: Standard Deviation

SDG: Sustainable Development Goals

SDPI-DP: Special Diabetes Programme for Indians

SDoH: Social Determinants of Health

SDT: Self-Determination Theory

SSA: Sub-Saharan Africa

T2D: Type 2 Diabetes

UHC: Universal Health Coverage

ZAR: South African Rand

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The world is faced with a pernicious epidemic of Type 2 Diabetes (T2D) and other Non-Communicable Diseases (NCDs). In 2019, the global prevalence of T2D amongst people above 20 years of age was 9.6% (Saeedi *et al.*, 2019), and of these, 79% of cases lived in Low and Middle-Income countries (LMICs), according to the International Diabetes Federation (IDF) (2019)

In South Africa, the prevalence of T2D for people over the age of 15 years has been estimated to be between 10-12% (Stokes *et al.*, 2017; Pheiffer *et al.*, 2018). Like many other Middle-Income countries (MICs), this high prevalence poses health system and economic challenges that impede reaching their Sustainable Development Goals (SDGs) and Universal Health Coverage (UHC). Growing burdens point to the need for greater investment in health resources and the strengthening of systems of care for this disease (Manne-Goehler, *et al.* 2019).

Managing and preventing T2D and other NCDs are pressing national and global public health concerns, not only due to their independent attributable Burden of Disease (BOD) but also their “syndemic” association (Levitt *et al.*, 2011; Mendenhall *et al.*, 2017; Swinburn, 2019) with HIV/TB and now the Coronavirus 2 (SARS-CoV-2) (Coetzee, *et al.* 2020; Horton, R. 2020).

Globally, management and prevention of the T2D epidemic and its syndemic diseases lean predominantly towards pharmaceutical interventions (Suhrccke, Boularte, and Niessen, 2012). Treatment adherence, patient support, and dietary and physical activity promotion by health care professionals, although not completely neglected, do not form the key element of the management of chronic diseases. There is limited evidence in the literature on the impacts and sustainability of holistic NCD management in LMICs, and there is a need for contextually adapted and “socially valid” strategies to match the resources and existing capacity of health and other sectoral systems (WHO, 2016). These strategies should form part of strong, sustainable, and scalable primary healthcare programmes (Checkley, *et al.*, 2014).

In LMICs, where resources are limited, lay or community health workers (CHWs) have played an essential role in mitigating some of the social and health inequities and increasing the reach of health care support through means of task shifting and outreach (Campbell and Scott, 2009; Fulton *et al.*, 2011; Tsolekile *et al.*, 2014; Scott *et al.*, 2018). This support is evident in TB-HIV care, maternal and child health, and in the prevention and treatment of malaria in most of Sub-Saharan Africa. However, evidence for the role of CHWs in the successful management and prevention of NCDs is still scarce.

The Diabetes Prevention Programme (DPP) is a High-Income Country (HIC), randomised control trial (RCT)-tested, lifestyle modification programme that focuses on health promotion and facilitated behaviour change in the context of social support. The DPP has repeatedly shown positive effects on risk and T2D markers, with participants both reducing body weight and increasing physical activity (Knowler *et al.*, 2002; Gruss *et al.*, 2019).

Systematic efforts to adapt and report on the implementation of such interventions in LMICs have been limited (Mathews *et al.*, 2017). The DPP is believed to have the potential for adaptation within the South African context, based on successful socio-culturally translated DPP programmes in other contexts (Nicolaou *et al.*, 2013; Tabak *et al.*, 2015; Mathews *et al.*, 2017; Aziz *et al.*, 2018; Thankappan *et al.*, 2018; Armenta-Guirado *et al.*, 2019). However, in these contexts of LMIC adaptations, trained professionals rather than community health workers have been at the forefront of delivery. This study looked at the capacity of CHWs to deliver such a programme.

The proposed use of CHWs as a cadre to do this work comes from evidence that lay, community educators have successfully implemented DPPs elsewhere (Ali, Echouffo-Tcheugui and Williamson, 2012). Based on the successful history and reach of CHW programmes in HIV and TB prevention, WHO has advocated for CHWs to be involved in NCD management and prevention (WHO, 2018).

1.2 DIABETES PREVENTION PROGRAMME LIFESTYLE AFRICA

This research drew on observational, implementation fidelity data, captured during the delivery of a novel cultural adaptation of the United States National DPP over an 8-month period spanning 2018 and 2019. (Catley *et al.*, 2019; 2022)

The DPP Lifestyle Africa programme is hereafter referred to as ‘Lifestyle Africa’. Lifestyle Africa aimed to evaluate the efficacy and feasibility of a CHW lead lifestyle programme in an under-resourced community in South Africa compared to usual care (Catley *et al.*, 2022) The effectiveness of Lifestyle Africa was evaluated using a two-arm parallel cluster RCT trial design. The primary outcomes of the research were weight loss. Secondary outcomes were changes from baseline of other biological markers such as HbA_{1c}, blood pressure and Lipids (Catley *et al.*, 2022; Wittington *et al.*, 2023)

Lifestyle Africa was delivered by CHWs who previously provided support to NCD patient groups monthly in ‘chronic disease clubs’ within their communities. These groups are run by government-contracted Non-Profit Organisations (NPOs) linked to the public Primary Health Care (PHC) system via CHWs. The NPOs are contracted to deliver medication, do health promotion and education, and provide basic health measurements on the participants’ (Tsolekile *et al.*, 2014).

The intervention, designed around motivational interviewing and group facilitation techniques, was implemented by specially trained CHWs on a weekly basis in 11 active NCD community support groups in a peri-urban settlement in Cape Town, South Africa. The groups varied in size and number of active members, ranging from 6-80 people. These support groups are predominantly frequented by elderly and/or unemployed members, who use the gatherings for a variety of purposes: health-promoting engagements, health screenings, social support, medicine collection points, arts-crafts and enterprise activities, prayer, and sometimes a daily meal. The groups meet in people’s homes, church facilities, schools/ECD facilities, or make-shift venues erected by the community, where they may not have always had access to municipal services such as electricity, running water, or ablution facilities on site.

1.3 PROBLEM STATEMENT

There is a shortage of professionally trained health workers to deliver lifestyle management programmes to prevent and manage T2D in South Africa and other LMICs. CHWs are a potential resource for delivering such programmes. CHWs are attuned to local community needs, cultures, and ways of addressing problems; and they are able to play several roles including that of brokering, translation, advocacy, and enabling community participation in

disease management. They are therefore ideally placed to deliver health promotion programmes within communities. As the incidence of NCDs increases, the need for building the skills and capacity of CHWs and CHW programmes to deliver community lifestyle management programmes in such settings will rise.

The available literature indicates there is a lack of appropriate training and supervision of CHWs to deliver T2D prevention and management programmes in LMICs, and this may be the reason for the poor outcomes reported. (Pallas *et al.*, 2013; Ballard and Montgomery, 2017; O'Donovan *et al.*, 2018; Scott *et al.*, 2018). There is also limited research and literature on CHW competencies and training and delivery adaptations required of professionally based T2D lifestyle programmes to make them suitable for delivery by CHWs in LMICs.

1.4 PURPOSE OF THE STUDY

The purpose of this research was to evaluate if CHWs are able to deliver as intended, a contextually adapted version of the efficacious DPP referred to as Lifestyle Africa. This study sought to assess the capacity of CHWs to deliver the Lifestyle Africa programme, and on the basis of this, to determine whether to advocate for CHW-led DPPs in South Africa.

1.5 AIMS AND OBJECTIVES

The aim of this study was to evaluate the capacity of CHWs to effectively deliver an adaptation of the Diabetes Prevention Programme -Lifestyle Africa in the urban setting of Cape Town.

The study had 3 main objectives:

- 1) Characterise the extent of the CHWs' overall fidelity to the Lifestyle Africa protocol with respect to:
 - i. Set-up Procedures (e.g. completing weigh-in and attendance, operating audio-visual equipment correctly)
 - ii. Basic Motivational Interviewing (MI) communication skills (e.g. using open questions, using reflective listening)
 - iii. Group facilitation (GF) skills (e.g. keeping the conversation going, giving everyone a chance to speak)
 - iv. Delivery of the session specific content

- 2) Assess variations in CHW capacity to deliver the programme across sessions by skill domains (Procedures, MI and GF), and club characteristics.
- 3) On the basis of above to draw conclusions on the functional and social competencies of the CHWs in their delivery of Lifestyle Africa

1.6 SETTING

The study was conducted in Khayelitsha, a peri-urban densely populated township situated 39 kilometres southwest of Cape Town city centre in the Western Cape Province of South Africa (Smit *et al.*, 2016).

Established in 1983 to accommodate 120,000 people, Khayelitsha is now home to nearly half a million people, making it the second-largest informal settlement, an area of rapid growth and in-migration characterised by informal housing, in South Africa. It is the largest township in Cape Town (South African History Online, 2019) and is also considered to be one of the poorest areas in the city with an unemployment rate of 41.7%. Although many people live in built structures, 55% live in informal dwellings (StatsSA, 2011). Khayelitsha has the highest mortality rate associated with NCDs in any of the local sub-districts within Cape Town (Groenewald *et al.* 2010) with the prevalence of T2D having increased by more than 50% over two decades (Peer *et al.*, 2012)

1.7 OVERVIEW

The remainder of this thesis is structured as follows: In Chapter Two, the researcher reviews the literature, aiming to frame the problem of NCDs and their management in LMICs, the use of CHWs to deliver health-promoting programmes and the evaluation of their capacity to do so to date. The literature looks at the efficacious NIH Diabetes Prevention Programme (DPP) and its potential in contextually adapted forms and delivery in groups as an option in the LMICS context to address diabetes prevention and management. It also explores the skill of motivational interviewing and a competency framework as a guide to understanding competence and a method of evaluating CHW competence in the context of intervention fidelity.

Chapter Three describes the methodology of this research. Chapter four presents the findings of the study and chapter five discusses the findings in relation to the literature, the concepts

of competence, capacity in the context of CHWs, and human resources for health as well as the limitations and recommendations.

The thesis ends with a conclusion and closing remarks for consideration.

1.8 DEFINITION OF TERMS

Community Health Workers – are lay health workers without formal training who provide health services to people within their own communities. They act as extenders, and bridge the gap between the community and the health system (Schaaf *et al.*, 2020)

Syndemic - presence of two or more disease states that adversely interact with each other, negatively affecting the mutual course of each disease trajectory (Lancet, 2017)

Fidelity – refers to the degree something is reproduced as intended. “It is the extent to which delivery of an intervention adheres to the protocol” (Mowbray *et al.*, 2003)

Capacity – refers to the potential someone has to accomplish a task. The main aim of this study was to demonstrate CHW’s capacity to deliver the Lifestyle Africa programme.

Competence – refers to the efficiency and effectiveness to accomplish something. “It is the ability to integrate and apply contextually appropriate knowledge, skills, and psychosocial factors (e.g., beliefs, attitudes, values, and motivations) to consistently perform successfully within a specified domain” (Vitello, S., Greator, J., and Shaw, S. 2021).

Universal Health Coverage – A target for 2030 Sustainable Development Goals. It refers to all people having access to quality essential health care and services when and where they need it regardless of economic status (WHO)

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter explores the increasing burden of Type 2 Diabetes (T2D) in Low and Middle-Income Countries (LMICs), risk factors for the disease, and management approaches adopted locally and globally and those recommended by the WHO. The review then describes the US National Institutes of Health-sponsored Diabetes Prevention Programme (DPP) as a model of T2D care and prevention and explores the potential of Community Health Workers (CHWs) in implementing such a programme. The review highlights what we know about CHWs and their role in addressing Non-Communicable Diseases (NCDs) and identifies the lack of empirical evidence of CHW-run programmes and the competence of CHWs in delivering T2D prevention programmes. Given the lack of evidence, the review proposes a theoretical model for assessing CHW competence, covering the social, cognitive, functional, and meta-domains. The chapter culminates in a review of motivational interviewing skill development and measurement as an expression of functional and social competencies and its use as a tool in assessing CHWs' competence to deliver a lifestyle-based health-promoting programme.

2.2 THE EPIDEMIOLOGY OF TYPE 2 DIABETES

T2D is a non-communicable disease that is both preventable and manageable (Asif, 2014; Galaviz *et al.*, 2015). There is now substantial evidence to show it is also reversible (Al-Mrabeh, *et al.*, 2020; Taylor, 2020 Taheri, 2020). Despite this, rates of T2D incidence continue to rise rapidly in LMICs (Liu *et al.*, 2022).

Multiple modifiable risk factors are implicated in the pathogenesis of T2D: obesity, smoking, high alcohol consumption, poor nutrition, and lack of physical activity, to name a few. However, factors such as socio-economic status, environment, mental health, and access to health care are also key underlying risk factors for T2D (Beulens *et al.*, 2021; Bilal *et al.*, 2018; Kyrou *et al.*, 2020; WHO, 2019).

2.2.1 T2D Prevalence

Globally we are facing an epidemic of T2D and other NCDs. By 2019, the global prevalence of T2D was 9.6%, equating to 463 million people (Saeedi *et al.*, 2019). According to the International Diabetes Federation (IDF) (2019), 79% of adults with diabetes and 87% of all

diabetes-related deaths worldwide are in LMICs. Half of these deaths are premature in people younger than 60 (Nugent *et al.*, 2018). In contrast, a total of 76 million people have been infected, and approximately 33 million have died from HIV/AIDS since the start of the HIV epidemic (WHO, 2019). There is a need to prioritise HIV and infectious diseases and NCD prevention and management equally. There is also a growing need to be more aware of the syndemic influences of NCDs on other prevalent conditions (Swinburn, *et al.* 2019) as well as the multimorbid nature of chronic diseases (Lalkhen and Mash, 2015; Pearson-Stuttard, Ezzati, and Gregg, 2019) impacting accumulatively on the Burden of Disease (BOD). This is particularly the case in LMICs like South Africa (World Economic Forum & World Health Organisation, 2011).

Although the true prevalence of T2D in Sub-Saharan Africa (SSA) is unclear, according to the WHO the diabetes prevalence in the African region in 2014 was 7.1%, an increase of 129% since 1980 (3.1%) which equates to 21 million more people living with diabetes in SSA. Despite having more than three-quarters of the global burden, only 35% of diabetes-related health expenditure is in LMICs (IDF, 2019).

In South Africa, although national NCD surveillance is limited and inadequate (Stokes, *et al.*, 2017), T2D prevalence has been estimated at 10% for persons over the age of 15 years (Pheiffer, *et al.*, 2018; Stokes, *et al.*, 2017). The South African National Health and Nutrition Examination Survey (SANHANES) report (2017) estimated that between 2011 and 2012, 80.6% of the diabetic population had unmet needs for care based on a continuum of care analysis (Stokes *et al.*, 2017). Similarly, a systematic review across 28 LMICs showed that 77.0% (95% CI: 74.9%–78.9%) of T2D patients were likely to have unmet needs, while 4 out of every 5 adults with undiagnosed diabetes live in an LMIC. This reflects the need for a greater investment of health resources to strengthen systems of care for this disease in LMICs (Manne-Goehler, *et al.* 2019).

Given the prevalence of T2D, Nolte, Bain, and Mckee (2006) suggest considering T2D as a tracer condition for examining a health system's competence. Based on both the SANHANES (2017) report as well as the 28-country study cited above, South Africa along with many other LMICs will likely face challenges in achieving Universal Health Coverage (UHC) based on their high prevalence of T2D and associated Burden of Disease BOD (Manne-Goehler, *et al.*, 2019). T2D is costly to manage and therefore should be a priority for

global health communities to prevent and manage more effectively if seeking to achieve UHC (Moucheraud, *et al.*, 2019).

2.2.2 Factors influencing risk for T2D in LMICS

In LMICs as elsewhere in the world, the development of T2D is influenced by “exposomes” or the sum total of environmental drivers of disease over the life span. “Internal exposomes”, genetics and the microbiome, are influenced by the “external exposomes”, classified into general exposomes including the built, social, physical-chemical, and lifestyle/food environments, and specific exposomes which encompass behaviours and exposures at an individual level such as alcohol consumption, diet, tobacco use, and financial status (Beulens *et al.*, 2022). The South African exposomes and that of many other LMICs are also affected by histories and legacies of occupation, segregation, and inequalities which have and continue to have ongoing structural, and systemic impacts (Achoki *et al.*, 2022). A case has also been made for the epigenetic impacts of psycho-social factors in the development of T2D and other NCDs. This in part can be attributed to intergenerational (Devakumar *et al.*, 2014) as well as transgenerational trauma and associated mental health issues (Phillips-Beck *et al.*, 2018; Alejandro *et al.*, 2020) endemic to vulnerable and marginalised populations in many LMICs. Their impact directly affects equity, and particularly health equity.

In LMICs, specifically in SSA, an emerging body of evidence speaks to the syndemic epidemics of HIV and tuberculosis (TB) and T2D, where a high prevalence of people living longer with greater accessibility to life-saving treatments, are at risk of T2D. This is mainly due to the concomitant metabolic effects of antiretroviral therapy (ART) (Levitt, *et al.*, 2011). As a result, there has been a noticeable “risk transition” where the shift is from diseases primarily infectious in nature to NCDs, both exacerbated by the poor socio-economic status of LMICs (Atiim and Elliott, 2016).

The literature on the prevalence of T2D in LMICS has been focused on the evidence of rapid globalisation and urbanisation over the last two decades and associated food transitions (Fox, Feng, and Asal, 2019). These include production and access to a greater number of easily accessible highly ultra-processed foods, alcohol, and tobacco products, aggressive marketing, and decreasing levels of physical activity. These strategies used by the private sector to promote products that are detrimental to health otherwise known as the commercial determinants of health (CDoH) impact economies, political systems, trade, rights, and

responsibilities as well as regulatory approaches and power dynamics. Each plays a direct part in determining the outcomes of population health and in particular health as it relates to T2D and other chronic diseases and indirectly on national economies and health systems which affect the management and prevention strategies for chronic diseases (de Lacy-Vawdon and Livingstone, 2020).

The Social Determinants of Health (SDoH), the circumstances in which people live and work that determine their health outcomes such as poverty and associated socio-demographics have been shown to be the highest risk factors for poor health and vulnerability to both communicable and non-communicable diseases in LMICs (Adler *et al.*, 1994; Wang and Geng, 2019). SDoH are proximal causes of chronic disease and are themselves primarily caused by “the failings to meet fundamental human needs of autonomy, empowerment, and human freedom” (Marmot, 2006). The fewer resources people have, the greater their risk of poor health (Marmot, 2006; Kyrou *et al.*, 2020).

In South Africa and other LMICs, wide economic inequalities exist between different population groups (Scott *et al.*, 2018) This has led to greater risk for people living in poverty. The people challenged by access to housing, sanitation, education, health care, nutritious food, clean water, transportation, and other services are the most vulnerable and at risk.

The increasing need for chronic disease care poses a significant challenge for already compromised primary healthcare systems in South Africa (Maphumulo and Bhengu, 2019). T2D and other NCD control and prevention is therefore an economic as well as development priority in all LMICs. There is a clear and urgent need for increased advocacy, policies, advice, and guidelines on managing NCDs in LMICs that are inclusive and adapted to local contexts (WHO, 2016). As pointed out by Marmot (2008), “Addressing health inequalities has become an ethical imperative in the 21st century in order to reduce the high burden of illness and premature mortality.”

2.3 T2D PREVENTION AND MANAGEMENT STRATEGIES IN LMICs

The global trend in LMICS for NCD interventions and resource allocation is towards doctor-centered, pharmaceutical remedies (Suhrccke, Boularte, and Niessen, 2012). However, these are not person-centered empowering strategies, contributing to self-efficacy, self-

determination or self-management, factors which are recognised as key to the prevention and management of NCDs (Sharifirad *et al.*, 2013; Tharek *et al.*, 2018; Hearn *et al.*, 2019).

In 2020, the Director-General of WHO, Tedros Ghebreyesus reiterated that “No country can treat its way out of the NCD epidemic. Health Promotion and disease management need to be prioritised” (WHO, 2020). WHO has identified “best buys” (16 practical cost-effective primary health solutions comprising 88 interventions) for interventions in LMICs to reduce deaths from NCDs in people less than 70 years old by 25% by 2025 (Table 2.1). These best buys focus on reducing modifiable risk factors such as tobacco use, harmful use of alcohol, unhealthy diets (both under and over-nutrition), and physical inactivity through overarching and enabling policy actions (WHO, 2017).

Despite these recommendations and guidelines, efforts aimed at prevention and control have been less than optimum in LMICs to date (Nyaaba, *et al.*, 2017). Isaranuwachai *et al.*, 2020 suggest that one of the reasons for the lack of uptake of “best buy” interventions in LMICs is that they are not sufficiently contextualised to assist in the prevention of NCDs.

The strategies used in preventing and managing NCDs in LMICs predominantly emanate from higher income countries. Facing a lack of financial and human resources, political instability or fragility as well as other limiting social determinants, LMICs have failed to implement adequate prevention and management strategies in the past. There is a clear need for contextual adaptation and assurance of “socially valid” (WHO, 2016) strategies to match the resources and existing capacity of health systems available to enable sustainable and scalable programmes (Checkley, *et al.*, 2014). Social validity addresses the levels of acceptability and satisfaction with the intervention procedures and content directly from the people who receive and implement the programmes or strategies (Luiselli, and Reed, 2011).

Table 2.1 WHO best buys for LMICS

Risk factor/disease	Intervention
Tobacco use	<ul style="list-style-type: none"> • Increase excise taxes & prices on tobacco products. • Implement plain/standardised packaging and or large graphic warnings on all tobacco packages • Enact & enforce comprehensive bans on tobacco advertising, promotion & sponsorship • Eliminate exposure to secondhand tobacco smoke in all indoor work, public and transport spaces • Implement effective mass-media campaigns that educate public about the harms of tobacco use and second hand smoke
Harmful alcohol use	<ul style="list-style-type: none"> • Increase exercise taxes & prices on alcoholic beverages • Restricted access to retailed alcohol • Ban on alcohol advertising
Unhealthy diets and physical inactivity	<ul style="list-style-type: none"> • Reduce salt intake through the reformulation of food products • Reduce salt intake within supportive environments & institutions such as hospitals, schools, workplaces, etc • Reduce salt intake through behaviour change communication and campaigns • Reduce salt intake through the implementation of front of pack labelling • Implement community-wide public education and awareness for physical activity, including mass media campaigns to support behaviour change around physical activity levels.
Cardiovascular disease & Diabetes	<ul style="list-style-type: none"> • Counselling and multi drug therapy (including glycemc and blood pressure control) for people with a high risk for developing cardiovascular events
Cancer	<ul style="list-style-type: none"> • Prevention of cervical cancer by screening and treating precancerous lesions • Vaccination against human papillomavirus of girls aged 9-13

WHO, 2017

2.3.1 T2D Prevention and Management Strategies in South Africa

Up until April 2023, South Africa did not have a national integrated NCD policy or strategy/action plan to realize the SDG 3.4 targets of reducing premature mortality due to NCDs by a third by the 2030 target.

In their recent analysis of population-level policies and interventions in the 5-year (2012-2017) national strategic plan targeting risk factors for diabetes and hypertension in South Africa, Uwimana-Nicol, Hendrick, and Young (2021) reported an absence of structured programmes in the PHC system and none including CHWs. A systematic review of CHW-delivered diabetes prevention programmes found programmes only in developed countries, mostly targeting minority communities (Hill *et al.*, 2017).

There are a few examples of NCD implementation studies from SA that are community-based and involve the public health sector, although the evidence from these has not been convincing, and similar to research from other LMICS they have been of low research quality (Werfali *et al.*, 2020).

Mash *et al.* (2014) examined the effectiveness of a primary health care centre group-based diabetes educational programme in underserved South African communities. The achievements in primary outcomes of 5% weight loss, 1% reduction in HbA_{1c}, and improvement in diabetes self-care activities were less than expected and attributed to contextual challenges, namely lack of suitable spaces to host the sessions and lack of communication resources for reminders and follow up. These are the realities faced by implementation in low-resourced environments that require attention. Similarly, the SMART2D Trial, a pragmatic intervention, based on a CHW-led self-management intervention for newly diagnosed diabetes patients failed to show any change in T2D control. The experience was similar to other studies, with additional issues of high levels of attrition and loss to follow-up (Guwatudde *et al.*, 2022)

As experienced elsewhere, implementation from trial to real-life practice has high levels of attrition and programme decline or termination (Jiang *et al.*, 2018). This appears to occur once the researchers, support, or funding are no longer available. This is an immense shortcoming of the research process where outcomes have not led to any policy integration and is therefore a necessary area of focus.

In 2014 Dube et al. undertook an audit of policy documents together with semi-structured questionnaires with providers and experts in both the public and private health sectors in South Africa to ascertain the extent of diabetes self-management education in the country. This research was informed by the knowledge that effective treatment for diabetes requires extensive self-care, and self-management education, particularly in resource-limited settings. They were not able to locate any policy documents in relation to diabetes self-management education specifically, although they were able to retrieve some educational material, all of it in English. The authors concluded this was not accessible for many, emphasising that South Africa has 11 official languages and that English is spoken by approximately one in 10 people (Dube *et al.*, 2015)

Although we have recommendations and knowledge about what works in T2D prevention implementation, evidence on knowledge translation in policy in South Africa and other LMICs is scarce.

2.4 DIABETES PREVENTION PROGRAMME (DPP)

There is long-standing and ongoing evidence for the efficacy of nutrition and physical activity interventions in the successful prevention and management of T2D and other NCDs in HIC. (Tuomilehto *et al.*, 2001; Diabetes Prevention Programme, 2002; Lindström *et al.*, 2006; Jackson, 2009; Venditti and Kramer, 2012; Aziz *et al.*, 2015, 2018; Katula *et al.*, 2017; Glechner *et al.*, 2018; Gruss *et al.*, 2019).

Flagship clinical trials such as the U.S. Diabetes Prevention Program (DPP) have demonstrated efficacy and given credibility to lifestyle interventions particularly focused on physical activity and dietary practices in the prevention of diabetes for people at risk (Kowler *et al.*, 2002). Knowler et al's (2002) original randomized controlled trial of DPP showed that lifestyle interventions were more effective in reducing the incidence of T2D than the use of pharmaceutical interventions (metformin) alone. On average over a 2.8-year period post-intervention in a high-risk cohort, the incidence of development of T2D was reduced by 58 % (95% CI, 48 to 66) and in the metformin group by 31% (95% CI, 17 to 43) in comparison to the placebo group.

The primary goal of the original 16-week curriculum-driven trial was to achieve a weight reduction and maintenance of at least 7% of body weight via a healthy diet and engagement

in moderate levels of physical activity for 150 minutes per week¹. These were individual sessions, followed by maintenance sessions monthly and added group-based support sessions. All coaching sessions were delivered by trained professionals (The Diabetes Prevention Program group, 2002).

Long-term follow-up of this and similar intensive trials (10-20 years post-intervention) as well as those showing less than 7% body weight losses through lifestyle interventions have also yielded sustained risk reduction increasing the efficacy of lifestyle-based interventions (Lindström *et al.*, 2006; Li *et al.*, 2008; Diabetes Prevention Program Research Group, 2009; Jiang *et al.*, 2018).

Although lifestyle interventions such as the DPP have proven efficacy, implementation within minority groups and LMICs still faces many challenges. Not only are these populations disproportionately affected by the global burden of NCDs, and lack resources, especially human resources in PHC systems, but the cost to implement such an intensive programme is prohibitive.

One potential way of scaling and adapting the DPP to meet LMIC's needs comes from studies done by Ackermann *et al.* (2008, 2015), who showed that a group-based DPP intervention achieved moderate weight losses, and was a feasible as well as cost-effective alternative (Ackermann *et al.*, 2008, 2015). Evidence is also growing to show that adaptation of the original DPP to LMICs and vulnerable groups is feasible and effective. The Special Diabetes Program for American Indians – Diabetes Prevention Program (SDPI-DP) the largest of the DPP adapted trials (n=8652, 46 programmes across 18 states) adapted the original DPP (context, culture, language and use of indigenous food substitutes) to meet the needs of the American Indian participants (Jiang *et al.*, 2018). T2D prevalence in this population is twice that of their White American counterparts (CDC, 2020), and they experience challenges similar to populations in LMICs.

The outcome of the intervention was moderate in terms of weight loss and maintenance. However, even at the lower range of weight loss outcomes (3-5% post-intervention), participants had a 40% (95% CI 24-53) reduced chance of developing T2D 6 years post the original intervention. This resulted in an incidence of 3.5 cases/100 person-years of diabetes incidence amongst pre-diabetics, which is similar to the pooled rate of 3.4 cases/100 from

other similar lifestyle intervention trials (Dunkley *et al.*, 2014); and a great reduction from 6.6 cases/100 reported in a similar population in an observational study (Wang *et al.*, 2010). In a meta-analysis report of the real-world setting implementation of the DPP across the USA, studies showed average weight losses of approximately 4% post-intervention (Ali, Echouffo-Tcheugui, and Williamson, 2012). Similar data is not available for LMICs as there is a lack of uniformity in the interventions to make comparisons. However, the outcomes in reducing risk in these trials were positive. This highlights the potential importance of non-pharmacological interventions and the need for further well-designed RCTs LMICs to reduce the risk of T2D in LMICs (Sarker *et al.*, 2022; Shirinzadeh *et al.*, 2023). One of the main challenges faced by LMICs in implementing DPP programmes is the lack of human resources. However, the meta-analysis report provided by Ali, Echouffo-Tcheugui, and Williamson, (2012) found no significant differences in the outcomes using medical and health workers compared to using lay community educators to implement the programme in US-based settings. This suggests CHW-facilitated community-based strategies or small-group health promotion-based interventions are feasible (Ahn *et al.*, 2013; Kim *et al.*, 2016).

2.5 CHW PROGRAMMES

Documented CHW programmes have existed since the 19th century. These early programmes include the “Feldshers” developed in Russia to assist in remote areas where physicians were not available (Ramer, 2018). Similarly, a large-scale CHW programme emerged in China, made up of minimally trained peasants who acted as change agents in managing public health problems. By 1972, there were an estimated 1 million “Barefoot Doctors” serving the 800 million strong Chinese rural population (Perry, 2013).

By the 1960s many LMICs, including those in the Middle East, North Africa region (MENA), the subcontinent, and much of SSA, began to utilise CHWs. Their availability, practicality, and potential cost-effectiveness (Vaughan *et al.*, 2015; Nkonki, Tugendhaft, and Hofman, 2017; Singh and Singh, 2022 offered a means of extending the reach of primary healthcare services and human resources to low-resourced and rural communities. This movement was an effort to “shift” a load of some of the tasks from the primary health care facility to community agents. This not only reduced the load on health system resources but widened reach to remote and impoverished communities (Fulton *et al.*, 2011; Checkley, *et al.*, 2014; Naal, *et al.*, 2020).

CHWs are uniquely community-embedded agents who have long-term relationships with the neighbourhoods in which they work (Schaaf *et al.*, 2020). This allows for acceptability, social connections, as well as reach.

The WHO (2018) suggests that these agents or CHWs and the model of task shifting is an appropriate way to address the load created by the chronic disease epidemic. In addition, Scott, et al.'s (2018) review of reviews on CHW-managed programmes highlights the definite potential for success where there is careful design of community-based interventions appropriate to the context, community, and disease needs.

2.5.1 CHWs in South Africa

South Africa has a history of formal CHW programmes from as early as the 1940s (Van Ginneken *et al.*, 2010; Murphy *et al.*, 2020). Today, a CHW in South Africa is typically a female lay worker with varying levels of education, paid the minimum wage, and provided with some training and support directly by the National Department of Health or indirectly through various non-governmental entities through third-party agreements. The primary role of the CHW is to provide selected health services to the community they live in at the household level. Some CHWs are engaged in group-based support for NCD care where they oversee treatment adherence clubs, and/or activity centers (Tsolekile *et al.*, 2014). However, the typical CHW role has primarily been centered around home-based care services, HIV treatment adherence, patient support, chronic medicine delivery, maternal and child health, palliative care, and social support, particularly for the elderly and frail (Puoane, Tsolekile, and Sanders, 2013).

Since 2011, the South Africa National Department of Health has implemented a programme referred to as the “Re-engineering of PHC”. This process has led to the formation of Ward-based Primary Healthcare Outreach teams (WBPHCOT) in which CHWs supported by other health professionals form a link between communities and services at the facility level (Schneider *et al.*, 2018). CHWs are expected to build trust, cohesion, and relationships supporting the PHC system. However, they are not always formally a part of this system (Tsolekile *et al.*, 2014; Abdel-All *et al.*, 2017; Tsolekile, Schneider, and Puoane, 2018).

2.6 CHWs IN NCD PROGRAMMES IN LMICs

LMICs experience multiple barriers to adequate diabetes management and prevention (Stokes *et al.*, 2017; Flood *et al.*, 2021). Several reasons for this have already been put forward in this review. This is largely due to a lack of resources and an over-emphasis in primary healthcare systems on acute and chronic treatment of NCDs, rather than primary prevention (Khetan *et al.*, 2017). Barriers to CHW-led programmes, apart from lack of resources, include high workloads, lack of appropriate training, and poor system and policy level support (Rawal *et al.*, 2021).

CHWs are uniquely positioned agents to facilitate comprehensive diabetes management strategies in under-resourced communities and their potential impact on preventing and mitigating disease burden, in particular T2D is immense, yet such roles are undervalued and underutilised in LMICs (Aloefe *et al.* 2017).

Aloefe *et al.* (2017) and Miles *et al.* (2020), reviewing CHW-led NCD programmes in India, reported that programmes have not been well documented, and indicated a large gap in knowledge on the role of CHWs in the prevention and management of T2D and other NCDs. The studies also did not always include effectiveness evaluation components so lacked sufficient credibility for recommending scale-up. However, they conclude that CHWs have the potential to improve knowledge, health behaviour, and health outcomes related to the prevention and management of T2DM in LMICs. CHWs are also embedded in their communities and therefore are better placed to determine community needs (Cottler and Nagaranjan, 2012).

In the studies reviewed by Khetan *et al.* (2017) from LMICs that included Asian and African countries, the reporting of implementation fidelity was poor and it was therefore difficult to assess if the negative findings were due to the CHW-based approach itself, or to poor implementation that could be ameliorated. As a result, the review authors strongly recommended reporting implementation fidelity in studies to increase reliability, reproducibility, and scientific confidence in the findings for future programming.

2.7 CHW TRAINING AND SUPERVISION IN LMICs

CHW training documented in the literature is predominantly didactic and varies greatly in length from a few hours to a couple of months, and reporting on CHW training and its impact is scarce (O'Donovan, *et al.* 2018).

The population changes and consequent need for healthcare brought on by rapid globalisation in LMICs have created a strong demand for task shifting of NCD and T2D care to a lay workforce. In turn, this has created a need for the availability of appropriate training and supervision of this workforce. In general, the studies conducted and reported in the literature on the effectiveness of training CHWs have been considered to be weak mainly due to poor study designs that lack information on training methods, outcomes, and characteristics of the CHWs (Abdel-All *et al.*, 2017).

In a qualitative study conducted in an urban township in Cape Town, Tsolekile, *et al.* (2014) observed that CHWs lack accurate standardised knowledge around NCDs (e.g. epidemiology, treatment, and lifestyle intervention benefits), and were also challenged by numerous complexities brought on by politics, community engagement, and system instabilities. In addition, they reported that the limited supervisor-to-CHW ratios posed challenges to navigating the NCD terrain and empowering CHWs to lead in closing the gaps in the NCD continuum of care (Tsolekile, *et al.*, 2014).

The literature reviewed indicates a lack of evidence on the content and methods used to train CHWs for NCD and T2D prevention and management (Pallas *et al.*, 2013). Abdel-All *et al.* (2017) further concluded that there is a lack of evidence on the impact of training on CHW knowledge, skills transfer, and retention, and on fidelity and factors such as contextual adaptation, language, supervision, and feedback (Abdel-All *et al.*, 2017). WHO (2018) guidelines on health policy and system support to optimize CHW programmes also highlight the lack of global standards for how CHWs should be trained or their competencies assessed, resulting in a wide variety of training programmes and forms of assessment.

2.8 EVALUATION OF CHW COMPETENCE

CHWs are uniquely placed agents who play a vital role between the community and the health sector (Kok *et al.*, 2017). This positioning allows for multiple roles as “service extenders, cultural brokers as well as social change agents” (Schaaf *et al.*, 2020). Given their broad and varied job descriptions and their unique contexts, (Kok *et al.*, 2017) it is difficult to assess CHW performance in a standardised manner. Moreover, many factors influence CHW performance, including individual motivation (Franco, Bennet, and Kanfer. 2002), incentives or remuneration, self-esteem and efficacy, attitudes, competencies, supportive supervision, resources available, training, job security, recognition, and intrinsic job satisfaction (Gopalan *et al.*, 2012). This research endeavour is focused on the competency component of CHW performance and its evaluation.

Competence is the ability to do a task successfully. Key competencies for CHWs in the context of decentralising care and delivering health-promoting programmes in under-resourced communities include skills to support, listen, collaborate, communicate, and facilitate engagement for better health outcomes within community settings where resources are limited. However, no such general measurable, standardised CHW competencies have been published in the peer-reviewed literature (Covert *et al.*, 2019). Measurable competencies are important for maximising CHW effectiveness, leveling health inequities, and advancing the role of CHWs within the health system (Ingram *et al.*, 2011).

Covert *et al.* (2019) propose a progressive linear framework for defining competencies in relation to scopes of practice and directing training towards roles and contexts along a continuum of increasing specialisation (Figure 2.1). Deist and Winterton (2005), on the other hand, argue that competence is not a linear concept and is influenced by a variety of determinants that a provider needs to be able to assimilate for the best outcomes (Figure 2.2) It is this “meta” overarching ability that speaks to competence (Deist and Winterton, 2005).

Taking the more holistic and multidimensional theorisation of elements of competency proposed by Deist and Winterton (2005), Tsolekile (2018) put forward a model of NCD competencies for CHWs. This model includes cognitive, functional, social and overarching meta competencies, each of which is described and expanded in Table 2.2 below.



Figure 2.1 Community Health Workforce Framework: United States 2017 (Covert *et al.*, 2019)

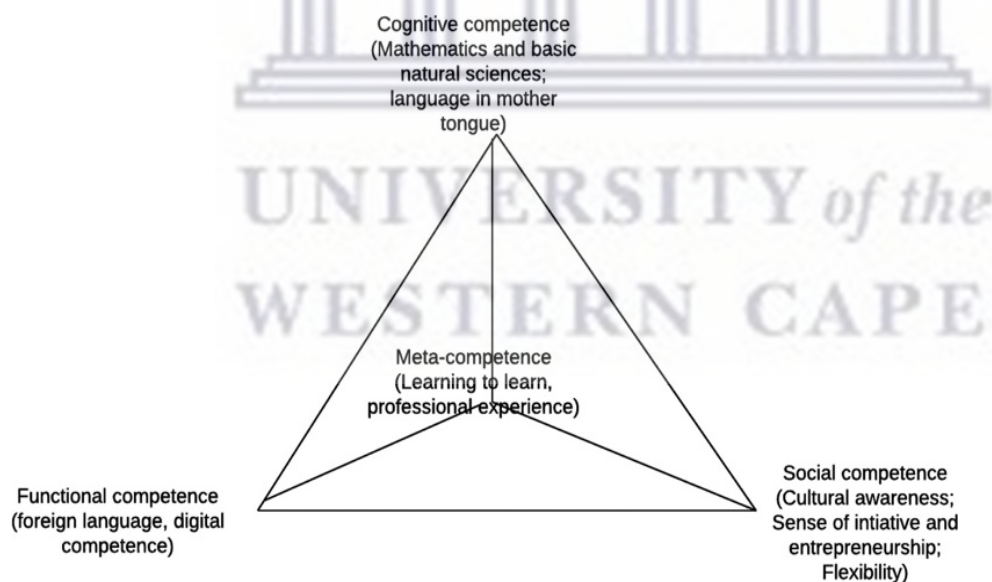


Figure 2.2 Holistic model of competences (Deist and Winterton, 2005)

Table 2.2 Competence Model for CHWs in the context of NCDs reproduced from Tsolekile, L. (2018)

Competency Category	Competence	Definition
Cognitive Competency	Knowledge of Community and needs	<ul style="list-style-type: none"> • Have tacit knowledge about their community as well as community health needs • Be able to refer clients to appropriate actors within the community
	Knowledge of basic NCD management, related risk factors and prevalence	<ul style="list-style-type: none"> • Know the most prevalent NCD • Understand self-management for NCD • Knowledge about foot examination and care • Knowledge of preventative measures and risk factors
Functional Competency	Communication skills	<ul style="list-style-type: none"> • Simple motivational interviewing of patients • Communicate health messages to groups & individuals • Clarity in spoken & written language
	Group facilitation Skills	<ul style="list-style-type: none"> • Facilitate Support groups • Understand group dynamics
	Basic Numeracy Skills	<ul style="list-style-type: none"> • Ability to calculate simple formulas such as BMI • Ability to use risk scores for screening
	Capacity to teach Self-management skills	<ul style="list-style-type: none"> • Ability to educate clients about foot examination • Ability to educate clients on how to measure blood glucose & pressure
Social Competency	Empathy & sensitivity	<ul style="list-style-type: none"> • Ability to treat patients with compassion • Be sensitive to patients' situations • Respect patient views • Engage with other players and assert their position in the community health system
	Ethical consideration	<ul style="list-style-type: none"> • Awareness of the ethical implications of one's actions • Respect for clients' rights
Meta Competency	Coping with work pressure	<ul style="list-style-type: none"> • Able to manage work-related demands and stress • Awareness of personal limitations as well as a need to debrief • Capacity to learn, adapt, problem solve, and manage change.

Cuvelier (2020) has proposed five ways to measure CHW competence.

1. Knowledge test. This method can be used to evaluate knowledge, in particular technical knowledge, however this is limited as it does not allow the evaluation of the application of knowledge in the field.
2. Self-assessment - this is most useful when combined with objective measures as one may over or underestimate their abilities.
3. Team feedback – especially from other teammates in a multidisciplinary team
4. Observation and field testing using standardised checklists
5. Clients’ or patients’ feedback

Evaluation of CHW performance in the literature focuses on the outcomes and effectiveness of CHW programmes rather than the process or levels of fidelity by which outcomes are reached. Fidelity is an important area of implementation science that allows one to better understand why and how an intervention works and what areas need improvement to improve outcomes (Carroll *et al.*, 2007).

2.9 MOTIVATIONAL INTERVIEWING

Although standardisation and measurable competency outcomes for CHWs have not been established fully in the literature, there are frameworks and theories to draw on for setting future measurable standards, practice, and guidance. One such area of research that has been developing in the field of health education in recent years is Motivational Interviewing (Moyers *et al.*, 2005; Miller and Rollnick, 2013). This is a skill-based technique to empower and improve behaviour change through facilitated self-identified motivation for change (Sohl, Birdee, Elam, 2016). MI has been shown to be effective in promoting positive health behaviours and outcomes in numerous randomised trials, systematic reviews, and meta-analyses (Burke *et al.*, 2003; Armstrong *et al.*, 2011; Resnicow and McMaster, 2012; Palacio *et al.*, 2016) and it has also more recently been shown to be an effective technique in group-based settings (Centis *et al.*, 2020; Ana *et al.*, 2021).

Healthcare and health promotion has typically been one-directional and delivered in a practitioner-centered way which is heavily reliant on providing advice, instruction, and information to clients. MI, however, is a client-centered approach that has been developed from models of psychotherapy, Self Determination Theory (SDT), and behaviour change

theory to increase long-term behaviour change (Sohl, Birdee, Elam, 2016). It is a non-judgmental, empathetic, and encouraging counseling technique that is nonconfrontational and supportive and therefore a technique that has drawn interest in public health in its adapted forms to address health behaviours such as diet and physical activity (Resnicow and McMaster, 2012; Elwyn, *et al.*, 2014) and one we have chosen to use in this study to deliver our intervention as it fulfils both functional and social competencies adopted in our evaluation framework

2.10 CONCLUSION

There is a disproportionately high prevalence of T2D in LMICs. There is also clear evidence that lifestyle interventions geared toward weight loss can effectively mitigate the advancement and prevention of this condition. However, in LMICs, interventions have not been implemented due to a lack of resources including suitably trained human resources. Studies suggest that lay health workers such as CHWs can be trained and supported to fill this gap and deliver such programmes. However, there is insufficient evidence of effective training methods, key competencies needed, and training outcomes. This evidence is necessary for translating and scaling CHW-based interventions to reduce the impact of T2D in LMICs. This thesis hopes to positively contribute to the current small body of evidence in promoting CHWs for T2D management and potentially other NCDs in LMICs through the evaluation of CHW competencies in group-based facilitation and the use of MI skills.

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CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

This study examines CHWs' capacity to deliver the adapted diabetes prevention programme (DPP), by evaluating their social and functional competencies (Deist & Winterton, 2005) through structured observations of their practices. Specifically, we assessed the completion of procedural activities, motivational interviewing, and group facilitation skills gained through training in the delivery of the adapted DPP. We also analysed the socio-demographic profiles of CHWs and club participants as contextual factors potentially shaping competence. The observations were collected as part of a fidelity assessment of a larger RCT study that looked at the health outcomes of the adapted DPP Lifestyle Africa.

The chapter begins by introducing the study conceptual framework; it then describes the study design, population and sampling, and data collection methods and tools before describing the analysis. The chapter concludes with the data management protocols and the ethical considerations observed.

3.2 CONCEPTUAL FRAMEWORK

The conceptual framework (Figure 3.1) for this study brings together the social and functional competency concepts of Deist and Winterton (2005), the more recent adaptations by Tsolekile (2018), and MI skills evaluation (Moyers *et al.*, 2005).

The conceptual framework depicted in Figure 3.1 describes the hypothesised causal pathway of Lifestyle Africa DPP: a tailored CHW training programme that enables CHW functional and social capacity to undertake necessary procedures, use motivational interviewing techniques, and provide group facilitation, leading to improved outcomes (reduced BMI and HbA_{1c}) in intervention clubs. These processes and outcomes are mediated by the profiles of the CHWs themselves (e.g. educational level, age, etc.) and the socio-demographic context of the club participants. The grey-shaded items indicate the domains evaluated in this thesis.

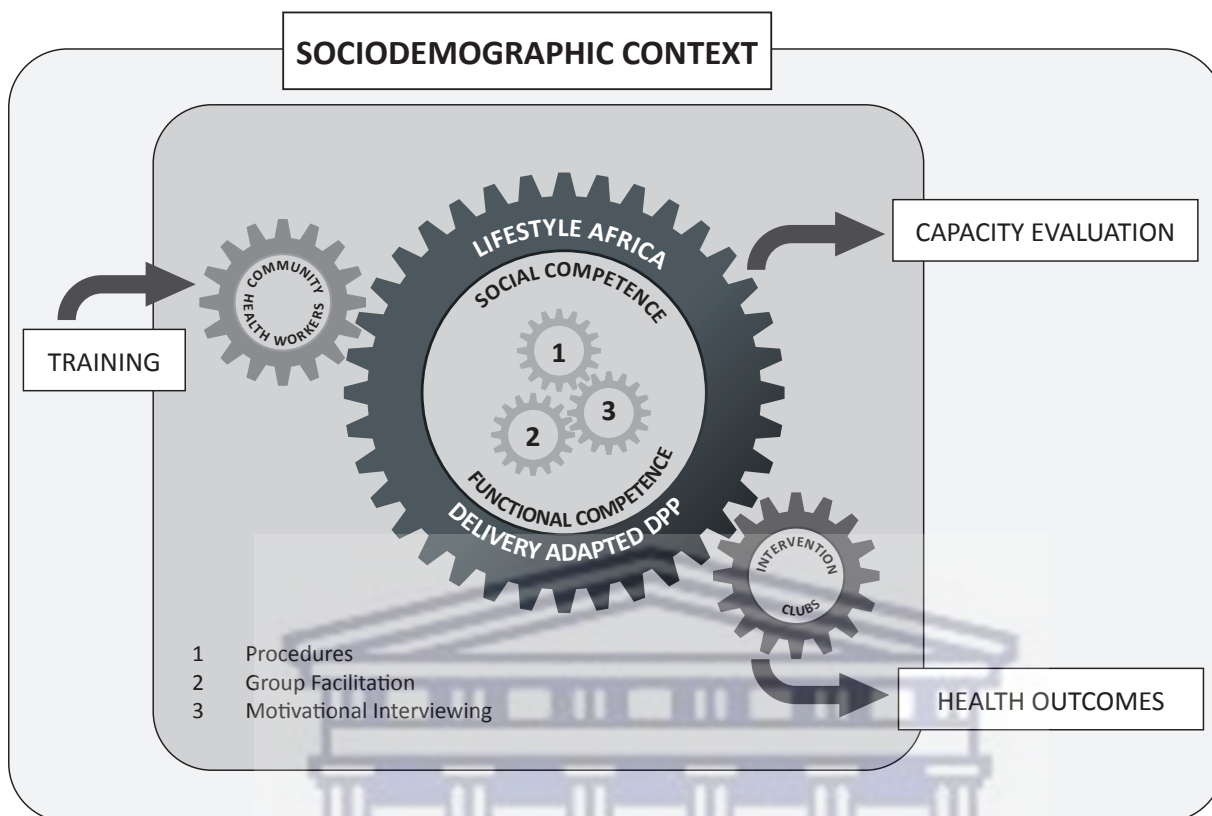


Figure 3.1 A Conceptual Framework for CHW Competence Assessment

The data analysed in this study were collected from the intervention arm of a two-arm parallel cluster randomised intervention control trial conducted between 2018 and 2019. All the data extracted involved a pairs of CHWs (n =11 pairs) and their associated health club participants (n=134), who were randomly allocated to either an intervention or control group for a minimum duration of 17 weeks. Each week trained CHW teams in the intervention arm would facilitate a core video and manual-based session of an adaptation of a Diabetes Prevention Programme (Knowler *et al.*, 2002, Catley *et al.*, 2019). Baseline demographics and biometrics as well as end-line biometric data were collected for analysis for the master study. The RCT design is described in detail elsewhere (Catley *et al.*, 2019).

In line with the original DPP (Knowler *et al.*, 2002), the intervention included a variety of evidence-based behaviour change techniques based on goal setting, monitoring of weight, dietary intake, and physical activity interventions (Venditti and Kramer, 2012; Catley, *et al.*, 2019; 2022). The intervention delivery also included various measurable social and

functional competence-based skills and intended roles that correspond with the holistic competence model for NCD roles proposed by Tsolekile (2018).

3.2.1 CHW Training

The training of CHWs was provided in five and a half days of didactic training which included education on T2D and management, behaviour change principles, motivational interviewing principles (MI), group facilitation (GF), projector use, logistics, and safety. The practical experiential training to deliver the intervention sessions was conducted weekly for half a day for eight weeks. This training was held as mock sessions being delivered on a rotational basis by each group of CHWs to practice delivering key aspects and skills required by the programme. Such tasks included doing and recording weigh-ins, setting up and using the projectors, and facilitating goal setting for diet-related and exercise sessions. All training and resources (manuals/workbooks) were delivered to the CHWs in isiXhosa (with optional English resources available) and delivered by trained first-language isiXhosa speakers who themselves were trained, in English, by experts in the field.

3.2.2 Support Materials

The participant sessions were framed by a pre-recorded video storyline which were shown during the sessions, supplemented with CHW manuals that included scripts with prompts and supplementary material. Research staff were also on hand to support if needed.

3.3 STUDY DESIGN

For this research, a cross-sectional descriptive study was conducted using fidelity data captured during the first wave of the Diabetes Prevention Programme “*Lifestyle Africa*” (Catley et al, 2019).

3.4 STUDY POPULATION AND SAMPLING

3.4.1 Community Health Workers

The study population was 18 of 45 CHWs from an established NGO partner in Khayelitsha township, who were trained to deliver a 17-week intervention programme to their health-promoting NCD support groups. This study looked at data of the 18 CHWs whose clubs (n=11) were randomly assigned to deliver the first wave of the RCT intervention.

All CHWs in this trial were current employees of an NGO. They all had previously received training covering basics in home-care required by their cadre (e.g. home based care, chronic disease management, and wellness) and were providing services to chronic disease health clubs allocated to their organisation for community-based health services by the local Department of Health sub-structure. The CHWs visited their allocated clubs, which were in the proximity of their organisation and within their own community, once a month. However, most clubs met independently of the CHW support on a more regular basis for a number of community support-based activities such as feeding schemes, craft, enterprise and/or spiritual practices.

3.4.2 Intervention Club participants

The support groups who received the intervention (n=11) comprised mainly unemployed and elderly community members and were served by two or more CHWs depending on the group size. The first 20 eligible participants from each club were included in the trial, with eligibility determined by having a BMI ≥ 25 kg/m² (n=134). Further inclusion and exclusion criteria for participation can be found in Catley et al, (2022).

3.5 DATA COLLECTION

CHW demographics were collected through a self-administered paper-based questionnaire as part of their evaluation of the programme.

Participant's socio-demographic and biometric data were recorded on a REDCAP data collection tool on handheld tablets by trained field workers in isiXhosa at a baseline enrolment session. The process is further described in the protocol paper (Catley *et al.*, 2019). The same protocol also describes the follow-up collection of participants' biomedical measures post-intervention. For the purposes of this study, the following participant data was collected and extracted for analysis: age, gender, point-of-care tested concentrations of glycated haemoglobin (HbA_{1c}) (Alfinion AS100 analyzers, Alere Technologies AS, Norway), anthropometric measures-height, and weight for calculating Body Mass Index (BMI). Socio-economic data collected included: housing status, years of formal education, and monthly income (ZAR).

The data on CHW performance was collected by seven trained members of the study team. The observers individually attended, observed and rated the competence of the CHW for

sessions 1-10, 14, and 17 of the 17 core intervention sessions. Observers who were not involved in the intervention were specifically recruited for the evaluation and assigned to a club and session depending on their availability. They recorded their observations and ratings manually using paper-based data collection tools. Data from these tools were extracted in Excel for use in this analysis.

3.5.1 Data collection tools

There were three data collection tools:

- A self-administered questionnaire of CHW demographic data completed anonymously, including age, education levels, and years of service and experience as a CHW.
- An interviewer-administered questionnaire of the participant's socio-economic and demographic status. Participant biomedical data were extracted from the master study data set, including diabetic medication, HbA_{1c}, height and weight measures and changes in these indices at the study end-line.
- Observation tools of CHW competence (fidelity measures). Nine elements were common to all sessions (room and equipment set up, completed weigh-in of all participants as well as opening statements or facilitation of the session) (Table 3.1). The items for group facilitation (GF) and motivational interviewing (MI) techniques were adapted from validated MI fidelity rating scales. (McMaster and Resnicow, 2015). The group facilitation skills were assessed with seven items that assessed how well the CHW kept the conversation flowing and on track, responded to questions, and or deferred for checking if answers were not known. One item with 4 categories was used to provide an overall (O) assessment of how well the CHW conducted the session. A 7-point Likert scale with verbal anchors (1 = poor/never; 4 = good/often; 7 = excellent/always) was used to rate all items on the checklist. (Catley *et al.*, 2020)

A predetermined threshold for performing procedural activities was set at 80%. A high threshold was deemed necessary as the procedures framed and guided the intended session. The procedural activities were also part of the support systems put in place to support the CHW in managing the session. The threshold for MI, GF, and the Overall ratings was set at 60% and was guided by the Likert Scale used (1-7). A score of 4/7 (57%) or higher on the

scale was considered a desirable threshold and reflected that the skill being assessed was used “often” or at a level judged as “good”.

In addition to the common elements, one to three areas of observation were specific to the particular session contents (e.g. demonstration of certain exercises or deep breathing and muscle relaxation techniques) (Table 3.2). Completion of each element was rated either “yes”, “no” or “partially” complete



Table 3.1 Constructs and scoring of CHW performance

Constructs	Components	Rating	Total Maximum Score	The threshold for acceptable performance
Procedures	Set up room appropriately Complete weigh in and attendance Operate Projector/video correctly (i.e. Select & show the correct video; ensure it can be seen; start & pause video as required) Conduct “opening facilitation” Follow verbal prompts during video pauses Review session handouts appropriately* Conduct goal setting & action plan Gave out stickers for attendance From session 3 onwards ; collect, review & return activity logs to participants	0 – no 1 – partially 2 – yes	18	14(80%)
Motivational interviewing	Uses open questions Uses reflective listening Encourages & Builds confidence Expresses empathy/warmth/acceptance Does not argue/confront client	1-7 Likert scale	35	21(60%)
Group Facilitation	Gives everyone a chance to speak Keeps the group on track Keeps focus on the group members Allows members to speak through problems	1-7 Likert scale	28	21(60%)
Overall	Overall, how well did the CHW conduct the session? How well did the CHW use the projector/video? How did CHW handle participant questions? How interactive was the session?	1-7 Likert scale	28	17(60%)

*each session had a specific handout with specific tasks pertaining to the session topic. These were scored separately for levels of completion (Table 1b)

Table 3.2 Scoring of individual session procedures

Session Number	Task or skill	Scoring
1.	Starting weight and correct weight log for each participant Entered goal weight for each participant Facilitated remember your values handout	0 – no 1 – partially 2 - yes
2.	Demonstrated physical Activity at moderate pace Facilitated dealing with difficulties	
3.	Demonstrated how to use activity log	
4.	Facilitated importance activity Explained “Foods to Choose Guide” handout Explained food tracking	
5.	Facilitated discussion and activity around food groups Facilitated “A Healthy Meal” and “Make your plate” handout activities Facilitated dealing with difficulties	
6.	Facilitated Values Check-in activity Demonstrated Muscle Building activities	
7.	Demonstrated measuring food (with measuring instruments & hand) Explained how to use the food log Explained how to use food labels	
8.	Explained how to use the Quick tracker Reviewed participant Food Logs, made comments	
9.	Reviewed the food groups Reviewed shopping & cooking tips	
10.	Explained stress & Effect on weight/health Demonstrated deep breathing & muscle relaxation exercises	
11.	Facilitated discussion tips to fit in activity	
12.	Facilitated values check-inactivity	
13.	Explained connection between fat & heart health Explained good and bad fats	
14.	Explained helpful & harmful thoughts	
15.	Explained how to ask people for support	
16.	Explained how to read menus Explained how to eat well away from home	
17.	Explained individual & group progress Helped participants set long-term goals Explained how to deal with long-term weight change	

3.5.2 Validity and Reliability of Measurements

The main observational tools were used consistently and unabridged throughout the duration of the data collection process. The content and construct validity of the tools were assured by using tools that were designed specifically to identify the skills of Motivational Interviewing (MI) and Group Facilitation (GF) and with MI fidelity rating scales established and validated by McMaster and Resnicow, namely the “one-pass measure for motivational interviewing competence” (McMaster and Resnicow, 2015). The remaining practical and procedural skills were evaluated using a checklist of procedures for each session developed for this study and based on the successful use of this approach in a number of prior large randomised health behaviour trials (Goggin *et al.*, 2013; Catley *et al.*, 2016).

An observational method was chosen to assess the internal validity or fidelity of intervention delivery because self-administered questionnaires are subject to self-reporting biases. As in all studies requiring observations, there is an expected degree of subject and observer error and bias. We aimed to decrease the subject (CHW) bias by having the same observer rate the same club consistently, even if this was not always possible. The main data collection tool for assessing adherence to MI principles was previously also shown to have high inter-tester reliability (McMaster and Resnicow, 2015). The investigative team also elected not to expend scarce resources on establishing the reliability of the fidelity instrument in this study since: (1) most items were straightforward to rate (e.g., did the facilitator complete the weigh-in); and (2) the investigators had considerable experience successfully utilising the same approach in prior large behaviour change intervention trials (Goggin *et al.*, 2013; Catley *et al.*, 2016)

Additional measures in the study included main outcome measures of body weight (% weight change), body mass index (BMI), and glycosylated haemoglobin (HbA1c). These were assessed using well-established protocols as part of the main study (Catley *et al.*, 2019).

3.6 DATA ANALYSIS

3.6.1 Socio-demographic and Biological Data Analysis

The CHWs' and participants' demographic, socio-economic, and biological data (HbA_{1c} and BMI) were analysed via IBM® SPSS® version 28.0.0.0 (190) to produce descriptive data. Club-level statistics were computed to produce mean club profiles for socio-economic and demographic variables, and differences between clubs were assessed using one-way ANOVA.

3.6.2 CHW Performance Analysis

Descriptive data analysis of the fidelity scores collected was conducted using IBM® SPSS® version 28.0.0.0 (190) computing percentages, means, and standard deviations of the various components of competency assessed.

3.6.2.1 Procedural performance

The ratings for the nine procedural constructs rated per session were collected for 133 sessions (123 sessions for the physical activity log books). These ratings were scored as either not completed (0), partially completed (1), or fully completed (2). The sum of scores was used to calculate the overall score as a percentage of the potential maximum for the construct based on the number of sessions scored. Frequencies of scores were measured and graphed using Microsoft Excel for Mac version.

3.6.2.2 Specific Task Performance

Every session (1-17) had a specific task, scored as not completed (0), partially completed (1), or fully completed (2). Scores for these tasks were also summed and the percentage of maximum scores was calculated.

3.6.2.3 Motivational interviewing, group facilitation, and overall performance

The ratings of these skills (MI, GF and overall) was on a Likert scale of 1-7 and numerical total scores computed of the elements in the construct. The mean, median and ranges were also calculated for each sub-skill making up the construct (MI 5, GF 4, and Overall 4 constructs, respectively). The mean of scores for all sessions rated was then calculated to determine if an acceptable threshold was reached for the overall skill for each club.

Trends in mean scores over time, from sessions 1 -17 were plotted. Club scores were also ranked and graphed using Microsoft Excel for Mac.

Lastly, ranked mean club characteristics (age, no of participants, participant's level of education, BMI, attendance, and HbA_{1c}) were plotted against mean scores for each skill.

3.6.3 Correlations between performance and outcomes

The correlation between the performance of the CHWs and primary outcomes of weight loss and changes in HbA_{1c} scores was analysed. A Pearson correlation coefficient was computed to assess if any linear relationship existed between the variables 1) MI scores, 2) Change in HbA_{1c} and 3) Change in weight. MI measures were used as the comparative independent variable as this was the main skill of interest.

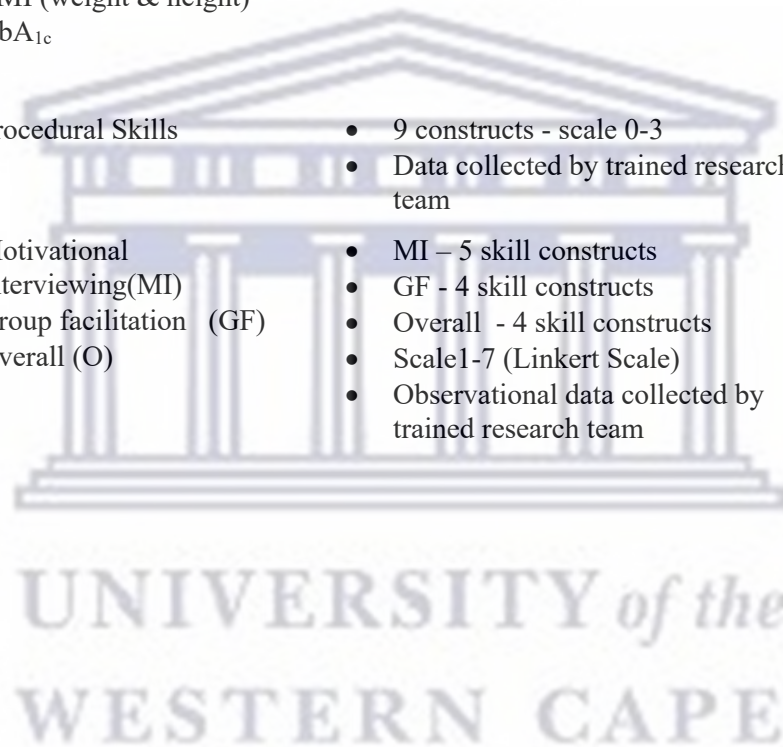
3.6.4 Observer rating variability

The analysis of observer processes and scoring across observers was not explicitly planned in the initial study protocol but emerged as an important consideration during the analysis. This analysis therefore draws on limited data on different observer ratings of the same club and none of the same session.

Mean rating, standard deviations and range of scores by observers were compared, to allow for a glimpse at possible inter and intra-observer variability. However, this is a limitation of the study and is discussed further in the discussion chapter.

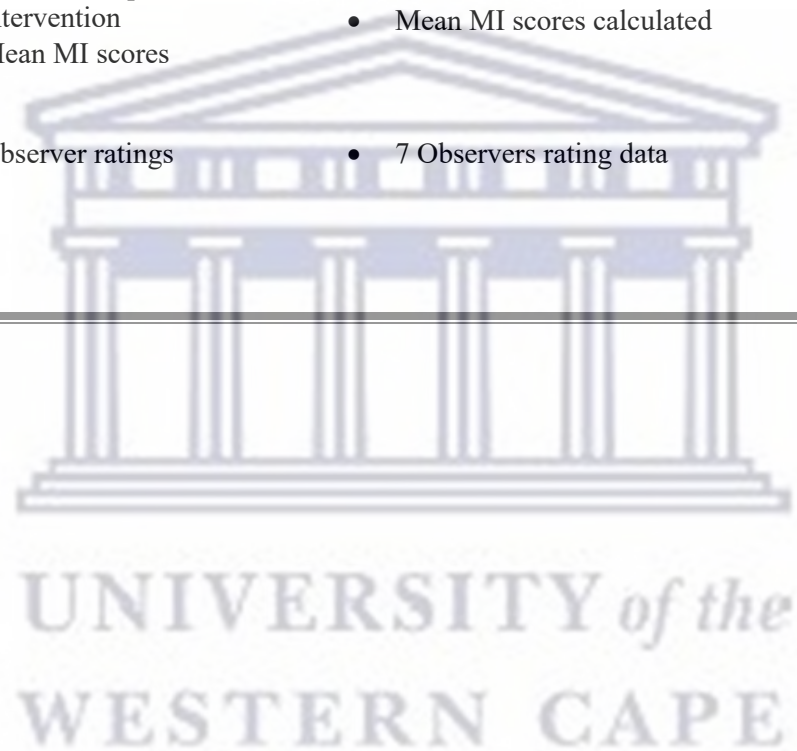
Table 3.3 Measures and analysis of collected data

Outcome	Variables	Data collection	Analysis
1. To describe the club participant attendance and profiles (age, gender, literacy levels and BMI)	<ul style="list-style-type: none"> • Age • Gender • Education • socio-demographic • BMI (weight & height) • HbA_{1c} 	<ul style="list-style-type: none"> • Continuous Data • Data collected via REDCAP survey by trained fieldworkers at baseline 	<ul style="list-style-type: none"> • Descriptive stats (frequencies individual & by club) • Ranked by club for each domain • One way ANOVA to describe club differences
2. To characterise the extent of CHWs' overall compliance to the Lifestyle Africa protocols	<ul style="list-style-type: none"> • Procedural Skills • Motivational Interviewing(MI) • Group facilitation (GF) • Overall (O) 	<ul style="list-style-type: none"> • 9 constructs - scale 0-3 • Data collected by trained research team • MI – 5 skill constructs • GF - 4 skill constructs • Overall - 4 skill constructs • Scale1-7 (Linkert Scale) • Observational data collected by trained research team 	<ul style="list-style-type: none"> • Descriptive stats (Mean (SD), median, range, mode) for summary of scores averaging scores across relevant category items) • For Procedures calculate 80 % of max scores as target acceptable level • Descriptive stats • Individual construct Mean (SD) and median • Summative scores for MI , GF & Overall for each observation • Mean, median & % max for each club • Trend analysis of summative scores over time • Target analysis of 60% of Max • Ranked scores by club



Outcome	Variables	Data collection	Analysis
3. To identify specific parameters (tasks & activities) of the adapted DPP training and intervention that require further exploration/adaption	<ul style="list-style-type: none"> Sessions 1-7 data exploring specific tasks and tools orientated to assisting participants to understand and engage in intervention 	<ul style="list-style-type: none"> Data collected via observation by trained member of research team 	<ul style="list-style-type: none"> Descriptive review and analysis Review data to see if any patterns or skill sets need further training or adaptation
4. Assessment of capacity to deliver the programme across sessions, skills domains (Procedures, MI & GF) and club characteristics	<ul style="list-style-type: none"> Skill domains (MI,GF& O) Size of club Age of participants Health status of participants Literacy levels of participants 	<ul style="list-style-type: none"> Data for the skills domains captured by trained research team member Data regarding clubs, demographics and health status of study participants as well as club metrics captured at baseline and through redcap data collection survey and attendance records captured by CHW as part of intervention. Club history captured during the formative exploratory phase of the larger study 	<ul style="list-style-type: none"> Descriptive analysis Means SD Ranges

Outcome	Variables	Data collection	Analysis
5. Correlations performance and outcomes	<ul style="list-style-type: none"> BMI pre and post intervention HbA_{1c} Pre & post intervention Mean MI scores 	<ul style="list-style-type: none"> Data collected by trained field workers Pre & Post intervention Mean MI scores calculated 	<ul style="list-style-type: none"> Change in parameters calculated Pearson correlation coefficient Plotted graphs
6. Observer rating analysis	<ul style="list-style-type: none"> Observer ratings 	<ul style="list-style-type: none"> 7 Observers rating data 	<ul style="list-style-type: none"> Descriptive analysis (mean (SD) and range) Split data excluding observers 2 & 5 Visual presentation



3.7 DATA MANAGEMENT AND ETHICAL CONSIDERATIONS

3.7.1 Data Management Protocols

All data and documentation for this study that was captured on pre-printed collection tools has been filed and saved in a locked-up facility at The School of Public Health, UWC.

To be able to analyse the data it has been de-identified and captured from the paper tools and exported from REDCAP into Excel and saved in a secure study-specific Dropbox folder accessible only by passwords by active research team members for ongoing analysis and manuscript production at UWC and University of Missouri – Kansas City.

3.7.2. Ethical considerations

Research participants were verbally and in writing informed about the study and its purpose. The information provided outlined the potential benefits, and minimal risk of participation, and assured confidentiality. Participants were informed that their participation was voluntary and withdrawal without consequence at any time was possible. All information was provided in the language of the participants' choice prior to signing an informed consent form.

The study had inclusion and exclusion criteria, however, no one from the selected health clubs was excluded from the initial baseline assessments or from taking part in the intervention programme. The hypothesis was that the intervention would cause no harm and only intended good, however, all activities and suspected adverse events were monitored and reported to an appointed Data Management Board (DMB). No directly related events were reported during the study.

All data collected and used for analysis in this study was data from a larger parent study. The larger parent study passed through two ethics boards. Health Sciences Faculty, University of Cape Town Human Research Committee (HREC REF no.109/2017); University of Western Cape, Research and Innovation (Ethics Ref no.BM17/8/22) for which I served as project coordinator. Approval for the unidentified data used for analysis in this thesis has been approved by the Principal Investigator (PI), Professor Delwyn Catley of the main study. Professor Catley serves as a co-supervisor in writing up this thesis. Ethics from UWC BMREC for current thesis awarded in August 2021 Reference BM21/6/2 (valid 23 July 2021- 23 July 2024) (Appendix II).

CHAPTER 4: RESULTS

4.1 INTRODUCTION

To assess the capacity of trained CHWs to deliver the “Lifestyle Africa” diabetes prevention programme intervention as intended, analyses are presented from the three datasets described in the methodology: 1) socio-demographic profile of CHWs (n=18) delivering the intervention across 11 intervention clubs of the RCT; 2) socio-demographic and selected outcome data of club participants (n=134) in the intervention clubs; and 3) structured observations (n=133) of CHWs delivering the intervention.

To frame the context, the chapter begins with a descriptive analysis of the socio-demographic profiles of the CHWs and the enrolled club participants. This is followed by the core of the analysis focused on the CHW intervention delivery performance. The data presented is of the structured observations collected by seven trained raters on the four main areas of competence: procedural completion, motivational interviewing, group facilitation, and overall performance.

The analyses and results that follow explore what potentially shapes CHW performance and associations with outcomes. Firstly, trends in CHW performance over time from sessions 1 to 17 are examined. Secondly, CHW performance for the three skills being assessed is ranked by club, and thirdly CHW performance scores relative to mean club characteristics. Finally, the relationship between observed CHW performance in MI and participant outcomes of weight loss and HbA_{1c} is reported.

The chapter concludes with an exploration of the variability of the observer ratings by looking at the distribution of ratings of two of the observers who rated the majority of the performances, and the remainder of the observers.

4.2 SOCIO-ECONOMIC AND DEMOGRAPHIC PROFILES OF CHWS AND CLUB PARTICIPANTS

4.2.1 CHW profiles

The CHWs participating in this study were all mature females, with a median age of 42 years, a mean of 11 years of schooling, and 6.9 years of experience in their current role (Table 4.1).

Table 4.1 Demographic characteristics of the Community Health Workers (*n* =18)

Variable	Mean (SD)*	Median	Range
Age in Years	40.9 (8.6)	42.0	26-54
Years of schooling	11.0 (1.2)	11.0	9 – 13
Years of Experience	6.9 (5.5)	6.0	1.8 – 13

*SD: (Standard Deviation)

4.2.2 Participant Profiles

The club participants enrolled in the study were also overwhelmingly (90%) female, with a mean age of 65.1 years (Table 4.2). They had a mixed educational profile, ranging from no schooling (8.2%) to tertiary-level education (1.5%). The majority (83.6%) of participants lived in fixed/formal housing, although mostly (87.3%) with an income at or below ZAR3,200 per month, considerably below the minimum wage at the time of R3,500/month.

Almost thirty percent (29.1%) of the cohort as per inclusion criteria were overweight, (71%) were considered obese by body mass index (BMI); 56 (42.2%) participants had glycated haemoglobin (HbA_{1c}) levels in the prediabetes range (5.7 – 6.4%) at baseline, while a further 41 (30.6%) had above normal (>6.5%) baseline HbA_{1c} levels. Of the 41 participants with elevated HbA_{1c} (above 6.5%), 41.5% were not diagnosed or on diabetes medication. Of those on diabetic medication (*n*=29), five (17.2%) had HbA_{1c} levels <6.5%.

Table 4.2 Socio-demographic & health characteristics of enrolled individual participants (n=134)

Variable		N	%
Gender	Male	14	10.5
	Female	120	89.5
Age	≤45	7	5.2
	45 – 55	18	13.4
	56 – 65	40	29.9
	66 – 75	41	30.6
	≥75	28	20.9
Education	None	11	8.2
	Primary	59	44.0
	Secondary	62	46.3
	Tertiary	2	1.5
Individual Monthly Income (ZAR)	No income	1	0.8
	1-800	7	5.3
	801-1600	56	41.8
	1601-3200	53	39.6
	3201-6400	14	10.4
	≥6401	3	2.3
Housing	Shack no services	4	3.0
	Shack serviced	18	13.4
	Permanent structure	112	83.6
BMI	Overweight 29.9 -30	39	29.1
	Obese ≥30	74	55.2
	Morbid Obesity ≥40	21	15.7
HbA1c (%)	Acceptable ≤6,5	93	69.4
	T2D ≥6,5	41	30.6

*BMI: body mass index; HbA1c: glycated haemoglobin; T2D: type 2 diabetes; ZAR: South African Rand

Figure 4.1 shows the participant profiles disaggregated by their club. The clubs were not homogeneous with respect to the number of participants, age, levels of education, and attendance levels. A one-way ANOVA analysis shows significant differences amongst the mean number of participants in each club ($p = <0.001$ 95% CI [12.99, 14.06]), the mean age of the participants ($p = <0.001$ C.I. 95% [63.53, 67.6]), average levels of education of the participants (95% CI [6.9, 7.9] $p = 0.013$) and mean levels of attendance to the 17 core

sessions ($p = 0.05$ 95% CI, [53.1%, 63.0%]). The clubs did not show significant differences based on mean BMI 33.5 (1.9) and Hb1c 6.4 (0.5).



Figure 4.1 Ranked distribution of participant profiles by club

Club socio-economic status is represented in Figures 4.2 and 4.3 by the distribution of income brackets of participants and that of their housing status. The mean club income was between ZAR 800 and 3200. More than 60% of the participants in each club lived in permanent structures except for all participants in club 5 who lived in shacks with services. Between 7-13% of the participants in clubs 1, 3, and 6 lived in shacks with no services.

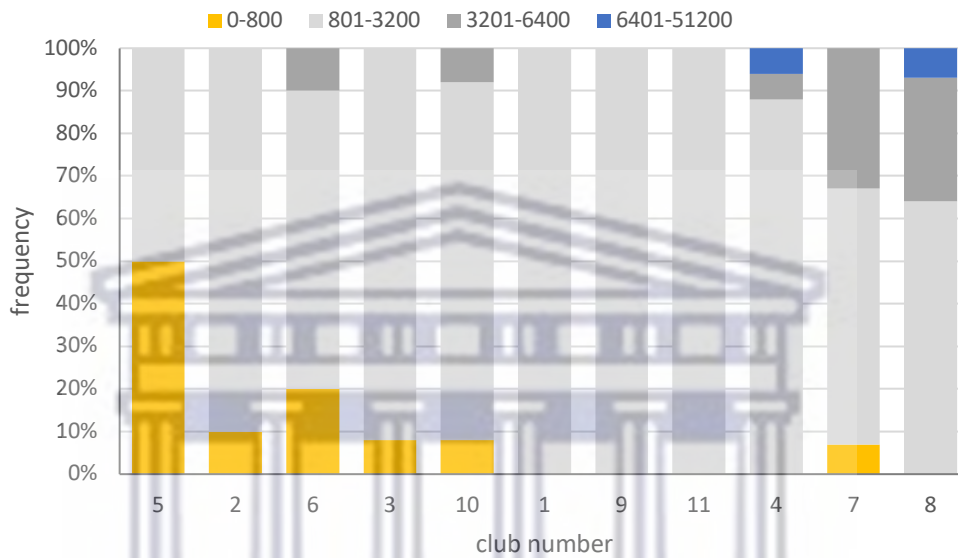


Figure 4.2 Ranked club frequency distribution of monthly income (ZAR)

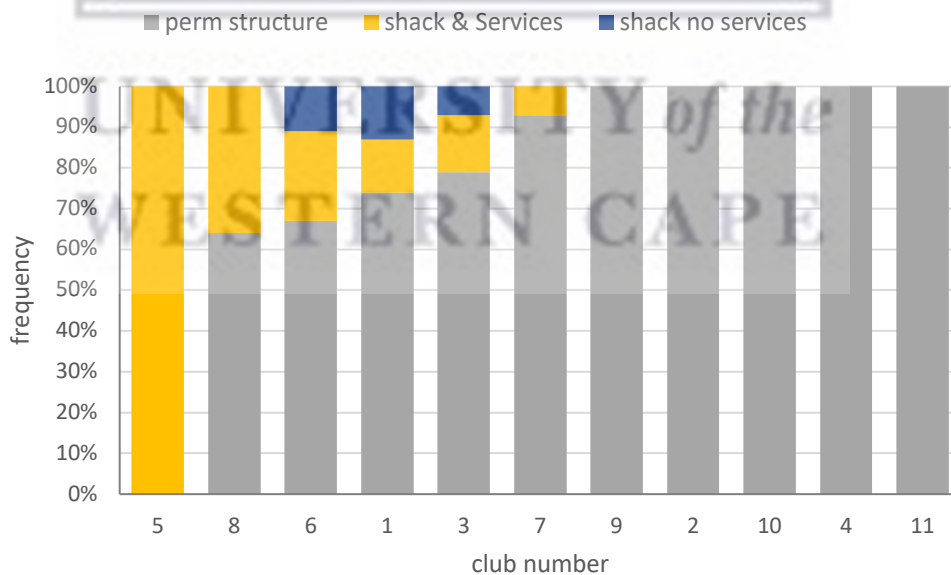


Figure 4.3 Ranked club frequency distribution of housing status

Club 5 was an outlier: it had the least participants ($n=3$), the lowest income and poorest housing status, the youngest group of participants, and the lowest BMI. Their educational levels, however, were the fourth highest.

4.3 OBSERVATIONS OF INTERVENTION DELIVERY BY CHWS

Using observation checklists, CHWs were assessed by independent observers for four areas of competence over the 17 sessions of the programme, namely: 1) completion of procedures (P), 2) Motivational Interviewing (MI), 3) Group Facilitation (GF) and 4) Overall performance.

The analysis describes the observations completed (n = 133) of 18 CHWs across a mean of 12 sessions (range 8-14) per club. These observations were completed by seven trained observers each completing observation checklists for a mean of 18 sessions each (range 2-45).

4.3.1 Completion of Procedures

As indicated in the methodology (Chapter 3, Table 3.1), nine procedural performance components were assessed. Ratings were scored as either not completed (0), partially completed (1), or fully completed (2). 133 sessions were observed. Of these, the CHWs collectively achieved the threshold performance level (80%) for seven of the nine procedural dimensions (Figure 4.4). The two procedural constructs CHWs did not reach the 80% threshold were being able to successfully operate the video equipment and the completion of the participant physical activity logbooks.

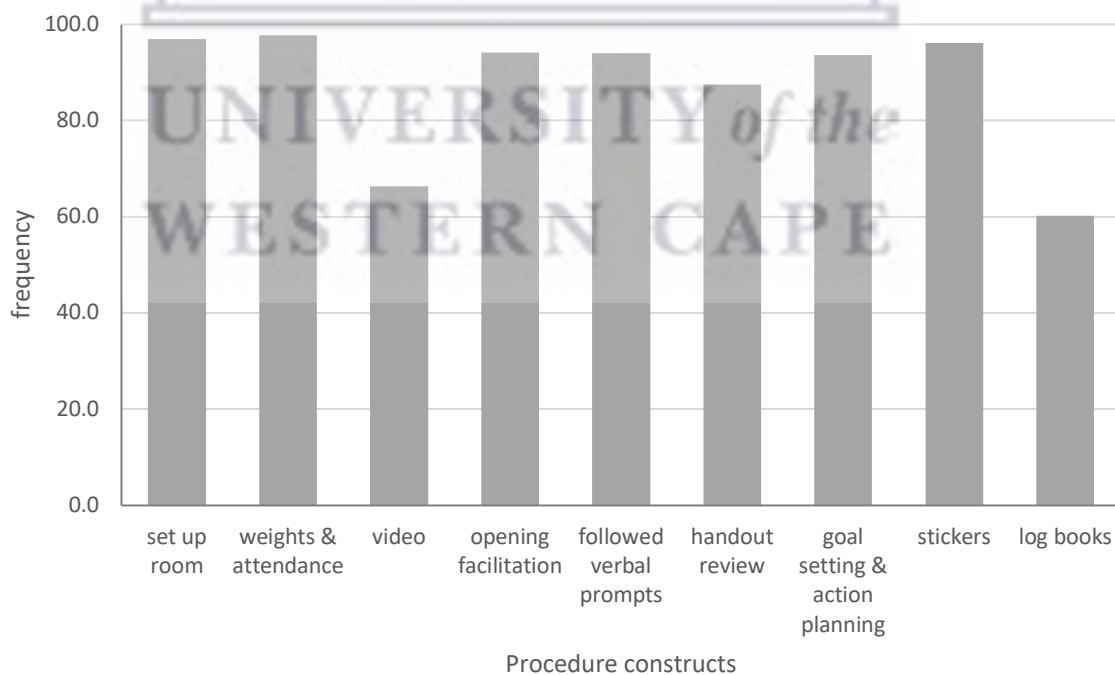


Figure 4.4 Percent completion of each procedural construct

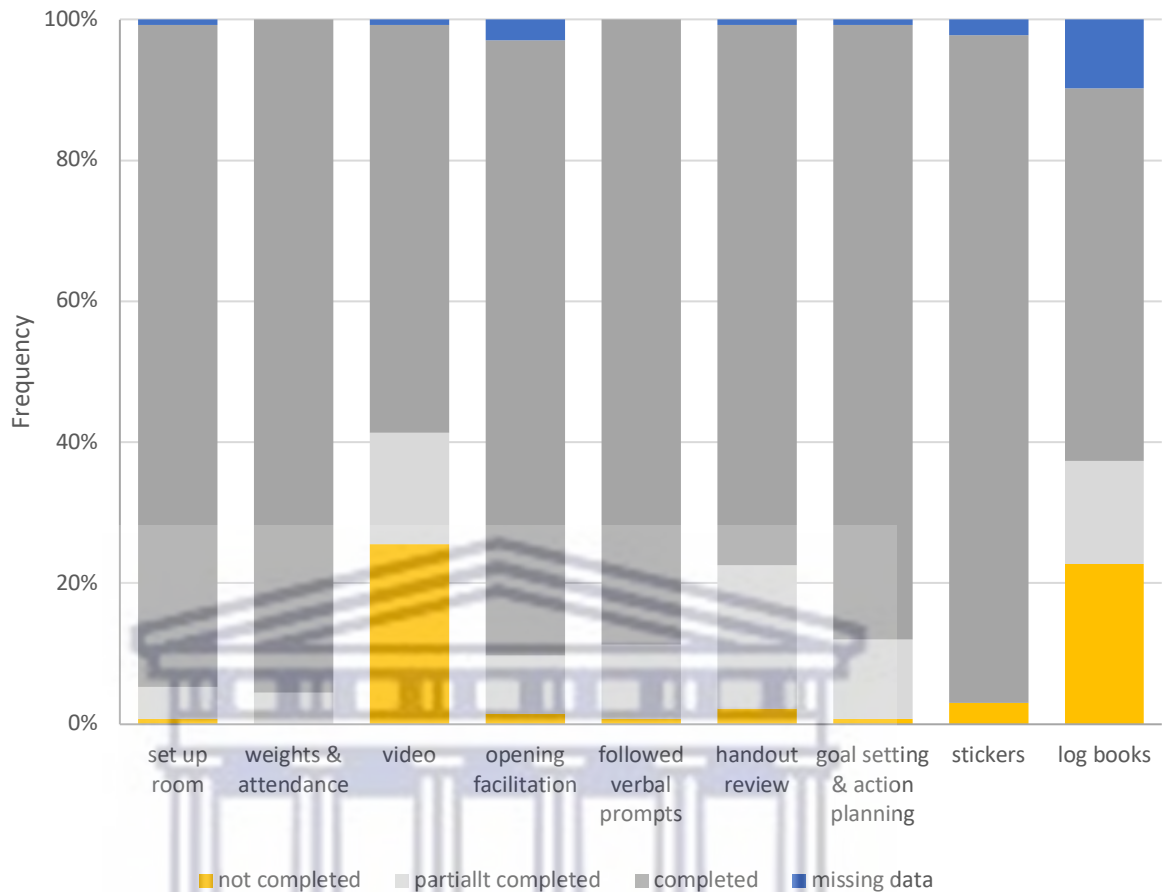


Figure 4.5 Frequency of scores for procedural constructs (n=133) logbooks (n =123)

4.3.1.1 Completion of specific tasks and activities in individual sessions

The CHWs were rated on their performance of the tasks and activities of individual sessions of the programme Table 4.3 summarises these tasks for each session and the sum of scores for each task completed by all the CHWs as follows; not completed – 0 partially completed – 1 and fully completed 2 .

The activities and tasks were judged fully completed in over 85% of sessions observed for all but two Items. These two items were, facilitating remembering your values in session 1 and explaining how to deal with long-term weight changes in session 17.

Table 4.3 Scores for session specific tasks

Session number	Task/skill	Number of Observations	Sum of scores	% of max
1	starting weight and correct weight log	10	19	95
	entered goal weight	10	18	90
	facilitated remember your values	10	14	70
2	demonstrate activity at moderate pace	11	21	95
	facilitated dealing with difficulties	11	21	95
3	demonstrated how to use activity log	11	22	100
4	facilitated importance of exercise	11	18	82
	explained foods to choose guide	11	20	91
5	facilitated discussion & activity around food groups	10	20	100
	Facilitated a healthy meal and make your plate	10	20	100
	facilitated dealing with difficulties	10	19	95
6	facilitated values check in activities	10	18	90
	demonstrated muscle building activities	10	18	90
7	demonstrate measuring food	10	19	95
	explained to use food logs	10	19	95
	explained how to use food labels	10	18	90
8	explained use of quick tracker	10	19	95
	reviewed food logs made comments	10	16	80
9	reviewed food groups	10	20	100
	reviewed shopping and cooking tips	10	19	95
10	explained stress and effect on weight gain/health	9	17	94
	demonstrated deep breathing and muscle relaxation exercises	9	18	100
11	facilitated discussion tips to fit in activity	3	6	100
12	facilitated values check in	10	19	86
13	explained connection between fat & heart health	1	2	100
	explained good and bad fats	1	2	100
14	explained helpful and harmful thoughts	8	14	87.5
15	explained how to ask for support	0	0	-
16	explained how to read menus	1	2	100
	explained how to eat well away from home	1	2	100
17	explained individual & group progress	8	16	100
	helped participants set long/short term goal	8	15	94
	explained how to deal with long term weight change	8	9	56
	Mean	8	14.9	89.7

4.3.2 Basic Motivational Interviewing

As indicated in the methodology (Chapter 3, Table 3.1) five motivational interviewing components were assessed. Ratings were scored on a Likert scale from 1-7, 1 being poor/never and 7 being excellent/always and with a midpoint score of 4 being good/often.

A total of 125 sessions were observed and rated for performance in the use of motivational interviewing skills.

Table 4.4 below provides the mean and median score for each of the five skills in the MI component for all CHWs and sessions observed (125 observations).

Table 4.4 Mean, Median, Ranges, and Standard Deviation of ratings (out of 7 total) for individual items of MI (n=125)

	Open - Questions (SD)*	Reflective Listening (SD)*	Builds Confidence (SD)*	Empathetic (SD)*	Non - Confrontatio nal(SD)*
Mean	5.2 (1.0)	5.3 (1.1)	5.0 (0.9)	5.0 (1.0)	5.5 (0.9)
Median	6.0	6.0	5.0	5.0	6.0
Ranges	2-7	2-7	2-7	3-7	3-7

*SD: (Standard Deviation)

Ratings between 1-7 on individual MI skills were added to give a total MI score, with a maximum possible total score of 35 for each observation. Using an acceptable performance threshold of 60% (score 21) and above, all CHWs displayed the capacity to use MI in their delivery of the observed sessions. The mean MI score across all sessions was 26/35 (75.5%). CHWs in clubs five, six and seven had mean scores above 80%.

Table 4.5 Median, mean and percentage scores (out of 35 total possible) for MI by club (n=125)

Club no	# observations	Mean score	Median score	% max
1	13	25.0	25.0	71.4
2	12	23.6	23.0	67.4
3	12	24.9	26.0	72.2
4	12	23.2	20.5	66.2
5	10	31.7	29.0	84.9
6	10	25.8	27.0	88.6
7	13	29.1	29.0	83.1
8	13	27.2	28.0	77.6
9	8	26.1	27.0	74.6
10	9	23.9	25.0	68.3
11	13	26.5	27.0	75.8
All observations	125	26.1	26.1	75.5

4.3.3 Group Facilitation (GF)

There were four constructs for GF rated on a Likert scale of 1-7, giving a maximum possible total score of 28 for each observation.

Acceptable performance was set at 60% and above. Although acceptable thresholds were achieved the outcomes for each component of GF below show relative weakness in CHWs' ability to allow members to speak through problems, a key listening skill in GF whereby the participant is given the chance to speak while everyone including the facilitator (CHW) listens with intent to understand and empathise.

Table 4.6 below gives the mean and median score for each of the four items in the GF skills across 127 observations.

Table 4.6 Mean, Median, Ranges and standard deviation of ratings (out of 7 total) for individual items of GF (n=127)

	Keep group on track (SD)*	Give people the chance to speak (SD)*	Keep focus on members (SD)*	Allow members to speak through problems (SD)*
Mean	5.5 (0.9)	5.4 (1.1)	5.4 (1.0)	5.0 (1.0)
Median	6.0	5.0	5.0	5.0
Range	4-7	3-7	3-7	3-7

*SD: (Standard Deviation)

All CHWs displayed the capacity to facilitate the group for the sessions that were observed. All mean GF scores were above the 60% requirement for all clubs, with a scores greater than 70% of the maximum (Table 4.7). CHWs in clubs five, seven, and eight had GF scores above 80%.

Table 4.7 below shows the overall mean, median, and overall percentage total GF scores per club and for all observations.

Table 4.7 Median, median and percentage scores for total GF scores by club (n=127)

Club no	# observations	Mean score	Median score	% max
1	13	19.9	19.0	70.7
2	12	19.9	18.5	71.1
3	11	20.5	21.0	73.2
4	12	19.7	18.5	70.2
5	11	24.7	25.0	88.3
6	14	21.2	23.0	75.8
7	14	23.2	24.0	85.7
8	12	23.4	23.0	83.6
9	8	21.3	22.0	75.9
10	9	21.7	21.0	77.5
11	11	21.5	20.0	76.8
All observations	127	21.5	21.3	77.2

4.3.4 Overall performance

The final component of the observer scores was the overall or global scores for the CHW performance in the delivery of the intervention. These scores were summative as well as cross-cutting, taking into consideration procedures, motivational interviewing skills as well as group facilitation. Scoring was also on a Likert scale of 1-7.

Table 4.8 below provides the mean and median score for each of the overall skills scored for all CHWs and sessions observed (131 observations).

Table 4.8 Mean, Median, Ranges, and standard deviation of ratings (out of 7 total) for individual items of overall performance(n=131)

	Overall, how well did the CHW conduct the session (SD)*	How well did the CHW use the projector/video (SD)*	How did the CHW handle participant questions (SD)*	How interactive was the session (SD)*
Mean	5.4 (1.0)	5.4(1.3)	5.2 (0.9)	5.5 (1.0)
Median	6.0	6.0	5.0	6.00
Range	3-7	2-7	3-7	3-7

*SD: (Standard deviation)

Table 4.9 Median, median and % scores for total overall scores by club (n=131)

Club no	# observations	Mean score	Median score	% max
1	14	20.07	21.00	71.79
2	12	19.25	19.50	68.75
3	11	19.45	21.00	69.48
4	12	19.83	19.50	70.83
5	11	24.64	24.00	87.99
6	13	18.85	19.00	67.31
7	14	24.14	24.00	86.22
8	13	22.46	23.00	80.22
9	8	22.00	22.50	78.57
10	10	23.30	23.50	83.21
11	13	22.08	23.00	78.85
All observations	131	21.55	21.82	76.68

4.4 FACTORS ASSOCIATED WITH PERFORMANCE

4.4.1 Trends in performance

The total mean MI, GF, and overall scores across all clubs over time, from sessions 1 to 17 are shown in Figures 4.6, 4.7 and 4.8. A Pearson correlation coefficient was used to assess the linear relationship between session number and scores. The correlation between session number and MI scores (n= 127) $r(14) = .724, p = .003$, GF scores (n=116) $r(14) = .727, p = .003$, and overall scores (n= 131), $r(14) = .814, p = .001$ n=131, was positive.

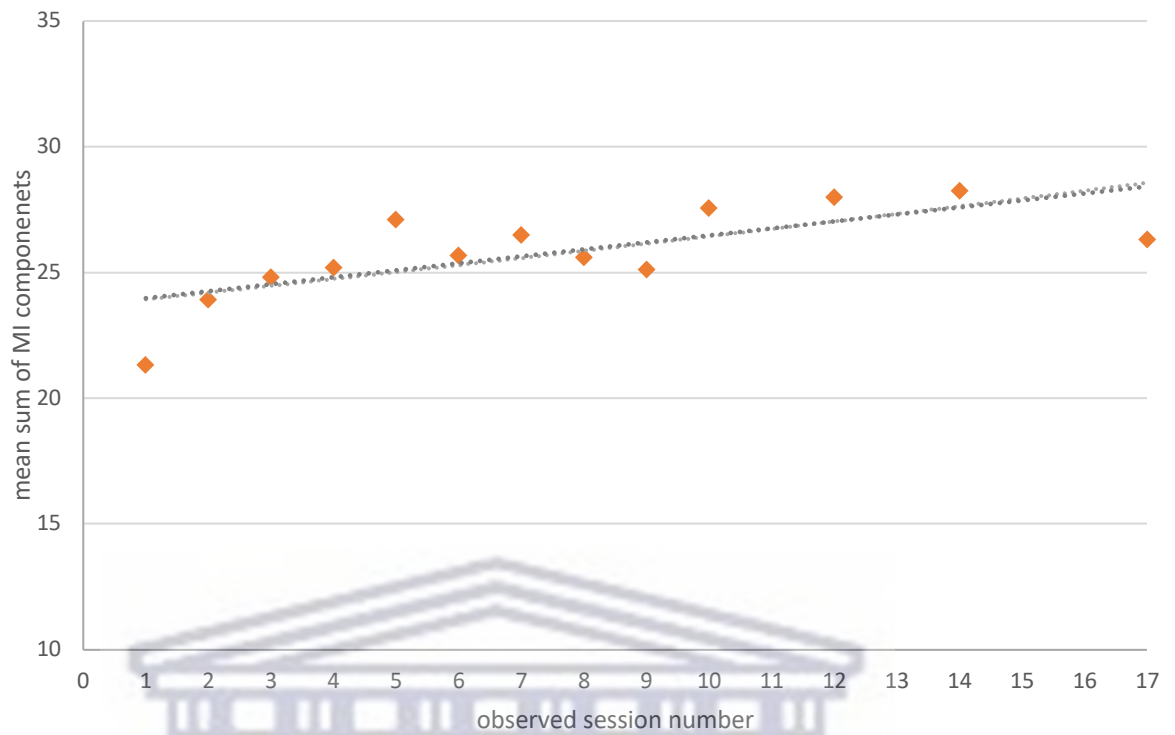


Figure 4.6. Mean MI scores for sessions observed over time (n=127)

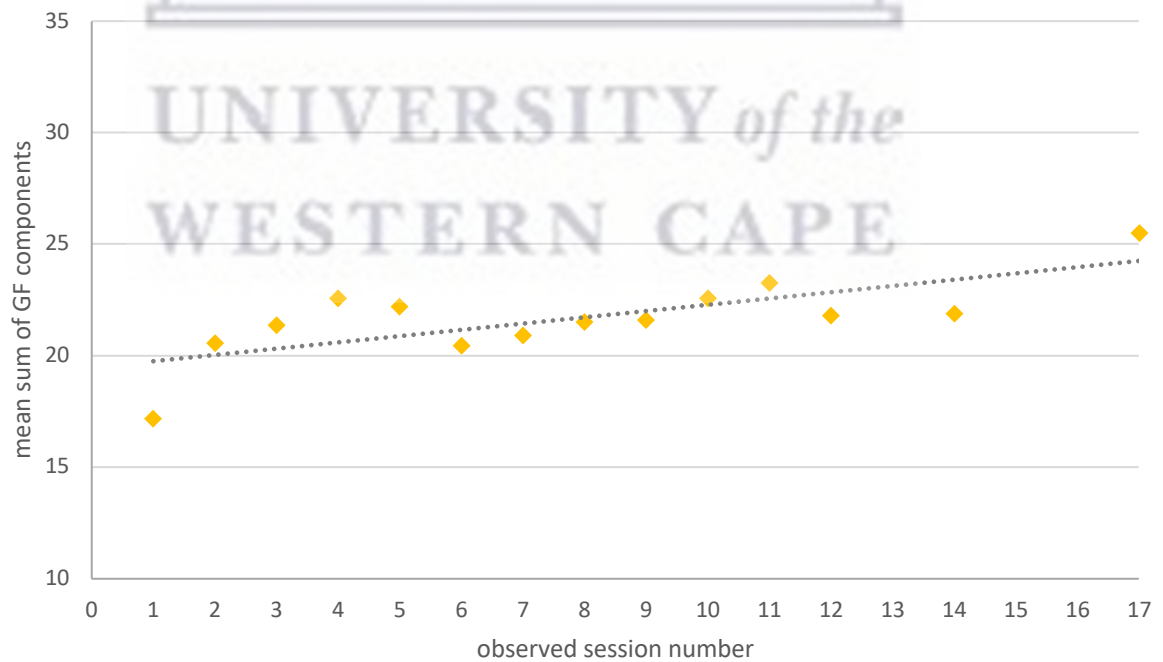


Figure 4.7 Mean GF scores for sessions observed over time (n= 116)

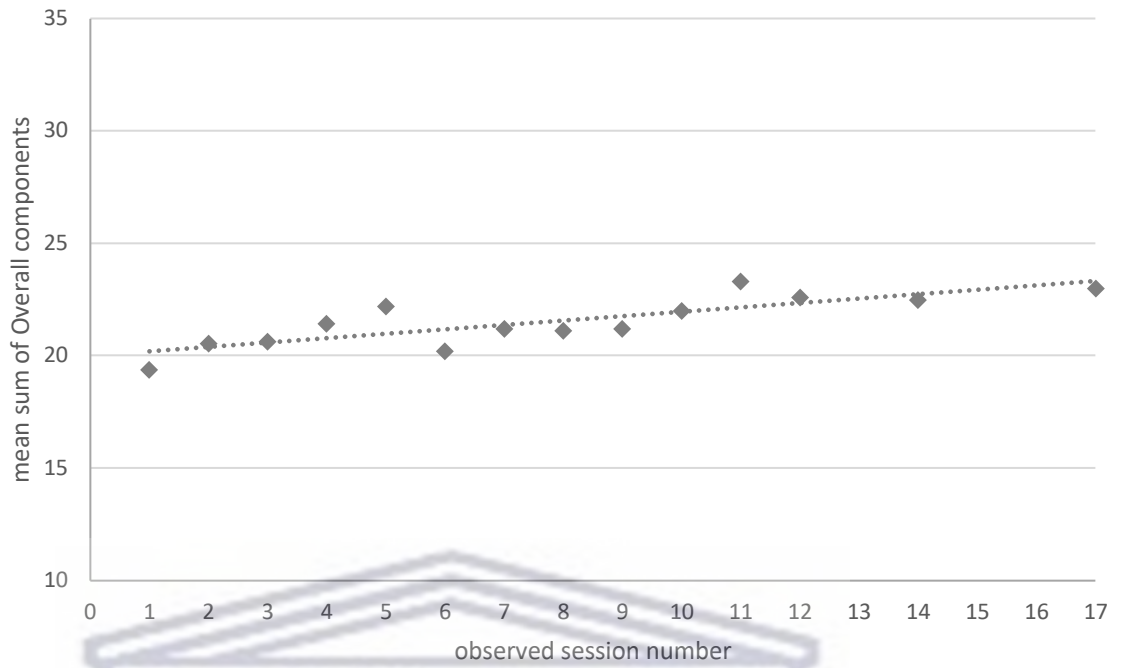


Figure 4.8 Mean overall scores for sessions observed over time (n=131)

4.4.2 Ranking per club for MI, GF & overall scores

Table 4.10 below displays the range and Mean (SD) performance scores for each construct (MI, GF and Overall) for all clubs (n=11)

Figure 4.9 compares the ranking of clubs' mean MI, GF, and overall scores across all the sessions (n = 11)

Table 4.10 Descriptive statistics for performance constructs

N = 11	N	Min	Max	Mean (SD)*
MI	11	23	32	26.1(2.5)
GF	11	20	25	21.5(1.6)
Overall	11	19	25	21.46 2.1)

*SD (Standard Deviation)

Clubs 5 and 7 ranked consistently the highest across all constructs while clubs 4 and 2 were the lowest.

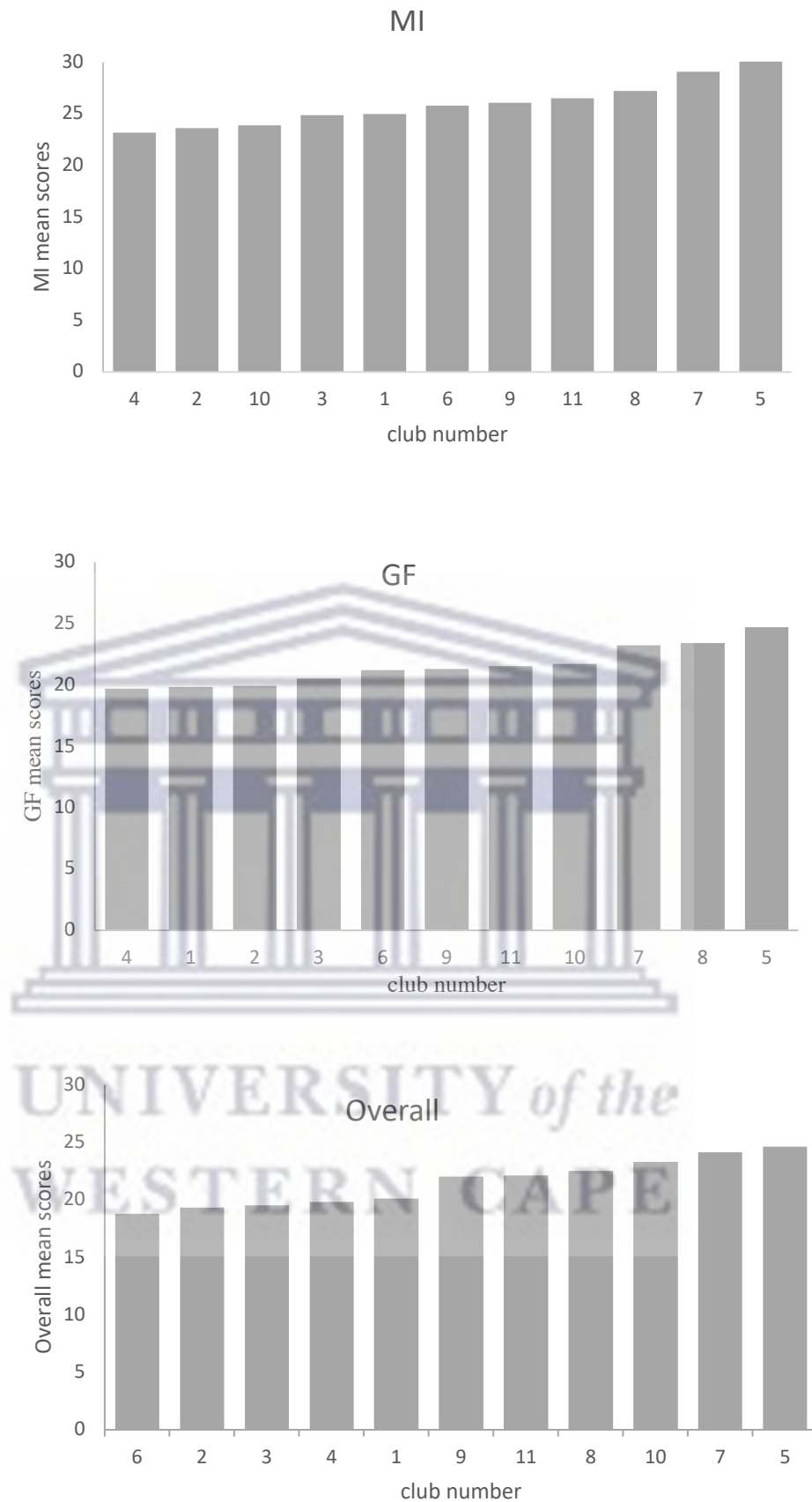


Figure 4.9 Mean scores ranked by club for MI, GF & Overall performance across all observed sessions.

4.4.3 CHW performance scores relative to mean club characteristics

Figures 4.10 through to 4.15 display patterns of MI, GF, and Overall scores against ranked club characteristics.

Based on the trendlines these figures suggest with increasing age ($r=0.55$), BMI ($r=0.20$), HbA_{1c} of participants ($r=0.49$) and the number of participants ($r=0.32$), there is a negative correlation and therefore a decrease in CHW performance and a positive correlation or increase in CHW performance with participant levels of education ($r=0.52$) and attendance ($r=0.32$)

Club 5 consistently across all club characteristics shows strong performances.

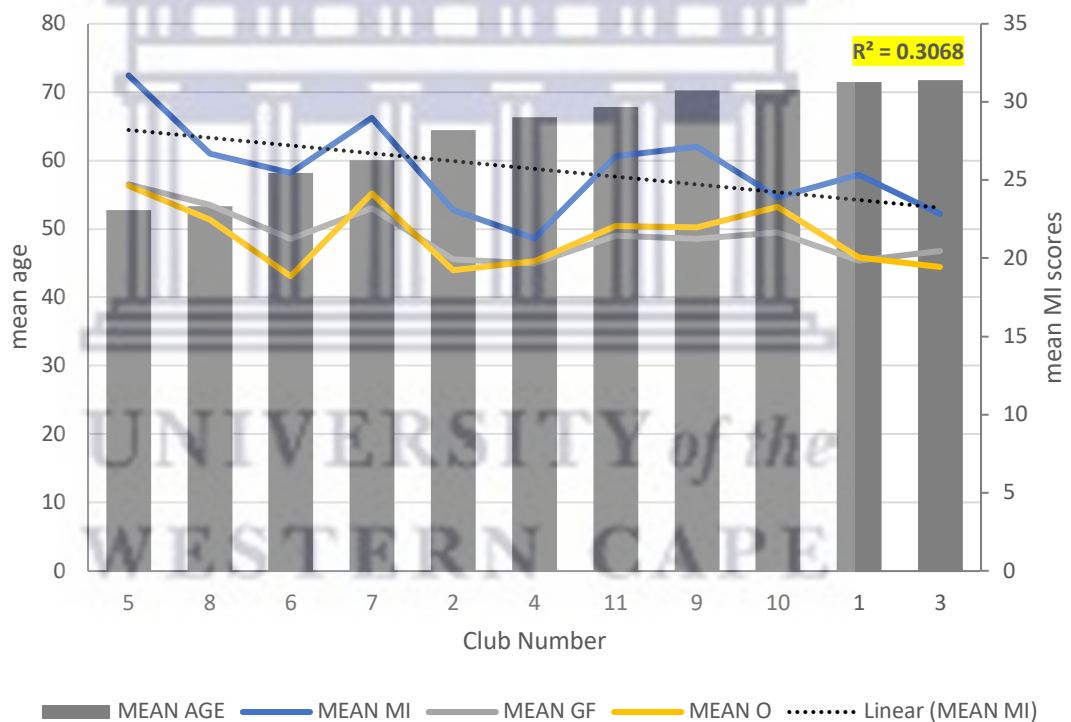


Figure 4.10 Mean club Age, MI, GF and Overall Scores

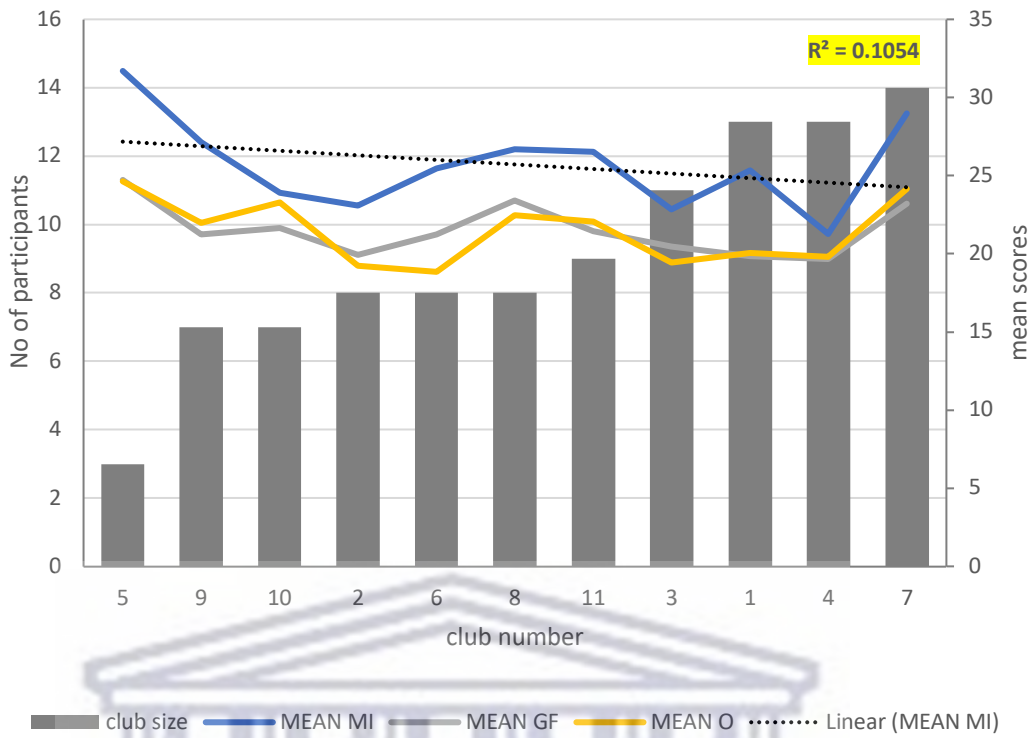


Figure 4.11 The mean number of participants, MI, GF, and Overall Scores

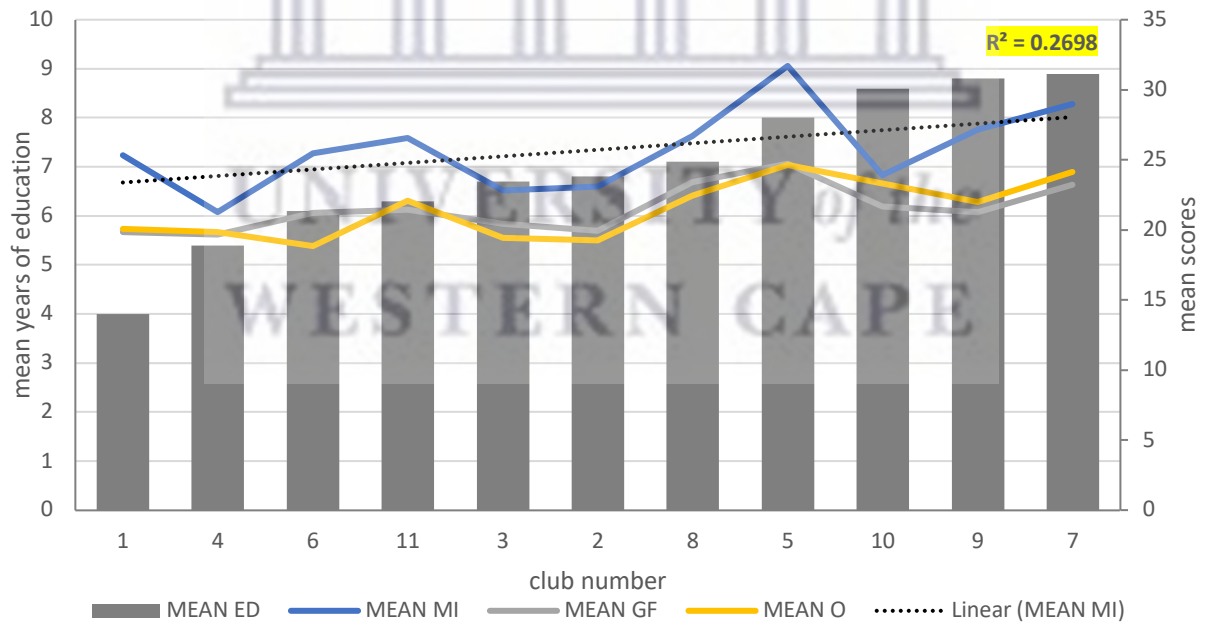


Figure 4.12 Mean years education, MI, GF and Overall scores

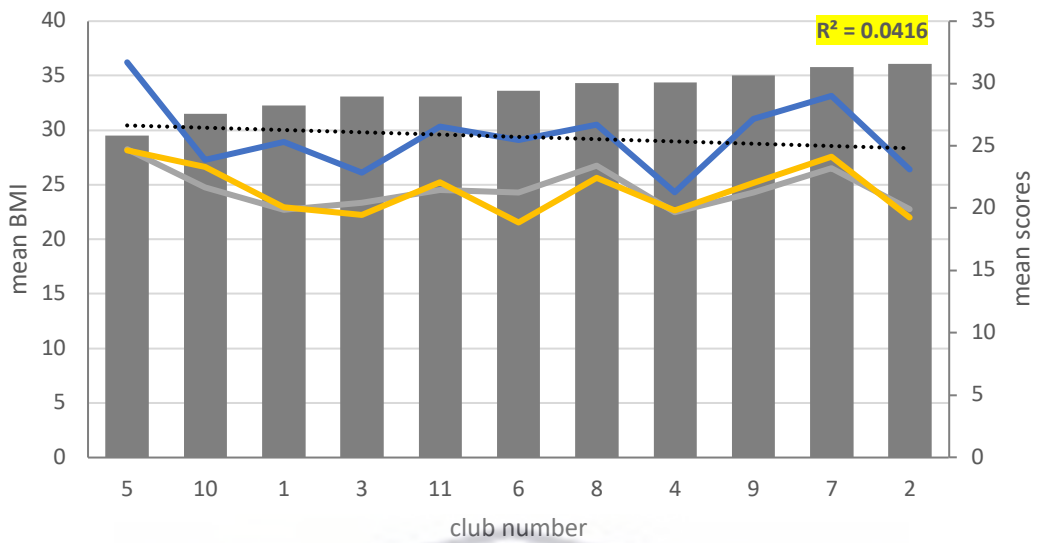


Figure 4.13 Mean club BMI, MI, GF, and Overall scores

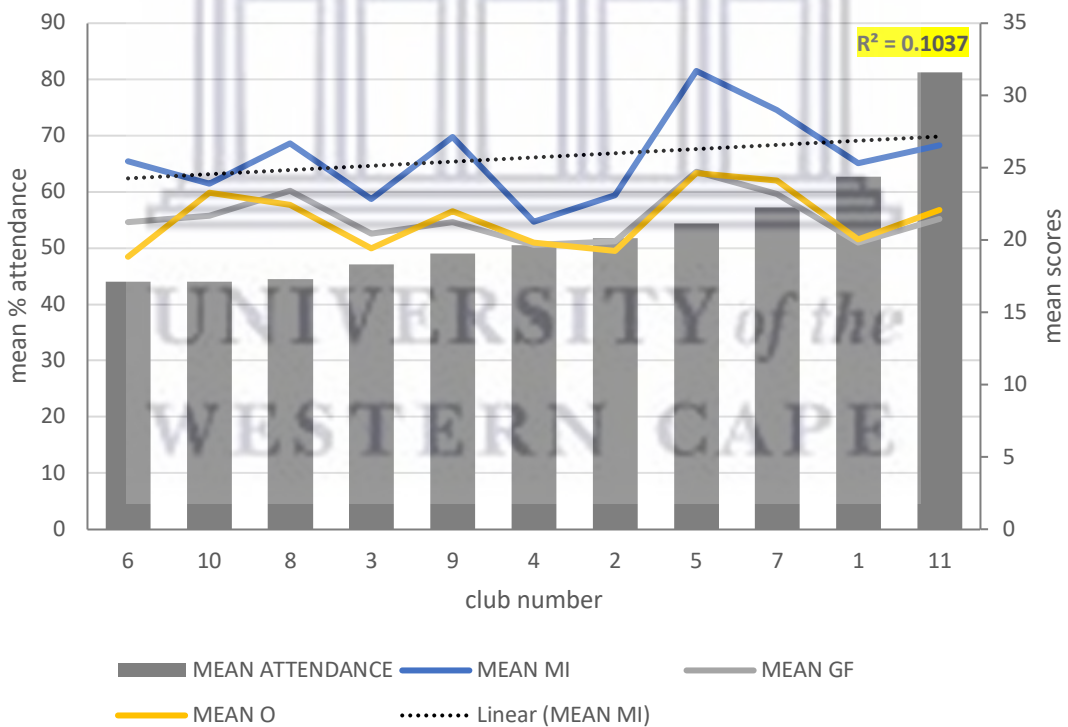


Figure 4.14 Mean club attendance rate, MI, GF and overall scores

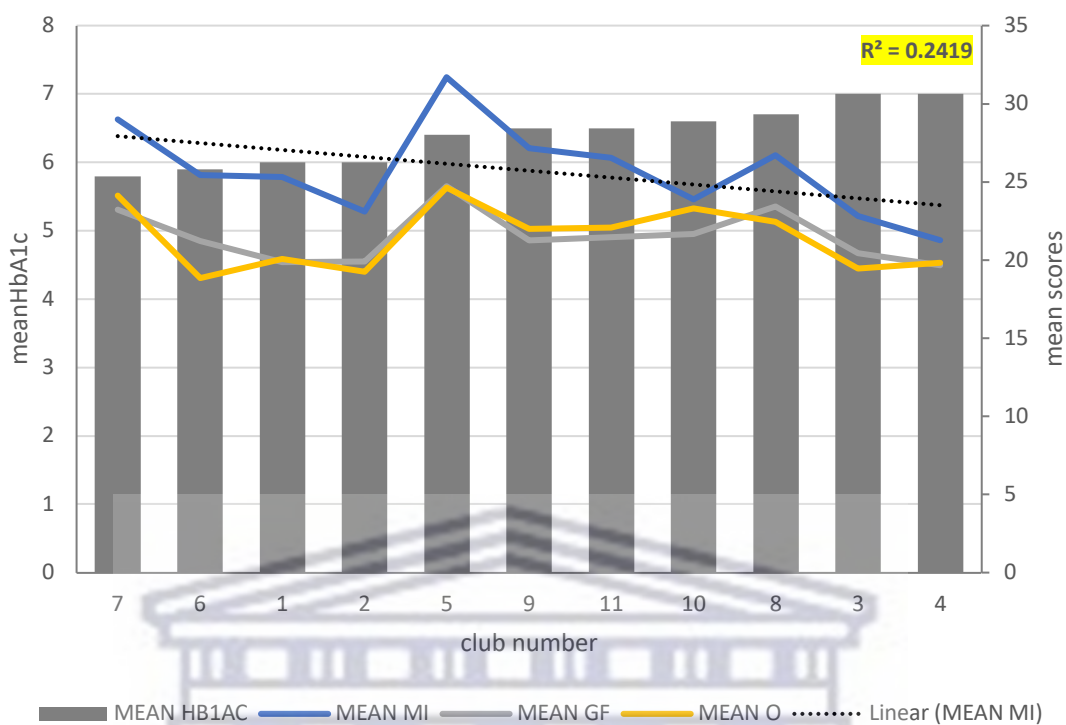


Figure 4.15 Mean HbA_{1c}, MI, GF and Overall scores

4.5 CORRELATIONS BETWEEN PERFORMANCE AND OUTCOMES

To assess whether performance predicted the key primary study outcomes of mean change in percentage body weight and HbA_{1c} by club, these variables were plotted against mean club MI scores (Figures 4.9 & 4.10).

A Pearson correlation coefficient was computed to assess the linear relationship between mean Motivational Interviewing scores and change in HbA_{1c} and % weight change post-intervention. There was a moderate positive correlation between MI scores and change in HbA_{1c}, $r = 0.516$ and a negligible correlation between variables MI scores and change in weight $r = 0.00$,

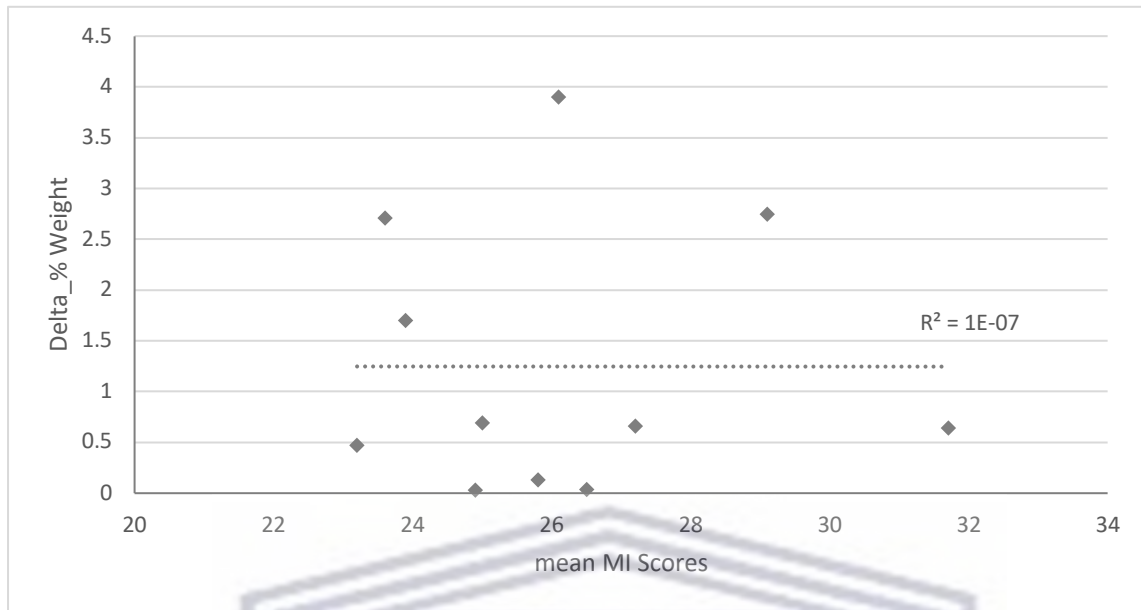


Figure 4.16 Mean MI scores vs changes in % weight post core sessions

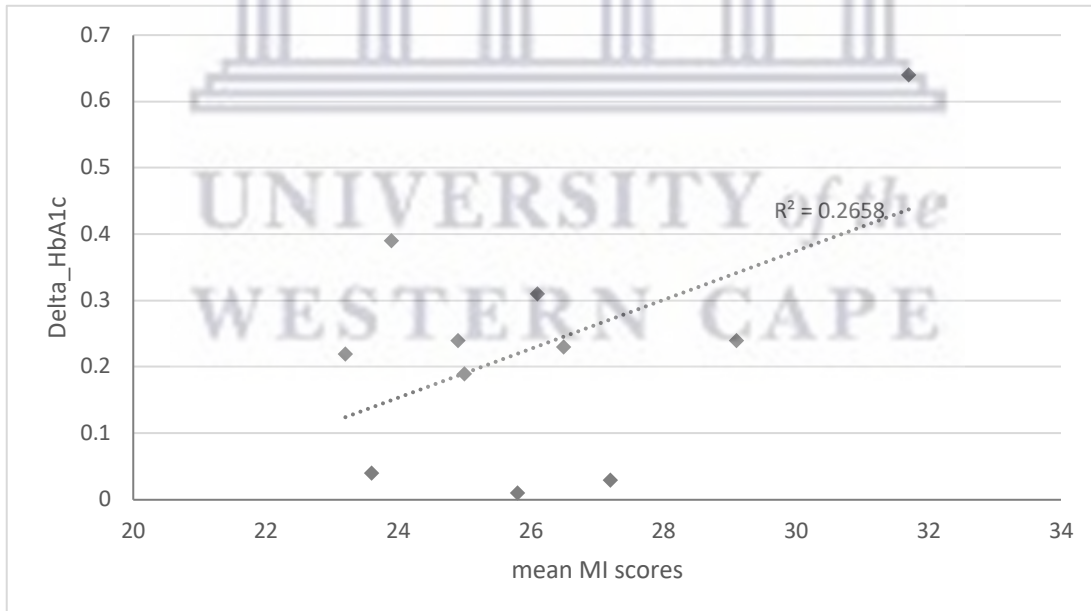


Figure 4.17 Mean club MI scores vs changes in HbA1c % post core sessions

4.6 OBSERVER RATING ANALYSIS

Descriptive analysis was done of all the observers (n=7) for all sessions (n=133). The data is separated into all observations from all observers excluding 2 and 5 and for observers 2 (n = 45) and 5 (n = 37) who performed the majority of the sessions across multiple sessions.

The data and figures below describe the variability between observer ratings and intra-observer consistency over time.

The trend for 5 out of the 7 observers was an increase in rating scores over time as shown in Figure 4.18 with high standard deviations and ranges within their ratings. Ratings from Observer 2 decreased over time (Figure 4.19) and showed less consistency than the ratings of Observer 5 (Figure 4.20). These results show variability and difference in trends amongst the observer ratings.

Table 4.11 Mean (SD) and range of observer scores of all observers (excluding 2 and 5) and observers 2 and 5

Session	Observer 2 mean	SD	range	Observer 5 mean	SD	Range	ALL Mean	SD	Range
1	25.5	4.9	22-29	21	0		23.1	2.6	19-25
2	23	3	20-26	26.5	4.9	23-30	23	4.1	20-28
3	26.7	0.6	26-27	27.7	2.3	25-29	23.5	3.7	20-28
4	22.7	2.1	21-25	27	2.8	25-29	25.5	4.9	20-27
5	26	5.3	22-32	29	1	28-30	26.5	5.1	20-31
6	26.2	4.5	19-31	29	0		23.8	2.9	20-27
7	26	4	22-30	29	0		22.3	4.0	20-27
8	25.7	4.2	21-29	30	1.4	29-31	23.4	6.1	17-30
9	23.7	5.9	17-28	28	0		25.8	4.6	20-31
10	25.4	2.6	22-28	28.7	0.6	28-29	35	0	
11	19	0		30	0		30	0	
12	27.3	2.2	25-30	28	1	27-29	25.5	7.8	20-31
13									
14	23	5.3	19-29	28.8	1	28-30	34	0	
15									
16	21	0							
17	21.5	2.1	20-23	29	2.6	24-31	35	0	

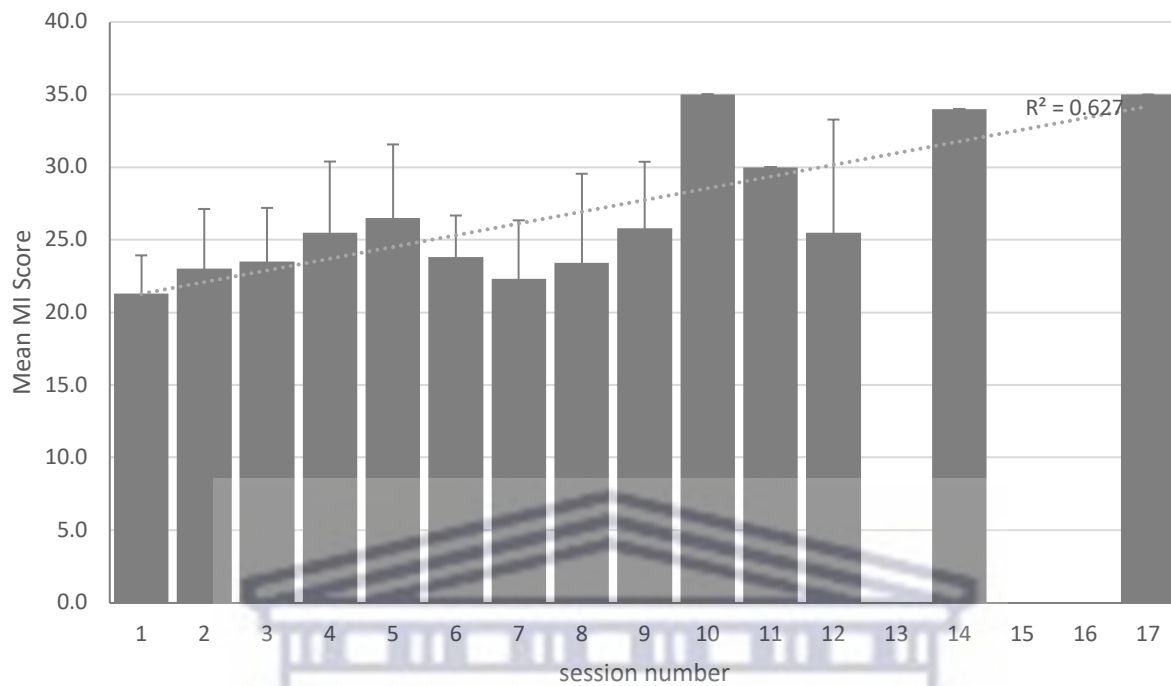


Figure 4.18 All observer mean MI (SD) scores (excluding observers 2 & 5)

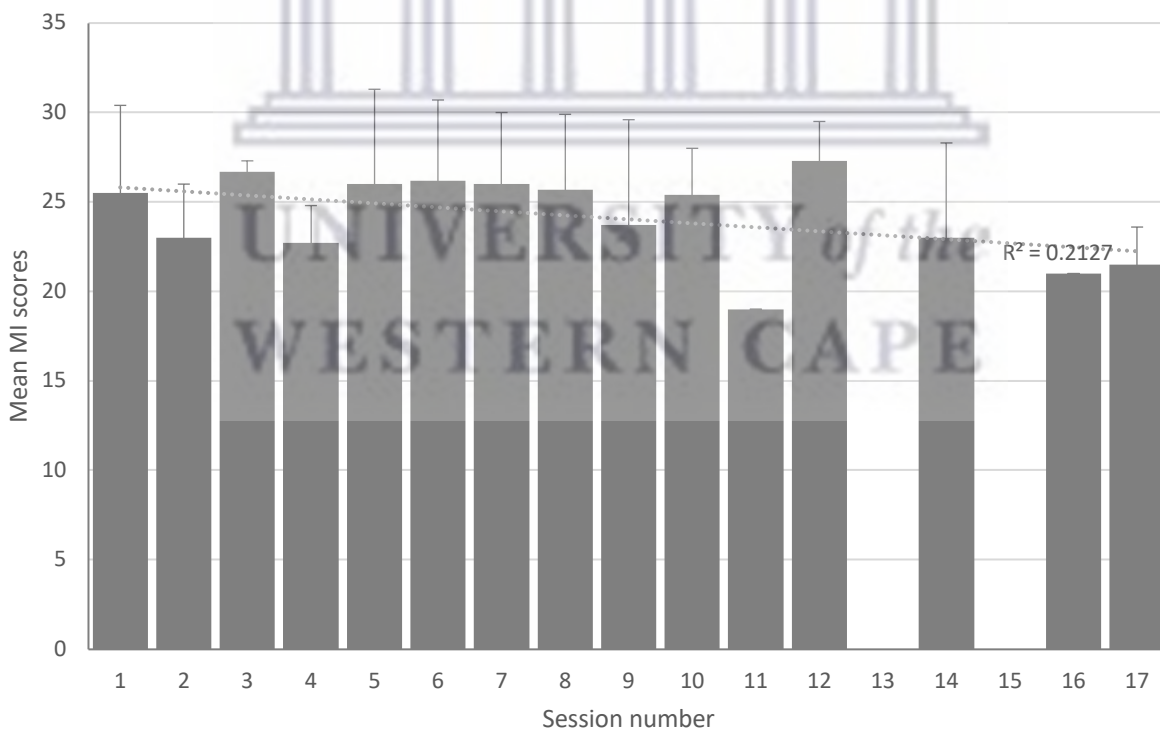


Figure 4.19 Observer 2 mean MI (SD) scores

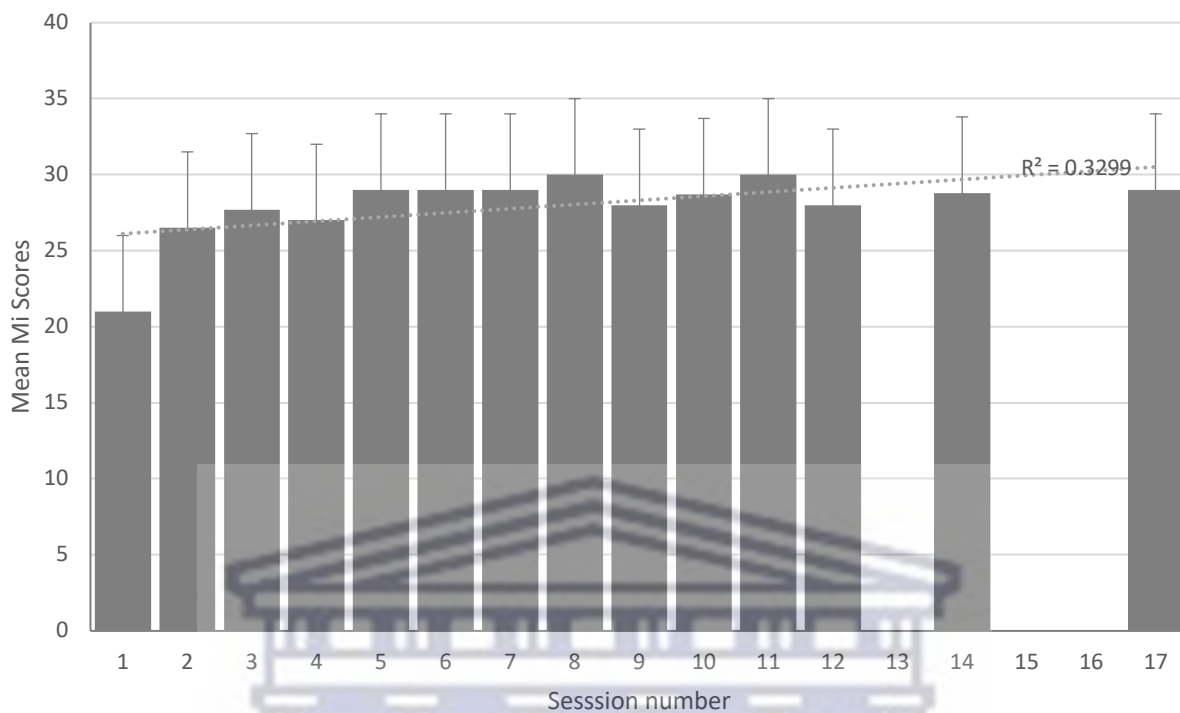


Figure 4.20 Observer 5 mean MI (SD) scores

4.7 SUMMARY

In summary, the main findings of this analysis are as follows:

- CHWs in the study varied in age and experience, however, all had similar levels of education.
- The intervention clubs were heterogenous in their socio-economic status and by size, while the participants were on average elderly obese females with mixed levels of education and income. Thirty percent (30%) of the participants had HbA_{1c} >6.5 at baseline.
- In their delivery of Lifestyle Africa the CHWs reached completion standards for completion of standard procedures set out except for the use of video equipment and completion of participant log books. They showed high levels of competence in the completion of session-specific tasks except for two tasks: a) remembering your values and b) how to deal with long-term weight changes
- Overall the CHWS showed the capacity to execute MI, GF skills.

- There were patterns or trends seen in performance where some CHW teams scored consistently higher than others. The trend was for CHW performance to improve over time and was also shaped by club characteristics.
- The greatest change in performance was seen between sessions one and two.
- Positive correlations were seen between better performance and positive changes in HbA_{1c} scores. However, no correlation was seen between performance and weight loss.
- When examining the observer variability in rating the CHWs showed intra-observer consistency over time. Differences between observer ratings could be reflective of real inconsistency amongst observers or differences in CHW performance due to club characteristics.



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CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

The responses to the growing burden of NCDs in LMICs have centered around traditional biomedical treatment approaches. Limited attention has been paid to preventative and promotive approaches, and lifestyle management programmes which have been shown to be successful in HICs are not widely available to vulnerable populations living in LMICs. (Tuomilehto *et al.*, 2001; Diabetes Prevention Programme, 2002; Lindström *et al.*, 2006a; Jackson, 2009; Venditti and Kramer, 2012; Aziz *et al.*, 2015, 2018; Katula *et al.*, 2017; Mathews *et al.*, 2017; Glechner *et al.*, 2018; Gruss *et al.*, 2019).

Globally there is a paucity of professionally trained health workers. This is particularly evident in LMICs where there is an increasing disparity between the incidence of specific NCDs such as T2D and available primary healthcare providers to assist in the prevention, support, and management of NCDs (Kabir *et al.*, 2022). An emerging, but still limited evidence base, suggests that CHWs can deliver lifestyle management programmes if provided with sufficient training and support (Tsolekile, *et al.*, 2014). It is hypothesised that if evidence for CHW competence exists in this area of PHC, the scale-up of lifestyle intervention programmes could increase access and health equity in the prevention and management of T2D and other NCDs (Abebe *et al.*, 2020; Rawal *et al.*, 2020). However, a gap still exists in the evidence and knowledge around CHW programme capacity, including CHW's competence in delivering such programmes.

The aim of this study was to evaluate the capacity of the CHWs to deliver a diabetes prevention programme, Lifestyle Africa, in an urban context of poverty and marginalisation. Intervention fidelity was assessed through structured observations of session content, procedures, group facilitation, and group-based motivational interviewing in 17 sessions over eight months.

Drawing on Deist and Winterton's (2005) framing of competencies, this chapter discusses what the study findings revealed of CHW functional, social, and cognitive competence, the possible factors shaping this, and how this compares to the wider literature on CHW competence and performance. The chapter also considers the dynamic nature of competence and highlights the study's methodological contributions and recommendations for policy, practice, and future research.

5.2 DISCUSSION OF KEY FINDINGS

5.2.1 Functional competence

The CHWs evaluated in this study generally scored well in ratings of performance. They showed the capacity to use the skills of motivational interviewing and group facilitation to successfully deliver Lifestyle Africa. In doing so they demonstrated an array of both functional and social competencies linked to practicalities of hosting a group and the successful use of MI and group facilitation skills.

Functional competencies generally describe the technical skills, the "*know-how*" necessary to successfully fulfill a given role (Deist and Winterton, 2005). In the case of this study that was operationalised by the group facilitation including all the procedural activities that are required to orchestrate formal group sessions. In the model proposed by Tsolekile (2018), functional competencies include communication skills, group facilitation, basic numeracy, clinical skills, and the capacity to teach self-management skills. Functional competency forms the scaffolding for the implementation of any programme. Mastery of the practical procedural and skill-based activities would, in turn, afford the implementer greater capacity to focus on the engagement and nuanced social aspect of working with participants.

We found that the CHWs in the intervention group displayed an overall ability to prepare and successfully perform the procedures set out for the sessions, despite the environment often not being ideal. Some sessions were held in spaces not always conducive to performance, lacking access to an electricity supply or adequate space for the participants. The CHWs, however,

adapted to these circumstances and generally scored well on procedural measures: room preparation, taking registers, and doing ‘weigh-ins’. They also performed well in facilitating the start of the sessions and executing other functional tasks such as assisting participants with goal setting, action planning, and handout explanations. They did, however, score lower with regard to technical issues such as the use of the projector and maintaining physical activity log books. It should be noted, that neither of these latter activities appeared to detract from the CHWs’ overall performance and observed higher-order competence. The equipment was unfamiliar in this setting and, as indicated, a number of the venues themselves were not ideal for the use of the technology. This observation of performance may, therefore be related more to the design of the project than competence, and the need to ensure a suitable environment for future iterations of the programme.

Similarly, physical activity log book completion was at times not in the CHWs’ control. The participants often did not record their physical activity or they did not bring their log books to the session. This suggests that, although levels of physical activity are an important component of a lifestyle intervention, it is plausible that either the tracking did not make sense to the participants or they did not see the importance of documenting their exercise in this manner. Also, the CHWs may not have seen this activity as an important component of the core performances being evaluated and thus did not stress its importance. Again, this is a possible programme design limitation that could be further investigated as this would likely limit the participant engagement with the CHW around their physical activity wins and/or challenges which could have ultimately impacted the primary study outcomes of weight loss.

Overall, thus, the CHWs in this study showed a high level of functional competence and fidelity to the procedural activities associated with facilitating an intervention group session and being given further time and training on the technical aspects would have displayed a good all-round performance on all the functional tasks. In addition, although CHWs were not formally tested on their knowledge, fidelity to the session content and guidelines would have required a level of knowledge and hence cognitive competence.

It appears that this CHW functional and cognitive competence was made possible by good support materials and appropriate training and guidance. Previous work with CHW programmes has suggested that the reason most programmes are not as successful is due to a lack of support and appropriate training and re-training. (WHO 2007; Tsolekile *et al.*, 2018).

5.2.2 Social competence

Social competence is the ability to evaluate social situations and to be able to determine what is appropriately expected or required in response. It is the ability to recognise the feelings and intentions of others and to be able to select responses and behaviours that are most appropriate in a given context (VandenBos, 2015).

According to the social competence evaluations conducted in this study, the CHWs were able to show good empathy, were non-confrontational, and allowed participants to speak through their problems more often than not, giving participants a voice. CHWs use of other MI-mediated communication skills such as responding to verbal prompts, reflective listening, and showing the ability to ask open-ended questions was also well executed. These all represent the “spirit” of the MI technique and all the ways in which the social competence of the CHWs was operationalised and evaluated in the study. This skill requires a paradigm shift from typically having the solutions for clients, to allowing them the space to come up with solutions. Research among health professionals suggests that such shifts are difficult (Bell and Roomaney, 2020). However, CHWs are considered “lay counselors” and therefore possibly unlike other healthcare practitioners do not see themselves as the experts with all the answers.

CHWs are also uniquely placed agents who understand the context of implementation and that of the participants firsthand, as it is their lived experience. It appears that their experience and social embeddedness (Schaaf *et al.*, 2020) allow CHWs to mobilise a level of tacit knowledge (Polanyi 1966 cited in Grant, 2007) and social understanding that they are able to tap into when given the opportunity and autonomy. This implicit knowledge is wisdom gained through time and experience. It is a type of knowledge difficult to define but can be witnessed in intuitive responses (Wang, 2013). This is seen in the relative ease with which CHWs were able to connect

and deliver this novel programme. This kind of wisdom and social embeddedness are intangible community-based assets that need greater recognition and utilisation to appropriately advance community-driven programmes as well as CHW empowerment and motivation. It also is an aspect of knowledge given little attention in research, although is postulated to play a significant role in programme implementation and outcomes (Kothari *et al.*, 2011). When the CHW performance was evaluated against biological outcomes, we were able to show a moderate correlation between MI scores and changes in HbA_{1c} levels, but not weight loss.

All the training and materials for Lifestyle Africa were presented in isiXhosa (the vernacular of the CHWs and participants), so we propose that this too presented an enabling opportunity for CHWs to showcase their capabilities, both intrinsic and acquired, and functional and social in delivery of this health-promoting group-based lifestyle programme. This notion is supported by the literature on how being taught in the mother tongue or vernacular best allows one to engage cognitively and socially (Stoop 2017).

Taking this holistic competence perspective (Deist and Winterton, 2005) this research concludes that CHWs exhibited good overall levels of performance and fidelity to protocol. This competence stemmed from a combination of social, functional, and cognitive competence, possibly producing the higher-order meta-competence described by Deist and Winterton (2005). However, without accompanying motivation to perform, competence is not always realised. Our observations suggest that motivation amongst CHWs in this study was achieved by extrinsic expectations of job security or better opportunities but also intrinsically by the satisfaction of helping others, self-improvement, and personal growth (Mlotshwa *et al.*, 2015). The literature suggests that good levels of support, training and availability of resources are also strong motivators for CHW performance (Colvin *et al.*, 2021).

5.2.3 Competence as dynamic

Besides overall meta-competence, the analysis showed how competence is a dynamic phenomenon. This was evident firstly in the data trend of performance improvement over time, and secondly, the apparent influence of participant and club profiles on performance.

The continued improvement over time suggests a level of reflexivity and learning from session to session, especially when provided with the appropriate feedback, support, training, and resources. Reflective of this the CHWs showed the greatest improvement in performance from session one to two. Other trends seen were that increasing age, BMI, and HbA_{1c} levels of participants, and the larger number of participants in a group appeared to have a negative effect on social aspects of performance, while greater levels of participant education and attendance had positive effects.

The participants in the intervention clubs in this study were older than those in other reviewed DPP studies by an average of 10 years (Knowler *et al.*, 2002; Aziz *et al.*, 2015; Aroda *et al.*, 2017). Although the outcomes can be matched to that in other LMICs and interventions in populations of low SES (Aziz *et al.*, 2015; Ackerman *et al.*, 2008; Jiang *et al.*, 2018) these age differences could have implications for the implementation design and outcomes. As seen from our results, with increasing age various capacities begin to decline, including cognition, and the ability to move for the desired period of time at recommended intensities (a primary requirement of the intervention). Metabolic and hormonal changes, and challenges also begin to surface. Sensory decline such as hearing and sight with associated age-related dementia and reduced levels of engagement may need to be considered differently for different population demographics. How these differences reflect on CHW's competence to deliver is unknown in other contexts and not fully explored in this study.

5.2.4 Methodological contributions

Literature to date focuses on knowledge, outputs, and outcomes but less often on observation of practices of CHWs. This relates particularly in the context of their normal work setting and is partly due to a lack of consensus on the methods to use (Griffiths *et al.* 2019). Observation reporting is considered better than self-reporting (Ampt *et al.* 2007) or other potential methods of evaluating this kind of pragmatic study.

Through observations, this study provides a unique perspective on CHW performance, competence, and capabilities. It also provides a theoretical and methodological approach to evaluating functional and social competencies.

5.3 LIMITATIONS

Although this study makes a methodological contribution it is not without limitations. The correlation between various assessments (MI, GF, and Overall) of performance provides an indication of internal validity. However, as a study based on observations of practice, the assessment of the CHW performance is subject to observer subjectivity and bias. There is also the risk to validity of the rating due to a Hawthorne effect as the CHWs knew they were being watched and would therefore be generally expected to have performed better.

In hindsight, the measures of reliability taken were inadequate. Ideally, two observers should have been assigned to the same sessions, or alternatively, a pilot of the rating and scoring using all the raters would have produced greater confidence in the outcomes of the observations and scoring.

Another limitation of the study is that evaluating only through observations of practice did not allow us to understand the CHWs' knowledge and intrinsic or extrinsic motivations to perform.

A further shortcoming of the study was that we were not able to match individual CHW characteristics with performance and analyse individual CHW performance in this context. CHW demographics such as level of education (Wanduru *et al.*, 2016) and years of service (Kawakatsu *et al.* 2015) have been shown to affect performance when implementing programmes (Chipukuma *et al.*, 2018), and would have been useful to assess the CHWs in this cohort.

5.4 IMPLICATIONS FOR POLICY, PRACTICE, AND RESEARCH

S.A. carries a great risk burden (Grundlingh *et al.*, 2022; Sosibo *et al.*, 2022), and action to prevent T2D must be expedited. As pointed out, “National diabetes prevention programmes in

LMICs are now a necessity and unless large-scale national prevention programmes are urgently implemented diabetes could become unmanageable” (Mohan, 2023). Our research has shown that CHWs have the capacity to deliver such programmes, however, achieving performance at scale under pragmatic CHW programme conditions is yet to be demonstrated.

5.4.1 Policy and practice recommendations

The key recommendations for policy and practice are:

- 1) Include CHWs and CHW-delivered efficacious prevention programmes in the national frameworks and policies addressing obesity and NCDs. In April 2023, a National Strategic Plan for the Prevention and Control of NCDs (2022-2027) was released. However, CHWs are not mentioned in the plan as possible agents in translating the policy into action.
- 2) Consider strategies for shifting from pilots/trial settings to scale-up and implementation in real-world programme settings. The shift from trial to routine conditions for diabetes prevention programmes has been shown to be successful (Dunkley *et al.*, 2014; Aziz *et al.*, 2015) and therefore the move to real-world programmes needs to be expedited.
- 3) Close the “*know-do*” gap. This study reinforces the importance of appropriate training, adequate materials, translated aids, (Greenspan *et al.*, 2013) supportive supervision (Gopalan *et al.*, 2012, Jigssa *et al.*, 2018), and job security to insure what we know is being put into practice. These considerations must be put into practice for CHW performance and motivation to be fully realised (Sarriot *et al.*, 2021).

5.4.2 Research recommendations

The key recommendations for future research include:

- 1) Assessment of knowledge transfer. Understanding diabetes and its management is necessary to facilitate a diabetes prevention programme. This study did not take the steps to look at knowledge transfer or test for it, so we would recommend this be done in future studies to add credibility to the training and the work the CHW is tasked with in facilitating such a programme.

- 2) Development and testing of novel CHW-led delivery innovations such as Lifestyle Africa with younger cohorts and working sectors of the population. Even though traditional CHW home and community group-based interventions have been shown to be effective, these delivery methods can be biased toward the elderly and unemployed and in some instances toward women.
- 3) Investigation of motivation to perform needs to be done to understand the CHW's motivation so that these factors can be taken into consideration when delivering an intervention in a real-life setting outside of a research protocol environment to ensure sustainability.
- 4) Follow-up studies to understand skill and capacity retention need to be undertaken. It is hoped that the skills gained and competencies shown are transferable and not transient.

5.5 CONCLUSIONS

The aim of the study was to explore CHWs' capacity to deliver a lifestyle intervention, however in doing so we are able to contribute to the knowledge gap that exists in what we know about CHWs' competence but also provide a novel methodological and theoretical approach to evaluating competence in the delivery of an intervention.

The CHWs in this study showed promising levels of fidelity and a level of meta-competence in delivering Lifestyle Africa, a novel adaptation of a lifestyle-based intervention for diabetes prevention. Their performance was suggestive of more than just competence, but a willingness, and motivation to perform. The outcomes of this investigation also suggest that not only do the CHWs possess the ability to learn and apply a high-level model of communication and group facilitation but one that may reflect a level of tacit knowledge application making them a holistically competent workforce given the appropriate training, resources, and supervision. Based on our findings CHWS are well suited as a potential non-professional cadre to deliver lifestyle interventions for diabetes prevention.

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Appendix I

Club name: _____	Club number: _____	Date: _____
CHW Team #: _____	Session #: _____	Rater: _____

Sivile Senza CHW Fidelity Form

SECTION A.

All Sessions Set up the room appropriately

	Yes	No	Partially	N/A
	[1]	[2]	[3]	[0]
1. Complete weigh in and attendance	Yes	No	Partially	N/A
2. Operated the projector/video correctly (i.e., select and show the correct video; ensure it can be seen; start/pause the video as required etc.)	Yes	No	Partially	N/A
3. Conducted "Opening Facilitation"	Yes	No	Partially	N/A
4. Followed verbal prompts during video pauses (excluding opening facilitation and goal setting)	Yes	No	Partially	N/A
5. Reviewed handouts appropriately	Yes	No	Partially	N/A
6. Conducted goal setting and action plan	Yes	No	Partially	N/A
7. Gave out stickers for attendance	Yes	No	Partially	N/A
8. (For session 4 onward) collected, reviewed, passed back activity logs	Yes	No	Partially	N/A

SECTION B.					
Session 1	Entered <u>starting</u> weight on “My Goals” handout & give correct weight log for each participant	Yes	No	Partially	N/A
	Entered <u>goal</u> weight on “My Goals” page for each participant	Yes	No	Partially	N/A
	Facilitated “Remember Your Values” handout	Yes	No	Partially	N/A
Session 2	Demonstrated physical activity at a moderate pace	Yes	No	Partially	N/A
	Facilitated Dealing with Difficulties	Yes	No	Partially	N/A
Session 3	Demonstrated how to use Activity Log	Yes	No	Partially	N/A
Session 4	Facilitated Importance activity	Yes	No	Partially	N/
	Explained “Foods to Choose Guide” handout	Yes	No	Partially	N/A
	Explained food tracking	Yes	No	Partially	N/A
Session 5	Facilitated discussion and activity around food groups	Yes	No	Partially	N/A
	Facilitated “A Healthy Meal” and “Make Your Plate” handout activities	Yes	No	Partially	N/A
	Facilitated Dealing with Difficulties	Yes	No	Partially	N/A
Session 6					

Facilitated Values Check-In activity	Yes	No	Partially	N/A
Demonstrated muscle-building activities	Yes	No	Partially	N/A
Session 7				
Demonstrated measuring food (with measuring instruments and hand)	Yes	No	Partially	N/A
Explained how to use the Food Log	Yes	No	Partially	N/A
Explained how to use Food Labels	Yes	No	Partially	N/A
Session 8				
Explained how to use the Quick Tracker	Yes	No	Partially	N/A
Reviewed participant Food Logs, made comments	Yes	No	Partially	N/A
Session 9				
Reviewed the foods groups	Yes	No	Partially	N/A
Reviewed shopping & cooking tips	Yes	No	Partially	N/A
Session 10				
Explained stress and effect on weight/health	Yes	No	Partially	N/A
Session 11				
Facilitated discussion around tips to fit in activity	Yes	No	Partially	N/A
Session 12				
Facilitated Values Check-in activity	Yes	No	Partially	N/A
Session 13				
Explained connection between fat & heart health	Yes	No	Partially	N/A
Explained good and bad fats	Yes	No	Partially	N/A
Session 14				
Explained helpful and harmful thoughts	Yes	No	Partially	N/A

Session 15				
Explained how to ask people for support	Yes	No	Partially	N/A
Session 16				
Explained how to read menus	Yes	No	Partially	N/A
Explained how to eat well away from home	Yes	No	Partially	N/A
Session 17				
Explained individual and group progress	Yes	No	Partially	N/A
Helped participants set long-term goals	Yes	No	Partially	N/A
Explained how to deal with long-term weight Change	Yes	No	Partially	N/A



SECTION C								
COMMUNICATION/MI SKILLS: How well/often did the CHW...?	Poor/ Never			Good/ Often			Excellent/ Always	
Ci. - MI SKILLS								
1. Uses open questions	1	2	3	4	5	6	7	NA
2. Uses reflective listening	1	2	3	4	5	6	7	NA
3. Encourages and builds confidence	1	2	3	4	5	6	7	NA
4. Expresses Empathy/Warmth/Acceptance	1	2	3	4	5	6	7	NA
5. Expresses Sharing of power	1	2	3	4	5	6	7	NA
6. Does not argue / confront the client	1	2	3	4	5	6	7	NA
Cii. GROUP FACILITATION								
1. Keeps conversation going	1	2	3	4	5	6	7	NA
2. Gives everyone a chance to speak	1	2	3	4	5	6	7	NA
3. Keeps the group on track	1	2	3	4	5	6	7	NA
4. Keeps focus on the group members	1	2	3	4	5	6	7	NA
5. Lets members talk through problems	1	2	3	4	5	6	7	NA
Ciii. OVERALL								
1. Overall, how well did the CHW conduct this session?	1	2	3	4	5	6	7	NA
2. How well did CHW use projector/video?	1	2	3	4	5	6	7	NA
3. How did CHW handle participant questions?	1	2	3	4	5	6	7	NA
4. How interactive was the session?	1	2	3	4	5	6	7	NA

Comments / Notes

Supervision Signature _____

Appendix II



UNIVERSITY of the
WESTERN CAPE



4 August 2021

Ms M Hassen
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM21/6/2

Project Title: Evaluating community health workers' capacity to deliver "Lifestyle Africa" in Cape Town South Africa. Adaptation of the Diabetes Prevention Programme for a middle-income country.

Approval Period: 23 July 2021 – 23 July 2024

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

Permission to conduct the study must be submitted to BMREC for record-keeping.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

NHREC Registration Number: BMREC-130416-050

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FROM HOPE TO ACTION THROUGH KNOWLEDGE.