IMPLEMENTATION OF UNIVERSAL HEALTH COVERAGE IN SOUTH AFRICA: FORMATIVE EFFECTS, PERCEIVED QUALITY OF HEALTHCARE AND MODELLING OF HEALTH SERVICE UTILISATION INDICATORS IN A NATIONAL HEALTH INSURANCE PILOT DISTRICT

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A THESIS

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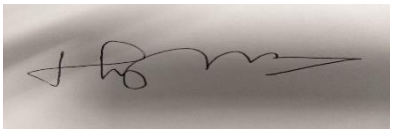
DECLARATION

I, Hillary Mukudu, declare that this thesis is my work. It is being submitted for the degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any degree or examination at any other university or institution. I confirm that the work I am submitting for assessment is my original and independent work excluding where I have explicitly indicated otherwise in the form of acknowledgements and references where appropriate.

Signature: 

Hillary Mukudu

Date: 19/01/2023

DEDICATION

I dedicate my thesis work to my family and siblings, who, in one way or another, had to be "taxed" for my educational furtherance.

My utmost gratitude to my lovely wife, Pearl (Fikile) Zikalala-Mukudu, and my two children, Lwandle (Dolly) and Shamiso (Philani), for their support and understanding along this journey.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABBREVIATION	DEFINITION
ADF	Augmented Dickey Fuller
AIC	Akaike information criterion
AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-Retroviral Therapy
BRICS	Brazil, Russia, India, China, South Africa
CCMDD	Central Chronic Medicines Dispensing and Distribution
CI	Confidence Interval
CITSA	Controlled Interrupted Time Series Analysis
COVID-19	Corona Virus Disease 2019
CVD	Cardio-Vascular Disease
DCST	District Clinical Specialist Team
DHIS	District Health Information System
DHIS2	District Health Information System 2
DHMIS	District Health Management Information System
DM	Diabetes Mellitus
ECT	Error Correction Term
FHS	Family Health Strategy
FPD	Foundation for Professional Development
GP	Gauteng Province
HAART	Highly Active Anti-Retroviral Therapy
HCW	Health Care Worker
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
HPRS	Health Patient Registration System
HQIC	Hannan-Quinn Information Criterion
HREC	Human Research Ethics Committee
HRH	Human Resources for Health
HTN	Hypertension

ICRM	Ideal Clinic Realisation and Maintenance
ISHP	Integrated School Health Programme
ITSA	Interrupted Time Series Analysis
KZN	KwaZulu-Natal
LMIC	Low- and Middle-Income Countries
MDG	Millennium Development Goals
MP	Medical Practitioner
NCD	Non-Communicable Diseases
NGO	Non-Governmental Organisation
NHI	National Health Insurance
NHIS	National Health Insurance Scheme
NP	Nurse Practitioner
OOP	Out-Of Pocket
OPD	Out-Patient Department
PEPFAR	President's Emergency Plan for AIDS Relief
PHC	Primary Health Care
PN	Professional Nurse
RMSE	Root Mean Square Error
RR	Relative Risk
SBIC	Schwarz or Bayesian Information Criterion
SDG	Sustainable Development Goals
SVS	Stock Visibility System
TB	Tuberculosis
TROA	Total Remaining on ART
UHC	Universal Health Coverage
VAR	Vector Auto-Regression
VECM	Vector Error Correction Model
WBPHCOT	Ward Based Primary Health Care Outreach Team
WHO	World Health Organisation
WISN	Workload Indicator of Staffing Need

THESIS MATERIAL

Original articles

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   Student's contribution to publication

   Conceived the presented idea, developed theory, and performed computations, conducted statistical analysis, compiled the results, and contributed to the writing and approval of the final manuscript.

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ABSTRACT

Background

According to the World Health Organisation, member countries should attain universal health coverage by 2030. To achieve this goal, South Africa introduced the National Health Insurance programme in 2012. Since then, the first phase of the pilot programme has been implemented in Tshwane and ten other country districts. Historically, no other health system reform in South Africa has generated more interest than the National Health Insurance. This 15-year preliminary plan and pilot received optimism and criticism depending on several factors. The pilot programme focusing on primary health care was implemented along with several other interventions. The components of the intervention included setting up: ward-based primary healthcare outreach teams, integrated school health programmes, district clinical specialist teams, centralised chronic medicine dispensing and distribution programmes, health patient registration systems, stock visibility systems, and contracting of private non-specialised (general) medical practitioners to provide services in public primary health care facilities. These interventions were envisaged to improve healthcare quality at the primary healthcare level and offset the burden of non-emergency (secondary) care at the hospital outpatient level. However, studies have yet to be done to determine population-level formative effects on primary and non-emergency secondary healthcare indicators, their relationships, and interdependencies. These data are needed to forecast and develop measures to meet the possible increase in health service utilisation. In addition, this information is essential to guide the possible scale-up of South Africa's National Health Insurance mechanism. Such guidance may be in setting benchmarks to monitor policy implementation, determine facility staffing, the package of health services, training needs, budget for medicines and consumables, and other resource allocation.

Aim

Therefore, this study first aimed to determine the formative effects of implementing the Medical Practitioners' contracting of the National Health Insurance pilot program on primary healthcare utilisation indicators measured at both primary and non-emergency secondary levels of care. A comparison was made between Tshwane national health insurance pilot district and Ekurhuleni district, which is not a pilot district. Furthermore, the study aimed to determine the relationships between healthcare utilisation indicators and their interdependencies and then provide a forecast for 2025.

Methods

This quasi-experimental and ecological study used selected primary health care and outpatient department indicators in the District Health Information System monthly reports between January 2010 and December 2019 for the Tshwane district and Ekurhuleni district. Thus, to determine the formative effects on primary healthcare utilisation indicators, the selected period was from June 2010 to May 2014. A total of 48-time periods (months), with 24 before (June 2010 to May 2012) and 24 after (June 2012 to May 2014) implementation of Medical Practitioners contracting of the National Health Insurance pilot programme. Similarly, June 2012 to May 2014 was the selected period to determine the effects on the perceived quality of care. A total of 24 months, with 12 before (June 2012 to May 2013) and 12 after (June 2013 to May 2014) implementation of the Medical Practitioners' contracting of the National Health Insurance pilot programme. To determine the relationship and interdependence between Primary Health Care and Outpatient Department indicators and forecasts for 2025, 113 time periods (quarters) were selected. There were 28 quarters before and 84 quarters after implementing the National Health Insurance pilot programme.

Similar methodological approaches were used to determine the effects of Medical Practitioners contracting in the National Health Insurance pilot programme on Primary Healthcare utilisation indicators and perceived healthcare quality. All study data types used in the thesis were continuous; thus, they were initially evaluated descriptively using means (standard deviations) and medians (interquartile ranges). The range was evaluated using minimum and maximum values. An Independent t-test assuming unequal variances was used to compare the means of Outpatient Department indicators in determining the effect of Medical Practitioners contracting in the National Health Insurance pilot programme on the perceived quality of healthcare. Single- and multiple-group (controlled) interrupted time series analysis was used to determine the effect of the National Health Insurance pilot project implementation on the utilisation of selected primary and non-emergency outpatient department indicators and perceived healthcare quality.

A different methodological approach was used to determine the interdependencies and relationships between selected primary healthcare and non-emergency outpatient department indicators and their forecasts for 2025. Initially, data were evaluated descriptively using means (standard deviations) and medians (interquartile ranges) and the range was evaluated using minimum and maximum values. Prior to the development of the vector error correction model, several steps were taken. Firstly, a natural log transformation of all time series data was done

to enhance additivity, linearity, and validity. Additionally, the level of lags at which variables were interconnected or endogenously obtained was determined due to the sensitivity of causality.

Furthermore, the stationarity of time series data was determined using both graphical means and the Augmented Dick Fuller test to confirm the stability of each time series. Finally, cointegration was determined using the Johansen cointegration test to check for the correlation between two or more nonstationary series. After developing the Vector Error Correction Model, the Granger causality test was done to determine whether one series is helpful for forecasting another. Then the Vector Error Correction Model relationships between variables of selected primary healthcare and non-emergency outpatient department indicators were used to forecast the utilisation of both levels of services by 2025.

Results

The findings showed changes in primary healthcare indicators measured at primary and non-emergency secondary levels before and after contracting private medical practitioners of the National Health Insurance pilot programme. The study also confirmed the influence of selected primary health care and outpatient department headcounts on each other by finding four cointegration relationships between the variables. There were differences between single-group and controlled interrupted time series analysis findings for Tshwane district and Ekurhuleni district considered independently and collectively on the utilisation of primary health care services. Thus, the positive impact observed in primary healthcare utilisation post-June 2012 is not attributable to the implementation of the Medical Practitioners' contracting of the National Health Insurance pilot programme. Conversely, there were similarities between single-group and controlled interrupted time series analysis findings for Tshwane district and Ekurhuleni district considered independently and collectively on the perceived quality of primary healthcare. In the interpretation of this finding, the similarities indicated that implementing the Medical Practitioners' contracting of the National Health Insurance pilot programme positively influenced the perception of a better quality of primary healthcare in the Tshwane district.

Regarding primary healthcare indicators, there were differences between single-group and controlled interrupted time series analysis. Single-group interrupted time series analysis showed a 65% and 32% increase in the number of adults remaining on anti-retroviral therapy in Tshwane and Ekurhuleni districts, respectively **(relative risk [RR]: 1.65; 95%** confidence interval **[CI]: 1.64–1.66; p < 0.0001** and **RR: 1.32; 95% CI: 1.32–1.33; p < 0.0001,**

respectively). However, controlled interrupted time series analysis did not reveal any differences in any of the post-intervention parameters. Furthermore, single-group interrupted time series analysis showed a 2% and 6% increase in the number of clients seen by a professional nurse in the Tshwane and Ekurhuleni districts, respectively **(RR: 1.02; 95% CI: 1.01–1.02; p < 0.0001** and **RR: 1.06; 95% CI: 1.05–1.07; p < 0.0001,** respectively). However, controlled interrupted time series analysis did not show any differences in any of the post-intervention parameters. In addition, single-group interrupted time series analysis revealed that there was a 2% decrease and 1% increase in the primary healthcare headcounts for clients aged ≥5 years in Tshwane and Ekurhuleni district **(RR: 0.98; 95% CI: 0.97–0.98; p < 0.0001** and **RR: 1.01; 95% CI: 1.01–1.02; p < 0.0001,** respectively). Similarly, there was a 2% decrease and a 5% increase in the total primary healthcare headcounts in the Tshwane district and Ekurhuleni districts, respectively **(RR: 0.98; 95% CI: 0.97–0.98; p < 0.001** and **RR: 1.05; 95% CI: 1.04–1.06, p < 0.0001,** respectively). However, controlled interrupted time-series analysis revealed no difference in all parameters before and after intervention in terms of total primary healthcare headcounts and primary healthcare headcounts for clients aged ≥5 years.

Regarding secondary non-emergency outpatient department headcounts, single-group and controlled interrupted time series analyses revealed similar findings. Despite these similarities, single-group interrupted time series analysis showed a disparate increase in the outpatient department not referred headcounts, which were lower in the Tshwane district **(3 387 [95%CI 901, 5 873] [p = 0.010])** than in Ekurhuleni district **(5 399 [95% CI: 1 889, 8 909] [p = 0.004])**. Conversely, while there was no change in outpatient department referred headcounts in the Tshwane district, there was an increase in headcounts in the Ekurhuleni district **(21 010 [95% CI: 5 407, 36 611] [p = 0.011])**. Regarding the outpatient department not referred rate, there was a decrease in the Tshwane district **(-1.7 [95% CI: -2.1 to -1.2] [p < 0.0001]),** but not in the Ekurhuleni district. Controlled interrupted time series analysis showed differences in headcounts for outpatient department follow-up **(24 382 [95% CI: 14 643, 34 121] [p < 0.0001]),** the outpatient department not referred **(529 [95% CI: 29, 1 029 [p = 0.038]),** and outpatient department not referred rate **(-1.8 [95% CI: -2.2 to -1.1] [p < 0.0001])** between Tshwane the reference district and Ekurhuleni district.

Four common long-run trends were found in the relationships and dependencies between primary healthcare indicators measured at the primary healthcare level and the non-emergency secondary level of care needed to forecast future utilisation. First, a **10%** increase in outpatient departments not referred headcounts resulted in a **42% (95% CI: 28-56, p < 0.0001)** increase

in new primary healthcare diabetes mellitus clients, **231% (95% CI: 156-307, p < 0.0001)** increase in primary healthcare clients seen by a public medical practitioner, **37% (95% CI: 28-46, p < 0.0001)** increase in primary healthcare clients on ART, and **615% (95% CI: 486-742, p < 0.0001)** increase in primary healthcare clients seen by a professional nurse. Second, a **10%** increase in outpatient department referrals resulted in an **8% (95% CI: 3-12, p < 0.0001)** increase in new primary healthcare diabetes mellitus clients, a **73% (95% CI: 51-95, p < 0.0001)** increase in primary healthcare headcounts for clients seen by a medical professional, a **25% (95% CI: 23-28, p < 0.0001)** increase in primary healthcare headcounts for clients on ART, and a **44% (95% CI: 4-71, p = 0.026)** increase in primary healthcare headcounts for clients seen by a professional nurse. Third, a **10%** increase in outpatient department follow-up headcounts resulted in a **12% (95% CI: 8-16, p < 0.0001)** increase in primary healthcare headcounts for new diabetes mellitus, **67% (95% CI: 45-89, p < 0.0001)** increase in primary healthcare headcounts for clients seen by public medical practitioners, **22% (95% CI: 19-24, p < 0.0001)** increase in primary healthcare headcounts for clients on ART, and **155% (95% CI: 118-192, p < 0.0001)** increase in primary healthcare headcounts for clients seen by a professional nurse. Fourth, a **10%** increase in headcounts for total primary healthcare clients resulted in a **0.4% (95% CI: 0.1-0.8, p < 0.0001)** decrease in primary healthcare headcounts for new diabetes clients. Based on these relationships and dependencies, the outpatient department follow-up headcounts would increase from **337 945** in the fourth quarter of 2019 to **534 412 (95% CI: 327 682–741 142)** in the fourth quarter of 2025, while the total primary healthcare headcounts would only marginally decrease from **1 345 360** in the fourth quarter of 2019 to **1 166 619 (95% CI: 633 650–1 699 588)** in the fourth quarter of 2025.

Conclusion

The study findings suggested that improvements in primary health care indicators in National Health Insurance pilot districts could not be attributed to the implementation of contracting private medical practitioners but were likely a result of other co-interventions and transitions in the district. However, it might have resulted in an improved perception of quality of care at primary health care facilities, evidenced by a reduction in the self-referral rate for non-emergency hospital outpatient departments. The study also confirmed the influence of selected primary healthcare and non-emergency outpatient department headcounts on each other by finding four common long-run trends of relationships. Based on these relationships and trends, outpatient department follow-up headcounts are forecasted to increase by two-thirds.

Conversely, the total headcount for primary healthcare clients seen by a professional nurse will marginally decrease.

Recommendations

Based on the study findings, the bidirectional referral between primary and non-emergency secondary levels of care in the Tshwane district should be strengthened to offset the burden of care at outpatient departments of district hospitals. Thus, the district health information system should include a down-referral indicator to monitor this activity. With the implementation of National Health Insurance, there is a need to improve the perception of quality of care at the primary healthcare level through appropriate training, recruitment, and placement of medical practitioners. Similarly, professional nurses, the core providers of primary healthcare services, should be supported and capacitated in line with the epidemiological transition.

1 CHAPTER 1: INTRODUCTION

1.1 Background

Universal health coverage (UHC), a target of the third goal of the Sustainable Development Goals (SDGs) of the United Nations (UN), is a concept aimed at the provision of protection against financial risk, quality essential health care, essential medicines, and vaccines[1]. In South Africa, National Health Insurance (NHI) is described as a health financing system set up by the government to achieve UHC[2]. It is designed to pool funds to provide quality and affordable personal health services for all citizens and legal immigrants in South Africa, irrespective of socioeconomic status[2]. However, the health system resources in the country are disproportionately distributed, with some estimating that the public health sector has 30% of medical practitioners (MPs) catering to 84% of the population without medical insurance. In contrast, the private sector has 70% of MPs providing services to only 16% of the population with medical insurance[3]. Among individuals accessing care in the public sector, 65% are entirely dependent on it, with 25% having to pay out-of-pocket in seeking primary health care (PHC) in the private sector due to perceived poor quality health services provided in the public system[4].

Several other challenges in the public healthcare system must be addressed before UHC can be accomplished. These challenges include the structural and high quadruple burden of disease. Structural challenges include poor quality of services, reflected by staff shortage [5], poor attitude of staff, long queues awaiting services, poor standards of cleanliness, stock-out of medicines, poor infection control, and sub-optimal security for both staff and patients[6,7]. The disease burden is due to communicable diseases such as human immunodeficiency virus (HIV) /acquired immunodeficiency syndrome (AIDS) and tuberculosis (TB); non-communicable diseases (NCDs), specifically diabetes mellitus (DM), hypertension, and cardiovascular diseases; maternal and child mortality; and trauma and injury[8, 9]. If not properly treated or managed in the early stages, communicable diseases and NCDs lead to complications that increase not only mortality but also the cost of resultant management, which negatively impacts the economy.

The NHI pilot programme was envisaged to be implemented in three phases, each lasting 5 years, along with other projects. The first phase, implemented in 2012, focused on PHC services, conformed to an ideal clinical realisation and maintenance (ICRM) model, and incorporated into the District Health Information System (DHIS) with a robust bi-directional referral system[10]. To achieve this, PHC re-engineering launched in 2010 is an integral part of

crucial health reforms that should be implemented as part of the PHC platform. In the first phase of NHI pilot programme implementation, four streams were established— municipal ward-based PHC outreach teams (WBPHCOTs) in 2011, integrated school health programme (ISHP) in 2012, district clinical specialist teams (DCSTs) in 2012, and contracting private non-specialised (general) MPs in 2012[11,12].

Several other programmes were implemented as part of the NHI preparatory work. Approximately six months before the launch of the NHI, the national department of health (NDoH) also launched the human resource for health (HRH) sector strategies for 2012–2017[5]. These strategies recognised the need to develop a contracting strategy to utilise private-sector health professionals to provide quality health care in the public sector. Its envisaged outcome is better resourced and organised health system that is accessible, affordable, and available for PHC services[13, 14]. This well-resourced health system would also reduce the burden on the non-emergency outpatient department (OPD) services provided in hospitals[15, 16]. As part of phase one and preparatory work for the NHI, the centralised chronic medicines dispensing and distribution (CCMDD) programme was conceptualised and launched in the eleven NHI pilot districts in 2014[17]. This CCMDD programme is an optional chronic medication access programme for public sector patients through a centralised dispensing operation. The programme ensures that patient prescriptions are obtained from health facilities, dispensed, and sends patient medicine parcels to the facility where the patient is registered or a more convenient alternative pickup point. Furthermore, the health patient registration system (HPRS) was launched in 2013 to capture patient-level data and create electronic files[18]. Additionally, the stock visibility system (SVS) aimed at improving the oversight of facility-level stock through an electronic system was launched in 2015[19].

The progress of the pilot NHI project has been well-documented in both programme reports and evaluation research findings. By March 2016, pilot districts had been incorporated into the DHIS in all provinces, specifically in highly underserved communities [20,21]. The services of contracted MPs at PHC clinics were incorporated into the district referral system. Similarly, NDoH increased the number of MPs by contracting a private partner, the Foundation for Professional Development, to contract more MPs[22]. Progress reports have shown increased uptake and utilisation of project services and incorporation of UHC activities into the existing DHIS[23]. An evaluation of the NHI pilot project in 2019 showed that >3500 WBPHCOTs were fully operational and provided outreach services in the community[21, 24]. Approximately 4.5 million children were screened through the ISHP, and >330 MPs were contracted, resulting in

increased access to MPs in PHC facilities and improved perception of quality of care by patients[24, 25]. In the ICRM, >1500 facilities had attained an ideal clinical status with a perception of improved quality by both facility managers and patients[21, 26]. At least 45 districts had functional DCSTs with a perception of improved clinical governance[21, 27]. The CCMDD programme was scaled beyond the target; 2900 facilities had >20 million patients registered on the HPRS system[21, 28]. The stock visibility system (SVS) was implemented in >3000 facilities, leading to reduced stock-out, and infrastructural improvements were completed in almost all facilities that needed them, leading to an improvement in the perceived quality of care by patients[21]. As a result of HRH implementation, Workload Indicator for Staffing Needs, a more standardised evidence-based staffing needs assessment at the facility level, was used to inform staff recruitment[21].

Despite the focus of the NHI pilot project being on PHC, the effects will be felt even at higher levels of care due to the structure of the health system in South Africa. The public healthcare system is structured such that non-emergency patients enter the health system at the PHC level and are then referred to OPDs of higher levels of care— district, regional, tertiary, central, and specialised hospitals—as per identified needs[29]. However, because of the perceived poor quality of PHC services, some patients enter the health system at higher levels of care in the Free State[30], Western Cape[31], Kwa-Zulu Natal (KZN) [32], Limpopo[33] and Gauteng provinces of South Africa[34]. Similarly, adherence to referral guidelines has been poor from both the PHC facilities and the hospitals[35, 36]. This non-adherence to referral guidelines can negatively affect the planning and allocation of resources for the NHI roll-out.

1.2 Rationale

Despite positive and negative findings on implementing the NHI pilot project, there are several gaps in the quality of clinical care, resource allocation, training needs, research, and policy directives for PHC. The resolution of these gaps depends on the pilot project's performance. The population-level impact of the NHI pilot project on PHC and OPD utilisation has yet to be determined. An increase in PHC utilisation may indicate increased confidence in the entry-level of care for the public healthcare system[37], leading to a reduction in non-emergency OPD utilisation[38]. Conversely, a reduction may mean a perception of poor quality of care at the PHC level, resulting in over-utilisation of non-emergency OPD services[30]. It is essential to determine the impact of the NHI pilot programme on PHC and OPD indicators as it will help measure the performance of the UHC pilot project in meeting the intended goals. This determination can be made by comparing findings on the need, utilisation, and perceived quality of health services

and future projections with the envisaged NHI goals. Comparing these findings among NHI pilot districts will also help identify district-specific gaps and help determine how the attainment of NHI goals will be measured after roll-out to other districts.

Several studies, reports, expert opinion articles, and policy papers have outlined the importance of knowledge of the effect of the NHI on the utilisation of health services. The NHI green paper attributed the poor quality of health services in the public sector to the increased utilisation[11]. Similarly, the paper explained that the high prices for healthcare in the private sector were due to providers' over-servicing of patients[39]. Furthermore, the NHI white paper identified affordability as one of its principles; that is, the NHI programme needs to determine the costs and projections for the future[40]. Thus, service utilisation now and in the future is critical. Additionally, an expert opinion article showed that one of the factors associated with the shortage of MPs at the PHC level is increased workload due to the overutilisation of services[41]. Thus, in this thesis, the effect of MPs contracting in the NHI programme on the utilisation of PHC services was done as the first objective.

The importance of determining the effect of MPs contracting in the NHI programme on health service utilisation is also supported by the historical effects of health reforms on the utilisation of health services. In 1978, the declaration of Alma Ata was adopted to provide comprehensive healthcare emphasising PHC. However, the goals were not attained due to increased utilisation, mainly due to the HIV/AIDS epidemic in Sub-Saharan Africa, which resulted in overcrowding of health facilities[42]. In 1993, the World Bank introduced health sector reforms using the private sector to deliver healthcare. These health sector reforms led to the failure of PHC at the peak of the HIV/AIDS epidemic[43]. However, in 2000, as part of the Millennium Development Goals (MDGs), the World Health Organisation developed health-related goals, including reducing the disease burden from HIV/AIDS and TB[44]. These MDGs resulted in significant gains in healthcare because of highly active ART[45, 46]. In 2005, the World Health Assembly recommended UHC as a vehicle for the provision of sustainable financing in health. In 2015, the goal of UHC was set for 2030, which will need significant health reforms for member countries and is anticipated to increase health service utilisation at the PHC level[42]. However, since 2012 countries in Sub-Saharan Africa are experiencing an epidemiological transition to one characterised by chronic infectious diseases (HIV/AIDS and TB) along with an increase in NCDs[9, 47]. This transition will have implications for PHC utilisation. Similarly, in South Africa, potential private MPs to be contracted have expressed concerns about the increased utilisation of PHC services due to unnecessary consultations using a free service[48]. Thus, a formative

evaluation of the effect of MPs contracting on PHC utilisation is vital in the overall planning of the roll-out of UHC in South Africa.

The perceived quality of healthcare is associated with optimal clinical outcomes and patient satisfaction[43, 44], which also impacts the utilisation of health services[45, 46]. According to Donabedian[47,48], structure, process, and outcomes make up the three components needed to measure healthcare quality. The outcome would include health-related events or status post-care[49]. However, outcomes may be not only a component of care but also a consequence of care[50]. To be considered a valid measure of perceived quality, the outcome must be closely related to processes of care that can be manipulated to affect it[51]. Thus, several population-level health indicators have been used as a measure of health outcomes[52], which may provide indications regarding clinical outcomes at the individual level. Three of these indicators, OPD headcounts not referred, OPD headcounts referred, and OPD not referred rate, are routinely collected at the hospital OPD in the DHIS. Though collected at the secondary level of care, these indicators collate the headcounts of clients that access care at a higher level of care with or without first being seen at PHC facilities. Individuals bypassing the PHC level, referred to as OPD not referred headcounts or self-referrals, show a preference for higher level health care as first contact with the health system, possibly because of a perception of poor quality of care at the PHC level.

The selected OPD indicators can be used as a proxy measure of the perceived quality of care at PHC. An increase in OPD not referred headcounts or self-referral rate would signify an increased perception of poor quality of healthcare at the PHC level. Similarly, a decrease in these indicators would indicate improvement in the perceived quality of healthcare at the PHC level and adherence to referral guidelines. Therefore, to evaluate indicators for the perceived quality of care, clinical outcomes, and utilisation of both PHC and OPD, it is crucial to determine the impact of the NHI pilot project on the OPD not referred and referred indicators. Since it measures the perceived content of a health service, the findings will help inform the implementation of the NHI in many areas. This perceived quality of healthcare will help prioritise and inform appropriate healthcare as perceived by the patient. These data are crucial to the development of guiding legislation, policies, and standard operations and procedures needed for the governance of the bi-directional referral of patients between PHC and higher levels of care.

Measuring the effect of the NHI pilot programme on the perceived quality of care is crucial to the attainment of the intended goals due to several factors. First, both the green and white papers of the NHI recognised the potential for increased utilisation of health services leading to overcrowding and delivery of poor-quality services[11, 53]. Similarly, the NHI white paper stressed the importance of the appropriateness of care provided by the NHI programme as perceived and accepted by users[11]. Second, the NHI policy identified the perception of poor quality of care as one of the three significant challenges to be resolved by contracting-in of MPs at the PHC level[54]. Furthermore, the perception of poor quality of care is counterproductive to the goals of UHC in South Africa because it would perpetuate OPPs, and even hinder buy-in from the public. Additionally, an expert opinion article noted the need for more data on the quality of care in the NHI pilot programme. It recommended the development of quality metrics or even proxy measures using data analysis techniques[55]. Thus, in the second objective of this thesis, OPD not referred indicator was used as a proxy measure of perceived quality of care.

Understanding the interdependencies and relationships between PHC and OPD indicators is key to forecasting the utilisation of services and resource allocation. Utilisation as an essential health outcome indicator is needed to measure and plan for roll-out[56], understand consumer satisfaction at different levels of care, and forecast access to care that can be used as a benchmark to guide health policy[57]. Therefore, it is crucial to determine how the NHI pilot programme implementation has affected the relationship between PHC and OPD services, given the different categories of staffing providing these services. Similarly, the effect of the implementation of the NHI on the relationship between PHC and OPD indicators is significant because the structure of the health system in South Africa ensures a continuum of care from PHC to OPD using the referral mechanism. This information is vital in determining the capacity of PHC facilities that will be needed in the long term as the epidemiological profile evolves and demand for certain levels of care increases or decreases as per current staffing profiles for PHC facilities[58]. The absence of PHC-level capacity information can negatively affect the planning and allocation of resources for the NHI roll-out. Crucially, one principle of the NHI programme is sustainability, defined as the ability to project into the future and ensure feasibility now and in the future[11].

The referral mechanisms in the NHI pilot program support the importance of determining interdependencies and the relationship between PHC and OPD indicators. **Figure1-1** below shows the integrated referral services for the service delivery platform of the NHI

programme[59]. It shows that patients are supposed to enter care from the community service provided by WBPHCOTs to the PHC (Clinics and Community Health Care Centres). As per need, patients must then be referred to district hospitals. Similarly, patients at these hospitals that need a lower level of care are to be down-referred to the PHC's next level of care. This bidirectional referral mechanism is one of the principles of the NHI program[11].

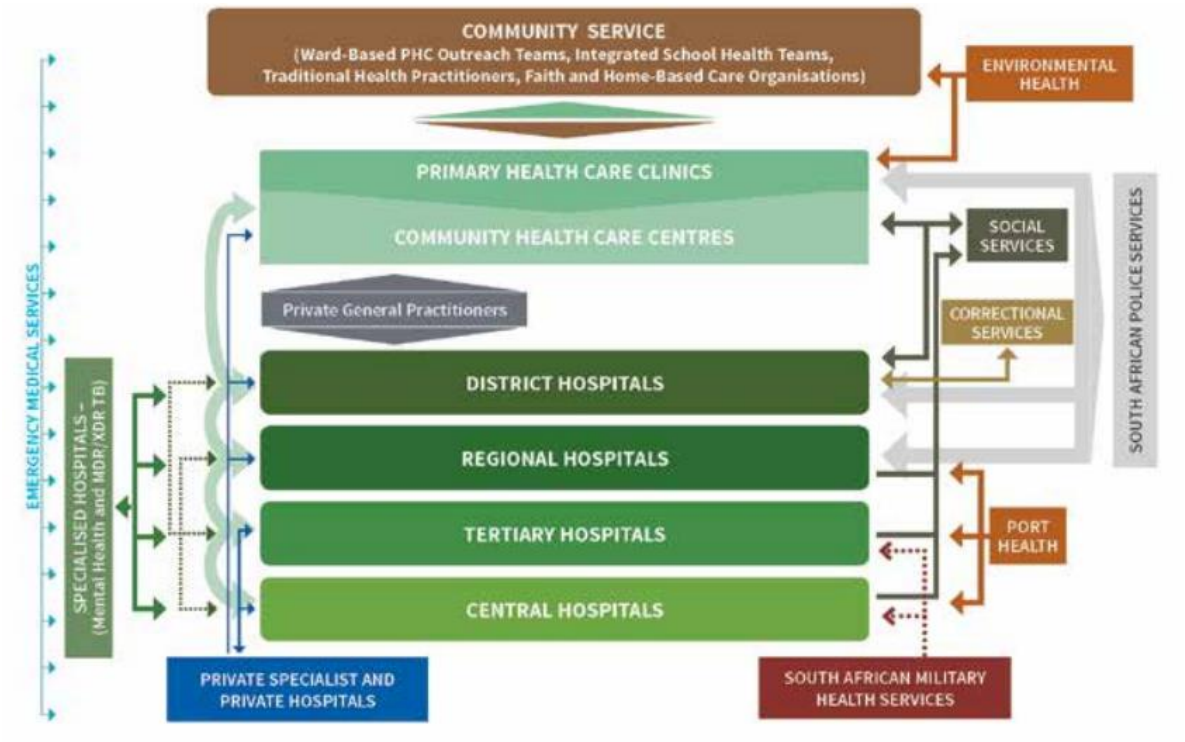

Figure 1-1: Service Delivery Platform-Integrated Referral Services

(Source: https://www.knowledgehub.org.za/elibrary/referral-policy-south-african-health-services-and-referral-implementation-guidelines)

The study's hypotheses were informed of anticipated changes in selected PHC and OPD indicators. As shown in **Figure 1-2**, this thesis assumes that before MP's contracting implementation, there was underutilisation of the PHC platform; however, there was overutilisation of the non-emergency OPD. Thus, implementation of private MPs contracting and WBPHCOTs at the PHC level would lead to increased services utilisation, as shown by the increase in PHC headcounts for adults remaining on ART, five years and older, diabetes clients new and total. The main driver of this increase is the improved perceived quality of care at the PHC level.

Conversely, PHC clients seen by a nurse practitioner and a public doctor would decrease as the contracted private MPs reduce the workload. Similarly, the placement of contracted MPs at the PHC level would lead to reduced headcounts for clients referred and not referred to OPD and subsequently reduced follow-up at this service platform. However, as outlined in the national referral policy, the headcounts of those down-referred from OPD to PHC would increase.

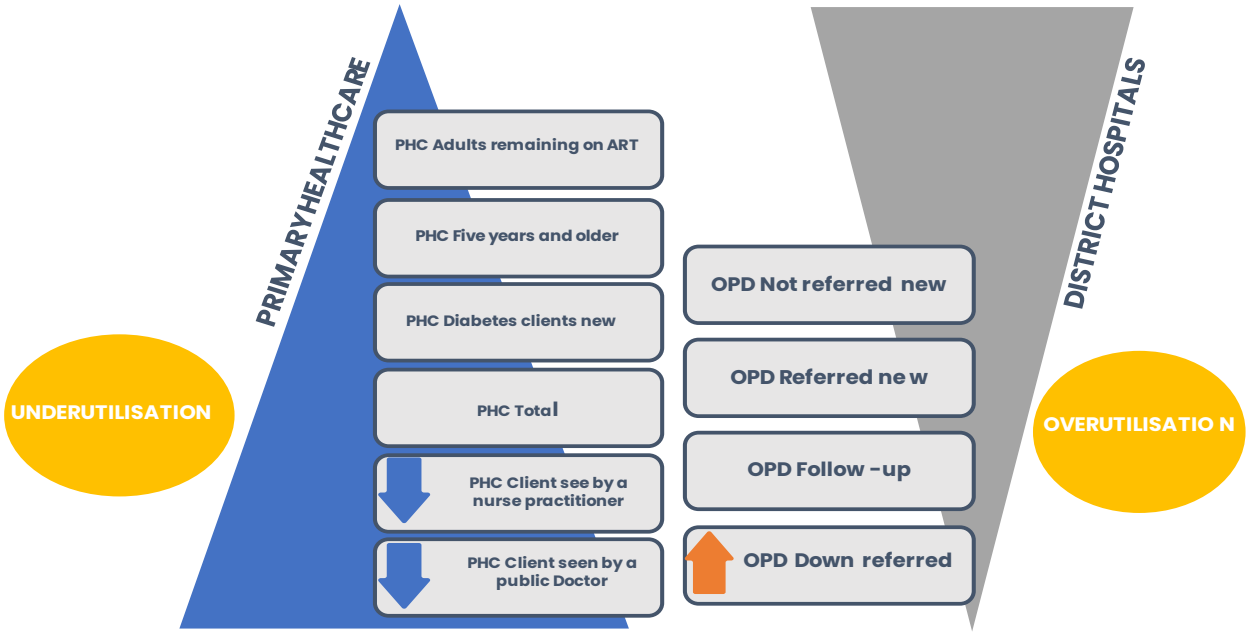

Figure 1-2: Study Hypothesis

This thesis aimed to determine whether contracting private MPs of the NHI in the Tshwane district increased the utilisation of PHC services due to an improvement in the perception of quality of care, as envisaged in the NHI white paper and evidenced by a reduction in self-referrals to non-emergency OPD care. Further, the capacity of care needed by 2025, about 5 years before UHC is projected to have been accomplished, will be determined as ascertained from utilisation of PHC and OPD services.

1.3 Aim

The overall aim of the study was to determine the formative effects of the implementation of the contracting of private non-specialised MPs in the pilot NHI programme on PHC utilisation indicators and non-emergency OPD referral indicators measured (as a proxy for perceived quality of care at PHC) at both primary and non-emergency secondary levels of care, respectively. The study also aimed to determine the interdependencies and relationships between PHC utilisation and OPD referral indicators and forecast them to 2025.

1.4 Objectives

The specific objectives of this thesis were divided into three parts.

1. Determine the formative effects of the NHI pilot project on PHC utilisation indicators (Paper 1)
2. Determine the formative effects of the NHI pilot project on the perceived quality of care of PHC services measured by OPD referral indicators (Paper 2)
3. Determine the relationships and independencies between PHC and OPD indicators and forecast utilisation of both services by 2025 (Paper 3)

1.5 Outline of the Divided Block Format Thesis

The thesis has been presented in the divided-block format. As per the Faculty of Health Sciences, the following constitutes a divided-block thesis format:

- A chapter on the literature survey
- A chapter on methods
- Separate, discrete chapters on the results are as follows:
    - Each chapter is subdivided into the introduction, methods, results, and discussion sections, like the format used in research publications.
    - References can appear at the end of each chapter, in which case only those articles cited in that chapter are listed.
- A chapter for discussion and conclusion to discuss and synthesise the results of this thesis

The structure of the chapters in the thesis is provided below.

Chapter 1: This chapter presents an introduction to the background of the problem. The study gaps are described, leading to the rationale and outline of the study's aims and objectives.

Chapter 2: This chapter is a critique and an account of the relevant literature on UHC, the South African context on UHC, NHI, and other co-interventions, including contracting of private non-specialised MPs, a review of studies, reports, and expert opinion articles chronologically arranged, quality of healthcare and the district health information system.

Chapter 3: This chapter describes the methods used in the study.

Chapters 4–6: These chapters present the Ph.D. study findings under their published titles:

- **Chapter 4:** Contracting private medical practitioners in a National Health Insurance pilot district: what has been the effect on primary healthcare utilisation indicators? Afr J Prm Health Care Fam Med 2020;12(1): a2563.
- **Chapter 5:** Perceived quality of primary healthcare post-National Health Insurance pilot implementation. Health SA Gesondheid 2021; 26(0): a1580.
- **Chapter 6:** Prepared manuscript titled: Modelling and forecasting primary healthcare utilisation, perceived quality of care, and non-emergency referrals to hospitals in a National Health Insurance pilot district of South Africa.

Chapter 7: This chapter provides an assimilated discussion of the overall study and overall study conclusions.

Chapter 8: This chapter provides conclusions and recommendations, policy implications, and possible areas for future research.

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2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This literature review provides a broader background on the principles and ideology underlining UHC and NHI in South Africa. The sub-themes are outlined as per the broad categories that follow—first, conceptualisation, development, monitoring, and impact of UHC programmes globally. Second, a review of the South African government policy papers and early findings post-implementation of the NHI pilot project. Third, the atypical conceptualisation of the UHC programme in South Africa. Fourth, interventions integral to the NHI pilot programme implementation focus on contracting non-specialised MPs. Fifth, other concurrent interventions that are targeting PHC in South Africa. Because this thesis uses secondary data routinely collected using the DHIS, this chapter also provides the background, development, strength, and weaknesses of using DHIS as a source. In addition, this chapter provides a background on measuring and monitoring quality in healthcare and justification for using perceived quality of care.

2.2 Universal Health Coverage

Poverty, emerging diseases, pandemics, and poor access and utilisation of health services have historically been challenging worldwide. The WHO global estimates on health coverage show that >400 million people cannot access essential health services annually due to out-of-pocket spending for health services, >100 million people experience poverty, and another 150 million experience financial constraint[1]. Thus, people-centred and integrated health services are crucial for reaching UHC. In particular, Sub-Saharan Africa accounts for 25% of the global burden of disease, yet only 3% of the world's population of healthcare workers (HCWs) reside here[2]. More than 40–50 million new HCWs need to be trained and deployed to bridge this gap in the shortage of HCWs in the next 20 years. Thus, the WHO has set a target to do so by 2030. This target includes financial risk protection, access to essential healthcare services, and safe, adequate, quality, and affordable essential medicines and vaccines[3].

The attainment of UHC presents a historic opportunity to make transformational improvements in world health, which has been long overdue. An early conceptualisation of UHC dates back to 1948 when the United Nations General Assembly enumerated the right to a universal minimum standard of health[4]. Despite this, all member countries collectively supported UHC only after 2005. Since then, the concept has undergone refinements in various aspects, such as definition, identification of appropriate financing models, call for political commitment, and research[5, 6]. About 10 years later in 2015, these refinements culminated in inclusion of UHC as

target number 3.8 of the third goal of SDGs in the 2030 agenda[7]. Further refinements have led to the recognition of PHC as the cornerstone for achieving UHC[8].

Despite social, political, economic, and historical differences, the WHO has identified the attributes of the envisaged health system for member countries that need to attain UHC. The five essential health system attributes are quality, efficiency, equity, accountability, and sustainability or resilience[9]. Identification of these five attributes implies that countries must improve healthcare quality by providing appropriate regulations and regulatory environments, ensuring that the system is effective and responsive to individual and population needs, and can engage individuals, families, and communities. These measures have been envisaged to avoid the overuse, underuse, and misuse of health resources. Moreover, the health system should be efficient using limited resources, but more investments are needed for some aspects[10]. Equity can be attained by ensuring that the health system responds to social, economic, and environmental factors that lead to inequality in access to healthcare. To ensure accountability, all stakeholders should provide information and feedback to improve performance. The health system should also be sustainable and resilient by ensuring that all current and future needs are met and should respond to disasters, economic volatility, and emerging diseases[11].

To monitor progress toward UHC, the WHO identified two performance indicators. These indicators are health service coverage and financial risk protection coverage that are jointly measured[12]. Health service coverage measures the average coverage of essential services based on identified critical interventions. These interventions are to be tracked in the general and most disadvantaged population capacity and access to reproductive, maternal, newborn, and child health; infectious diseases; NCDs services[13]. In a 2014 study, the WHO recommended and measured progress toward UHC in selected countries, including South Africa, by monitoring effective service coverage[14, 15], defined as "the fraction of the potential health gain delivered to the population through the health system given the capacity"[15]. The study found challenges with data on effective treatment for communicable diseases and NCDs, an integral part of effective coverage. Thus, a 2017 study showed that service coverage could be measured using tracer indicators from collected country-level data[16]. In 2019, just before the coronavirus disease (COVID-19) outbreak, another study involving 204 countries monitored the effective service coverage from 1990 to 2019, confirming the utility of the measurement and indicating a 15% improvement in the effective coverage index globally from 45.8 in 1990 to 60.3 in 2019. However, the variability between states was high, with countries such as Japan and Iceland

having an index as high as 95. In contrast, countries such as Somalia and the Central African Republic have an index as low as 25[17]. In South Africa, the effective coverage index was 60, with the main improvements in reproductive health, immunisation, and antiretroviral therapy coverage[17].

Financial risk protection coverage is measured by the proportion of households that experience catastrophic health expenditure that exceeds a proportion of their total income or consumption[18]. However, some studies have identified limitations in the usefulness of this indicator for the financial protection component of UHC[19]. Indirect inferences can be made based on government spending on health services[20]. A study on health sector spending and spending on HIV) /AIDS, TB, and malaria in 195 countries covering the years 1995 to 2017 has shown that spending has significantly increased and is projected to increase further by 2030[21]. Similarly, another study involving 188 countries projecting expenses to 2040 from 2016 has found that global health spending will double[22]. However, health spending growth in South Africa lags behind that of other Sub-Saharan African countries[23]. Similarly, a 2019 study found that a low percentage of families experienced catastrophic OOP health expenditures in the country[24]. This finding is similar to findings from 132 other countries, showing a marginal increase in catastrophic health spending from 2000 to 2010[20].

Implementation of UHC programmes in some countries has resulted in disparate findings on healthcare utilisation and quality of healthcare services. In Ghana, the National Health Insurance Scheme (NHIS), as a vehicle for UHC, was adopted in 2003 as an insurance scheme paying for private providers in their respective facilities[25]. A 2012 study on perceptions and experiences of healthcare providers and clients showed an increase in the utilisation of healthcare services post the programme's introduction. This finding could have led to a perception of abuse of services by patients, thus increasing the workload among providers. Private providers reported a delay in reimbursements for the services provided. Patients insured under the NHIS also experienced increased waiting times, verbal abuse by providers, sub-optimal physical examination, and less attention than uninsured patients who paid for their service. However, insured and uninsured patients reported being satisfied with the care provided[26]. Another study found evidence of a reduction in the incidence of OOP expenditures, which was particularly strong among poor individuals[27]. A mixed-methods study involving key stakeholders found that despite the many success stories of the NHIS programme in Ghana, serious challenges needed to be addressed, such as inadequate funding, dissatisfaction of providers due to delayed reimbursements, and inadequate benefit packages[28].

In Rwanda, Mutuelles de Sante (Mutuelles), a community-based health insurance programme was set up in 1999 as part of the national health strategy for providing universal healthcare and reaching the Millennium Development Goals. A comparison of three cross-sectional studies conducted in 2000, 2005, and 2008 using DHIS data showed an increase in the utilisation and coverage for childcare and skilled birth attendance[29]. Another study measured the effect of UHC in Rwanda on seven metrics—insurance and access, equity and financial risk protection, rights-based approach, the package of services, quality of healthcare, socioeconomic risk protection, and self-financing capacity. The study found that despite an increase and improvement in almost all metrics, healthcare quality was a significant challenge[29].

Similar to other BRICS (Brazil, Russia, India, China, and South Africa), the NHI pilot programme approach was meant to improve the capacity and quality of public services[30]. In Brazil's Family Health Strategy (FHS), studies conducted over the past 20 years have shown that it is cost-effective and has improved the population's health. These improvements include reductions in infant mortality and post-neonatal mortality due to reduced infections causing diarrhoea and respiratory symptoms. In adults, the reduction in mortality, morbidity, and complication due to cardiovascular disease and DM, with the resultant decline in hospitalisation rates, was attributed to implementing FHS. Other accomplishments of the FHS include improved oral health, disease detection, and vital statistics reporting. However, studies have shown that this system has many challenges, including disparities in family health teams' capacity and outputs, unavailability of essential equipment and HCWs, and variations in oversight and institutional support of the teams[31, 32]. More recent studies have also shown a reduction in healthcare quality, evidenced by inadequate treatment in overcrowded, understaffed, and underequipped public hospitals[33].

Despite significant progress toward UHC globally, there are several challenges[34]. First, lower and middle-income countries needed more funding to support their UHC projects[35]. To mitigate this challenge, the WHO has recommended broadening funding sources to include direct taxes, indirect taxes, non-tax revenue, and funding from external partners[36]. Other studies have recommended leveraging the HIV/AIDS programme funding model to include private funding sources[37]. In South Africa, the NHI white paper has suggested using payroll tax, increasing the value-added tax, and taxable income[38]. The revised NHI bill includes reallocating credits paid for medical schemes to the NHI fund[39]. However, other private healthcare providers have objected to these sources of funds because of the country’s poor economic outlook[40].

Second, other countries, including high-income countries, find implementing their UHC projects financially unsustainable as expenditure outstrips revenue[41]. Some suggested solutions to address this include a political commitment with an explicit financial pledge and the creation of financial efficiency in the delivery of services[42].

Third, despite the increase in health spending, some studies have found that this has yet to improve certain health outcomes[43]. Thus, health spending efficiencies in ensuring that limited resources are appropriately used and monitored have been suggested as UHC indicators[44].

Fourth, some UHC programmes have escalated costs beyond the budgeted amounts[42]. However, addressing this challenge by containing costs may reduce coverage and weaken financial protection[42].

Fifth, there has been some misalignment between the UHC's commitment capacity to deliver health services due to a shortage of qualified MPs. In South Africa, the NHI pilot programme contracted private non-specialised MPs to provide services in public PHC facilities to bridge this gap. In contrast, in other countries, private MPs provide services in their private facilities.

Sixth, despite an increase in the coverage of health services, some studies have found poor-quality services[34]. In South Africa, there are concerns regarding the provision of maternal, peripartum, and postnatal care for both mothers and babies and diabetes treatment, evidenced by an effective coverage index as low as 21 at the end of 2019[17]. Thus, to address the challenges related to maternal and child morbidity and mortality, DCSTs were established as part of the four streams of PHC re-engineering and subsequently as part of the NHI pilot project45. A DCST consists of a gynaecologist, a paediatrician, an anaesthetist, a family physician, an advanced midwife, an advanced pediatric nurse, and a PHC nurse.

2.3 Milestones, reports, and studies in the history of Universal Health Coverage in South Africa

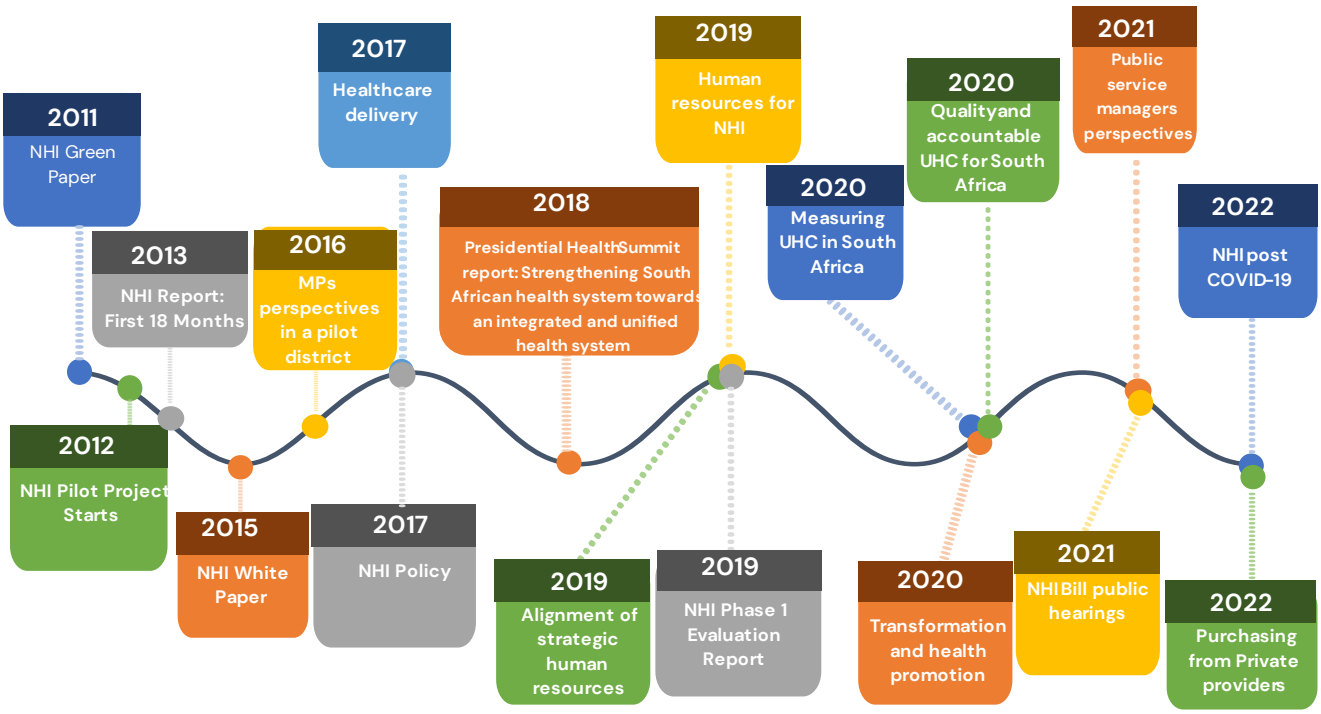

Figure 2-1: Milestones, reports, and studies on NHI in South Africa

The formative discussions and proposals about UHC in South Africa were contained in the NHI green paper published in 201[46], as shown in **figure 2-1** above. The paper described the post-1994 health system as a perpetuation of the two-tiered system (private and public) divided along socio-economic lines, lacking equitable distribution of resources. Consequently, the public sector experiences a shortage of critical human resources such as MPs. The increased utilisation of services in the public sector led to the delivery of poor-quality healthcare. Similarly, the paper noted that the private sector experienced higher prices for the provision of services, triggered by the over-servicing of patients by private providers. Thus, both sectors' demand for resources is not sustainable. About a year after publishing the green paper, the NHI pilot project was launched[47]. Therefore, to deal with the challenges of critical human resource shortages at the PHC level and improve access to quality services, the paper recommended contracting and accreditation of MPs at the district level. Thus, this thesis focussed on the MPs' contracting effect on attaining the NHI pilot programme goals. Other interventions were DCSTs, ISHP, and WBPHCOTs[48], which could also directly or indirectly affect MPs' impact on the NHI pilot programme goals.

About 18 months after the launch of the NHI pilot project, a report outlined the achievements, challenges, and way forward[49], as shown in **figure 2-1** above. This report showed that 10 000 Community Healthcare Workers (CHWs) had been re-trained in line with the revised PHC approach. An ISHP policy had been developed focusing on disadvantaged schools and was to be supported by mobile clinics. More than 43% of the positions in the DCSTs were filled. Thus, the report also noted that 165 new medical student places had been created to deal with staff shortages in the future. However, the contracting of 600 MPs in the pilot districts had been earmarked for the early part of 2013. Furthermore, the report stressed the importance of further analysis and consultation as improved quality of PHC would lead to increased utilisation[49].

Before the NHI bill was introduced, the NHI statements on policy and proposed legislative changes of the NHI by the South African Government were contained in the NHI white paper published in 2015[50]**,** as shown in **figure 2-1** above. The paper noted that the contracting of MPs had been added as a fourth stream of PHC re-engineering during the 2013/2014 financial year. This fourth stream improved access and reduced waiting times in the pilot districts. An additional 20 000 HCWs were to support the WBPHCOTs. The ISHP had identified learning barriers in more than 201,770 children and had helped increase immunisation coverage. The DCSTs were active in all 52 districts, with more than 228 professionals appointed. The NHI white paper also noted that three of the eight principles of NHI were affordability, effectiveness, and appropriateness. These are the focus of the three parts of this thesis. Affordability has entrenched in it the aspect of sustainability; thus, future projections of utilisation will be critical. Effectiveness is the use of evidence to inform improved health outcomes. Appropriateness addresses issues of acceptability by users for the level of care. Thus, perception of care and bi-directional referrals are crucial.

In 2016, as shown in **figure 2-1** above, a study was done in the Tshwane district, one of the pilot districts in the NHI pilot project[51]. Despite supporting the NHI concept, this qualitative study found that some contracted MPs are generally unhappy with the implementation of the NHI pilot project. Some challenges included contractual arrangements, shortage of appropriate equipment, poor infrastructure, and non-optimal integration into the facilities. However, a minority of MPs were happy with their presence in public facilities. These successes included improving the standards of care specifically for chronic conditions at the PHC level.

On 30**th** June 2017, as shown in **figure 2-1** above, the NHI policy was published[39]. The policy recognised that the preparatory work done for NHI included improving and strengthening the

PHC delivery platforms. Two identified health delivery challenges were the poor perceived quality of care experienced by users and shortages of key health professionals such as MPs. Thus, the paper recommended both contracting-in and contracted-out services at the PHC level by MPs. Similarly, the structure of the health system was to provide a continuum of care, from the community to PHC level and higher levels of care, as guided by the referral mechanism. This referral mechanism would need robust bidirectional referral approaches. In the same year, an expert opinion article on the barriers to implementing the NHI was published[52]. The article identified the perception of poor quality of health services as a critical factor that needed to be addressed. This perception of poor-quality healthcare had the potential to perpetuate OPPs and expensive medical insurance premiums, which inevitably undermine participation in the NHI. Additionally, the article recognised factors contributing to the shortage of MPs. These factors include demotivation and increased workload resulting from overutilisation of services in the public sector.

One of the most significant events in the evolution of UHC using NHI in South Africa was the first-ever presidential health summit of 2018[53], as shown in **figure 2-1** above. The summit was held in recognition of the need for stakeholders to work together. This working together was needed to map a way forward for the health sector in the country. The summit identified challenges that needed to be dealt with, including users' dissatisfaction with the quality of healthcare services and shortages of key personnel. The role of the private sector in assisting in this regard was clearly defined. Thus, a unification of the private and public healthcare systems in South Africa was seen as a critical component of the solution. Similarly, in 2018, about six years after the launch of the NHI pilot project, a cross-sectional survey on the awareness of NHI among HCWs in the Tshwane pilot district was done[54]. Despite being done in the public PHC facilities and district hospitals, most HCWs needed to be fully aware of the activities of the NHI pilot programme in the Tshwane district.

Several significant events and milestones took place in 2019, as shown in **figure 2-1** above. First, the NHI pilot project evaluation report was released. This report concluded that the programme had mixed success, in that some aspects had shown improvement, but challenges still existed in many other areas. Notably, contracting MPs and hiring other key health personnel experienced challenges. Second, a narrative review of NHI, PHC re-engineering, and HRH policies was done[55]. This review found that the HRH policies must align with the NHI pilot programme and PHC re-engineering. One of the significant misalignments was the placement of contracted-in MPs at the PHC level. Finally, South African Health Review

(SAHR) found that the lack of HRH planning will potentially compromise the successful implementation of the NHI[56].

In 2020, as shown in **figure 2-1** above, a critical expert opinion article discussed service coverage and quality indicators in the NHI[57]. The article noted that the phase 1 NHI evaluation report[58] could not provide information on service coverage due to the limited implementation time to manifest impact and a lack of district-level data. Thus, the paper recommended a population view of performance to monitor the NHI programme. Also, the lack of a quality measure for UHC in South Africa was noted as required by the WHO. This measure is critical for measuring effective coverage as the recommended indicator for UHC tracking[17].

Consequently, the article recommended the development of quality metrics or even proxy measures using data analysis techniques. Furthermore, the quality of healthcare and utilisation of services were recognised as essential drivers for morbidity and mortality that are critical in a UHC programme. Thus, the thesis used population-level data to determine the effect on the utilisation of PHC services and used a proxy measure of the perceived quality of healthcare.

After submission to parliament in 2019, the NHI bill was opened for public comment on 18th May 2021[59], as shown in **figure 2-1** above. The bill enshrined the right of citizens to the best possible state of physical and mental health, medical attention when needed, and access to health services. Similarly, it described the citizens' responsibilities to ensure entry at the PHC level and adherence to the bidirectional referral pathways[59]. All these expectations will influence the utilisation of PHC services, perceived quality of healthcare, referral mechanism, and sustainability of the NHI programme. Hence, the thesis focuses on the utilisation of PHC services, the perceived quality of healthcare as informed by referral to non-emergency OPD, and the projection of demand into the future.

The 2019 global outbreak of COVID-19 affected the utilisation of services at PHC and OPD levels of care[60, 61], as shown in **figure 2-1** above. However, this pandemic did not affect people's perceptions about the need for UHC in South Africa using the NHI[62]. Conversely, the economic impact of COVID-19 resulted in a projected budgetary shortfall for NHI implementation by 2025, driven by high private care costs. Thus, a recommendation to contract private providers was made to reduce costs[63]. Hence, the emphasis made by the thesis is on measuring the effect of contracted-in MPs on both PHC and OPD indicators.

2.4 Atypical Conceptualisation of the Universal Health Coverage Pilot Programme in South Africa

Although South Africa is a member country of the WHO UHC 2030 goal[64], its conceptualisation of the NHI pilot programme, historical context, funding source, disease burden, and implementation sector for contracting private MPs is unique. According to the WHO, "UHC means that all individuals and communities receive the health services they need without suffering financial hardship. It includes the full spectrum of essential, quality health services, from health promotion to prevention, treatment, rehabilitation, and palliative care across the life course"[65]. Historically, Section 27 of the Constitution of the Republic of South Africa guaranteed all the right to access all essential health care services and non-refusal to emergency medical care[66]. This guarantee suggests that the country had accomplished some level of UHC in theory. However, this constitutional provision had a narrow scope of services, specifically curative, compared to that covered by the WHO recommendation, which includes all forms of essential healthcare, including preventive.

Similarly, there are several challenges in the provision of healthcare in public healthcare, including poor and unreliable services due to lack of finances[67]. Thus, the pursuit of UHC in South Africa using the NHI broadens the scope of health coverage provided, improves the quality of services, and provides financial protection[68]. Similarly, the WHO recommendations for progress toward UHC include countries with adequate access to affordable health services. However, they now have increased financial constraints due to an increase in both population and the costs of health services[69]. Thus, despite the constitutional provisions, South Africa still had to move toward UHC as recommended by the WHO.

Deviations between the NHI pilot programme from other UHC programmes worldwide include the terminology used to describe NHI preparatory work. The first phase of the NHI was termed a pilot programme to be implemented in 11 districts[70]. A pilot programme is defined as “an initial small-scale implementation that is used to prove the viability of a project idea”[71]. It confirms viability, appropriateness, compliance with statutory standards, and robustness and validates proposed processes, benefits, investment appraisals, and procedures to be tested. Thus, the pilot programme is a miniature mirror image of the envisaged full-scale programme. The WHO describes a successful pilot programme as one designed with the end in mind[72], that is, targets, outcomes, and monitoring per the scaled-up programme. However, the NHI pilot programme objectives were to bridge the gap between the private and public PHC systems by improving the management, staffing, infrastructure, and equipment at public health facilities[73].

However, after full implementation, the NHI can pool funds and purchase quality and affordable services for all South African citizens from private and public providers[73]. Thus, the preparatory work implemented for NHI cannot be referred to as the pilot programme, and it could best be described as the first phase of a staged implementation.

The financing of the NHI pilot programme is unique compared to that of other UHC programmes[74]. After full implementation, the NHI will be financed using funds pooled by the government from several sources to buy services from health providers. The NHI pilot programme was funded by the NHI PHC conditional grant (CG), created in the 2012–2013 budget. The funds were meant to aid the national department of health (NDoH) in developing frameworks and models that could be used to inform the phased implementation of the NHI in selected pilot districts and not to purchase services from providers. The grant was restructured in the 2013–2014 budget year. The CG for financing various pilot interventions in the country is now composed of direct and indirect components. The direct component focuses on the NHI pilot districts, while the indirect component focuses on financing activities for contracting MPs[75].

The burden of disease in South Africa, both historically and currently, presents a unique challenge. The most significant contributor to these challenges is the HIV/AIDS burden. South Africa has the biggest HIV epidemic worldwide, with an estimated 7.5 million people living with HIV in 2019[76]. It also accounts for one-third of new HIV infections in the Southern Africa region[77]. In 2019, 200,000 new HIV infection cases were reported, and 110,000 people in South Africa succumbed to AIDS-related illnesses[76]. The ART programme in South Africa is the largest globally. In 2015, the country invested >$1.34 billion to run its HIV programmes[61]. This funding has been used to develop a monitoring and evaluation system[78], develop clinical guidelines[79], and train providers on effectively managing HIV/AIDS[80]. The positive impact of the ART programme is evidenced by the increase in national life expectancy from 61.2 years in 2010 to 67.7 years in 2019[81].

Resource allocation and epidemiological transition have affected the response to the HIV epidemic. The peak of the president's emergency plan for AIDS relief (PEPFAR) support in 2012 coincided with an increase in NDoH resource allocation, leading to increased HIV testing and ART initiation[82, 83]. However, in the last 5 years, there has been a shift and convergence in disease burden. The disease burden has shifted to NCDs, such as cardiovascular disease, cancer, and trauma, which require higher levels of care, from infectious diseases driven by the

high burden of HIV/AIDS, which is now predominantly handled at the PHC level of care. Currently, the burden of disease in South Africa is characterised as quadruple, consisting of an amalgam of four epidemics, namely maternal, newborn, and child health; HIV/AIDS and TB; NCDs; and violence and injury[84].

The engagement of the private sector in support of UHC in South Africa is also distinctive. According to WHO recommendations, governments should aim for an aligned mixed health system (private and public) [85]. This alignment entails that the population can access standardised care from the public and private sectors. Thus, contracted private providers can continue to provide services in privately owned facilities. However, in the NHI pilot programme, contracted private MPs were stationed in public facilities accessible to currently underserved communities. The envisaged performance outcomes for the contracted MPs included improving PHC utilisation and management of chronic diseases such as HIV/AIDS, diabetes, and hypertension and contributing toward reducing the maternal mortality ratio and reduced child and infant mortality rates[86]. In South Africa, private providers were contracted to provide services in public PHC facilities[87]. In Ghana and other lower-income countries, the NHIS was adopted as a vehicle for UHC in 2003 as an insurance scheme paying for private providers in their respective facilities[25].

2.5 National Health Insurance Pilot Programme Interventions

The NHI is a significant shift in policy that would lead to a massive revamping of the current healthcare system. In South Africa, the public healthcare system consists of PHC, hospitals and specialised services, and emergency medical services[88]. However, PHC was recognised as an area of priority for implementing the NHI pilot programme as it represents an ideal entry point for individuals in the health system. Thus, the NHI pilot programme's first phase concentrated on preventive and curative services for all essential health needs provided at community clinics and community health centres. It aimed to strengthen health systems, including improving quality, governance, workforce, availability of medicines and re-engineering PHC[89]. The envisaged outcome was better-resourced and organised PHC facilities that are accessible, affordable, and available for services. The ICRM was launched in 2015 to monitor progress toward attaining these standards[90]. After implementation, some studies have shown significant improvements in scores of the measured standards[91, 92]. However, challenges in health outcomes, measured by health indicators[91]; shortage of skilled staff; and suboptimal implementation continue to hamper its progress[92].

The geographic unit of intervention used to test the NHI was the district. The NHI pilot was implemented in 11 districts of the country in every province—OR Tambo (Eastern Cape); Gert Sibande (Mpumalanga); Vhembe (Limpopo); Pixley ka Seme (Northern Cape); Eden (Western Cape); Dr. Kenneth Kaunda (Northwest); Thabo Mofutsanyane (Free State); Tshwane (Gauteng); and Amajuba, uMzinyathi, and uMgungundlovu (KwaZulu-Natal). The pilot districts were selected based on poor socioeconomic performance, health service performance, and financial and resource management indicators. The rationale behind these pilot districts was to evaluate their capability of procuring health services from private providers and inform scale-up to other districts[47].

Thus, to improve PHC, PHC re-engineering should be integral to implementing the PHC platform of the NHI pilot programme. In the NHI pilot programme's first phase, three streams were established—municipal WBPHCOTs, ISHP, and DCSTs were launched before 2012. However, on March 22, 2012, contracting of private non-specialised MPs was added as a fourth stream[93]. The WBPHCOT strategy was launched in 2011 based on the community. As an offshoot of NGO-based community care in response to the HIV/AIDS pandemic, the strategy involves the mobilisation of non-skilled individuals under the leadership of nurse team leaders in the community[94]. Each team is linked to a PHC facility in a politically designated ward to detect disease, support, and refer patients for health services at their homes. Several studies conducted after the launch showed that WBPHCOTs could provide comprehensive care in communities[95, 96], despite operational and governance challenges[97, 98]. To respond to these challenges, in 2017, the NDoH developed policy guidelines to optimise the performance of WBPHCOTs[99].

The ISHP was implemented in 2012 as an off-shoot of the 2003 National School Health Policy[100]. The program's objective was to provide a comprehensive package of health services in schools to address health-related barriers to learning and detecting diseases affecting children and adults[101]. Despite the program's relative success, specifically in detecting disease among learners[102], it has been beset by several challenges, including poor coordination between important stakeholders (provincial departments of health and basic education) [100,103], and suboptimal implementation[104, 105].

The DCST was launched in 2012 to improve clinical governance at the district level. This improvement in clinical governance was to be done by improving the healthcare for newborns, children and mothers[106]. The team comprises seven specialist healthcare provider categories,

namely an obstetrician/gynaecologist, an advanced midwife, a paediatrician, a paediatric nurse, a family physician, a PHC nurse and an anaesthetist[45]. At inception, 172 specialists were appointed as members of DCSTs, accounting for 47% of the estimated 364 posts to be filled nationally[107]. Some studies have shown that the teams have created a bridge between PHC and recipient hospitals, contributing to improving health services[108, 109]. However, other studies have indicated role ambiguity, potential skill loss among team members, and suboptimal implementation[106].

2.6 Contracting of Private Providers in the South African Universal Health Coverage programme

Contracting private MPs for PHC services in the NHI pilot programme was envisaged to improve the quality of public healthcare at PHC facilities by several mechanisms. First, the contracted MPs would see patients, reducing waiting times and strengthening clinical governance. Second, they would implement quality improvement activities such as infection prevention inspections, file reviews, morbidity/mortality reviews, and monitoring drug stock levels[89]. Additionally, they were to mentor and provide ongoing training to professional nurses (PNs) on managing acute and chronic diseases. Furthermore, they would take up and manage complicated medical cases beyond the capacity of the PNs. Thus, the presence of contracted private MPs would minimise onward referrals and a reduction in workload at higher levels of care[110]. However, it was also envisaged that the improved perceived quality of care at PHC facilities could lead to increased utilisation of services leading to an increased workload to which the contracted MPs would respond by increasing referrals to the next level of care[111]. The project contracted 326 GPs in these districts to provide health services in PHC clinics. These services have been incorporated into the existing district referral system. The project also incorporated the DCST to provide clinical support to MPs contracted in the pilot programme. To increase the contracting of MPs, the NDoH also contracted a private partner, Foundation for Professional Development, to recruit and contract more doctors[112].

Despite the WHO recommendation for governments to contract private providers to attain UHC[85], most governments have limited previous experience in this approach. Most studies on contracting healthcare services by private providers have been primarily conducted in developed countries such as Canada, Finland, the Netherlands, New Zealand, Sweden, the United Kingdom, and the United States of America[113]. Limited studies on contracting primary care services, specifically, private MPs contracted to provide services in public facilities, have been conducted in low- and middle-income countries (LMICs). However, contracting has

become a specific component of health reform packages promoted by bilateral and multilateral agencies in LMICs[114]. A review of the literature published in 2004 showed that among the 18 studies conducted in LMICs on contracting healthcare services, only one study conducted in Romania was specific to the provision of PHC services by MPs[115]. This study showed that contracting MPs for preventive and curative PHC services to improve access, efficiency, and quality had benefits, including higher patient satisfaction and more preventive care. However, there were no changes in the use of hospital services or access for underserved communities, leading to an increased number of consultations and a weak regulatory and monitoring system. The performance indicators in this study were immunisation coverage, number of consultations, number of registered patients, and the number of home visits by MPs[116, 117].

Another literature review published in 2007 on contracting health services in LMICs found 13 relevant studies. Six of these studies involved contracting PHC services[118]. Only one study in South Africa involved contracting MPs to improve quality in terms of care indicators, provider knowledge, the percentage of sexually transmitted infections (STIs) treated correctly, and the efficiency of the PHC service in input shares and costs. This finding showed that the cost of contracting private MPs was like that of contracting public MPs. However, the overall clinic costs were higher and care indicators were relatively worse when using private providers[119]. Another study was conducted earlier in South Africa in 2004 to evaluate whether contracting private MPs to provide STI treatment would improve the quality of service. However, the study results were inconclusive as the treatment for STI improved in both study groups[120]. The literature also shows that despite progress toward contracting out (outsourcing) health services by governments, there are knowledge gaps, including feasibility, costs, government's ability, and sustainability of countrywide contracting of private MPs and contracting healthcare services[121, 122].

Therefore, the debate on contracting out health services to private providers for public purposes is not new[123]. This literature survey has shown that several attempts have been made to contract private providers in various arrangements in different countries[120, 124]. As with any process, several successes and failures were recorded in contracting out private providers in various countries. Failure of MP contracts has been attributed to weak institutional arrangements for the contracting process, poor contract management by the public sector, and perverse incentives occasionally generated by the types of contracts and payment arrangements between the public sector and private providers[125, 126]. However, evidence suggests that if properly designed, managed, or regulated, contracting private providers can significantly improve

effective health coverage by increasing both geographical and financial access and the quality of services[127]. South Africa also has a history of contracting out of health services, evidenced by the role of district surgeons contracting out of private hospitals and various other public-private sector partnerships in healthcare, especially at the hospital level, for clinical and non-clinical services[120]. The NHI white paper has highlighted the need to explore innovative ways of engaging private sector providers. The 11 pilot districts have provided a scientific opportunity to systematically assess the performance of different contractual arrangements with private providers.

2.7 Other PHC-Related Co-Interventions

Implementation of the NHI pilot programme was preceded by and coincided with not only PHC re-engineering but also other related initiatives in all districts, which could confound the study findings. One intervention is the Centralised Chronic Medicines Dispensing and Distribution (CCMDD) programme[128, 129]. The programme provides an alternative chronic medication access system for patients in the public sector through a centralised dispensing operation. The programme obtains prescriptions from health facilities, dispenses, and sends patient medicine parcels to the facility where the patient is registered or a more convenient alternative pick-up point[130]. The goals of the CCMDD programme are: to reduce patient waiting times, improve access to chronic medication, identify pick-up points accessible to patients, ensure that clients access chronic medicines closest to their homes, decongest health facilities, reduce health provider workload, and improve client satisfaction[131].

The rationale for the CCMDD programme is based on the epidemiological profile of South Africa. Over the past decades, South Africa has seen an increased disease burden, mainly due to HIV/AIDS, TB, NCDs, and injury and violence[132]. This increased disease burden has led to unprecedented growth in patients accessing chronic medication. In South Africa, there now is universal access to ART for patients living with HIV and AIDS. Similarly, there has been an increase in NCD patients who need chronic therapy[133]. Additionally, the epidemiological profile change in South Africa has led to increasing demand for healthcare facilities. As a result, an enormous strain has been placed on the available resources leading to medicine shortages and challenges in the quality of care provided[134, 135].

Several studies have assessed the performance of the CCMDD programme. A study conducted in 2020 found that the programme successfully engaged patients with different chronic conditions. The study concluded that the rising burden of HIV and NCDs in South Africa could be addressed successfully[130]. Factors associated with the high uptake of the CCMMD

programme were age, employment status, self-perceived barriers to care, and self-efficacy[136]. However, another study conducted in 2020 found that despite improved accessibility to medication offered by the programme, there was no evidence of improved clinical outcomes, specifically in patients with type 2 DM[137]. The other challenges experienced by the programme included delayed delivery of medicines, inability to track medicine parcels in transit, delayed sending of collection notification messages, issuing of incorrect medicines, shortage of enough pick-up points specifically in rural areas, and lack of patient data in clinic facilities[138].

Another intervention targeting medicine stockouts in PHC facilities was the stock visibility system (SVS) strategy launched in 2016[139]. Along with the mobile application, the system was designed to report vaccine and medicine stock levels at a facility to the district, provincial, and national managers. Every week, every item in stock is counted, updated, and captured on an online platform accessible to all stakeholders[140]. Despite the high uptake among providers, several challenges were noted by this strategy. One study conducted in 2019 found that most providers felt that the strategy increased their workload more due to a chronic shortage of skilled staff, particularly in rural areas. Similarly, there needed to be more alignment between detecting stock shortages and replenishment due to delivery delays for restocking[141].

2.8 Use of District Health Information System Data

Despite differing views regarding quality and completeness, this thesis depended heavily on DHIS data, routinely collected monthly by the NDoH. This decision was based on the historical non-availability of alternative data to answer the research question. Before 2000, several studies indicated the need for standardisation of data in health at the district level[142]. Thus, since 2000, the NDoH has been collecting and managing monthly routine health-based standardised information in PHC facilities and hospitals using the DHIS at the facility, subdistrict, district, provincial, and national levels[143]. The data were initially entered into facility registers by HCWs, then collated at the facility level by data capturers. The data was then sent to the DHMIS officer, tasked with creating electronic formats (in MS Excel); thus, it was a standalone application based on Microsoft Office.

In the initial 10 years (2000–2010) since its inception, several challenges with the DHIS have been noted in South Africa and other resource-limited countries. In 2003, studies in Tanzania showed that data reported in the DHIS were insufficient to support health planning decisions due to inaccuracy, incompleteness, and late completion of the entry. However, the system was suitable for use[144 145]. Other challenges specific to areas with scarce human technical skills were also noted and addressed, and sustainability plans were put in place[146]. In some rural areas,

weaknesses in data collection, processing, and use were noted, requiring further training and support to optimise the use of DHIS data[147]. Similar challenges were also noted in using DHIS data to inform the performance of large public HIV prevention programmes[148]. In response to these challenges, a flexible and essential dataset was created in South Africa to inform performance and streamline data flow accurately[149]. Studies conducted across several districts in KZN (urban/rural) showed that simple, practical data improvement interventions could significantly increase the completeness and accuracy of DHIS data used to monitor PHC services[150]. Thus, several studies used DHIS data to inform the improvement of healthcare quality[151].

In the last 10 years (2011–2020), several changes were made to the DHIS to improve the operability, timeliness, and accuracy of data. The system was upgraded to a web-based system branded DHIS2[152]. This system is now considered the largest platform by more than 73 LMICs[153]. Despite this, in 2015, the challenges noted were nonoptimal acceptance owing to a lack of human resources, data quality, and information flow issues[154]. Some studies have shown that these challenges result from human factors, such as deficiency in their competence to use and interpret DHIS information[155]. Despite these challenges, DHIS data helped improve health service delivery in LMICs in another study[156].

In South Africa, the DHIS has been used as a data source in several studies using different methodologies and covering a broad spectrum of health problems. DHIS data have been used to assess the impact of specialised immunisation campaigns on health systems[157], despite the noted data inaccuracy [158]. The data have also been used to estimate maternal mortality and its causes[159]. More recently, DHIS data have been used to assess the performance of HIV public health programmes[160-162], measure the burden of chronic NCDs such as hypertension[163], evaluate the utilisation of PHC services[164], estimate vaccine coverage[165], determine the impact of COVID-19 on the utilisation of hospital services[61], and model the performance of HIV prevention strategies[166]. Despite this progress, some challenges related to the details of the collected information, such as limited patient-level data. The successful use of DHIS data has led some researchers to recommend the expanded use to include patient-level data.

2.9 Quality of Healthcare

Healthcare quality is a complex concept with varied definitions. However, the most accepted definition by the Institute of Medicine is “the degree to which health services provided at the individual and population levels increase the likelihood of having desirable health outcomes based on current professional knowledge”[167]. According to the Donabedian model, health care

quality can be measured using its components[168, 169]. Avedis Donabedian suggested that healthcare comprises a structure, process, and outcome. Thus, healthcare quality relates to not only each component individually but also the relationships between them. The structure is the prevailing condition of healthcare delivery, and they are material, physical, human, and intellectual resources. Thus, healthcare quality can be measured at three levels— care by practitioners (individual), care implemented by patients (individual), and care received by the community (population)[170]. The data sources for healthcare quality measures are medical records, disease-specific registers, survey data, direct observations, and administrative data[171].

Medical records can be paper-based or electronic and can be used by practitioners to measure healthcare quality. It focuses on adherence to clinical guidelines and changes in documented health outcomes[172]. Indicators derived from adherence to clinical guidelines have been developed for several conditions[173]. However, there are challenges in obtaining this type of information. First, electronic records require significant equipment, training, and time investment. Second, using medical records is not feasible in some areas owing to poor documentation and availability of health records[174, 175]. Third, there needs to be more linkage and uniformity across different facilities for paper-based records. Fourth, an effort is required to aggregate the data to produce a measurement.

Disease-specific registers are databases containing data on the demographics of a specific type of disease. They are either hospital or population-based, and the data includes diagnosis, severity, clinical investigations, treatment, outcomes, and other related factors[176]. However, the main challenge is that resource-limited settings, such as those in South Africa, may need more resources to set up and maintain these registers, given the disease burden.

Direct observation entails that an observer sits during a patient-provider interaction. Despite directly verifying observable events and situations, this method is beset by several challenges. These interactions introduce provider bias, in which they change their behaviour[177]. The method is also not feasible where there is a lack of staff and information is frequently needed. This direct observation by a third party also introduces ethical challenges.

Surveys are an essential data source for patient-centred care. They capture patient experiences and interactions with providers. They also capture patients' perspectives, such as symptoms, functioning, and mental health. However, there needs to be a better match between the perceived and actual clinical quality of healthcare[178]. Thus, this data source captures the perceived quality of healthcare.

Similarly, several challenges with this data source are noted. These challenges include representativeness, selection bias, nonresponse bias, sample size, and resources[171]. Despite this, several studies, including those conducted in South Africa, have shown that the perceived quality of healthcare is the key driver for the utilisation of health services[179].

Administrative data are the most readily available sources for measuring and monitoring healthcare quality. Despite the lack of clinical data, it allows for comparison and analysis at the population level through standardised classifications and codes. Population-level measurement of healthcare quality is crucial for monitoring progress toward UHC[180]. At the population level, the quality of healthcare considers how patients receive care on an equitable basis, which will optimise the well-being of the entire population[181]. Health indicators have been used to measure outcomes related to the perceived quality of healthcare[174, 175]. An indicator routinely collected at the hospital outpatient department in the District Health Information Management System is the headcount of clients referred, self-referrals (not referred), and total follow-up. Several studies conducted in the USA[177, 182], Iran[183], Free State[184], Kwa-Zulu Natal[185, 186], Limpopo[187], Western Cape[188], and Tshwane[189] have shown that there is a directly proportional relationship between self-referrals to the following levels of care and the perception of poor quality of services at lower levels.

2.10 Conclusion

Pursuing UHC by the UN member countries is the most crucial goal in improving healthcare globally. This literature review shows that UHC will enable member countries to provide financial risk protection, access to quality essential healthcare services, and safe, adequate, quality, and affordable essential medicines and vaccines for all citizens. Progress has been monitored using health service coverage and financial risk protection coverage, which has shown disparate findings, with Sub-Saharan Africa still having a long way to go.

In South Africa, the NHI pilot project, the vehicle for UHC, has been conceptualised and implemented atypically compared to other countries, given the historical and disease burden context. While some interventions were implemented solely for the NHI pilot project in specific districts, others were part of the PHC re-engineering for all the districts. A review of the key reports, expert opinion articles, and studies related to NHI recognised the importance of utilisation of health services and perceived quality of healthcare and their interrelationship. The possible impact on the sustainability of the NHI was also noted to be crucial to successful implementation. In determining the progress of the NHI pilot project, this review has shown

that DHIS is a reliable source of routinely collected data. Similarly, some indicators in DHIS can be used as proxies for healthcare quality per the recommendation of expert opinion articles.

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3 CHAPTER 3: METHODS

3.1 Introduction

This chapter describes the methodological approach used in this thesis. The study was conducted in three parts based on the study objectives. First, Paper 1 investigated the causal effect of private medical practitioners (MPs) contracting on the utilisation of PHC services. Second, Paper 2 determined if the causal effects observed in Paper 1 were due to an improved perception of the quality of healthcare at PHC facilities measured at the OPD level. Finally, Paper 3 determined the relationship and interdependencies between the PHC and OPD indicators and forecasted to 2025. However, the methodological approach was divided into two parts. The first part looks at methodological aspects common to all three parts of the study (cross-cutting), and the second part discusses each study separately, concentrating on their unique aspects.

3.2 Cross-cutting methodological features

3.2.1 Aim

This study aimed to determine the formative effects of implementing private MPs contracting of the pilot programme of national health insurance and other co-interventions on primary healthcare utilisation indicators as measured at both primary and non-emergency secondary levels of care. Thus, to achieve this, the study compares findings between the Tshwane NHI pilot district and Ekurhuleni non-pilot districts. Furthermore, the study aimed to determine the relationships and interdependencies between primary healthcare utilisation and non-emergency secondary-level indicators and forecast them to 2025.

3.2.2 Study Design

The study was an ecological quasi-experimental design[1]. It was an ecological design because the unit of observation was the population or community of the Tshwane district, which was defined geographically and by time trends[2]. An ecological study is observational in design; thus, there was no study intervention; health-related indicators were recorded as reported in the routine data collection. Therefore, ecological studies are usually inexpensive and easy to perform[3]. There are weaknesses in this study design. First, the aggregation across the analysis unit may not represent the population. Second, it is susceptible to ecological fallacy, an association seen at a group level is assumed to be applicable at the individual level[3]. However, some authors have found that it is applicable in circumstances where aggregate exposures serve as instrumental variables. Thus, confounding unmeasured variables in the associations between individual exposure and outcome is possible[4]. Thus, the application of the aggregate exposures and ITSA to deal with the weaknesses of an ecological study. Similarly, the study design is

acceptable when alternative observational data is unavailable and obtaining individual-level data is impractical5. This situation was applicable in this study as individual-level data on the effect of the NHI pilot project was unavailable and impractical to collect and interpret accurately.

This study was also quasi-experimental in that it aimed to establish a causal relationship between the independent and dependent variables. However, unlike actual experimental studies, it is not randomisation dependent. Instead, the participants were allocated to groups based on non-random criteria[6]. Thus, quasi-experiments are most likely conducted in settings where random assignment is impractical[7]. This non-randomisation was applicable in this study as the selection of the NHI pilot programme districts had been conducted in a non-random manner and not as part of an experiment. Some authors have described interrupted time series analysis (ITSA) as a sub-type of the quasi-experimental study design[8]. The greatest strength of this type of study is that the identified associations fulfill the requirement of causality since the outcome measurement comes after the intervention. However, when done singly, the weakness of this study is its difficulty in measuring or controlling for important unmeasured confounding variables and regression to the mean[9]. Thus, to address these internal validity threats, CITSA (ITSA with a control district) was used. The selected control district was Ekurhuleni district due to several considerations highlighted below.

3.2.3 Study Setting

The study was done in the Republic of South Africa Gauteng province. As shown in Figure 3-1 below, two of the five districts in the province are Tshwane district and Ekurhuleni district.

Figure 3-1: Map of Gauteng province showing relative positions of Tshwane district and Ekurhuleni district

Source: https://coronavirus.mediahack.co.za/2020/06/22/covid-19-in-gauteng-a-district-level-breakdown/

3.2.3.1 Tshwane Health District

The studies were conducted in the Tshwane Health District (terminology used in this thesis is Tshwane district), the northernmost district of Gauteng Province, as shown in **Figure 3-2**[10]. This district includes the Tshwane Metropolitan Municipality (or Category A municipality), one of the province's three districts bordering three other provinces: Limpopo, Mpumalanga, and Northwest. Covering 6 298 km², it is the largest district compared to the Johannesburg and Ekurhuleni Health Districts in the province[11]. **Appendix 1** shows the different types of public health facilities in the Tshwane district.

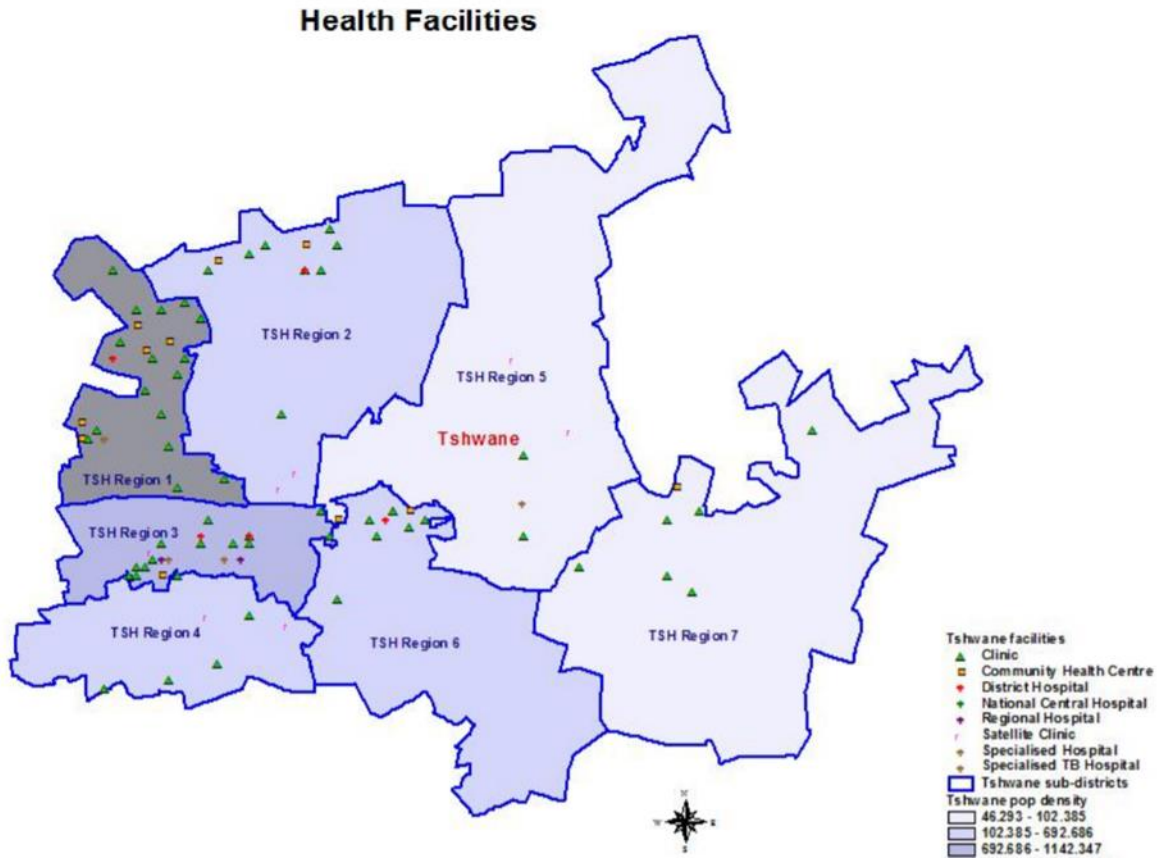

Figure 3-2: Map of Tshwane Health District showing public healthcare facilities (Source:https://www.hst.org.za/publications/NonHST%20Publications/Gauteng-%20Tshwane%20District.pdf)

In 2020, Tshwane District had an estimated population of 3,555,741[12,13]. Thus, the population density is high at 472.9 people per square kilometer. The district is divided into seven health sub-districts (Regions 1-7). However, the most populous areas are:

- Region 1 (Ga-Rankuwa, Soshanguve, Mabopane, and Rosslyn) accounts for 27% of the population.
- Region 6 (Eersterust, Lethabong, Mamelodi, Silverlakes, and Garsfontein) accounts for 22%.
- Region 3 (Pretoria CBD, Hercules, Danville, Atteridgeville, Laudium, Saulsville, and Lotus) accounts for 18%[12].

According to the Department of Cooperative Governance and Traditional Affairs, Tshwane District's health status is characterised by the poor performance of the primary health care level coupled with unequal access[12]. Thus, this district is one of the 11 NHI pilot districts in South Africa. It has 124 health facilities, both public and private. The public facilities are classified as clinics, community health centres, district and regional hospitals, and central/tertiary hospitals. Most of these facilities are in Regions 1, 2, and 3, and a few in Regions 6 and 7, but not in Regions 5 and 6[12]. Despite having the highest percentage of the population with medical insurance coverage, approximately 69.5% of the district population receives PHC services from 68 public facilities (PHC facility ratio of 1:36 980)[14,15]. These refer patients for higher levels of care to 12 hospitals (five districts, one regional, one provincial tertiary, two central nationals, and three specialised) [16].

The burden of disease, as measured by the cause of death in the district, is mainly attributed to HIV/TB; communicable diseases with maternal, perinatal, and nutritional conditions; and injuries. According to the district health barometer for 2012-2020[17], injuries affected males more than females, whereas the other conditions were evenly distributed between the two sexes. During the period covered in the report, the prevalence of HTN and DM has been increasing. However, DM treatment coverage has been reduced. The number of MPs per 100 000 of the population has increased; in contrast, that of pharmacists and PNs has reduced. Approximately 100% of all public facilities have attained ICRM status[18]. This milestone means that despite the improvement in specific indicators for a better quality of healthcare delivery, the district still has challenges that could weaken the impact of any interventions.

3.2.3.2 Ekurhuleni Health District

The studies' findings, specifically paper 1 and 2, were compared with those in Ekurhuleni Health District (Category A municipality), as shown in **Figure 3-3**, a non-NHI district. The

district has a population of 3,774,638[19,20], covering an area of 1 975 km^2. It has a high population density of 1,715/km^2[21]. Approximately 76.2% of the population in the district receives PHC services from 90 facilities (PHC facility ratio of 1:42 421) [15,22].

Figure 3-3: Map of Ekurhuleni showing the three regions subdivided into six

Source : https://scholar.sun.ac.za › motja_cultural_2014

The district is divided into six sub-districts as part of the COVID-19 response, namely:

- Ekurhuleni North 1 (Kempton Park, Crystal Park, Ethafeni, Olifantsfontein, Tembisa, and Winnie Mandela)
- Ekurhuleni North 2 (Bedfordview, Boksburg, Chief Albert Luthuli, Dan Kubheka, Edenvale, Endayeni, Esangweni, Itireleng, Kemston, Lethabong, Ramaphosa, Reiger Park, and Van Dyk Park)
- Ekurhuleni East 1 (Etwatwa, Daveyton, Brakpan, and Tsakani)
- Ekurhuleni East 2 (Springs, Kwa-Thema, Duduza, and Nigel)
- Ekurhuleni South 1 (Alberton, Brackenhurst, Eden Park, Primrose, Germiston, Leondale, Dawn Park, Tswelopele, Vosloorus, and Villa Liza)

- Ekurhuleni South 2 (Thokoza, Greenfields, Kathlehong, Moleleki, Zonkizizwe, Palm Ridge, Moleleki, Tsietsi Sunrise View, Tamaho, Khumalo, and Motsamai) [23].

According to the district health barometer for 2012-2020[17], the disease burden is similar to that in the Tshwane district. Furthermore, during this period, there has been an increase in the prevalence of HTN and the number of MPs. Conversely, there was a decrease in pharmacists per 100 000 of the population. Unlike the Tshwane district, Ekurhuleni district decreased DM prevalence with a corresponding increase in DM coverage. However, the number of PNs remained unchanged[18].

A comparison district was required to control for time-varying confounders as per the selected analysis method. ITSA compared PHC/OPD data elements and indicators across time within a single population of the Tshwane district. It accounted for pre-existing trends in the outcomes. Thus, it avoids between-group differences such as selection bias of unmeasured confounders[24]. However, this would include confounders that did not form part of the pre-existing trend, like contemporary interventions around the time of the NHI pilot project[24]. Thus, to counter these threats, a control district was selected to control for other examples of time-dependent concurrent interventions implemented in both districts. The choice of Ekurhuleni district was based on the proximity of the two districts, similar demographic profiles, and the same provincial government of DoH, which assures uniformity of implementation[22,25]. **Table 3-1** below compares demographic characteristics between the Tshwane district and Ekurhuleni district, which are similar. It also shows the medical insurance coverage for the Tshwane district being higher than in the Ekurhuleni district from 2010-2019[26,27].

Table 3-1: Population Estimates and Primary Health Care characteristics of Tshwane Health Pilot and Ekurhuleni Health Non-Pilot district

	Tshwane Health District										Ekurhuleni Health District									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Population [32][33]	**2 836 329**	**2 921 488**	**3 012 054**	**3 105 428**	**3 201 696**	**3 345 772**	**3 499 678**	**3 660 663**	**3 825 393**	**3 978 026**	**3 091 226**	**3 178 470**	**3 256 978**	**3 337 426**	**3 419 860**	**3 470 000**	**3 559 000**	**3 649 000**	**3 741 000**	**3 818 000**
Age																				
Young (1-14 years) (%)	24.6	24.6	23.2	23.2	23.2	24.2	25.7	25.7	25.7	25.7	24.6	24.6	24.3	24.3	24.3	23.8	22.7	22.7	22.7	22.7
Working age (15-64 years) (%)	71.9	71.9	71.9	71.9	71.9	70.6	69.0	69.0	69.0	69.0	71.7	71.7	71.7	71.7	71.7	71.5	71.2	71.2	71.2	71.2
Elderly (≥ 65 years) (%)	4.4	4.4	4.9	4.9	4.9	5.1	5.4	5.4	5.4	5.4	3.5	3.5	4	4	4	5.1	6.1	6.1	6.1	6.1
Percentage with medical insurance (%)	33.2	33.2	33.2	33.2	33.2	33.0	33.1	29.2	29.6	30.6	25.5	25.5	25.5	25.5	25.5	27.9	26.2	23.7	23.1	24.6

3.2.4 Study Population

The population under investigation comprised people utilising primary and secondary non-emergency care in public facilities. The selected population was people utilising public health services from January 2010 to May 2019, covering the two years before and eight years after implementing the NHI pilot programme for all three objectives. This population represents people targeted for UHC in a district who do not have medical insurance or use OOP funds for non-emergency private PHC/OPD services, thus receiving non-emergency services at public facilities. However, PHC clients utilising exclusively nurse-driven services were excluded as unlikely to be impacted by the functioning of contracted MPs. These services include maternal, child health, and reproductive services[28].

Similarly, OPD clients utilising specialised and emergency services at hospitals were also excluded as these do not have direct interaction with PHC facilities in the district. Thus, for non-emergency OPD indicators, only the data from district hospitals were used. **Appendix 2** shows the PHC facilities in the Tshwane and Ekurhuleni districts.

3.2.5 Data Collation and Management

In this thesis, secondary data routinely collected from the DHIS monthly reports from January 2010 to December 2019 were used[29]. Each district facility (PHC and OPD) collects data and sends it to a DHIS officer who creates electronic formats (in MS Excel). Data on the selected variables in the DHIS were complete because the elements' values were reported every month for the period selected for the study. PHC headcounts were used because PHC is the focus of implementing the first phase of the NHI pilot programme. **Appendix 3** shows the comprehensive list and definitions of data elements and indicators considered for the study.

3.2.6 Ethical Considerations

Ethics approval for this study was obtained from the University of Witwatersrand Human Research Ethics Committee (HREC) (certificate number: M180956), shown in **appendix 4**. Approval from the National Health Research Database (Reference Number GP_201811_007) shown in **appendix 5** was granted to access the Gauteng DoH DHIS data. These data were aggregated at the district level; thus, they contained no identifiers.

3.2.7 Possible Limitations

The main cross-cutting possible limitation in the thesis is the use of DHIS data. Several studies done in the past have indicated gaps in the use of this data source. Despite the challenges and weaknesses of these data, they remain the only source of public healthcare utilisation information in the country. Notably, several recent studies have shown the usefulness of DHIS

data for determining and projecting the utilisation of pharmaceuticals[30], vaccines[31], PHC[32], and even COVID-19-related health services in South Africa[33]. The DHIS data is subject to random and systematic errors addressed using appropriate methodological and analytical rigour of the study. Thus, robust statistical methods were applied before, during, and after analysis to mitigate these limitations. Before analysis, the selected variables and times points used only the complete data, which was entered every month. Second, data elements and indicators that underwent definition and calculation change in the intervening period were excluded. During analysis, the selected techniques, ITSA/CITSA and VECM have inbuilt mechanisms for measuring and dealing with autocorrelation, stationarity, and collinearity. After analysis, in the synthesis of findings, considerations of changes in the measurement and collection of data that may have taken place over the study period were made.

3.3 Specific methodological features by objective

This section describes the specific methodological features for each objective.

3.3.1 Paper 1

3.3.1.1 Objective

To determine the formative effects of the national health insurance pilot project on primary health care indicators.

3.3.1.2 Variables and Outcome Measurements

The variables and outcome measurements selected for this study were the monthly PHC utilisation data elements and indicators in the DHIS system. These are shown in **Table 3-1**, with definitions, uses, context, proposed impact models, and the mechanism of action.

The selection of the variables and time points was based on several considerations. First, health service utilisation is an essential multidimensional outcome indicator of health service use, measured by the number of visits to a health care facility in a given period[34]. Second, compared to patient-reported data or surveys, utilisation indicators are more objective because their measurement hinges on the volume of medical services offered by healthcare providers to patients and recorded in databases[35]. Third, PHC utilisation data elements and indicators were selected based on the focus of implementing the first phase of the NHI from 2012. Fourth, HIV/AIDS, DM, and HTN data elements and indicators at the PHC level were considered because of the prevailing epidemiological profile in South Africa[36]. Thus, the capacity to manage these conditions at the PHC level is essential. However, several changes in the definition of the variables and incomplete data made them obsolete. Fifth, the selected PHC

utilisation indicators also met the criteria of the ability to change comparatively quicker after implementing MPs contracting or post a clearly defined lag[37], which is a prerequisite for ITSA.

Table 3-2: Definitions and impact models of PHC data elements and indicators in DHIS

Data element or indicator	Definition	Usage and context	Proposed impact model	Mechanism of impact model
ART adult remain on ART end of the period	Total number of adults remaining on treatment for HIV at the end of the reporting month	Used in calculating ART client remain on ART end of the month – total which monitors the total adults remaining on lifelong ART at the month end	Level and slope change	Improvement in service delivery would lead to increase in number of patients willing to be seen at PHC facilities[38, 39].
PHC client seen by a nurse practitioner	A PHC client of any age consulted and/or treated by a professional nurse for a Primary Health Care service	Monitors services rendered by professional nurse for a PHC service.	Slope change	Contracting of GPs to provide services at PHC facilities would reduce the load on professional nurses who have been providing services in these facilities[40, 41].
PHC headcount 5 years and older	All individual clients 5 years and older seen for Primary Health Care	Monitors PHC access and utilisation by clients 5 years of age and older	Level and slope change	Improvement in service delivery would lead to increased confidence in the PHC facilities and privately contracted GPs spend more than 90% of their time on those in this age[42]
PHC headcount total	All individual clients seen for Primary Health Care. Clients of all ages attending the facility for Primary Health Care. Each client is counted once a day regardless of the number of services provided on that day	Monitors overall utilisation of a PHC facility for PHC services	Level and slope change	Improvement in service delivery in PHC facilities, envisaged from contracting of private GPs would significantly increase total PC headcounts[40].
PHC client seen by private doctor	A PHC client of any age consulted and/or treated by a private doctor on contract for a Primary Health Care curative and preventative service. The service is provided in a public health facility	Monitoring of services rendered by private doctors employed on contract to consult PHC clients in public health facilities in accordance with the NHI objectives to increase doctor coverage	Level and slope change	Contracting of GPs to provide services at PHC facilities would lead to increase in the number of patients seen by this category of staff[40].
PHC client seen by public doctor	A PHC client of any age consulted and/or treated by a doctor employed in the public sector in a Primary Health Care curative and preventative service	Curative services that entail the diagnosis and/or treatment of clients. This data element should be collected in all PHC facilities with full or part-time doctors. Clients might originally be seen by a professional nurse for a PHC service or may be seen directly by the doctor	Slope change	Contracting of GPs to provide services at PHC facilities would reduce the load on public doctors who have been providing services in these facilities[40].

3.3.1.3 Selection of time points

The time trends under investigation in this study influenced the selection of the time points. The selection of time points was also based on the analysis requirements using single-group and controlled ITSA[37]. A total of 48-time periods were selected, with 24 before (June 2010 to May 2012) and 24 after (June 2012 to May 2014) the implementation of MPs contracting in the NHI pilot district. Thus, the intersection of the time series was May 2012, based on the announcement of the NHI pilot district initiation[43]. The minimum required time points for ITSA are 10 before and 10 after the implementation of a programme to have at least 80% power to detect a difference[44]. The selection can detect a change level of at least five standard deviations in the pre-data if the autocorrelation is >0.4[44].

3.3.1.4 Statistical Analysis

The key statistical method used in this study was the ITSA. Although some authors describe it as a study type[45], most describe it as a standard statistical method for assessing the impact of a planned or unplanned intervention on a time series of relevant outcome indicators[46]. Thus, the point of occurrence of an event can be known or unknown. Despite validity challenges with the single-group ITSA (without control)[47], the multiple-group (controlled) CITSA is now considered the gold standard for assessing interventions without randomisation, as in RCTs[48]. Thus, in this study, both methods were implemented.

All data types in the study were continuous. Thus, they were initially evaluated descriptively using means (standard deviations) and medians (interquartile ranges). The range was evaluated using minimum and maximum values. Then, a single group ITSA of PHC indicators from the DHIS[49, 50], in which the pre-intervention trend was projected for the post-intervention period, served as a counterfactual for each district separately. The regression coefficients were estimated using the ordinary least squares method, producing Newey-West standard errors. Regression diagnostics were tested using the Cumby-Huizinga test on the error distribution to test for residual autocorrelation, which was adjusted by Prais-Winsten regression. The test was performed to determine whether there was a statistically significant difference between the pre- and post-intervention slopes outside the intervention period in both districts. The monthly counts were assumed to follow a Poisson distribution, adjusting for over-dispersion. Seasonality was accounted for using dummy variables to define each month of the year, with dummy variables used as adjustment factors in the analysis.

The formula used for the single ITSA was as shown in **equation 3-1**:

Equation 3-1

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 T_t + \beta_3 X_t T_t + e_t$$

where Y_t is the aggregate outcome variable measured at t equally spaced time points.

- T_t is the time elapsed since the beginning of the study
- X_t (indicator) represents the intervention
- $X_t T_t$ is an interaction term
- e_t is the random error
- β_0 is the intercept of the line on the vertical axis (initial level of the outcome variable)
- β_1 is the slope or trajectory of outcome variables before the intervention
- β_2 is the change in the outcome level immediately after the introduction of the intervention
- β_3 is the difference between the pre-and post-intervention slopes.

Therefore, the significant *p*-values at β_2 indicate an immediate intervention effect and the significant *p*-values at β_3 indicate an intervention effect over time.

The Prais-Winsten AR(1) regression model was used to perform multiple groups or CITSA. This allowed us to control for both the pre-intervention trends in the outcomes and potential confounding events that would have affected both the Ekurhuleni district and Tshwane district study groups. A Poisson distribution was assumed as all outcomes used in the study were individual counts. The association was modelled as a slope change rather than an immediate level change because the selected outcomes were likely to change gradually as the MPs contracted. Multiple-group ITSA was performed according to Linden's description[24]. The differences in the coefficients were estimated using the following formula shown in **equation 3-2** below:

Equation 3-2

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 T_t X_t + \beta_4 Z + \beta_5 Z T_t + \beta_6 Z X_t + \beta_7 Z T_t X_t + e_t$$

Where:

- Z is a dummy variable for assignment to treatment or control.
- Y_t is the aggregated outcome variable
- t is the equally spaced time points when measurements of outcome variable are done
- T_t is the time since the start of the study

- X_t is a dummy variable representing the intervention with pre-intervention period denoted as 0 and post-intervention denoted as 1
- X_tT_t is an interaction term
- β_0 is the intercept or starting level of the outcome variable
- β_1 is the slope of the outcome variable until the introduction of the intervention
- β_2 is the change in the level of the outcome that occurs in the period immediately following the introduction of the intervention (compared with the counterfactual)
- β_3 is the difference between pre-and post-intervention slopes of the outcome.

The effect of the intervention is derived from significant *p*-values in β_2 to indicate an immediate intervention effect or in β_3 to indicate an intervention effect over time[24].

3.3.1.5 Possible Limitations

This study has two possible limitations. First, determining the formative effect of contracting MPs on PHC indicators as per the study design could be limited by the limited number of contracted MPs and the limited time they spend at clinics[51]. By the end of 2014, 77 MPs worked in only 17 of the 68 PHC clinics in the district[52]. However, an NHI report for the same period showed that >75% of the MPs were contracted by the end of 2012[28]. Thus, according to the implementation plan, the project contracted more than three-quarters of the required staffing complement for contracted MPs. In any case, the study was designed to mitigate against this effect, that is, the selection of PHC indicator based on MPs contracting sensitive data elements in DHIS. Thus, the study selected only indicators that could readily be affected by the presence of MPs in a PHC facility. Predominantly nurse driven PHC indicators such as child and maternal health were excluded from the study.

Second, the presence of a statistically significant difference in the preintervention parameters of the PHC indicators using CITSA comparing the two districts may limit the validity of the findings. This statistically significant difference may indicate poor selection of a control district. In mitigating this limitation, the selected control district of Ekurhuleni was closely matched in many aspects, including similar baseline demographic characteristics. Similarly, Ekurhuleni district is the most closely related region to the Tshwane district of all the 10 other NHI pilot districts.

3.3.2 Paper 2

3.3.2.1 Objective

To determine the formative effects of the national health insurance pilot project on non-emergency outpatient department care indicators.

3.3.2.2 Variables and Outcome Measurements

The variables and outcome measurements selected for this study were monthly non-emergency OPD utilisation data elements and indicators in the DHIS system. These are shown in **Table 3-3**, with definitions, uses, context, proposed impact models, and the mechanism of action. Specifically, OPD data elements and indicators of self-referrals and referrals were used as proxies for the perceived quality of care at the PHC level. This proxy measure of perceived quality of health was performed based on several considerations. Globally, several studies have shown that clients access entry-level healthcare at higher levels of care if they perceive the designated entry-level healthcare as poor. These studies were conducted in the USA and Iran[53, 54]. Similar studies were conducted in several provinces in South Africa, such as the Free State[55], Kwa-Zulu Natal[56, 57], Limpopo[58], Western Cape[59] and Gauteng[60]. The Gauteng study was conducted in the Tshwane district, which is the study setting for this thesis. This study concluded that clients bypass PHC to enter care at the OPD level because of the perception of poor quality of services of PHC facilities attributable to the absence of MPs[55]. Thus, the DHIS indicators monitoring includes headcounts and the rate of clients seen at non-emergency OPD without a referral letter from the PHC facility[61].

3.3.2.3 Selection of time points

The selection of time points was based on ITSA requirements to determine the time of intervention implementation. Progress reports were made to determine the time the MPs' contracting at PHC facilities of the NHI pilot programme could have affected indicators at the OPD level of the NHI pilot districts. First, the 2012 annual report showed that despite the announcement to start the NHI pilot programme in March 2012[43,62], private MPs had yet to be contracted by the end of 2012. Second, a 2013 report showed that 55 MPs were active in the Tshwane district by the end of 2013[63]. Thus, the midpoint of 2013 (June) was selected as the intersection of the MPs' contracts of the NHI pilot district. A total of 24-time periods, 12 before and 12 after implementing MPs' contracting, were selected.

3.3.2.4 Statistical Analysis

This was performed exactly as in Paper 1. All statistical analyses assumed a two-sided hypothesis at a 5% significance level. Analyses were conducted using STATA 16.1, StataCorp. 2019. *Stata Statistical System: Release 16*. College Station, TX, StataCorp LLC[64].

3.3.2.5 Possible Limitations

There are two possible limitations to this study. First, a statistically significant difference in pre-intervention parametres of OPD indicators using CITSA may explain post-intervention findings. However, the two comparison districts of Tshwane district and Ekurhuleni district were closely matched on several characteristics. Furthermore, the study used ITSA initially for each district independently, which meant inferences about concurrent interventions common to both districts could be made.

Second, our study inferences could be limited by the need for a directly collected health quality data measure. These data are collected from surveys or the use of clinical outcomes. However, these indicators are based on what the client or clinical provider reports and are not the main drivers for utilisation. The study used the perceived quality of healthcare as a measure of quality. Thus, the strength of the approach is the use of data that reports on the actual behaviour.

Table 3-3: Definitions and impact models for OPD data elements and indicators in DHIS

Data element or indicator	Definition	Usage and context	Proposed impact model	Mechanism of impact model
OPD headcount not referred new	New clients attending a general or specialist Outpatient clinic WITHOUT a referral letter from a PHC facility or doctor	Monitors the utilisation trends of clients who bypass PHC facilities	Level and slope change	This is likely to reduce as patients will be seen by doctors at PHC level first as the reason for this was absence of doctors at PHC facilities [55,65].
OPD new client not referred rate	New OPD clients not referred as a proportion of OPD new clients – total. [{OPD headcount not referred new}] ÷ [{OPD headcount not referred new} + {OPD headcount referred new}]	Monitors the utilisation trends of clients bypassing PHC facilities and the effect of PHC re-engineering on OPD utilisation. Do not include OPD follow-up and emergency clients in the denominator	Level and slope change	This is likely to reduce as patients will be seen by doctors at PHC level first as the reason for this was absence of doctors at PHC facilities [55,65].
OPD headcount referred new	New client attending a general or specialist Outpatient clinic with a referral letter from a PHC facility or a doctor	Monitors the utilisation trends of clients who do not bypass PHC facility	Level and slope change	This is likely to increase as doctors at PHC are required to write a referral letter when transferring patients to a higher level of care[55].
OPD headcount follow-up	Client attending a general or specialist Outpatient clinic for follow-up care	Monitors patient activity (numbers) at outpatient clinics partly to track the burden of disease trends, referral, workload, and utilisation/allocation of resources.	Level and slope change	This is likely to reduce as some patients who by-pass PHC facilities due to a lack of doctors can be adequately treated and managed at the PHC level by private contracted GPs[65].

3.3.3 Paper 3

3.3.3.1 Objective

To determine the relationship and independencies between PHC and OPD indicators and forecast utilisation of both services to 2025.

3.3.3.2 Variables and Outcome Measurements

Table 3-4 lists the variables used in this study. This table includes variable definitions and a short format. The short text was included to simplify the equations writing as per the study's statistical outputs. The variables were those used in Paper 1 for PHC-level effects and in Paper 2 for OPD-level effects. The study's aim guided the selection of the variables: to determine the interdependencies and relationships between indicators of the two levels of care. Routinely collected secondary data for these indicators from the DHIS were collated monthly[29]. However, monthly variations would be minimal to detect any significant changes. Thus, quarterly data were used by combining the three-monthly reports into quarters of a year.

The selection of time points was based on available complete data and the uniformity of the indicator recording. Thus, data for some HTN and DM indicators could not be included as definitions had changed several times and, in some cases, needed to be included. A total of 113-time periods (January 2010–December 2019) were selected, with 29 quarters before and 84 quarters after the implementation of the NHI pilot programme. These selections allowed for the consideration of relationships before and after the NHI pilot programme.

Table 3-4: Definitions and short formats of PHC and OPD indicators

Variable	Variable definition	Short format
Out-Patient Department headcount not referred new	New clients attending a general or specialist Outpatient clinic WITHOUT a referral letter from a PHC facility or doctor.	*OPD_not_ref*
Out-Patient Department headcount referred new	New client attending a general or specialist Outpatient clinic with a referral letter from a PHC facility or doctor.	*OPD_ref*
Out-Patient Department headcount follow-up	Client attending a general or specialist Outpatient clinic for follow-up care.	*OPD_follow_up*
Primary Health Care headcounts total	Clients of all ages attending the facility for Primary Health Care. Each client is counted once a day regardless of the number of services provided on that day.	*PHC_total*
Primary Health Care, diabetes client treatment new	Newly diagnosed clients with a fasting blood glucose of > 7mmol/L or random blood glucose >11.1mmol/L.	*PHC_DM_new_clients*
Primary Health Care client seen by public doctor	A PHC client of any age consulted and/or treated by a doctor employed in the public sector in a Primary Health Care curative and preventative service.	*PHC_public_MP*
Primary Health Care client seen by professional nurse	A PHC client of any age consulted and/or treated by a professional nurse for a PHC service.	*PHC_PN*
Primary Health Care ART adult remain on ART at end of period	Total adults remaining on ART (Adult TROA) at the end of the reporting month are the sum of the following: Any adult that has a current regimen in the column designating the month being reported on. Any adult who is not yet considered loss to follow-up (LTF) in the column designating the month being reported on. Clients remaining on ART equals [naïve (including Post Exposure Prophylaxis and Prevention of Mother to Child Transmission) + Experienced (Exp) + Transfer in (TFI) + Restart] minus [Died (RIP) + loss to follow-up (LTF) + Transfer out (TFO)]	*PHC_ART_remain*

NB: Short format refers to the variable names used in the statistical table outputs/graphs.

3.3.3.3 Statistical Analysis

All study data were continuous; thus, they were initially evaluated descriptively using means (standard deviations) and medians (interquartile ranges). The range was evaluated using minimum and maximum values.

A particular case of vector autoregression (VAR) of multivariate time series regression analysis called VECM was used for statistical analysis. The use of VECM was necessitated by the presence of non-stationarity in the time-series data. Thus, the data violated the primary assumption of the time series, stationarity. Stationarity implies that data in different time frames should have constant mean and variance[66]. Thus, the VECM is considered the gold standard for analysing time series with non-stationary data[64,67]. Although this analysis is predominantly used in economics, it has recently been used to analyse disease trends, including modelling of COVID-19[68, 69]. The model combines levels and differences of non-stationary multiple time-series data without differencing, ensuring long-run relationships among the integrated variables by adding an error correction term (ECT) to the VAR system[70, 71]. The significance of the t-statistic on the ECT parameter indicates evidence of a long-run relationship and long-run causality between the variables[72]. Thus, unlike VAR, the VECM allows for stationary and non-stationary variables analysis. It can also be used as a dynamic system that forecasts the impact of one variable on another by directly indicating the speed of adjustment of one variable to restore equilibrium after a change in another variable[67].

Preparatory work had to be performed on time-series data before developing the VECM. The natural log transformation of all time-series data was performed to enhance additivity, linearity, and validity[73]. The general model equation was as shown in **equations 3-3** below[74]:

Equation 3-3

$$Y_t = \alpha + \beta T + \gamma Y_t - 1 + \sum_{i=1}^{n} \delta_t Y_t - i + \epsilon_t$$

where $Y_t = \mathrm{N} - \mathrm{Dimensional\ time\ series}$

α=Intercept

T=Trend

$\gamma = \mathrm{Matrices\ with\ coefficient\ parameters}$

$\delta_t - i = \mathrm{lagged\ time\ series}$

ϵ=Residuals

Several steps must be taken to develop and test this model. First, the determination of the level of lags at which variables are interconnected or endogenously obtained due to the sensitivity of causality and the number of lags were selected. Lags were selected using Akaike's information criterion (AIC), Hannan–Quinn information criterion (HQIC), and Schwarz Bayesian information criterion (SBIC), with the lowest being the best[72]. Second, stationarity was assessed using both graphical means and the augmented Dick Fuller (ADF) test to confirm the stability of each time series[71]. Third, the Johansen cointegration test was conducted to evaluate cointegration. This statistical method is used to test the correlation between two or more non-stationary time series in the long run or for a specified period[75]. Fourth, a VECM was developed[70]. Fifth, an error correction bias was conducted using the Granger causality test to determine whether one-time series was helpful in forecasting another. If the probability value was less than α level (0.05), the hypothesis was rejected at that level[70]. If a causal relationship existed between each time series, the future values of the variables could be predicted. Finally, the VECM relationship between the variables in the model was employed to forecast data for 2025[76].

All statistical analyses assumed a two-sided hypothesis with 10% and 5% significance level. Analyses were conducted using STATA 16.1, StataCorp. 2019. *Stata Statistical System: Release 16*. College Station, TX, StataCorp LLC[64].

3.3.3.4 Possible Limitations

Several limitations exist in interpreting vector error correction model (VECM) findings. First, the model diagnostics may exhibit a problem with a non-normal distribution of error residuals, which may compromise the model's efficiency. However, this does not limit consistency[77]. Second, the selected forecast year was 2025, 4 years ahead of time, which is inherent to model performance and less accurate than a shorter period. However, the model is effective in forecasting for shorter periods. Third, there is evidence of the impact of coronavirus disease (COVID-19) on the utilisation of both PHC and OPD[78]. However, the period covered in this study was from 2010 to 2019, which was before the COVID-19 pandemic. Thus, the model performance would still be valid if vaccination and other measures reduced the impact of the pandemic on the healthcare system to pre-pandemic levels.

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4 CHAPTER 4: CONTRACTING OF PRIVATE MEDICAL PRACTITIONERS IN A NATIONAL HEALTH INSURANCE PILOT DISTRICT: WHAT HAS BEEN THE EFFECT ON PRIMARY HEALTH CARE UTILISATION INDICATORS?

Mukudu H, Otwombe K, Fusheini A, Igumbor J: Contracting of private medical practitioners in a National Health Insurance pilot district: What has been the effect on primary healthcare utilisation indicators? Afr J Prm Health Care Fam Med. 2020;12(1), a2563.

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4.1 Introduction

Universal Health Coverage (UHC) is a pillar of sustainable development and global security[1]. Globally, it is estimated that 400 million people lack access to essential health services and 150 million suffer financial catastrophe because of out-of-pocket (OPP) expenditure on health services[2]. Despite accounting for 25% of the global burden of disease, Sub-Saharan Africa is home to approximately 3% of the world's medical practitioners[3]. To correct this, 1 million new

medical practitioners (MPs) will need to be trained and deployed in the next 10 years [4].Thus, the World Health Organisation (WHO) recognises the attainment of UHC as a goal for 2030 for all member countries[5]. The UHC goal seeks to address healthcare access, utilisation and quality challenges facing public healthcare[6, 7].

Progress toward UHC in South Africa has been hampered by inequitable distribution of MPs between the two-tiered system of public and private providers which needs to be addressed[8]. The South African public health sector is staffed by 30% of medical practitioners to service the 70% of the uninsured population. The remaining 70% of MPs cater for 15% of the population who have medical insurance[9]. Perceived inferior services in public compared to private health care system means that 25% of the uninsured population pay Out-of-Pocket (OPP) for private-sector care[1011]. Thus, in 2012 the South African government through the National Department of Health (NDoH) launched the National Health Insurance (NHI) pilot project and Human Resources for Health (HRH) strategy as part of a plan toward addressing the inequitable distribution of MPs[12]. The first phase of NHI focusing on Primary Health Care (PHC) was implemented from 2012 to 2017 in 11 pilot districts. A key component of this was contracting-in of private MPs to provide primary health care services in community clinics[13]. Nurse Practitioners (NPs) and not MPs have historically provided services at public PHC facilities. Thus, the NHI white paper recommended contracting private MPs to strengthen the public PHC system. It was envisaged to lead to an improvement in clinical quality of care, offsetting of capacity constraints, expansion of a range of services and provision of clinical leadership and capacity building of the PHC team[14, 15]. The result of which would be increased utilisation of PHC services including those of HIV/AIDS services[16]. The latter services (HIV/AIDS) have been largely supported from 2007 to 2011 by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) [17].

Health services utilisation as a surrogate measure of access is an important health outcome indicator[18]. Effect of the NHI private MPs contracting on utilisation of PHC services is crucial for planning, appropriate allocation of scarce resources and determination of barriers to access of PHC services[19]. Absence of this data means that there is no comprehensive indicator for tracking progress and benchmarking performance of the programme. Utilisation of PHC services for planning has been monitored using routinely collected sequential district level data on headcounts using District Health Management Information System (DHMIS) database[20]. However, the effects of NHI private MPs contracting pilot programme on the utilisation of PHC services has not been well explored. These data are imperative in informing legislation

and policies to govern the rollout of NHI in South Africa at present. Thus, an assessment of the NHI pilot programme in attaining the intended goals is critical and hence this study. To our knowledge, this is the first study to determine population-level formative effects of UHC on PHC headcounts of adults remaining on ART, seen by a Nurse Practitioner (NP), total and five years and older in South Africa.

4.2 Methods

4.2.1 Research design

We adopted a quasi-experimental ecological study to investigate the causal effect of private MPs contracting on utilisation of PHC services of the NHI pilot programme in a pilot NHI district by comparing utilisation of PHC services against a non-NHI pilot district.

4.2.2 Study setting

The study was done in one of the NHI pilot districts of South Africa which has a population of 2,921,488 people, receiving PHC services from 68 facilities (PHC facility ratio of 1:36 980). The estimated medical scheme coverage in the district at the time of the study was 33.2% and the DoH expenditure on primary health care (PHC) was 56.7%[21]. It is also the most diverse district in terms of socio-economic status of the population. The Findings were compared with those in a non-NHI district with a population of 3,178,470 people accessing 90 PHC facilities (PHC facility ratio of 1:42 421). The estimated medical scheme coverage of which was 25.5% and a DoH expenditure on PHC services of 83.1%[21]. Selection of comparison district was not only based on proximity of the two districts but also similarities in demographic profiles and being under the same provincial government and uniformity in the implementation of health programmes. The districts also have similar burden of disease profile as measured by death by broad cause namely injuries, non-communicable diseases (NCDs), HIV and TB and communicable diseases[22].

4.2.3 Study population

We studied the population of children above five years old and adults utilising public PHC facilities in an NHI pilot and a non-NHI district from June 2010 to May 2014. However, PHC clients utilising services less likely to be affected by presence of MPs at the community clinics (nurse driven services) such as maternal, child health and reproductive services were excluded from the study[23].

4.2.4 Data collation and management

In this study we made use of routinely collected secondary data. DHMIS monthly reports from June 2010 to May 2014 for the two districts were collated. Each PHC facility in the district collects data, sends to DHMIS officer who creates electronic formats (in MS Excel). Data in DHMIS were deemed complete for the selected variables as the values for the elements were reported monthly for the period of the study. We used PHC headcounts because PHC is the focus of the implementation of the first phase of NHI pilot programme. The complete list of variables, definitions, use, impact model and mechanism of the impact model are shown in **Table 4-1**.

Table 4-1: Definitions and impact model of Primary Health Care data elements and indicators in DHIS

Data Element	Definition	Use and context	Proposed impact model	Mechanism of impact model
ART adult remain on ART end of period	Total number of adults remaining on treatment for HIV at the end of the reporting month	Used in calculating ART client remain on ART end of month – total which monitors the total adults remaining on life-long ART at the month end	Level and slope change	Improvement in service delivery would lead to increase in number patients willing to be seen at PHC facilities.
PHC client seen by a nurse practitioner	A PHC client of any age consulted and/or treated by a professional nurse for a Primary Health Care service		Slope change	Contracting of GPs to provide services at PHC facilities would reduce the load on professional nurses who have been providing services in these facilities.
PHC headcount 5 years and older	All individual clients 5 years and older seen for Primary Health Care	Monitors PHC access and utilisation by clients under 5 years of age and older	Level and slope change	Improvement in service delivery would lead in increased confidence in the PHC facilities and privately contracted GPs spend more than 90% of their time on those in this age.
PHC headcount total	All individual clients seen for Primary Health Care. Clients of all ages attending the facility for Primary Health Care. Each client is counted once a day regardless of the number of services provided on that day		Level and slope change	Improvement in service delivery at PHC facilities, envisaged from contracting of private GPs would significantly increase total PC headcounts.
PHC client seen by private doctor	A PHC client of any age consulted and/or treated by a private doctor on contract for a Primary Health Care curative and preventative service. The service is provided in a public health facility	Monitoring of services rendered by private doctors employed on contract to consult PHC clients in public health facilities in accordance with the NHI objectives to increase doctor coverage	Level and slope change	Contracting of GPs to provide services at PHC facilities would lead to increase in the number of patients seen by this category of staff.
PHC client seen by public doctor	A PHC client of any age consulted and/or treated by a doctor employed in the public sector for a Primary Health Care curative and preventative service	Curative services entail the diagnosis and/or treatment of clients. This data element should be collected in all PHC facilities with full or part-time doctors. Clients might originally be seen by a professional nurse for a PHC service or may be seen directly by the doctor	Slope change	Contracting of GPs to provide services at PHC facilities would reduce the load on public doctors who have been providing services in these facilities.

The use of a comparison district was done to control for time varying confounders. Interrupted Time Series Analysis (ITSA) compared selected PHC data elements across time within the single population of an NHI pilot district accounting for underlying trends in the outcomes, which avoids between group differences such as selection bias of unmeasured confounders. However, this did not exclude confounders, which do not form part of the underlying trend, such as interventions or events occurring around the time of NHI pilot project. To limit these threats, we selected a control district of a non-NHI pilot district to control for other examples of time varying co-interventions implemented in both districts that could affect the outcomes.

The selection of variables and time points was based on requirements of analysis using both single and controlled ITSA[24]. We measured and compared selected monthly PHC headcounts in the two districts which met the criteria of ability to change relatively quickly after the implementation of MPs contracting or after a clearly defined lag[24, 25]. The unit measure for selected data points was months as per DHMIS reporting. A total of 48-time periods with 24 before (June 2010 to May 2012) and 24 after (June 2012 to May 2014) implementation of MPs contracting were selected. The minimum required for ITSA is 10 before and 10 after implementation of a programme to have at least 80% power. The selection can detect a change level of at least 5 standard deviations of the pre-data if the autocorrelation is >0.4[26].

4.2.5 Ethics

Ethics approval for this study was obtained from University of Witwatersrand Human Research Ethics Committee (HREC) (Certificate number: M180956). The DHMIS data is aggregated at district level, thus it does not contain any identifiers.

4.2.6 Statistical analysis

We firstly did a single group ITSA of selected PHC secondary data elements from the DHMIS [27,28], in which the pre-intervention trend was projected for the post-intervention to serve as a counterfactual for each district separately. We estimated regression coefficients by the ordinary least squares' method, producing Newey-West standard errors. Regression diagnostics were tested using the Cumby-Huizinga test on the error distribution to test for residual autocorrelation, which was adjusted for by Prais-Winsten regression. This was done to determine whether there was a statistically significant difference between the pre- and post-intervention slopes outside the intervention period in both districts. The series of monthly counts were assumed to follow a Poisson distribution allowing for over dispersion. Seasonality was accounted for using dummy variables to define each month of the year, dummy variables being used as adjustment factors in the analysis.

The formula used for this single ITSA was as shown below in **equation 4-1**.

Equation 4-1

$$Yt = \beta 0 + \beta 1Tt + \beta 2Tt + \beta 3XtTt + et$$

Where:

- Y_t is aggregate outcome variable measured at t equally spaced time points
- T_t is time elapsed since the beginning of the study
- *Xt* (indicator) represents the intervention.
- X_tT_t is an interaction term
- e_t the random error
- β_0 intercept of the line on the vertical axis (initial level of the outcome variable)
- β_1 slope or trajectory of the outcome variable before the intervention
- β_2 change in level of outcome immediately after the introduction of the intervention
- β_3 difference between the pre- and post-intervention slopes. Therefore, significant values of p at β_2 indicate an immediate intervention effect, and significant values of p at β_3 indicate an intervention effect over time.

We then used the Prais-Winsten AR(1) model of regression to perform a multiple group or Controlled Interrupted Time Series Analysis (CITSA). This allowed us to control for both the pre-intervention trends in the outcomes and for potential confounding events that would have affected both the control and the study groups. A Poisson distribution was assumed, as all the outcomes used in the study were individual counts. We modelled the association as a slope change rather than an immediate level change because the selected outcomes were likely to change gradually as MPs were contracted. Multiple group ITSA was done according to Linden's description[29]. We estimated differences in coefficients according to the following formula in **equation 4-2** below:

Equation 4-2

$$Yt = \beta 0 + \beta 1\,T + \beta 2\,Xt + \beta 3TXt + \beta 4Z + \beta 5ZT + \beta 6ZXt + \beta 7ZTXt + et$$

Where *Z* is a dummy variable for assignment to treatment or control

Stata statistical software package, version 16 (StataCorp 4905 Lakeway Drive, College Station, Texas 77845 USA) was used to perform all the statistical analyses.

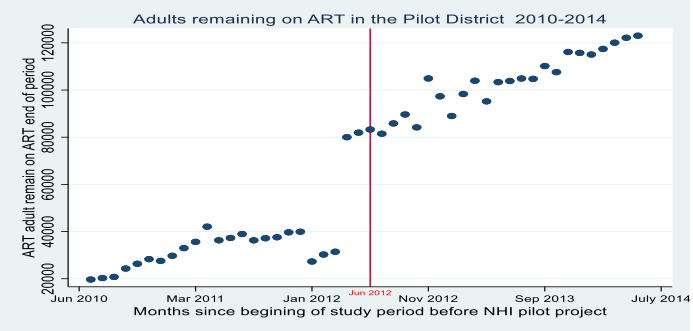
4.3 Results

4.3.1 Time series plots

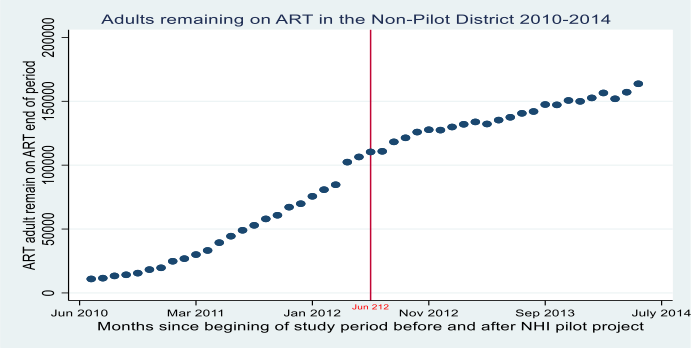
Figure 4-1 shows time series plots of the selected PHC data elements in both districts from 2010-2014. There was a more pronounced increase in adults remaining on ART in the pilot than the non-pilot district. Conversely, there was a higher increase in PHC headcounts for clients five years and older, total PHC headcounts and clients seen by a Nurse Practitioner in non-pilot than a pilot district.

The intersection for NHI MPs contracting assumed a 3 months lag period for recruitment processes after March 2012, which was when announcement to start NHI activities was made[30]. A 12-month progress report in 2013 showed that contracting of MPs for PHC facilities was more than 75% complete in May-July 2012 in all pilot districts[31].

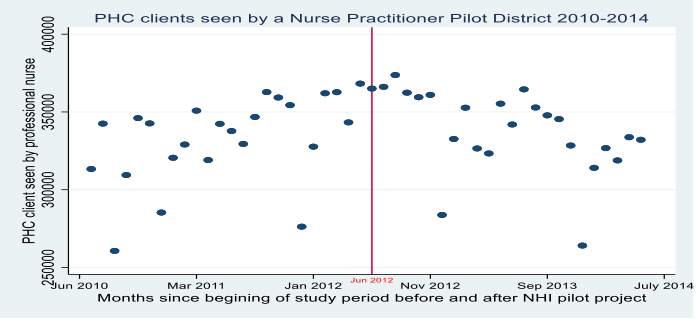
A. Adults remaining on ART in Tshwane District



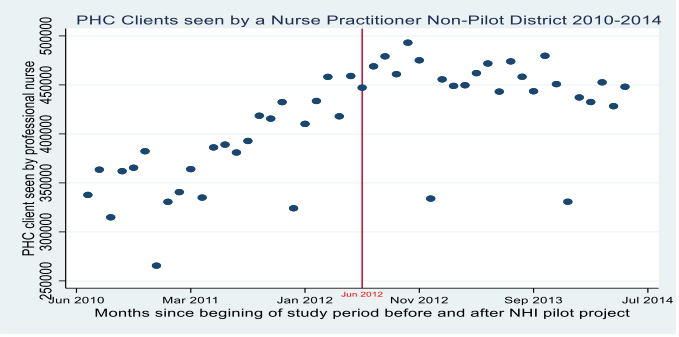
B. Adults remaining on ART in Ekurhuleni District



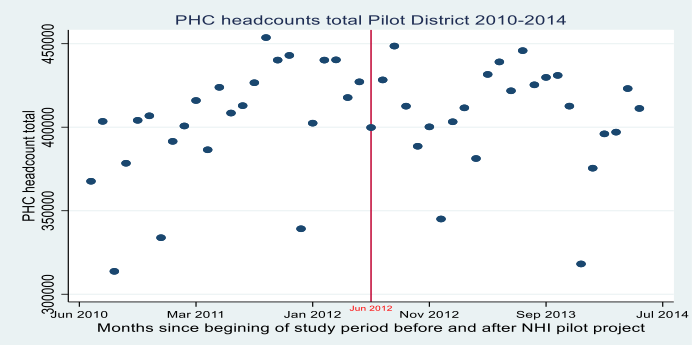
C. Clients seen by a Nurse Practitioner in Tshwane District



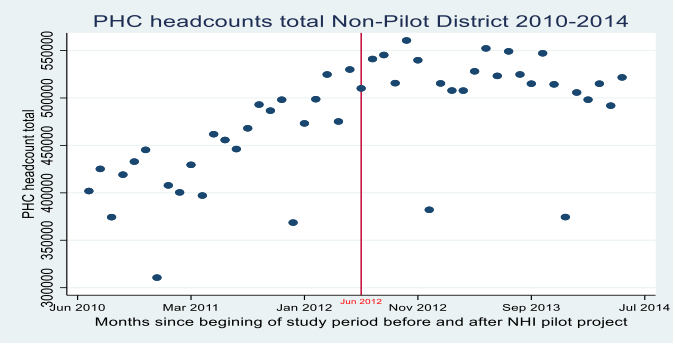
D. Clients seen by a Nurse Practitioner in Ekurhuleni District



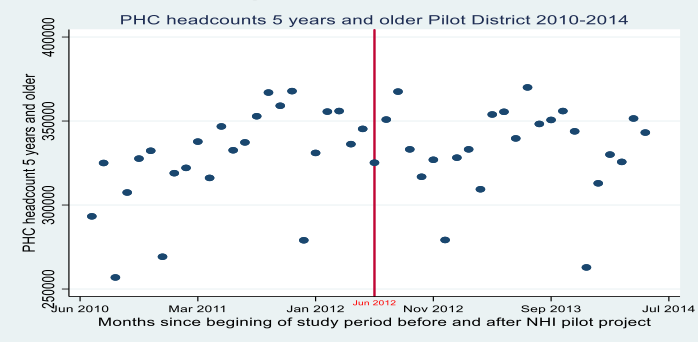
E. PHC headcounts total in Tshwane District



F. PHC headcounts total in Ekurhuleni District



G. PHC headcounts 5 years and in Tshwane District



H. PHC headcounts 5 years and older in Ekurhuleni District

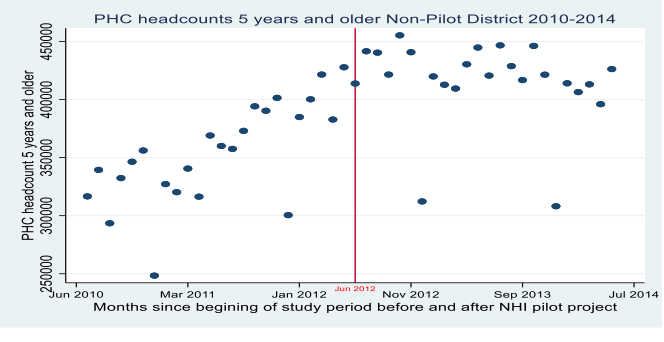


Figure 4-1: Time series plots for PHC indicators in Tshwane and Ekurhuleni districts

The middle red line (Jun 2012) represents the transition from before to after implementation of the NHI pilot project in Tshwane district and the corresponding time in Ekurhuleni district.

4.3.2 Interrupted Time Series Analysis and Controlled Interrupted Time Series Analysis

Table 4-3 shows pre-intervention and post-intervention PHC headcounts in each district separately using ITSA. In both districts, there was an increase in adults remaining on ART, but it was higher in the pilot than in the non-pilot district [Relative Risk (RR) 1.65 (95% Confidence Interval (CI) 1.64-1.66), p-value (p)<0.0001] vs [RR 1.32 (95% CI 1.32-1.33, p<0.0001]. The increase in PHC clients seen by nurse practitioners in both districts was minimal [RR 1.02 (95% CI 1.01-1.02), p<0.0001] vs [RR 1.06 (95% CI 1.06-1.07), p<0.0001]. There was a marginal decrease in PHC headcounts for clients five years and older in the pilot [RR 0.98 (95% CI 0.97-0.98), p<0.0001]. However, in the non-pilot district, there was a marginal increase [RR 1.01 (95% CI 1.01-1.02), p<0.0001]. Similarly, for PHC headcounts total there was a decrease in the pilot district [RR 0.98 (95% CI 0.97-0.98), p<0.0001], but an increase in the non-pilot [RR 1.05 (95% CI 1.04-1.06), p<0.0001].

Table 4-2: ITSA summary statistics for PHC indicators in Tshwane and Ekurhuleni districts

DHMIS data element (variable)		**Pilot District**	**Non-Pilot District**
Adults remaining on ART			
	Change	Increase	Increase
	Magnitude	65%	32%
	RR	1.65	1.32
	95% CI	1.64-1.66	1.32-1.33
	p-value	<0.0001	<0.0001
PHC clients seen by a Nurse Practitioner			
	Change	Increase	Increase
	Magnitude	2%	6%
	RR	1.02	1.06
	95% CI	1.01-1.02	1.06-1.07
	p-value	<0.0001	<0.0001
PHC headcounts five years and older			
	Change	Decrease	Increase
	Magnitude	2%	2%
	RR	0.98	1.02
	95% CI	0.97-0.98	1.01-1.02
	p-value	<0.0001	<0.0001
PHC headcounts total			
	Change	Decrease	Increase
	Magnitude	2%	5%
	RR	0.98	1.05
	95% CI	0.97-0.98	1.04-1.06
	p-value	<0.0001	<0.0001

Figure 4-2 and **Table 4-4** show pre-intervention and post-intervention PHC headcounts using CITSA. A comparison of adults remaining on ART shows that, there was a statistically significant difference in the base level [Coefficient = 16 043 (95% CI 952, 31 134), p=0.037] and base trend [Coefficient=-2 262 (95% CI -3 919, -606), p=0.008]. However, there was no difference in change in level and change in trend. For PHC clients seen by nurse practitioners, there was a statistically significant difference in base trend between the two districts [Coefficient -2 994 (95% CI -5 450, -539), p=0.017]. Conversely, there was no statistically significant difference in base level, change in level and change in trend. The PHC headcounts total and PHC headcounts 5 years and older shows that for both data elements, there was no statistically significant difference in base level, base trend, change in level and change in trend.

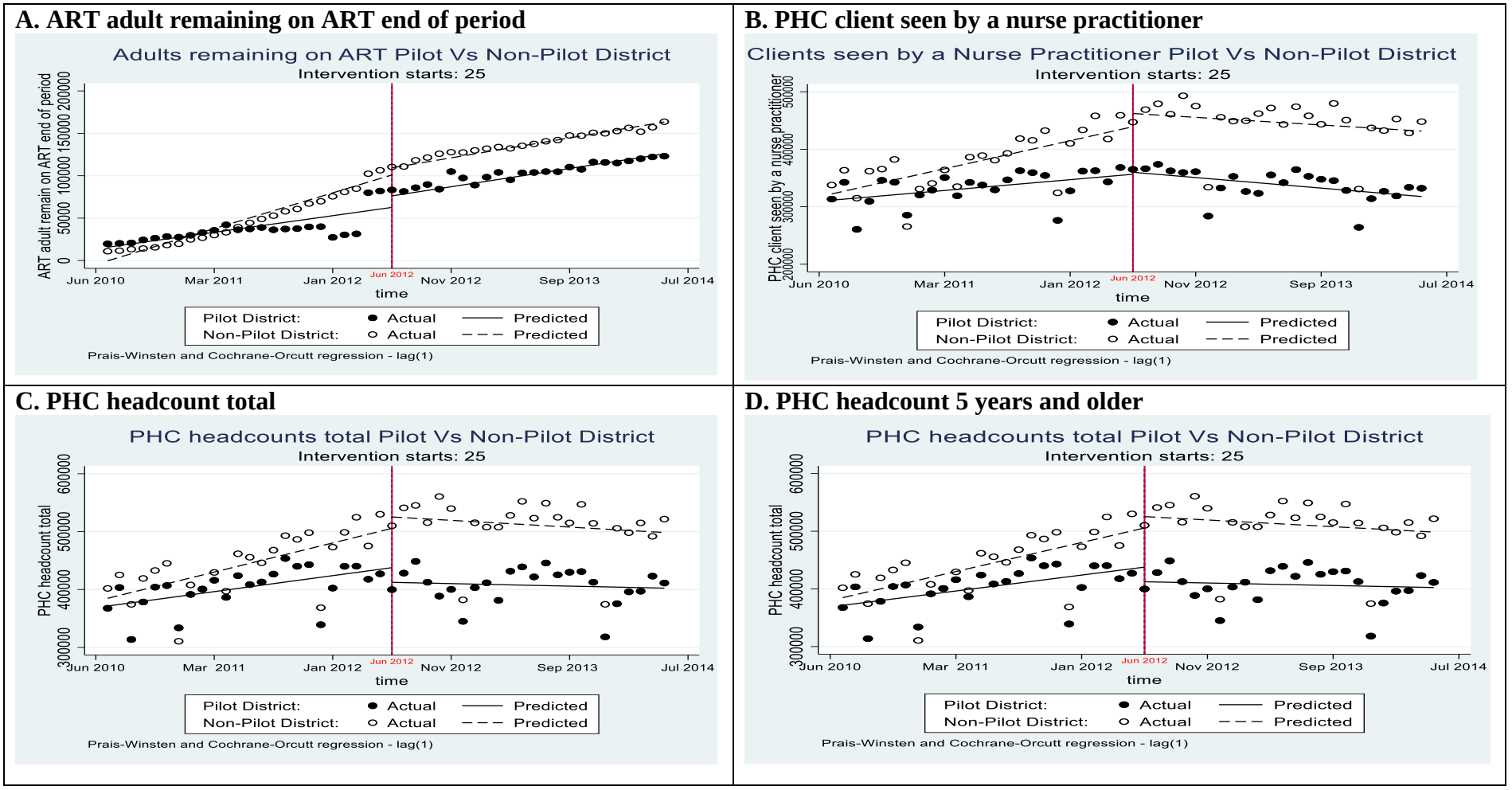


Figure 4-2: (A-D) CITSA for the PHC indicators

The dots represent monthly data collected for each variable from June 2010 to May 2012 whilst the straight lines are for the trend. The middle red line corresponds to June 2012 which is the transition for before to after implementation of National Health Insurance pilot project.

Table 4-3: (A-D) CITSA summary statistics for the PHC indicators

A. ART adult remaining on ART end of period: ***Total number of adults remaining on treatment for HIV at the end of the reporting month***			
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	**1 6043 (952, 31134)**	7 593	**0.037**
Difference: Mean baseline slope (Base trend) (β_5)	**-2 262 (-3919, -606)**	834	**0.008**
Difference: Pre-Post trend (Change in level) (β_6)	2 065 (-175, 4 306)	1 127	0.070
Difference: Trend post-intervention (Change in trend) (β_7)	-197 (-1 020, 627)	415	0.636
Durbin-Watson statistic (original) = 1.2, Durbin-Watson statistic (transformed) =1.8			
B. PHC client seen by a nurse practitioner: ***PHC client of any age consulted and/or treated by a professional nurse for a Primary Health Care service***			
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	-10 873 (-44 831, 23 085)	17 087	0.526
Difference: Mean baseline slope (Base trend) (β_5)	**-2 994 (- 5 450, -539)**	**1 235**	**0.017**
Difference: Pre-Post trend (Change in level) (β_6)	2 483 (-849, 5 816)	1 677	0.142
Difference: Trend post-intervention (Change in trend) (β_7)	-511 (-2 770, 1 750)	1 138	0.654
Durbin-Watson statistic (original) = 2.0, Durbin-Watson statistic (transformed) =2.0			
C. PHC headcount total: ***All individual clients seen for Primary Health Care. Clients of all ages attending the facility for Primary Health Care***			
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	-13 300 (-52 220, 25 618)	19 584	0.499
Difference: Mean baseline slope (Base trend) (β_5)	-2 273 (-5 160, 614)	1 453	0.121
Difference: Pre-Post trend (Change in level) (β_6)	3 004 (-1 048, 7 055)	2 039	0.144
Difference: Trend post-intervention (Change in trend) (β_7)	731 (-2 100, 3 566)	1 426	0.610
Durbin-Watson statistic (original) =2.0, Durbin-Watson statistic (transformed) =2.0			
D. PHC headcount 5 years and older: ***All individual clients 5 years and older seen for Primary Health Care***			
Parameter	**Coefficient ((95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	-3 226 (-33 544, 27 092)	15 256	0.833
Difference: Mean baseline slope (Base trend) (β_5)	-1 985 (-4 216, 245)	1 122	0.080
Difference: Pre-Post trend (Change in level) (β_6)	2 954 (-207, 6 116)	1 591	0.067
Difference: Trend post-intervention (Change in trend) (β_7)	969 (-1 282, 3 220)	1 132	0.395
Durbin-Watson statistic (original) = 2.0, Durbin-Watson statistic (transformed) =2.0			

4.4 Discussion

Our findings using ITSA showed 65% and 32% increase in number of adults remaining on ART in the pilot and non-pilot districts respectively. However, CITSA found a difference in base level and base trend but not in post-intervention parameters. Both districts showed an increase in clients seen by a NP using ITSA of 2% pilot and 6% for non-pilot, but a difference in only base trend using CITSA. ITSA on total headcounts and five years and older clients showed a 2% decrease in both districts for the earlier, but an increase of 1% and 5% in the pilot and non-pilot districts respectively for the latter. CITSA found no differences in all parameters

before and after the intervention. These findings are suggestive of an overall improvement in PHC indicators except utilisation over the study period which is not attributable to implementation of the MPs contracting of the NHI pilot programme.

A comparison of adults remaining on ART between the two districts using ITSA showed a differential increase of 65% for the pilot and 32% for the non-pilot district. An increase for the earlier analysed singly may suggest a causal effect of MPs contracting in the pilot district which is in line with findings of an impact study on NHI pilot districts comparing data from 4 months prior to placing private MPs and the last 4 months of their placement[32]. Similarly, findings of increased utilisation of PHC services post-implementation of a UHC programme were observed in Burkina Faso[33], Ghana[34], China[35], Mexico[36], and Rwanda[37]. However, a CITSA comparison found that despite prior difference in base level and trend before, after the intervention there was no change in all parameters. Given that the project was only implemented in the pilot district, this finding suggests that the outcome could be attributable to an intervention common to both districts. Thus, the increase in the number of adults remaining on ART in the pilot district cannot entirely be attributable to the implementation of the MPs contracting of the NHI pilot project. It may be attributed to roll-out of HIV testing and ART in all districts and the morbidity transition in South Africa, which increased from 2010 and peaked in 2012[38]. This is also in line with HIV/AIDS treatment programme milestones such as increased testing and ART initiation as a result of NDoH significant increase in resource allocation and peak of PEPFAR support in 2012[17,39]. Differential findings between ITSA and CITSA attributable to different interventions aside from MPs contracting of the NHI pilot programme illustrate the strength of our approach in this study.

As core providers of services in PHC facilities, it was important to determine the effect of private MPs contracting on the headcounts for clients seen by a NP[40]. They provide PHC services such as reproductive, maternal and child health. Comparison of pre to post intervention

independently using ITSA showed increases of 2% and 6% in pilot district and non-pilot district respectively. This could potentially lead to a compromise of quality of PHC services due to increased workload for the NPs[41]. However, the predicted plots given the post-intervention trends show that after the intervention, there will be a predicted decline in both districts. This is a positive finding in that excessive workload on NPs has been associated with dissatisfaction with work, burnout and stress[42,43,44]. Conversely, on comparing the two districts using CITSA, the only difference was in base trend but not in any other measured parameters. This may be due to a confounder that was implemented in both districts such as other aspects of PHC re-engineering, namely establishment of municipal Ward based PHC Outreach Teams (WBOTS), Integrated School Health programme (ISHP) and District Clinical Specialist Teams (DCST) in all districts [45,40].

PHC headcounts total were found to be equivalent to sum of headcounts for clients seen by a NP and by public MPs before NHI pilot project and after to headcounts of clients seen by a NP public MPs and private MPs. On comparison of PHC headcounts total and those five years and above using ITSA, it showed an increase of 2% and 5% respectively in the pilot and the non-pilot district. This could be explained by in-migration which over the period of the study was found to be higher in the non-pilot than in the pilot district[46]. However, in the pilot there was a 2% decrease in both data elements, a reduction in utilisation of PHC services after the introduction of NHI pilot project which is in contrast to findings in other developing countries[47,48,49]. This could be explained by the difference in the contracting models between South Africa and other countries where health insurance was extended to underserved communities and healthcare providers compensated by the insurance fund for their services. However, the contracting model for MPs implemented in the first phase of NHI pilot districts in South Africa was for contracted MPs to be physically placed at PHC facilities and compensated by way of a salary irrespective of number of patients seen. Nevertheless, there was no difference in all the parameters of CITSA.

In all the measured variables using CITSA, it was clear that after the implementation of NHI pilot project, there was no difference in parameters when compared with non-pilot districts. However, in the ITSA there was an improvement in the selected data elements. These findings show that in as much as there was no effect attributable to implementation of the MPs contracting of the NHI pilot project in pilot districts, there were positive findings in both districts. These findings may be attributable to implementation of programmes common to both districts. Before MPs contracting in the implementation of the NHI pilot project was added as

the fourth stream of PHC reengineering in 2012, the NDoH had been implementing three other streams at PHC level since 2011 in all districts[45]. It may be that these had a positive effect on PHC in the districts.

Effects of contracting private providers on utilisation of PHC services in the context of our study sites may also have been influenced by other confounders such as sociodemographic factors and other health reforms implemented around the same time[50]. These include population density, access to PHC facilities, quality of care and epidemiological transition [51]. From 2010 to 2015, HIV/AIDS became the biggest contributor to the burden of disease in South Africa as testing and treatment became readily available resulting in increased demand for health services due to scale-up of HIV/AIDS treatment[38]. However, studies informing decisions to implement UHC did not take this into consideration[52].

Despite the existence of an association between perceived quality of health care and utilisation[49], our study inferences were limited by lack of a quality measure. However, a postulation can be made to explain the findings. Of the four outcomes under investigation, only the number of people remaining on ART comparing pre- to post-MPs contracting showed a significant increase in both districts, but the others reduced or minimally increased. This could be explained by the fact that an increase in provision of ART has significantly reduced morbidity in the districts to an extent where utilisation for other HIV related health services has reduced[40]. Thus, we can hypothesise that providing ART to all HIV positive people will lead to a reduction in utilisation of PHC services and workload. However, inferences of the perceived quality of care at the PHC level can be made from the utilisation of these services at the higher levels of care[49].

There are several limitations to interpretation of our findings. Firstly, the lack of effect attributable to MPs contracting in the selected PHC data elements in the pilot district may be due to limited number of contracted MPs and in some instances the limited time they spend at the clinics[14]. By the end of 2014, there were only 77 MPs in the district working in only 17 out of the 68 PHC clinics[53]. However, an NHI report for the same period showed that contracting of MPs was more than 75% complete by the end of 2012[23]. Secondly, the presence of a statistically significant difference in base level and base trend in the CITSA comparing pilot to non-pilot district in adults remaining on ART and difference in base trend in PHC clients seen by a NP shows that our selection of a control district based on a closely matched region having similar baseline characteristics may have limited the validity of the study. However, selection

of control based on location was the only possible method as NHI pilot project is a community intervention. Thirdly, the close proximity of the two districts may have made the findings subject to contamination, substitution and migration effects[24, 46, 54]. Finally, use of secondary data (DHMIS) that is collected in a non-research setting may not be powered to detect differences between groups [55]. However, these data are subject to both random and systematic errors, which were countered by the research methodology and analytical methods, employed in the study. Our interpretation of findings also took note of any changes in the way data were measured or collected that may have taken place over the study that could limit inferences. To mitigate against these limitations, we applied robust statistical methods during the analysis.

4.5 Conclusion

Our findings suggest that the implementation of Private Medical Practitioners contracting of the National Health Insurance pilot project may not have resulted in the observed changes in PHC indicators, rather co-interventions implemented in all districts such as PHC re-engineering and other HIV programmatic shifts may have done so.

4.6 Recommendations

An understanding of the reasons behind our findings would be made by determining the perceived quality of care at the PHC level in the districts as these have an effect of utilisation of services. Since quality of care at the PHC level was beyond the scope of this study, we thus recommend that further studies be done to understand the quality of care at PHC level both perceived by patients and clinical outcomes.

4.7 Acknowledgements

We would like to acknowledge the National Department of Health and Gauteng Health Directorate of Health Information Management for allowing access and extraction of data from the District Health Management Information system.

4.8 Competing interests

The authors of this study would like to declare that there was no personal or financial interest that could have inappropriately influenced the conduct, interpretation of findings and writing of this article.

4.9 Author contributions

H.M. and J.I. conceived the presented idea. H.M. developed the theory and performed the computations. H.M. and K.O. verified the analytical methods. J.I., AF and KO encouraged H.M. to investigate using interrupted time series analysis and supervised the findings of this work. All authors discussed the results, contributed, and approved the final manuscript.

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4.11 Data availability statement

The data that support the findings of this study are available from the corresponding author [HM], upon reasonable request.

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5 CHAPTER 5: PERCEIVED QUALITY OF PRIMARY HEALTHCARE POST NATIONAL HEALTH INSURANCE PILOT IMPLEMENTATION

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5.1 Introduction

Understanding the effects of the perceived quality of Primary Health Care (PHC) is critical to the attainment of Universal Health Coverage (UHC) globally[1]. In 2019 the United Nations (UN) reaffirmed UHC with strong health systems based on the values of PHC for the provision of quality healthcare as a goal for member countries to attain by 2030[1]. Poor quality of health service has been recognised as a significant problem in developing countries[3]. In South Africa, structural challenges with the public PHC system have contributed to a perception of poor quality of services which include a shortage of staff, poor staff attitudes, long waiting times, low standards of cleanliness, drug stock-outs, poor infection control and inadequate security for both staff and clients and the non-availability of integrated patient-level health information system for data collection and reporting[2]. All this is happening at the time when the country is experiencing a convergence of epidemiological challenges as a result of HIV/AIDS and antiretroviral treatment, non-communicable diseases (NCD) such as hypertension, diabetes mellitus, asthma, cancers, cardiac diseases, mental health problems and other lifestyle-related diseases and complex social and behavioural changes and injuries[2]. The impact of these factors has been over-utilisation of Outpatient Departments (OPD) of district hospitals as clients bypass PHC facilities to receive care at a higher level due to shortage or non-existence of medical doctors at the PHC level[5]. The National Health Insurance (NHI) pilot project implemented in Tshwane and ten other districts in South Africa from 2012 as part of UHC, focusing on various health system strengthening interventions at the PHC level[6], was envisaged to address this by contracting private Medical Practitioners (MPs) to provide services in PHC clinics[7].

There are several mechanisms through which MPs were anticipated to improve the quality of PHC services. It was envisaged that MPs would, apart from seeing PHC clients, strengthen clinical governance, reduce waiting times, do infection control inspections, drug stock checks, file reviews, nurse mentoring and training and conduct morbidity and mortality reviews[3]. The outcome of this would be to not only take-on and manage complicated cases at the PHC level beyond the capacity of Nurse Practitioners (NPs) but also minimise referrals to higher levels. Thus, it was hypothesised that the presence of privately contracted MPs in the PHC facilities would lead to improvement of care at the PHC level, resulting in a reduction in workload at the higher levels of care[4]. The mechanism of this would be through MPs reducing secondary care activity by various means, including restricting referral criteria, supporting community-based

care models, investing in preventative healthcare, and promoting services to prevent readmissions[5].

Others have hypothesised that perceived improved quality of care at PHC facilities would lead to high volumes of clients and that MPs would have an increased workload, to which they would respond by increasing referrals to the next level of care[6]. However, studies have shown that the increase in the utilisation of PHC services in NHI pilot districts cannot be attributed only to the contracting of private MPs[7]. This raises questions about the appropriate measure of the quality of care in view of simultaneous implementation of other aspects of PHC re-engineering and healthcare reforms such as Ward Based Outreach Teams (WBOTS), District Clinical Specialist Teams (DCST), Centralised Chronic Medicine Dispensing and Distribution (CCMDD), Ideal Clinic Realisation and Integrated School Health Programme (ISHP) [8].

Definitions of quality of health care are varied and contested[9], just as quality measures. However, one generally accepted definition is that it is the "degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge"[10]. By this, individuals and populations perception of quality is likely to differ, making quality measurement a contested issue due to the different approaches and models for assessment. One essential requirement for a better quality of care is universal access. This, notwithstanding, Donabedian has stated that quality of healthcare can be measured from three components: structure, process and outcomes, which refers to the state of health or events that follow care that may be affected by health care[11]. However, the outcome of care, such as perceived quality, may not only be a component but a consequence of healthcare [9]. Quality of care also has an impact on the implementation fidelity of an intervention and affects the outcome[12].

Health indicators are used as a measure of outcome by the District Health Information System (DHIS) of the National Department of Health (NDoH). One of the indicators routinely collected at hospital outpatient departments (OPD) in the DHIS is the headcounts and rates of clients not-referred (self-referral) [13]. Several studies in the USA[14], and the South African provinces of Kwa-Zulu Natal[15], Limpopo[16], Western Cape[17], and in the district of Tshwane[18], have shown a directly proportional relationship between self-referrals to higher levels of care and a perception of poor quality of services at lower levels of healthcare (PHC). Other related indicators at OPD are headcounts of clients referred and follow-up[13].

Measuring perceived quality in health care is important as it differentiates effective coverage from crude intervention coverage[19]. The measurement of the perceived quality of care of a health service will help inform the implementation of NHI in many areas, such as benchmarking and measurement of programme implementation. The perceived quality of UHC is crucial because it bridges the gap between health systems building blocks and the desired health outcomes[20]. It will also help prioritise patient interest and determine the perceived appropriateness of the care they receive. These data will be imperative in informing legislation and policies to govern clients' referral from PHC to higher levels of care, suggest possible structural changes to the district health system approach, and prioritise resources and capacity building. We thus set out to determine the effect of private MPs contracting as part of the NHI pilot project on the headcounts and rates of clients not referred (self-referral) at district hospitals as a proxy for perceived quality of PHC services[16]. We used Controlled Interrupted Time Series Analysis (CITSA) in comparing headcounts and rates of self-referral before and after implementation of the programme. We hypothesise that private MPs' placement in PHC facilities would improve the perceived quality of care, leading to a reduction in onward self-referrals. To the best of our knowledge, this is the first study to determine the perceived quality of care at the PHC level using secondary data on effect at higher levels of care.

5.2 Methods

5.2.1 Study design

We used a quasi-experimental study design by Controlled Interrupted Time Series Analysis (ITSA) using DHIS monthly reports[21]. This design is recommended for evaluating a population-level intervention because it considers pre-existing secular trends and that there is a clear differentiation of the pre-intervention and the post-intervention periods[22].

5.2.2 Study setting

The study was done in district hospitals of the Tshwane NHI pilot district, Gauteng province, South Africa, which has the largest and most diverse population in terms of socio-economic status of all the NHI pilot districts[23]. The district has a population of more than 2,921,488 people receiving PHC services from 68 facilities (Facility to population ratio of 1:36 980)[24]. We compared the findings with those in a non-NHI district, Ekurhuleni, which has a higher population of 3,178,470 people with 90 PHC facilities (Facility to population ratio of 1:35 316)[25]. The selection of Ekurhuleni as a comparison district was based on the proximity of the two districts and similarities in demographic profiles[25]. Being under the same provincial governance, a uniformity of implementation of health programmes was assumed.

5.2.3 Variables and outcome measurements

We measured and compared the selected OPD indicators as they met the criteria of reflecting intended and unintended outcomes and the ability to change relatively quickly after implementing an intervention or after a clearly defined lag[22]. It was anticipated that the improvement of health care services in PHC facilities would offset workload in OPD clinics based at district hospitals[26]. The primary outcome variable was the rate of new OPD clients not referred by a PHC facility accessing services at a district hospital OPD (self-referral rate) as well as the secondary outcome of the headcounts of these self-referred clients due to difference in population size between the two districts. 'Self-referral' in the study was defined as the sum of new clients attending a general or specialist outpatient clinic without a referral letter from a PHC facility or a doctor. The measurement was used to monitor utilisation trends of PHC clients' bypassing clinics and Community Health Centres (CHCs) and the effect of PHC re-engineering on OPD utilisation. The self-referral rate was calculated using self-referred clients as a proportion of the total OPD new clients. The target for both is lower numbers, as an indication of clients entering the health system at the appropriate level of care[27]. Other variables collected were 'follow-up', defined as the sum of clients attending a general or specialist outpatient clinic for follow-up care and 'referred', defined as the sum of new clients attending a general or specialist outpatient clinic with a referral letter from a PHC facility or a doctor. The complete list of variables, definitions, use, impact model and mechanism of the impact model are shown in **Table 5-1**.

Table 5-1: Definitions and impact model of outpatient department data elements and indicators

Data Element or indicator	Definition	Use and context	Proposed impact model	Mechanism of impact model
Self-referral: OPD headcount not referred new	New clients attending a general or specialist Outpatient clinic WITHOUT a referral letter from a PHC facility or a doctor	Monitors the utilisation trends of clients who bypass PHC facilities.	Level and slope change	This is likely to reduce as patients will be seen by doctors at the PHC level first as the reason for this was the absence of doctors at PHC facilities.
Self-referral rate: OPD new client not referred rate	New OPD clients not referred as a proportion of OPD new clients – total. [{OPD headcount not referred new}] ÷ [{OPD headcount not referred new} + {OPD headcount referred new}]	Monitors utilisation trends of clients by-passing PHC facilities and the effect of PHC re-engineering on OPD utilisation. Do not include OPD follow-up and emergency clients in the denominator	Level and slope change	This is likely to reduce as patients will be seen by doctors at PHC level first as the reason for this was the absence of doctors at PHC facilities.
Referred: OPD headcount referred new	New client attending a general or specialist Outpatient clinic with a referral letter from a PHC facility or a doctor	Monitors the utilisation trends of clients who do not bypass PHC facility.	Level and slope change	This is likely to increase as doctors at PHC are required to write a referral letter when transferring patients to a higher level of care.
Follow-up: OPD headcount follow-up	Client attending a general or specialist Outpatient clinic for follow-up care	Monitors utilisation of OPD services.	Level and slope change	This is likely to reduce as some patients who bypass PHC facilities due to a lack of doctors can be adequately treated and managed at PHC level by private contracted MPs.

5.2.4 Data quality and management

District Health Information System (DHIS) monthly reports from June 2012 to May 2014 for OPD headcounts of 'follow-up', 'referred', 'self-referral' and self-referral rate in Tshwane and Ekurhuleni districts were collated. Each district hospital collected data on the clients attending outpatient services and sent these to Health Information Management (HIM) officers who create electronic formats (Excel). The data in the DHIS were complete as the values for the elements were reported for every month for the period of the study.

5.2.5 Time limits and selected data points

The unit measure for selected data points was months as per DHIS reporting. A total of 24-time periods with 12 before and 12 after implementation of MPs contracting were selected. The minimum required for ITSA is ten before and ten after implementation of a programme to have at least 80% power. The selection can detect a change level of at least five standard deviations of the pre-data if the autocorrelation is >0.4[28]. The intersection for NHI MPs contracting was informed by two annual progress reports of the NHI pilot programme for 2012[29] and 2013[30]. The 2012 report showed that despite the announcement to start the NHI pilot programme in March 2012[29], by the end of 2012 no private MPs had been contracted yet. However, the 2013 report showed that 55 MPs were active in the Tshwane district by the end of 2013[29]. We thus selected the midpoint of 2013 (June) as the intersection of the intervention.

5.2.6 Statistical analysis

We compared population characteristics from 2010 to 2014 between Tshwane and Ekurhuleni districts using data from Statistics South Africa[24]. DHIS data for OPD indicators were then collated, and a comparison of the means (average) of pre-and post-NHI indicators for the two districts was made. On further analytical comparison, we first did a single group ITSA of selected OPD secondary data elements from the DHIS[13] to project the pre-intervention trend for the post-intervention measurement as a counterfactual for each district separately. We estimated regression coefficients by the ordinary least squares method, producing Newey-West standard errors. Regression diagnostics were tested using the Cumby-Huisinga test on the error distribution to test for residual autocorrelation, which was adjusted for by Prais-Winsten regression. This was done to determine whether there was a statistically significant difference between the pre-and post-intervention slopes outside the intervention period in both districts. The series of monthly counts were assumed to follow a Gaussian distribution which is not affected by over-dispersion[28]. Seasonality was accounted for using dummy variables to define each month of the year as adjustment factors in the analysis.

The formula used for the single ITSA is as shown in **equation 5-1** below.

Equation 5-1

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 T_t + \beta_3 X_t T_t + e_t$$

Where:

- Y_t is aggregate OPD headcounts measured at t equally spaced time points
- T_t is the time elapsed since the beginning of the intervention
- *Xt* (indicator) represents the intervention
- $X_t T_t$ is an interaction term between OPD headcounts
- e_t the random error
- β_0 intercept of the line on the vertical axis (initial level of the OPD headcounts)
- β_1 slope or trajectory of OPD headcounts before the intervention
- β_2 change in the level of OPD headcounts immediately after the introduction of the intervention
- β_3 difference between the pre-and post-intervention slopes. Therefore, significant values of p at β_2 indicate an immediate intervention effect, and significant values of p at β_3 indicate an intervention effect over time.

We then used the Prais-Winsten AR(1) model of regression to perform multiple groups or Controlled Interrupted Time Series Analysis (CITSA). This allowed us to control for both the pre-intervention trends in the outcomes and for potential confounding events that would have affected both the control and the study groups. We modelled the association as a slope change rather than an immediate level change (sudden increase in headcounts/rates) because the selected outcomes were likely to change gradually as MPs were contracted. Multiple group ITSA was done according to Linden's description[31]. We estimated differences in coefficients according to the following formula for CITSA in equation 5-2 below.

Equation 5-2

$$Y_t = \beta_0 + \beta_1 T + \beta_2 X_t + \beta_3 T X_t + \beta_4 Z + \beta_5 Z T + \beta_6 Z X_t + \beta_7 Z T X_t + e_t$$

Where:

- *Z* is a dummy variable for assignment to treatment or control.
- Y_t is the aggregated outcome variable
- *t* is the equally spaced time points when measurements of outcome variable are done
- T_t is the time since the start of the study
- X_t is a dummy variable representing the intervention with pre-intervention period denoted as 0 and post-intervention denoted as 1

- X_tT_t is an interaction term
- β_0 is the intercept or starting level of the outcome variable
- β_1 is the slope of the outcome variable until the introduction of the intervention
- β_2 is the change in the level of the outcome that occurs in the period immediately following the introduction of the intervention (compared with the counterfactual)
- β_3 is the difference between pre-and post-intervention slopes of the outcome.

Stata statistical software package, version 16 (StataCorp 4905 Lakeway Drive, College Station, Texas 77845 USA), was used to perform all the statistical analyses.

5.3 Results

A pre- to a post-NHI comparison of all measured OPD indicators **(Table 5-2)** showed increases that were more pronounced in Ekurhuleni district than in Tshwane district except for the OPD headcounts not referred which were reduced. Paired t-test found a statistical difference for all variables in the two districts except for 'referred' in the non-pilot district before and after NHI MPs contracting. In comparing the two districts using the independent t-test assuming unequal variances, there were statistical differences in ‘referred’, ‘not referred’ and ‘follow-up’ except for the self-referral rate.

Table 5-2: Annual OPD data elements and indicators for Tshwane NHI pilot district and Ekurhuleni district from June 2012 to May 2014

Tshwane District				**Ekurhuleni District**			**Tshwane Vs Ekurhuleni*** **(p-value)**
	Pre-NHI (N)	**Post-NHI (N)**	**Pre Vs Post# NHI (p-value)**	**Pre-NHI**	**Post-NHI**	**Pre Vs Post# NHI (p-value)**	
Mean OPD headcount follow-up (follow-up) (N)	37 393	57 788	**<0.0001**	10 640	27 251	**0.0012**	**<0.0001**
Mean OPD headcount not referred new (self-referral) (N)	6 442	8 644	**<0.0001**	8 313	15 236	**0.0012**	**0.0001**
Mean OPD not referred new rate (self-referral rate) (N)	52.7	48.8	**0.0092**	61.4	52.9	**0.0430**	0.3478
Mean OPD headcount referred new (referred)(N)	8 418	9 636	**<0.0001**	8 031	26 127	0.5362	**0.0032**

Paired t-test

* Independent t-test assuming unequal variances

Table 5-3 shows a single ITSA comparison of pre to post NHI implementation in OPD headcounts for each district separately. There was an increase in base trend for 'self-referral' in both the pilot district {**3 387 (901, 5 873)** (p-value=**0.010**)} and the non-pilot districts {**5 399 (1 889, 8 909)** (p-value=**0.004**)} and 'referred' in the non-pilot district {**21 010 (5 407, 36 611) (**p-value**=0.011)**} but not in the pilot district. A change in base trend was also found in the non-pilot district for 'referred' {**21 010 (5 407, 36 611) (**p-value**=0.001)**} but not in the pilot district. However, for self-referral rate there was a decrease in both change in rate {**-1.7 (-2.1, -1.2) (p-value<0.0001)}** and change in trend {**-1.5 (-1.8, -1.2) (p-value<0.0001)}** in the pilot district but not in the non-pilot district.

Table 5-3: Single Interrupted Time Series Analysis for Tshwane pilot and Ekurhuleni non-pilot districts

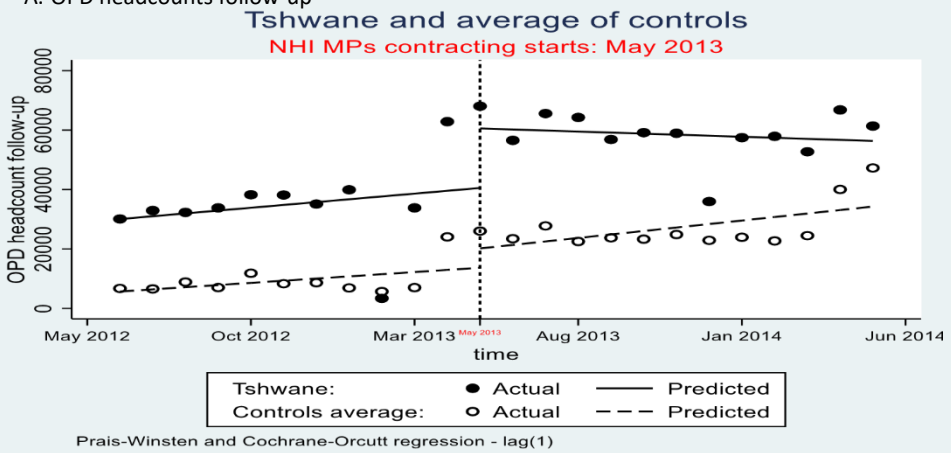
Tshwane NHI pilot project district				**Ekurhuleni non-pilot project district**		
OPD headcounts follow-up (follow-up)						
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Base level (β_0)	844 (-2 514, 4 201)	1 609	0.606	929 (-1 054, 2 913)	951	0.340
Base trend (β_1)	21 381 (-8 040, 50 804)	14 105	0.145	2 910 (-10 231, 16 052)	6 300	0.649
Change in level (β_2)	-1 268 (-4 817, 2 280)	1 701	0.465	643 (-2 340, 3 627)	1 431	0.658
Change in trend (β_3)	-423 (-1 500, 652)	516	0.4202	1 572 (-9, 3 153)	758	0.0513
Durbin-Watson statistic (original) 1.9, Durbin-Watson statistic (transformed) 2.0				Durbin-Watson statistic (original) 1.0, Durbin-Watson statistic (transformed) 1.5		
OPD headcounts not referred new (self-referral)						
Base level (β_0)	-155 (-440, 130)	137	0.270	352 (-13, 719)	50	0.8950
Base trend (β_1)	**3 387 (901, 5 873)**	**1 191**	**0.010**	**5 399 (1 889, 8 909)**	**1 682**	**0.004**
Change in level (β_2)	156 (-146, 457)	145	0.295	-369 (-785, 44)	199	0.077
Change in trend (β_3)	0.5 (-113, 116)	55	0.9934	-16 (-238, 204)	106	0.8697
Durbin-Watson statistic (original) 2.2, Durbin-Watson statistic (transformed) 2.0				Durbin-Watson statistic (original) 2.6, Durbin-Watson statistic (transformed) 2.0		
OPD headcounts referred new (referred)						
Base level (β_0)	67 (-452, 585)	249	0.792	840 (-964, 2 645)	866	0.344
Base trend (β_1)	-335 (-3 154, 2 483)	1 351	0.807	**21 010 (5 407, 36 611)**	**7 479**	**0.011**
Change in level (β_2)	151 (-670, 973)	394	0.706	-1 867 (-3 991, 258)	1019	0.082
Change in trend (β_3)	217 (-210, 645)	205	0.3018	-1 030 (-2 190, 131)	555	0.0791
Durbin-Watson statistic (original) 0.9, Durbin-Watson statistic (transformed) 1.5				Durbin-Watson statistic (original) 2.0 Durbin-Watson statistic (transformed) 1.9		
OPD headcounts not referred new rate (self-referral rate)						
Base level (β_0)	0.2 (-0.2, 0.6)	0.9	0.339	1.4 (-0.1, 2.8)	0.7	0.058
Base trend (β_1)	3.8 (-0.7, 8.4)	2.2	0.096	**-19 (-30, -9)**	**5**	**0.001**
Change in level (β_2)	**-1.7 (-2.1, -1.2)**	**0.2**	**<0.0001**	-1.1 (-2.6, 0.3)	0.7	0.121
Change in trend (β_3)	**-1.5 (-1.8, -1.2)**	**0.1**	**<0.0001**	0.2 (-0.3, 0.8)	0.2	0.3470
Durbin-Watson statistic (original) 3.1, Durbin-Watson statistic (transformed) 2.3				Durbin-Watson statistic (original) 2.5, Durbin-Watson statistic (transformed) 1.9		

Table 5-4 and **Figure 5-1** show differences in CITSA parameters of OPD headcounts between the pilot district (reference) and non-pilot district (control). There were differences in headcounts {**24 382 (14 643, 34 121)** (p-value **<0.0001**)} for follow-up, trend {**-516 (-969, -66) (p-value =0.026)}** and change in headcounts {**529 (29, 1 029)** (p-value = **0.038**)} for self-referral, change in trend {**1293 (77, 2 508)** (p-value=**0.0376**)} for referred and change in trend {**-1.8 (-2.2, -1.1)** (p-value **<0.0001**} for self-referral rate.

Table 5-4: (A-D) Controlled Interrupted Time Series Analysis comparing Tshwane pilot to Ekurhuleni non-pilot districts

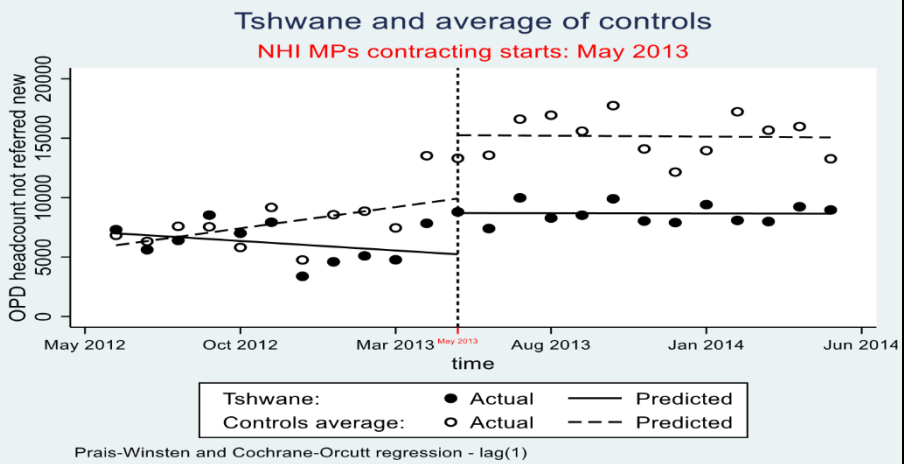
A. OPD headcounts follow-up: *Client attending a general or specialist Outpatient clinic for follow-up care*			
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	**24 382 (14 643, 34 121)**	**4 819**	**<0.0001**
Difference: Mean baseline slope (Base trend) (β_5)	223 (-3 511, 3 956)	1 847	0.905
Difference: Pre-Post trend (Change in level) (β_6)	-1 745 (-5 959, 2 468)	2 085	0.407
Difference: Trend post-intervention (Change in trend) (β_7)	-1 520 (-3 200, 156)	831	0.074
Durbin-Watson statistic (original)= 1.7, Durbin-Watson statistic (transformed)=1.9			
B. OPD headcounts not referred new self-referral: *New clients attending a general or specialist Outpatient clinic WITHOUT a referral letter from a PHC facility or a doctor*			
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	1008 (-885, 2 901)	937	0.288
Difference: Mean baseline slope (Base trend) (β_5)	**-516 (-969, -66)**	**223**	**0.026**
Difference: Pre-Post trend (Change in level) (β_6)	**529 (29, 1 029)**	**247**	**0.038**
Difference: Trend post-intervention (Change in trend) (β_7)	11 (-233, 256)	121	0.9247
Durbin-Watson statistic (original)= 2.3, Durbin-Watson statistic (transformed)=2.1			
C. OPD headcounts referred new referred: *New client attending a general or specialist Outpatient clinic with a referral letter from a PHC facility or a doctor*			
Parameter	**Coefficient (95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	5 915 (-813, 12 643)	3329	0.083
Difference: Mean baseline slope (Base trend) (β_5)	-784 (-2 686, 1 119)	941	0.410
Difference: Pre-Post trend (Change in level) (β_6)	**2 077** (-187, 4 340)	1120	0.071
Difference: Trend post-intervention (Change in trend) (β_7)	**1293 (77, 2 508)**	**601**	**0.0376**
Durbin-Watson statistic (original)=1.9, Durbin-Watson statistic (transformed)=2.0			
D. OPD headcounts not referred new rate self-referral rate*: New OPD clients not referred as a proportion of OPD new clients.*			
Parameter	**Coefficient ((95% CI)**	**Standard Error**	**p-value**
Difference: Initial mean level (Base level) (β_4)	1.5 (-5.7, 8.8)	3.7	0.685
Difference: Mean baseline slope (Base trend) (β_5)	-1.2 (-2.6, 0.1)	0.7	0.076
Difference: Pre-Post trend (Change in level) (β_6)	-0.5 (-1.9, 0.88)	0.7	0.447
Difference: Trend post-intervention (Change in trend) (β_7)	**-1.8 (-2.2, -1.1)**	**0.3**	**<0.0001**
Durbin-Watson statistic (original)= 2.7, Durbin-Watson statistic (transformed)=1.9			

A. OPD headcounts follow-up



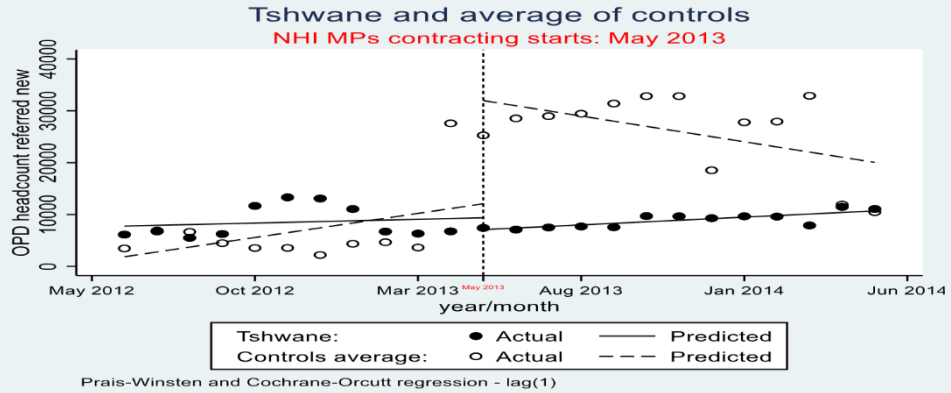
Before and after NHI pilot project OPD headcounts follow-up in the pilot district was significantly higher than in the non-pilot district. However, after NHI pilot project there the trend was increasing in the non-pilot and decreasing in the pilot, but this difference was not statistically significant.

B. OPD headcounts new self-referral



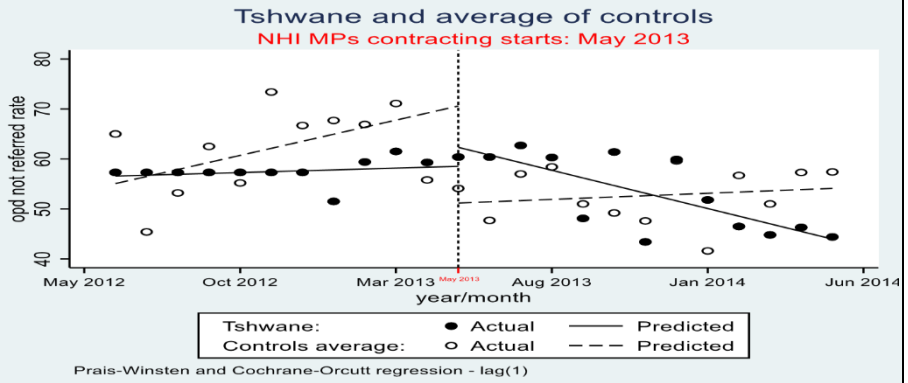
Before NHI pilot project there was difference in trend despite similarity in level in OPD headcounts of self-referrals. However, after implementation, there was a difference in level despite similarity in trend.

C. OPD headcounts new referred



Despite similarity in level and trend of OPD headcounts referred before NHI MPs contracting, after there was a significant difference in post intervention trend.

D. OPD headcounts new self-referral rate



Before the NHI pilot project, there was no significant difference in baseline and slope. After NHI pilot project, there was a decrease in both level and trend for self-referral rate in the pilot than in the non-pilot district.

Figure 5-1: Controlled Interrupted Time Series Analysis graphs for OPD headcounts

5.4 Discussion

Our findings were based on ITSA, which compared pre- to post-intervention level and trends of OPD headcounts in a pilot and a non-pilot district separately and CITSA that compared headcounts/rate and trends between the two districts before and after NHI's MPs contracting. Analysis of our findings using ITSA shows that after the NHI's MPs contracting implementation, there was an increase in the trend for self-referral in both districts and for referred in the pilot district. However, there were decreases in both headcounts/rate and the trends in the pilot district and non-pilot district for self-referral rate. In comparing the two districts using CITSA, there were statistically significant differences in the headcounts/rate for 'follow-up', trend, and headcounts for self-referral, the trends for referred and self-referral rate. In comparing before and after MPs contracting using ITSA, there were statistically significant monthly increases in 'self-referral' of about 3400 clients in the Tshwane district. Similarly, in the Ekurhuleni district, the monthly increase was about 5400. This confirms previous findings of bypassing of PHC services potentially leading to overburdened district hospitals and underutilisation of PHC services due to self-referral which can lead to wastage and poor allocation of resources[23]. The differential findings between the two districts were supported by findings of monthly decreases for both self-referral rate and trend in the post-intervention period of 1.7 and 1.5 in the rate respectively in the pilot, but not in the non-pilot district. The findings were also confirmed by the CITSA findings of a difference in the monthly decrease in the post-intervention trend for the self-referral rate of 1.8 and a monthly increase of 1293 in the post-intervention trend for 'referred' in the pilot district compared to the non-pilot district. These CITSA findings of a reduction in self-referral and self-referral rate could be explained by the implementation of MPs contracting in the pilot district and are in line with findings in countries that have implemented some form of UHC with strong PHC such as the United Kingdom (UK) and contrast to those without such as the United States of America (USA)[41]. The mechanism of action could improve perception of the quality of healthcare at the PHC level because of the presence of NHI contracted MPs which has resulted in some clients not seeking primary care in hospitals as per the hypothesis of our study. Conversely, the increase in 'referred' could be explained by MPs' response to an increased workload at the PHC level. There was an absence of an immediate increase but rather a gradual one post-intervention as evidenced by an absence of a level change in 'self-referral rate' but an increase in its post-intervention trend only[11], or an identified need for higher level of care by MPs in clients historically treated by NPs.

The increase in the utilisation of OPD services post MPs contracting is similar to those in countries that have implemented UHC programmes such as Brazil, Chile, Ghana, Mexico and Rwanda[32]. However, there are differences between the UHC models, epidemiological profiles, timing of evaluation and funding mechanism. For example, in Ghana, the National Health Insurance Scheme (NHIS) that began operations in 2005, was implemented by providing insurance for citizens to access care at public and private providers. Thus, in a study done in 2012 (7 years after initiation of NHIS), the UHC programme had led to increased utilisation of both outpatient and inpatient services. This study did not disaggregate PHC to OPD services even if both clinics and district hospitals were included in the study[43]. Similarly, in Rwanda, even if the Mutual Health Insurance (MHI) programme was scaled up in 2005, by 2007, an increase in the utilisation of health services was already noted, which coincided with stabilisation and reduction in the HIV disease burden in the country[33].

The statistically significant CITSA difference in OPD follow-up headcounts between the two districts of more than 24000, shows that despite having a lower population and higher medical insurance coverage, there is a higher burden of disease on the district hospitals in the pilot compared to the non-pilot district. This could be explained by a non-optimal down referral mechanism from the district hospital to the PHC facilities in the pilot district[34].

The findings of this study as well as those found in Singapore that also had private medical providers contracting as part of UHC interventions[35], illustrate important lessons for the NHI in South Africa. There is a need to develop the capacity of PHC facilities and create organisational structures that would enhance coordination of activities between them and district hospitals by improving down referral and supportive supervision of the PHC team by clinical specialists. This finding is crucial in addressing the immediate significant MP shortages and capacity at the PHC level and realising the broader vision of a single integrated system as envisaged by NHI.

There are several limitations to the interpretation of our findings. Firstly, the use of secondary data such as DHIS, which were not intended for the specified research question, may be incomplete and the interpretation limited. For example, we are not able to conclusively determine that the high number of follow-up headcounts in the pilot district is due to non-optimal down referrals as there is no data collected for this indicator both at the PHC and OPD level. However, the pre-selected data elements used in this study were complete in that they

were reported for every month of the period under consideration. Secondly, the proximity of the two districts being compared could have led to population contamination, substitution, and migration effects. However, this effect could also be considered negligible as the population growth in both districts was similar.

5.5 Conclusion

Our findings suggest that the implementation of private medical practitioners contracting as part of the National Health Insurance pilot project in primary healthcare facilities in the Tshwane district may have resulted in the decrease in self-referrals at district hospitals. Thus, it could have resulted from an improvement in the perceived quality of healthcare at the PHC level. Despite a general reduction in the selected OPD headcounts, the follow-up at the district hospital level was high in the Tshwane district, suggesting an increased workload for staff at district hospitals after private MPs were contracted to work at PHC facilities.

5.6 Recommendations

We recommend that with the implementation of NHI, the down referral systems from district hospitals to PHC facilities and their capacity in managing conditions dictated by the epidemiological transition should be improved.

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6 CHAPTER 6: MODELLING AND FORECASTING OF PRIMARY HEALTHCARE UTILISATION, PERCEIVED QUALITY OF CARE AND NON-EMERGENCY REFERRALS TO HOSPITALS IN A NATIONAL HEALTH INSURANCE PILOT DISTRICT OF SOUTH AFRICA

Mukudu H, Otwombe H, Fusheini A, Igumbor J: Submitted to Southern African Journal of Public Health

6.1 Introduction

The World Health Organisation (WHO) set 2030 as the year by which member countries should have attained universal health coverage (UHC) by addressing challenges facing public health care [1,2], including strengthening health systems. This attainment of UHC is critical for Sub-Saharan Africa, which has the worst access to health services despite accounting for 25% of the global burden of disease[3]. In 2012, the South African Government (SAG), through the National Department of Health (NDoH), introduced the National Health Insurance (NHI) pilot programme in 10 districts, including Tshwane, as a strategy toward this goal[4,5]. The first phase of the NHI pilot programme focusing on strategies to improve primary health care (PHC) services, was envisaged to be implemented over five years[6]. These strategies include: the ideal clinic realisation and maintenance (ICRM) model incorporated into the district health system (DHS) with a robust bi-directional referral system[7], ward-based PHC outreach teams (WBPHCOTs), integrated school health programme (ISHP), district clinical specialist teams (DCST), contracting of private non-specialised medical practitioners (MPs) [4,8,9], centralised chronic medicine dispensing and distribution programme (CCMDD) [10], health patient registration system (HPRS) [11] and stock visibility system (SVS) [12]. Implementing these strategies was anticipated to improve access to appropriate and efficient quality of care at the PHC level and offset the burden on the OPD[6].

Nearly nine years after the launch of the NHI pilot programme, studies have yet to be conducted to assess the interdependencies and relationships between PHC and OPD indicators and forecasted utilisation to 2025 toward the 2030 goal. This information is crucial because, in public healthcare, PHC is the entry point for non-emergency patients referred to OPDs for higher levels of care as per identified need[13]. However, previous studies found that due to the perceived poor quality of PHC services, some patients enter the health system at higher levels of care[14, 15]. Similarly, adherence to referral guidelines could have been better from the PHC and OPDs [16,17]. In the immediate post-NHI pilot implementation in the Tshwane district, some studies showed a decrease in utilisation of PHC services and an improvement in the perception of the quality of PHC services, as evidenced by a reduction in self-referral headcounts in OPD[18,19], but the long-term impact is not known. Despite the success of the NHI pilot evaluation report[20], several gaps in the provision of PHC exist, such as the lack of medical equipment, inadequate monitoring of contracted MPs, lack of critical medical specialists, lack of integration of different aspects of the project, and inability to adequately monitor the effectiveness of the referral system[20]. Notably, NHI pilot implementation coincides with the

changing epidemiological profile in South Africa from HIV/AIDS to convergence with and a possible shift to non-communicable diseases (NCDs) [21,22]. However, PHC services have predominantly been capacitated for and provided HIV/AIDS services and related conditions for the past few years[23]. Thus the rationale for contracting private MPs at the PHC level is part of the NHI[24].

Understanding the interdependencies and relationships between PHC and OPD indicators is key to forecasting service utilisation. As an essential health outcome indicator, utilisation is needed to measure and plan for roll-out[25], understand consumer satisfaction, determine access to care, and can be used as a benchmark to guide health policy and resource allocation[26]. Given the above, it is crucial to determine how implementing the NHI pilot programme has affected the relationship between PHC and OPD services, given the different categories of staffing providing these services. This information is vital in determining the capacity of PHC facilities that will be needed in the long term as the epidemiological profile evolves[27]. The focus of this study was to empirically analyse the relationship between selected PHC and OPD utilisation indicators in a pilot NHI district and then forecast to 2025.

6.2 Methods

6.2.1 Research design

This quasi-experimental ecological study used secondary data routinely collected monthly in the district health information system (DHIS) by the Gauteng Department of Health (GDoH) between January 2010 and December 2019.

6.2.2 Study setting

The study was conducted in the Tshwane District of Gauteng Province, which is one of the NHI pilot districts in South Africa. It has a population of 2,921,488 people[28], receiving PHC services from 68 public facilities (PHC facility ratio of 1:36 980)[29], and referral services from 12 hospitals (five districts, one regional, one provincial tertiary, two national central, and three specialised)[30].

6.2.3 Study population

We studied the population of adults and children aged five years and older, utilising non-emergency public PHC and OPD services in the Tshwane district from January 2010 to May 2019. The population represents the people targeted at UHC in the district. OPD clients utilising specialised and emergency services at hospitals were excluded because they do not have direct interaction with PHC facilities.

6.2.4 Data collation and management

We used routinely collected secondary data from monthly reports from the District Health Information System (DHIS)[31]. The selection of variables **(Table 6-1)** and time points was based on several considerations. We use quarterly data by combining three monthly reports into quarters of a year. The PHC data elements and indicators were due to the focus on implementing the first phase of the NHI pilot programme. We also included HIV/AIDS, diabetes mellitus (DM), and hypertension (HTN) data elements and indicators at the PHC level because of the prevailing epidemiological profile in South Africa[22].

Table 6-1: Definitions and short formats of selected PHC and OPD Indicators

Variable	Variable definition	Short format
Out-Patient Department headcount not referred new	New clients attending a general or specialist Outpatient clinic WITHOUT a referral letter from a PHC facility or a doctor.	*OPD_not_ref*
Out-Patient Department headcount referred new	New client attending a general or specialist Outpatient clinic with a referral letter from a PHC facility or a doctor.	*OPD_ref*
Out-Patient Department headcount follow-up	Client attending a general or specialist Outpatient clinic for follow-up care.	*OPD_follow_up*
Primary Health Care headcounts total	Clients of all ages attending the facility for Primary Health Care. Each client is counted once a day regardless of the number of services provided on that day	*PHC_total*
Primary Health Care, diabetes client treatment new	Newly diagnosed clients with a fasting blood glucose of > 7mmol/L or random blood glucose >11.1mol/L	*PHC_DM_new_clients*
Primary Health Care client seen by public doctor	A PHC client of any age consulted and/or treated by a doctor employed in the public sector for a Primary Health Care curative and preventative service	*PHC_public_MP*
Primary Health Care client seen by professional nurses	A PHC client of any age consulted and/or treated by a professional nurse for a PHC service.	*PHC_PN*
Primary Health Care ART adult remain on ART at end of period	Total adults remaining on ART (Adult TROA) at the end of the reporting month are the sum of the following: Any adult that has a current regimen in the column designating the month being reported on. Any adult who is not yet considered loss to follow-up (LTF) in the column designating the month being reported on. Clients remaining on ART equals [naïve (including Post Exposure Prophylaxis and Prevention of Mother To Child Transmission) + Experienced (Exp) + Transfer in (TFI) + Restart] minus [Died (RIP) + loss to follow-up (LTF) + Transfer out (TFO)]	*PHC_ART_remain*

6.2.5 Ethics

Ethics approval for this study was obtained from the University of Witwatersrand Human Research Ethics Committee (HREC) (certificate number: M180956). The DHMIS data were aggregated at the district level; thus, they did not contain identifiers.

6.2.6 Statistical analysis

Since the study data types were continuous, they were initially evaluated descriptively using means (standard deviations) and medians (interquartile ranges). The range was evaluated using minimum and maximum values.

We employed a particular case of vector autoregression (VAR) of multivariate time-series regression analysis called the vector error correction model (VECM). This model was developed to determine the interdependence and dynamic relationship between indicators of PHC and OPD services. We conducted a natural log transformation of all time-series data to enhance additivity, linearity, and validity[32]. The model combines levels and differences of nonstationary multiple time-series data without differencing, ensuring long-run relationships among the integrated variables by adding an error correction term (ECT) to the VAR system[33,34]. The significance of the t-statistic on the ECT parameter indicates evidence of a long-run relationship and long-run causality between the variables[35]. Thus, unlike VAR, the VECM allows for stationary and nonstationary variables analysis. It can also be used as a dynamic system that forecasts the impact of one variable on another by directly indicating the speed of adjustment of one variable to restore equilibrium after a change in another variable[36]. The general model equation is as shown in equation 6-1 below[37].

Equation 6-1

$$Y_t = \alpha + \beta T + \gamma Y_t - 1 + \sum_{i=1}^{n} \delta_t Y_t - i + \epsilon_t$$

Where:

- $Y_t = \mathrm{N} - \mathrm{Dimensional\ time\ series}$
- α=Intercept
- T=Trend
- $\gamma = \mathrm{Matrices\ with\ coefficient\ parameters}$
- $\delta_t - i = \mathrm{lagged\ time\ series}$
- ϵ=Residuals

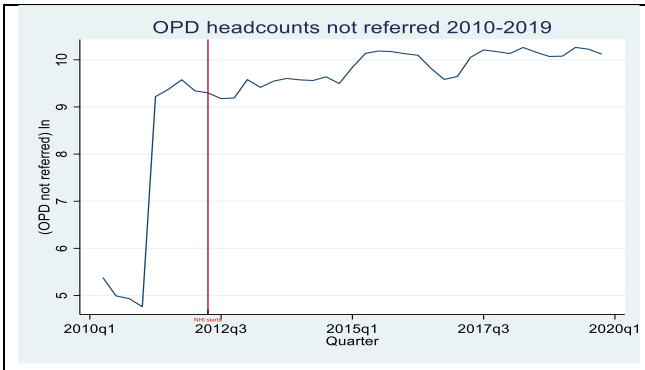
We first determined the level of lags at which variables are interconnected or endogenously obtained because of the sensitivity of causality and the number of lags. Lags were selected using information criteria: Akaike's information criterion (AIC), Hannan–Quinn information criterion (HQIC), and Schwarz Bayesian information criterion (SBIC), with the lowest being the best[35]. Stationarity was assessed using both graphical means and the Augmented Dick Fuller (ADF) test to confirm the stability of each time series[34]. The Johansen cointegration test was conducted to evaluate cointegration, defined as a statistical method used to test the correlation between two or more nonstationary time series in the long run or for a specified time period[38]. We subsequently developed a VECM model for error correction[33]. Additionally, an error correction bias test was conducted using the Granger causality test to determine whether one time series is useful for forecasting another. If the probability value is less than any α level, the hypothesis is rejected at that level[33]. If a causal relationship exists between each time series, future variables can be predicted; thus, we employed the VECM relationship between variables in the model to forecast data for 2025[39].

All statistical analyses assumed a two-sided hypothesis with 10% and 5% significance levels. Analyses were conducted using STATA 16.1, StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX, StataCorp LLC[40].

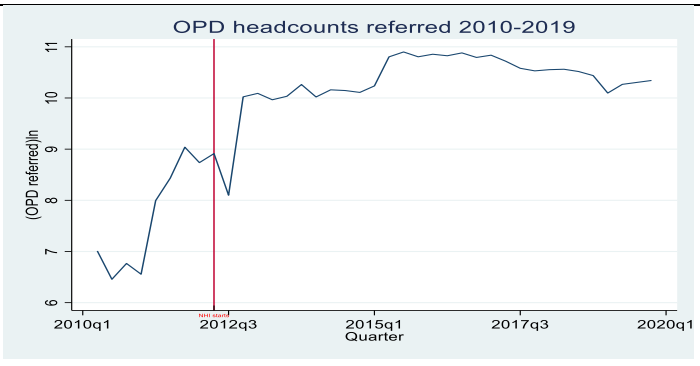
6.3 Results

The basic statistics of the time-series data of the selected PHC and OPD indicators are listed in **Table 6-2.** Approximately 1.4% of PHC clients self-referred to OPD centres in a quarter. In comparing PHC and OPD follow-up, there were 6.7 times more patients being seen at the PHC than at the OPD. A comparison of the categories of staff that saw patients at the PHC level showed that 91% of the clients were seen by professional nurses compared with 7% seen by public MPs, meaning that only 2% were seen by private MPs.

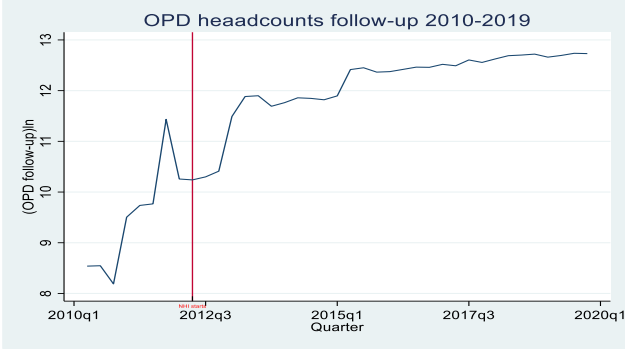
Figure 6-1 shows that since the implementation of the NHI private GP contracting pilot programme, there has been a gradual increase in the selected OPD indicators: *OPD_not_ref (1.a) and OPD_ref (1.b), OPD_follow_up (1.c)* and *PHC_ART_remain (1.h).* There was also a marginal decline in *PHC_public_MP (1.d), PHC_PN (1.e), and PHC_total (1.g). PHC_DM_new_ client (1.f)* remained relatively constant.



6.a



6.b



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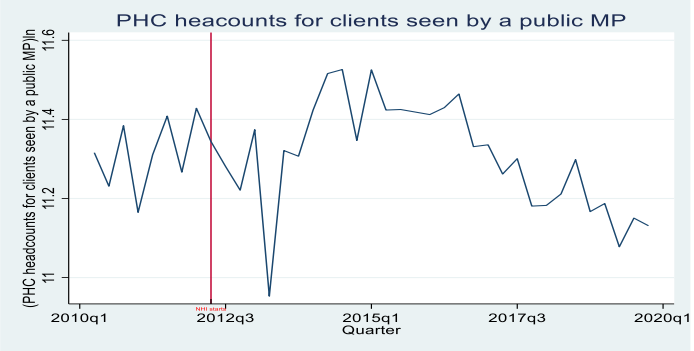

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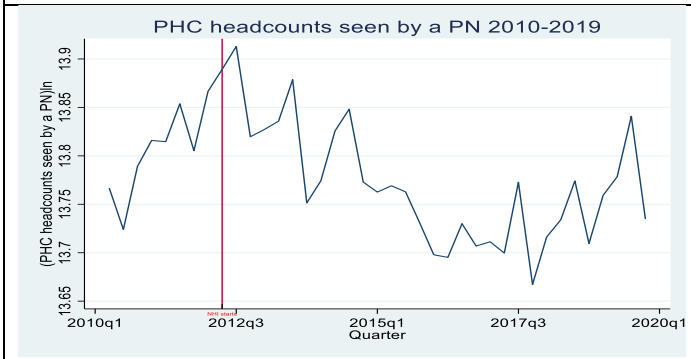
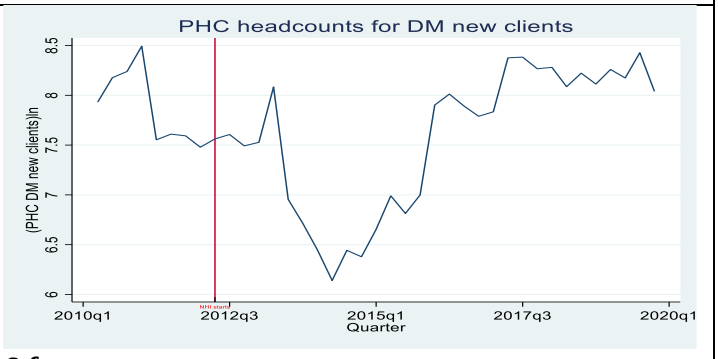


6.e



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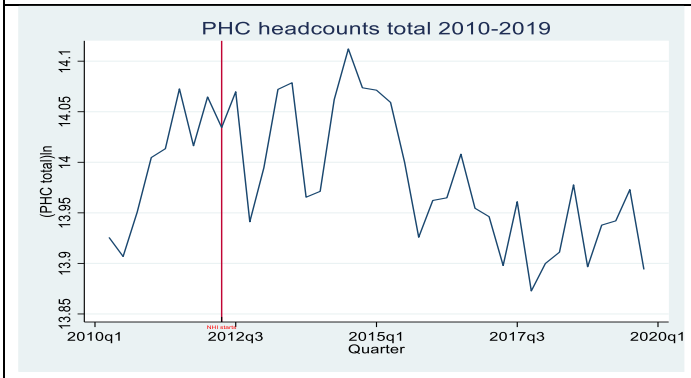

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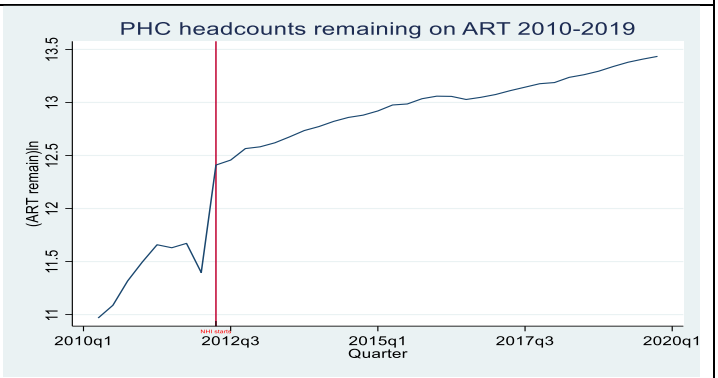

6.h

Figure 6-1: (a-h) Trend of selected OPD and PHC headcounts by time series data from 2010-2019

The unit root test **is shown in Table 6-2** to confirm the stability of each time series variable. It showed that the null hypothesis could not be rejected for all the selected variables, as they had a less negative number and a non-significant p-value at the 5% level, except for *PHC_public_MP*, which had a significant p-value. These findings are confirmed by the graphs

in **Figure 6-1**, which show that all variables exhibit a downward or upward trend. Thus, the time series of all the variables cannot have a constant mean and variance. Therefore, we used a vector error correction model (VECM).

Table 6-2: Unit root test using the Augmented Dickey-Fuller Test (ADF)

Variable	T-statistics at intercept	Critical value at 5%	p-value
OPD_not_ref	-2.812	-2.964	0.0566
OPD_ref	-2.187	-2.964	0.2111
OPD_follow_up	-2.270	-2.964	0.1817
PHC_total	-2.788	-2.964	0.0601
PHC_DM_new_clients	-1.628	-2.964	0.4685
PHC_public_MP	-3.566	-2.964	**0.0064**
PHC_PN	-2.748	-2.964	0.0661
PHC_ART_remain	-2.479	-2.964	0.1208

Lag selection is shown in **Table 6-3** using Akaike's information criterion (AIC), Hannan–Quinn information criterion (HQIC), and Schwarz Bayesian information criterion (SBIC)[38] showed a selection of three lags. However, in conducting model diagnostics to test for autocorrelation, it was found that it did not exist only for lag 1 (p-value= 0.16765) and lag 2 (p-value= 0.35686).

Table 6-3: Lag selection

Lags	LL	LR	p-Value	AIC	HQIC	SBIC
0	93.8974			-4.90842	-4.7857	-4.55291
1	228.155	268.52	<0.0001	-8.92316	-7.81867	-5.72359
2	361.652	266.99	<0.0001	-12.894	-10.8081	-6.85077
3	614.541	505.78*	<0.0001	-23.6881*	-20.62*	-14.8004*

LL is the likelihood value and (*) indicates appropriate lags by information criteria.

Johannsen's cointegration test **shown in Table 6-4** confirms that at the 5% significance level, there were four cointegration relationships between the variables, as both the trace and maximum eigenvalue statistics were smaller than the critical value.

Table 6-4: Johansen Cointegration test

			Trace		Max Eigenvalue	
Rank	**LL**	**Eigenvalue**	**Trace Statistic**	**5% Critical**	**Max Statistic**	**5% Critical**
0	171.91241		278.4776	156.00	99.4968	51.42
1	221.6608	0.93206	178.9808	124.24	61.2797	45.28
2	252.30065	0.80914	117.7011	94.15	48.1683	39.37
3	276.38482	0.72797	69.5328	68.52	29.1929	33.46
4	290.98127	0.54570	40.3399*	47.21	18.9503	27.07
5	300.45644	0.40081	21.3895	29.68	10.9152	20.97
6	305.91406	0.25547	10.4743	15.41	7.6724	14.07
7	309.75024	0.18727	2.8019	3.76	2.8019	3.76

(*) Indicates that trace and the maximum eigenvalue statistic are smaller than the 5% critical value.

*Denotes rejection of the null hypothesis.

Table 6-5 shows the results of the estimation of the VEC model, which were statistically significant at the 10% level, as evidenced by the chi-square and R-squared values. To ascertain long-term causality, four error correction terms (ECT) were derived for each variable in the cointegrating relationships and the speed of adjustment coefficient, which indicates how quickly the unbalanced error deviating from the long-term balance returns to the balanced state. This was significant for all variables, except for *OPD_ref* and *PHC_DM_new_clients*. ECTs generally showed a balanced relationship between the selected PHC and OPD indicators.

Table 6-5: VECM model results for short and long-term equilibrium relationship

Error correction	**OPD_ not_ ref**	**OPD_ref**	**OPD_follow_up**	**PHC_total**	**PHC_DM_new_clients**	**PHC_public_MP**	**PHC_ PN**	**PHC_ ART remain**
Cointegrating Equation 1	-0.10	**0.29*** **	**0.35*** **	0.01	0.02	0.02	0.02	-0.06
Cointegrating Equation 2	-0.01	-0.04	-0.04	**0.02***	-0.05	0.03	0.02	**0.17*** **
Cointegrating Equation 3	0.14	**-1.04*** **	**-1.09*** **	-0.02	-0.08	0.01	-0.02	0.05
Cointegrating Equation 4	0.72	**4.46***	2.43	**-1.02*** **	-3.8	0.66	-0.33	-0.98
Constant	0.02	-0.004	0.0151	-0.0145	-0.0022	0.0163	0.0009	-0.0005
D_OPD_not_ ref	**LD** = 0.04	**LD** = -0.09	**LD** = -0.51	**LD** = 1.39	**LD** = -0.26	**LD** = -1.88	**LD** =-0.99	**LD** = -0.09
D_OPD_ref	**LD** = 0.08	**LD** = **-0.62*** **	**LD** = **0.63*** **	**LD** = -3.08	**LD** = -0.27	**LD** = -0.51	**LD** = 2.67	**LD** = **-1.91*** **
D_OPD_follow-up	**LD** = **-0.28** **	**LD** = **0.37** **	**LD** = 0.15	**LD** = 0.25	**LD** = 0.16	**LD** = 0.63	**LD** = 3.57	**LD** = **-0.72***
D_PHC_total	**LD** = 0.01	**LD** = 0.01	**LD** = 0.02	**LD** = **0.63***	**LD** = 0.02	**LD** = -0.06	**LD** = -0.10	**LD** = **0.10***
D_PHC_ DM_ new_ clients	**LD** = 0.06	**LD** = -0.02	**LD** = -0.03	**LD** = -0.62	**LD** = 0.15	**LD** = 0.70	**LD** = -0.83	**LD** = -0.17
D_PHC_public_MP	**LD** = -0.01	**LD** = 0.03	**LD** = -0.03	**LD** = -0.06	**LD** =-0.07	**LD** = -0.44	**LD** = 0.47	**LD** = 0.09
D_PHC_PN	**LD** = 0.01	**LD** = -0.01	**LD** = 0.01	**LD** = 0.23	**LD** = 0.03	**LD** = -0.04	**LD** = 0.23	**LD** = 0.08
D_PHC_ART_ remain	**LD** = 0.04	**LD** = **-0.13** **	**LD** = **-0.26*** **	**LD** = 0.11	**LD** = 0.06	**LD** = -0.09	**LD** = -0.12	**LD** =-0.16
RMSE	0.797576	0.324298	0.315851	0.041041	0.322786	0.097718	0.04048	0.116393
R-squared	0.2687	0.6835	0.6929	0.6538	0.4596	0.6631	0.5948	0.7433
Chi-square	8.083792	47.50118	49.64236	41.54355	18.70898	43.30266	32.29446	63.71525
p-value	0.8381	**<0.0001**	**<0.0001**	**<0.0001**	0.1324	**<0.0001**	**0.0022**	**<0.0001**
Information criterion	**AIC =-9.242231, HQIC = -7.400315, SBIC = -4.017632**							

*p<0.100

**p<0.05

***p<0.0001

6.3.1 Long-term equilibrium relationships

The derived cointegration equations and interpretations if the four ECTs in the long-term equilibrium relationship were 0, are shown in T**able 6-6.**

Table 6-6: Long-term equilibrium relationships

Equation	Long-term elasticities	Interpretation
[If $ECT1_t$=0] $OPD\_not\_ref_t$ =-1177 +4.2$PHC_DM_new_clients_t^{***}$ +23.1$PHC_public_MP_t^{***}$ +61.5$PHC_PN_t^{***}$ +3.7$PHC_ART_remain_t^{***}$	*PHC_DM_new_clients*, *PHC_public_MP*, *PHC_ART_remain* and *PHC_PN* were 4.2, 23.1, 3.7, and 61.5 respectively with all independent variables being significant at 1% level	A 10% increase in *OPD_not_ref* results in 42% increase in *PHC_DM_new_clients*, 231% increase in *PHC_public_MP*, 37% increase in *PHC_ART_remain* and 615% increase in *PHC_PN*.
[If $ECT2_t$=0] OPD_ref_t= -168 +0.8$PHC_DM_new_clients_t^{***}$ +7.3$PHC_public_MP_t^{***}$ + 4.1$PHC_PN_t^{**}$ +2.5$PHC_ART_remain_t^{***}$	*PHC_DM_new_clients*, *PHC_public_MP*, *PHC_ART_remain* and *PHC_PN* with respect to *OPD_ref* was 0.8, 7.3, 2.5 and 4.1 respectively, with all independent variables being significant at 5% level.	A10% increase in *OPD_ref* results in 8% increase in *PHC_DM_new_clients.* Additionally, a 73% increase in *PHC_public_MP* results in 25% increase in *PHC_ART_remain* and 441% increase in *PHC_PN.*
[If $ECT3_t$=0] $OPD\_follow\_up_t$= -312 +1.2$PHC_DM_new_clients_t^{***}$ +6.7$PHC_public_MP_t^{***}$ $^{+}$15.5$PHC_PN_t^{***}$ +2.2$PHC_ART_remain_t^{***}$	*PHC_DM_new_clients*, *PHC_public_MP*, *PHC_ART_remain* and *PHC_PN* with respect to *OPD_follow_up* were 1.2, 6.7, 2.2, and 15.5 respectively, with all independent variables significant at 1% level	A10% increase *OPD_follow_up* results in 12% increase in *PHC_DM_new_clients*. Additionally, a 67% in *PHC_public_MP* results in 22% increase in *PHC_ART_remain*, and 155% increase in *PHC_PN.*
[If $ECT4_t$=0] PHC_total_t= 9.2 +0.1$PHC_DM_new_clients_t^{**}$ +0.1$PHC_public_MP_t$ +0.3$PHC_PN_t^{*}$ -0.01$PHC_ART_remain_t$	*PHC_DM_new_clients*, *PHC_public_MP, and PHC_ART_remain* and *PHC_PN* with respect to *PHC_total* was -0.1, 0.1, -0.01 and 0.3 respectively	A10% increase in *PHC_total* results in 1% decrease in *PHC_DM_new_clients* and a 3% increase in *PHC_PN*

$^{*}p<0.100$

$^{**}p<0.05$

$^{***}p<0.0001$

6.3.2 Short-term equilibrium relationships

The short-term equilibrium relationships among the models are listed in **Table 6-7.**

Table 6-7: Short-term equilibrium relationships

Dependent Variable (↑10%)	Independent Variable 1	Independent Variable 2	Independent Variable 3
Δ*OPD_not_ref*	Δ*OPD_follow_up* (↓1.1%)	-	-
Δ*OPD_ref*	Δ*PHC_total* (↓1.5%)	Δ*PHC_PN* (↓1.2%)	
Δ*OPD_follow_up*	Δ*PHC_total* (↑1.6%)	Δ*PHC_PN* (↑1.3%)	Δ*PHC_ART_remain* (↓5.1%)
Δ*PHC_total*	Δ*OPD_follow_up* (↓19.2%)	-	-
Δ*PHC_DM_new_clients*	Δ*OPD_follow_up* (↓2%)	-	-
Δ*PHC_public_MP*	Δ*OPD_follow_up* (↑15.6%)	-	-
Δ*PHC_PN*	Δ*OPD_follow_up* (↑43.7%)	Δ*PHC_total* (↑7.9%)	-
Δ*PHC_ART_remain*	Δ*OPD_follow_up* (↓8.5%)	Δ*PHC_total* (↓4%)	Δ*PHC_PN* (↓5.5%)

Since the VECM showed that the independent variable affected the dependent variable but did not explicitly show the direction of causality, we performed a Granger causality analysis on the variables determined to have a significant effect on the model, as presented in **Table 6-8** to assess the direction that showed its existence in all the models.

Table 6-8: Granger causality test

Hypothesis	lags	Chi2	p-Value
OPD referred			
Δ *OPD_follow_up→ OPD_ref*	2	11.33	**0.0008**
Δ *PHC_ART_remain→ OPD_ref*	2	18.59	**<0.0001**
OPD follow-up			
Δ *OPD_not_ref→ OPD_follow_up*	2	6.26	**0.0123**
Δ *OPD_ref→ OPD_follow_up*	2	4.27	**0.0388**
Δ *PHC _ART_remain→ OPD_follow_up*	2	2.82	**0.0929**
PHC total			
Δ *PHC_ART_remain→ PHC_total*	2	3.04	**0.0813**
PHC client remaining on ART			
Δ *OPD_ref→ PHC_ART_remain*	2	3.99	**0.0457**
Δ *OPD_follow_up→ PHC_ART_remain*	2	15.24	**<0.0001**
Δ *PHC_total→ PHC_ART_remain*	2	0.02	0.9002

Table 6-9 and **Figure 6-2** show the forecasts for the PHC and OPD indicators for the fourth quarter of 2025. On comparing the fourth quarter of 2019 to that of 2025, the headcounts will be slightly more than twice the headcounts for OPD not referred. However, there will be a 5.4% and 5.7% decrease in the PHC total and PHC clients seen by a PN, respectively.

Table 6-9: Forecast of selected PHC and OPD headcounts

Variable	2019Q4	2025Q4	95% CI
OPD headcounts for clients not referred	24 842	26 776	-16 831, 88 130
OPD headcounts for clients referred	31 008	36 368	-37 939, 104 622
OPD headcounts for follow-up	337 945	534 412	327 682, 741 142
PHC total headcounts	1 081 677	1 166 619	633 650, 1 699 588
PHC headcounts for diabetes mellitus new clients	3 101	2 836	-6 869, 12 542
PHC headcounts for clients seen by a public medical practitioner	68 259	53 368	-35 083, 141 821
PHC headcounts for clients seen by a professional nurse	922 405	978 745	532 913, 1 424 577
PHC ART adult remain on ART end of period	683 222	1 043 182	834 506, 1 379 257

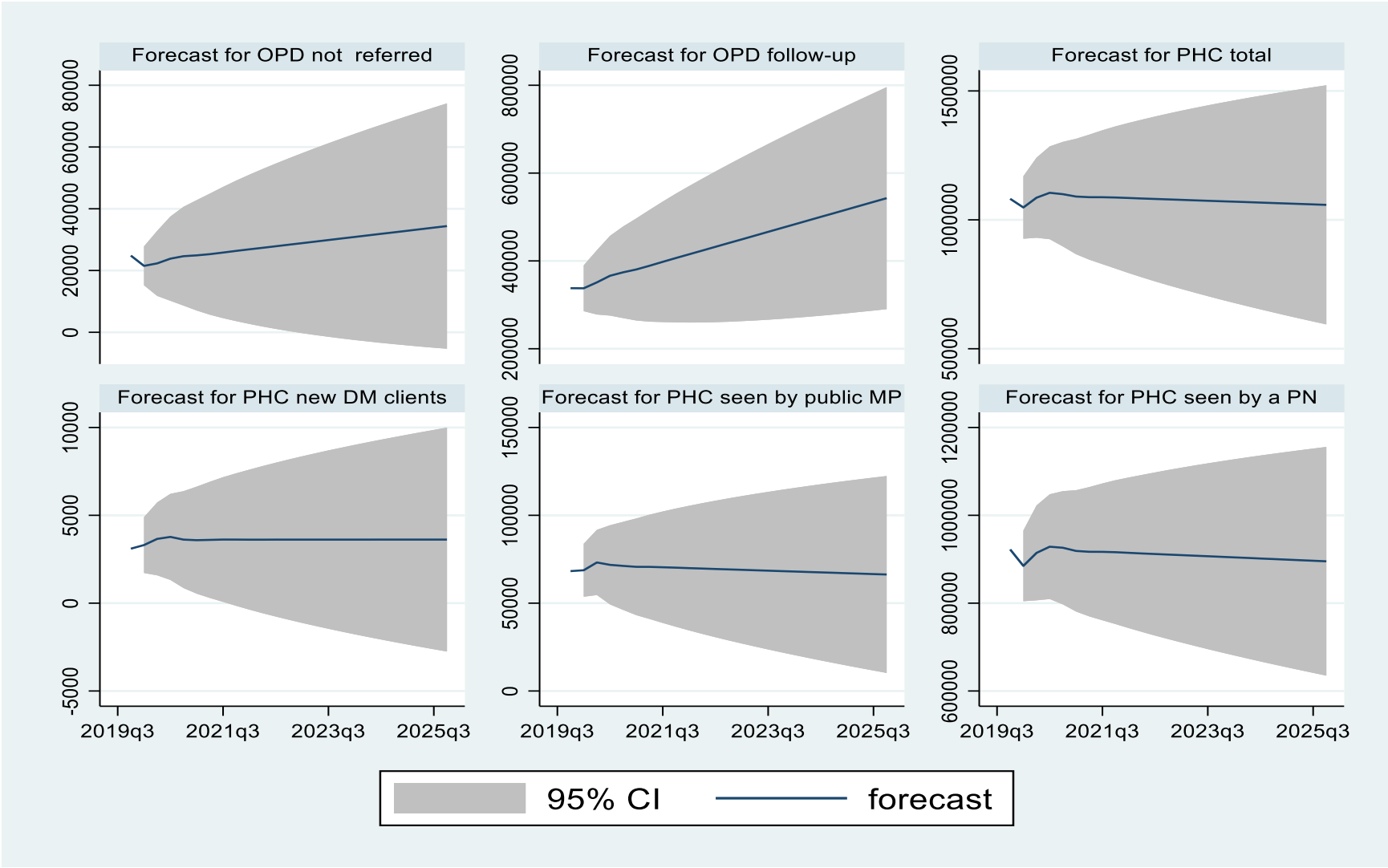

Figure 6-2: Forecast of selected PHC and OPD headcounts for 2025

6.4 Discussion

The study found that professional nurses provided most non-emergency care at PHC. The study also confirmed the influence of the selected PHC and OPD headcounts on each other by identifying four cointegration relationships between the variables. Both long -and short-run causality exist between the two. Based on these relationships, we forecast that by the end of 2025, the OPD follow-up headcounts will have increased by two-thirds, but both PHC total and PHC clients seen by a PN will marginally decline.

In the causality assessment for OPD referrals, we found that increases in PHC clients, newly diagnosed with DM, remaining on ART, seen by a public MP, and seen by a PN, would lead to an increase in both OPD referred and self-referred clients. The increase in PHC indicators indicates increased workload at the PHC level for both MPs and PNs, resulting in increased waiting times and patients responding to this by seeking care at higher levels, leading to an increase in self-referrals[41]. The increase in OPD referrals could be explained by MPs and PNs referring patients to higher levels of care in response to increased workload at the PHC level. This finding is similar to those in a study in the United Kingdom (UK), which showed that general practitioners (GPs) respond to an increase in workload by referring patients to specialists in the National Health Service (NHS)[42]. The significantly higher increases in PHC indicators compared to those for referred and self-referred indicate that the increase in workload at the PHC facilities has a very high threshold before they affect OPD indicators. This high threshold suggests a significant reduction in perception of care at the PHC level before affecting OPD; thus, there is a critical need to improve the quality of care at the PHC level with the roll-out of NHI[43]. These findings were supported by decreases in clients newly diagnosed with DM at the PHC level with increases in both the total volume of clients at PHC and those seen by PNs. Thus, an increased volume of patients at the PHC level led to an increased workload at the OPD level and compromised the quality of care at the PHC level. Hence, there is a need to improve not only the clinical staffing but also the capacity of PNs in PHC facilities to detect and manage NCDs, specifically DM[44].

In the causality assessment for OPD follow-up, we found that increases in PHC clients, newly diagnosed with DM, remaining on ART, seen by public MPs, and seen by PNs led to an increase in patients being followed up in the OPD. This increase in OPD follow-up means that an increase in PHC indicators leads to an increase in workload at the OPD level and can be explained by suboptimal down referral from hospitals to PHC facilities[45]. This sub-optimal down referral mechanism is also supported by findings in the short-run causality assessments

for PHC indicators, which show an inversely proportional relationship between the volume of patients at the PHC and OPD levels, which reflects the referral mechanism between the two systems. It emphasises the need for higher levels of care to refer patients down and improve the perception of care at PHC facilities. Similarly, the short-run causality assessment found that the volume of patients newly diagnosed with DM at the PHC level positively impacts the volume of patients being followed up in OPD, possibly because DM patients are referred to OPD for care. Contrarily, the volume of those remaining on ART at PHC has a negative impact, possibly due to the retention of patients at the PHC level, as ART care represents the majority of headcounts and workload for PNs[46].

A forecast of the PHC and OPD indicators by 2025 shows that while the earlier would remain relatively the same and, in some respects, marginally reduce, the latter would significantly increase, except for referred patients. This increase in OPD referrals means that if the perception of poor quality of services at PHC facilities continues, it will lead to overutilisation of OPD services. Thus, despite an improvement in the perception of quality of care[43], the current levels of implementation of the NHI pilot programme in Tshwane are insufficient to attain the 2030 goal. Thus, the need to address challenges at PHC facilities, such as staffing and capacity, is critical to the realisation of UHC goals in South Africa.

There are several limitations to the interpretation of our findings. First, these findings are based on secondary data from the DHIS, which was not designed for research but had challenges that have been highlighted previously[47]. Despite this, it helps provide scientific insights into the utilisation of healthcare services[48]. Second, the model diagnostics exhibited a problem with a non-normal distribution of error residuals, which may compromise the model's efficiency. However, this does not limit consistency[49]. Third, the selected forecast year was 2025, 4 years ahead of time, which is inherent to model performance and is less accurate compared to a shorter period. However, the model is still effective in forecasting for shorter periods. Fourth, there is evidence of the impact of coronavirus disease (COVID-19) on the utilisation of both PHC and OPD[50]. However, the period covered in this study was from 2010-2019, before the pandemic. Thus, the model performance would still be valid if vaccination and other measures reduced the impact of the pandemic on the healthcare system to pre-pandemic levels.

6.5 Conclusion

Our findings confirm a relationship between PHC and OPD indicators that can be used to plan the provision of services in the future. Based on this relationship and current trends, we found that implementing the NHI pilot programme is unlikely to attain the envisaged goal by 2030.

6.6 Recommendations

With the implementation of NHI, there is a need to improve the perception of quality of care at the PHC level by appropriate staffing capacity to manage NCDs as an epidemiological transition. We also recommend strengthening the bidirectional referrals between PHC facilities and hospital OPD.

6.7 Acknowledgements

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6.8 Author contributions

H.M. and J.I. conceived the study. H.M. developed the theory and performed computations. H.M. and K.O. verified the analytical method. J.I., AF, and KO reviewed the manuscript developed by H.M. All the authors discussed the results and contributed to and approved the final manuscript.

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6.10 Data availability

The data that support the findings of this study are available from the corresponding author [HM] upon reasonable request.

6.11 Disclaimer

The authors of this study declare that there are no personal or financial interests that could have inappropriately influenced the conduct, interpretation of findings, and writing of this article.

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7 CHAPTER 7: DISCUSSION

7.1 Introduction

This chapter discusses the findings of the study. It is divided into four parts—the first three are based on the three objectives of the study, and the final part discusses cross-cutting issues. The first objective was to determine the formative effects of contracting private MPs in the NHI pilot programme. The second objective was to determine the effect of contracting private MPs in the NHI pilot programme on the perception of quality of care at the PHC level. The third objective was to determine the relationships and interdependencies of the PHC and OPD indicators and their forecasts to 2025. The cross-cutting issues include findings that are linked to at least two or more outcomes or indicators, specifically on adults on ART, new DM clients, OPD clients, and OPD follow-ups.

This thesis showed similar findings between PHC and OPD indicators using ITSA but not CITSA. In comparing PHC indicators, before and after MPs contracting of the NHI pilot programme using ITSA, there was a generally decreased utilisation of PHC services in the Tshwane district. The exceptions to the above findings were a significantly increased number of clients remaining on ART. Similarly, the number of clients seen by a PN and 5 years and older only marginally increased. However, these changes were not attributable to the implementation of the NHI pilot programme as similar findings were also noted in Ekurhuleni district, which did not implement the programme. Comparing OPD indicators found that the decrease in OPD self-referrals in Tshwane could be attributable to implementation of the NHI pilot programme as Ekurhuleni district did not show a similar decrease. As shown in **figure 7-1** below, these PHC findings are supported by the VECM forecast. The forecast shows that, by 2025, PHC utilisation is projected to remain the same or even marginally reduce. However, the projection of OPD indicators would increase with a resultant increase in OPD follow-up. These findings show that despite not affecting PHC indicators, contracting private MPs in Tshwane has improved the perceived quality of care at the PHC level measured at the OPD level. This finding results from the interrelationships and interdependencies of the two levels of care. However, the non-optimal down referral mechanisms between the two levels of care will lead to overutilisation of non-emergency of OPD care.

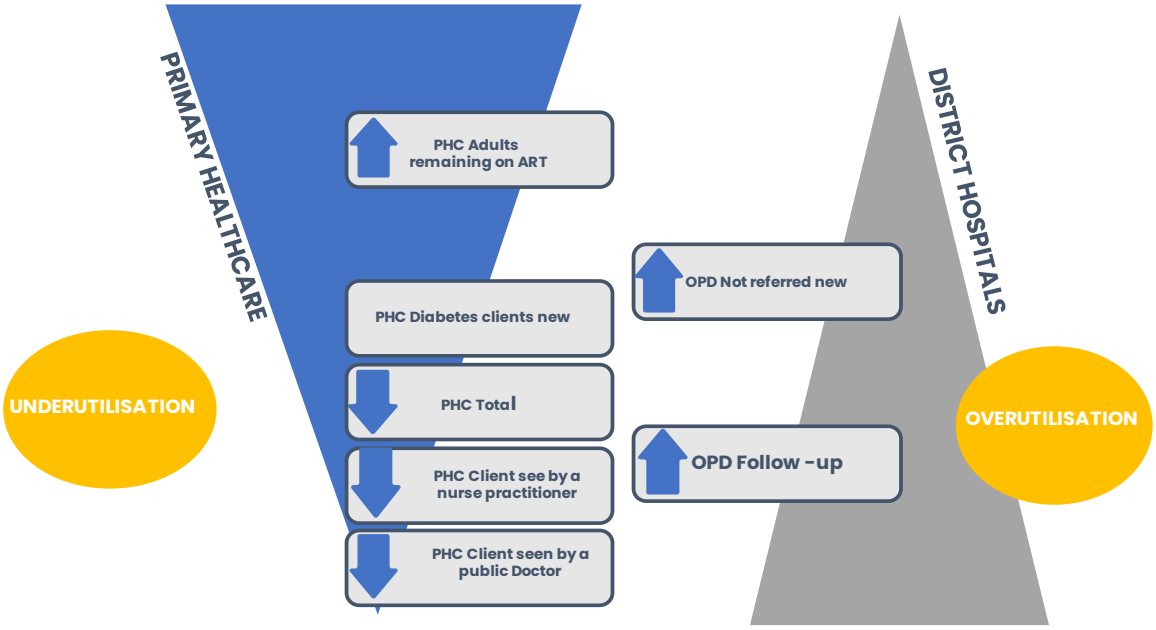

Figure 7-1: Projections of primary healthcare and non-emergency outpatient department indicators to 2025

7.2 Formative Effects of the NHI Pilot Project on PHC Indicators

7.2.1 General Findings

There were disparate findings between ITSA and CITSA indicative of no effect on PHC indicators attributable to private MPs contracting the NHI pilot project. ITSA showed a 65% and 32% increase in the number of adults remaining on ART in the Tshwane and Ekurhuleni districts, respectively. However, CITSA showed differences in the number of clients on ART and an increase in the number of clients on ART at the beginning of the pre-intervention period. In contrast, there were no differences in the post-intervention parameters. Furthermore, ITSA revealed a 2% and 6% increase in the number of clients seen by a professional nurse (PN) in the Tshwane and Ekurhuleni districts; however, CITSA only revealed a difference in the increase in the number of clients between the districts in the pre-intervention period.

Moreover, ITSA showed a 2% decrease in total headcounts in both districts and a 1% and 5% increase in the number of clients aged ≥5 years in the Tshwane and Ekurhuleni districts, respectively. However, CITSA did not reveal any differences in pre-intervention and post-intervention parameters. The increase in clients on ART indicates overall improvement in PHC performance, except utilisation during the study period. However, it is not attributable to contracting MPs in the NHI pilot programme, as suggested by the similarity between ITSA and CITSA findings.

The finding of improvements in PHC not attributable to MPs contracting but rather to other co-interventions has implications for the roll-out of NHI. Thus, as part of the roll-out of NHI, all the co-interventions should be strengthened. These co-interventions should be monitored and evaluated as part of the UHC activities. Similarly, studies would need to be done to determine the cost-effectiveness of these interventions.

7.2.2 Formative Effects of Contracting Private MPs on Adults on ART

There was an improvement in the number of adults remaining on ART in both districts not attributable to the implementation of the private MPs contracting of the NHI pilot project. A comparison of the number of adults remaining on ART between the two districts using ITSA showed a differential increase of 65% and 32% in the Tshwane and Ekurhuleni districts, respectively. An independent analysis using ITSA on the increase in the Tshwane district suggested a causal effect of contracting MPs in the district, which is in line with the findings of an impact study on NHI pilot districts comparing data before and after 4 months of contracting MPs[1]. Similarly, increased utilisation of PHC services after implementing a universal health coverage (UHC) programme was observed in Burkina Faso[2], Ghana[3], China[4], Mexico[5], and Rwanda[6].

Despite the above findings, a comparison of the increase in adults remaining on ART between the Tshwane district and Ekurhuleni district collectively was done using CITSA. This comparison revealed that there was no change in post-intervention parameters despite prior differences in initial headcounts and an increase in the number of adults on ART in the pre-intervention period. These findings suggest that the changes in the PHC indicators are instead attributable to the effect of other interventions implemented in both districts because private MP contracting was implemented in the Tshwane district but not in the Ekurhuleni district. Thus, the increase in the number of adults remaining on ART in the Tshwane district is not attributable to contracting MPs in the NHI pilot project. Other factors likely contributing to these findings could be the scale-up of HIV/AIDS programmes. These programmes were implemented in all districts and increased from 2010 onwards, peaking in 2012[7]. The critical outcomes of these programmes included increased testing and ART initiation, and increased resource allocation by NDoH, coinciding with the peak of the president's emergency plan for AIDS Relief (PEPFAR) support in 2012[8,9]. The differential findings between ITSA and CITSA attributable to different interventions in addition to contracting MPs in the NHI pilot programme illustrate the strength of our approach in this study.

7.2.3 Formative Effects of Contracting Private MPs on Headcounts of PHC Clients seen by a PN

An improvement in the PHC headcounts of clients seen by a PN indicated only a marginal increase, not attributable to the NHI pilot project's effect on private MPs contracting. It is essential to determine the effect of contracting private MPs on the headcounts of clients seen by a PN who are core providers of services, such as reproductive, maternal, and child health services in PHC facilities[10]. An independent comparison of pre-intervention and post-intervention using ITSA showed an increase of 2% in the Tshwane district and 6% in the Ekurhuleni district. The higher increase in this indicator could compromise the quality of PHC services owing to an increased workload for PNs[11]. However, given the post-intervention trends, the predicted plots show a decline in both districts post-intervention. This is a positive finding considering that workload on PNs is associated with work dissatisfaction, burnout, and stress[12,14]. However, comparing both districts using CITSA only showed a difference in the increase in the number of clients seen by PNs in the pre-intervention period and no difference in the other measured parameters after the intervention. This finding may be due to confounders in both districts, like the implementation of concurrent PHC re-engineering programmes like WBPHCOTs, ISHP, and DCSTs implemented in all districts[10,13].

7.2.4 Formative Effects of Contracting Private MPs on Total PHC Headcounts and PHC Headcounts for Clients Aged ≥5 years

There were disparate changes in total PHC and PHC headcounts ≥5 years not attributable to private MPs contracting of NHI pilot project. The total PHC headcounts were equivalent to the sum of headcounts for clients seen by a PN and those seen by public MPs before and to the headcounts of clients seen by PNs, and private MPs after the implementation of the NHI pilot project. A comparison of the total PHC headcounts and headcounts for clients aged ≥5 years using the ITSA showed an increase of 2% and 5% in the Ekurhuleni district. This finding could be explained by in-migration, which was higher in the Ekurhuleni district than in the Tshwane district during the study period[14]. However, in the Tshwane district, there was a 2% decrease in both headcounts. Findings from developing countries15,17,19 contrast this reduction in utilisation of PHC services post-NHI pilot project implementation. A possible explanation for this could be differences in the contracting models between South Africa and other countries. While most countries extended health insurance to underserved communities and healthcare providers were compensated by the insurance fund for their services, in South Africa, private MPs were paid a salary to provide services in public PHC facilities physically. Nevertheless, CITSA did not reveal any difference in all pre- and post-intervention parametres.

7.2.5 Formative Effects Attributable to Other NHI Pilot Programme Concurrent Interventions

The improvement of PHC indicators was attributable to implementing other concurrent interventions along with the NHI pilot project. CITSA showed that after implementing the NHI pilot project, there was no difference in all the measured variables when the Tshwane district was collectively compared to the Ekurhuleni district. However, ITSA showed an improvement in the measured variables. These findings showed that although there was no effect attributable to contracting MPs in the NHI pilot project in the Tshwane district, both districts had positive findings. These findings may be attributable to implementing programmes common to both districts. Before MP contracting in the NHI pilot project was added as the fourth stream of PHC re-engineering in 2012, the NDoH had implemented three other streams at the PHC level since 2011 in all districts[13]. These might have had a positive effect on PHC in the districts.

The effects of contracting private MPs on utilisation of PHC services in the study district may have also been affected by confounders such as person-level factors, health system factors, and other health reforms effected concurrently[16]. These include population density, access to PHC facilities, quality of care, and epidemiological transition[17]. The contribution of HIV/AIDS to the burden of disease in South Africa was at the highest in the period from 2010 to 2015; HIV/AIDS as the test-and-treat strategy became a reality, resulting in increased demand for health services[7]. However, studies informing decisions to implement UHC have yet to consider this [18,23-25].

7.3 Formative Effects of the NHI Pilot Project on OPD Indicators

7.3.1 General Findings

There was a reduction in OPD clients by passing PHC facilities, indicative of improvement in the perception of quality of care at the PHC level. However, there was an increase in non-emergency clients being followed at OPD. Both these findings were attributable to the contracting of private MPs of the NHI pilot project. Analysis using ITSA in both districts showed that post MPs contracting, there was an increase in OPD follow-up headcounts. In contrast, there was a decrease in OPD not referred headcounts (self-referral), new OPD not referred rate (self-referral rate), and new OPD referred headcounts. Comparing the two districts using CITSA showed statistically significant differences in the increase of OPD follow-up headcounts and the decrease in OPD not referred headcounts and new OPD not referred rate. However, there was no difference in the decrease in OPD-referred headcounts between the Tshwane and Ekurhuleni districts.

7.3.2 Formative Effects on OPD follow-up headcounts

There was an increase in OPD follow-up headcounts attributable to contracting of private MPs of the NHI pilot project. A comparison before and after contracting MPs in each district using ITSA showed an increase in OPD follow-up headcounts after the implementation, leading to possibly increased workload at the district hospital OPD level for both districts. This finding is in line with those in many LMICs resulting in increased spending in hospital-based services as they are considered to be more expensive than PHC services[19]. This finding could be explained by the shift in disease burden to NCDs, such as cardiovascular disease, cancer, and trauma, which require higher care levels than infectious diseases affecting both districts[20,21]. Studies in six LMICs, including South Africa, showed that between 2007 and 2012, utilisation of OPD services due to NCDs increased as life expectancy increased[22,23]. Thus, innovative ways of scaling up and supporting skills in managing NCDs at the PHC level are crucial because previously piloted interventions such as telemedicine and the DCST have yet to succeed[24,25].

The increase in OPD follow-up headcounts was more of a challenge in the Tshwane district than in Ekurhuleni district, as evidenced by ITSA findings, which showed a higher increase in all parameters in Tshwane district than in Ekurhuleni district. CITSA confirmed this finding by showing an increase of approximately 763 more monthly patients in the Tshwane district compared to the Ekurhuleni district. This increase in OPD follow-up could be explained by a non-optimal down-referral mechanism from the district hospitals to PHC facilities in Tshwane district[26], given that over the same period, there was a decrease in PHC headcounts. These findings are in harmony with a Singaporean study[27] that also contracted private medical providers as part of UHC interventions and illustrated essential lessons for the NHI in South Africa[27]. The lessons include developing the capacity of PHC beyond managing infectious diseases and creating organisational structures that would enhance the coordination of activities between PHC facilities and district hospitals. This capacitation should improve down referrals and supportive supervision of the PHC team by clinical specialists. Lessons from HIV management in other LMICs, such as Malawi, have shown that task-sharing in non-physician models can improve patient outcomes[28].

7.3.3 Formative Effects on the Perception of Quality of Care at PHC Measured as OPD Level

There was an improvement in the perception of quality of care at the PHC level, as indicated by a reduction in clients accessing primary-level care at the secondary level attributable to the implementation of contracting of private MPs of the NHI pilot project. ITSA findings on new OPD "self-referral" headcounts and new OPD "self-referral rate" showed a marginal decrease

in the Ekurhuleni district but a higher decrease in the Tshwane district. However, CITSA showed a significant difference in the decrease in the number of clients entering healthcare at the OPD level for non-emergency care in the Tshwane district compared to that in the Ekurhuleni district. This finding could be due to an improved perception of quality at the PHC level because of the presence of NHI-contracted MPs, which resulted in patients not seeking primary care in hospitals, as per the hypothesis of our study. The findings in this study suggested that before the implementation of the NHI pilot project, the new OPD not referred headcounts and new OPD not referred rate were higher, indicating overburdened PHC facilities. However, during the same period, there was a decrease in PHC utilisation in the pilot district[29]. It can also be that people prefer to access PHC from private providers as studies have indicated up to 70% growth in private provider activities for both districts over the same period[30]. However, it is impossible to estimate the distribution of utilisation across different types of healthcare providers using most of the available data sources[31]. This finding is crucial in addressing the immediate significant MP shortages and capacity at the PHC level and realising the broader vision of a single integrated system as envisaged by the NHI. These findings are in contrast with those reported in other LMICs. One of these countries, Thailand, which implemented a UHC programme, showed an increase in accessing hospitals for PHC services. Factors influencing decisions to visit hospitals and non-designated PHC facilities included free healthcare services, perception of serious illness, need for special tests, and continuity of care[32].

7.3.4 Formative Effects on OPD Referred Headcounts

The change in headcounts of PHC clients correctly referred to OPD was not attributable to implementation of the contracting of private MPs of the NHI pilot project. Comparing new OPD referred headcounts using ITSA showed a decrease in both districts. However, a comparison of the two districts using CITSA showed that, there was no statistically significant difference. This finding implies that ITSA findings in the Tshwane district could not be explained by contracting MPs but by factors common to both districts, such as the HIV/AIDS epidemiological transition. Similarly, this could be explained by a reduction in PHC utilisation. In contrast, studies in Austria showed that an increase in workload at the PHC level leads to an increase in referrals to the next level of care[33].

7.4 Relationships and Interdependencies of PHC and OPD Indicators and Their Forecasts

7.4.1 General Findings

The study identified relationships and interdependencies between PHC and non-emergency OPD levels of care in the Tshwane district, with a forecasted two-thirds increase in OPD follow-up by 2025. This finding confirms the influence of PHC and OPD headcounts on each other by finding the existence of long-trend relationships between the variables. There is both short-term and long-term causality between the variables. Based on these relationships, we forecast that by the end of 2025, the OPD follow-up headcounts will show a two-thirds increase, but both the total PHC headcount and the number of PHC clients seen by a PN will marginally decline.

7.4.2 Relationship and Interdependencies of Clients Referred or Not Referred to OPD with PHC Indicators

The study found that OPD referral indicators were related and interdependent on some PHC indicators. In the causality assessment for OPD referrals, it was found that increases in PHC clients newly diagnosed with DM, on ART, seen by a public MP, and seen by a PN, would lead to an increase in both OPD referrals and self-referrals. The increase in PHC indicators indicates increased workload at the PHC level for both MPs and PNs, resulting in increased waiting times and patients responding to this by seeking care at higher levels leading to an increase in self-referrals[34]. The increase in referrals to the OPD could be explained by MPs and PNs referring patients to higher levels of care in response to the increased workload at the PHC level. This finding is similar to that reported in a UK study, which showed that general practitioners respond to the increased workload by referring patients to specialists in the National Health Service[35]. The significantly higher increases in PHC indicators compared to that in OPD referral and self-referral indicate that the increase in workload at the PHC facilities has a very high threshold before they affect OPD indicators. This finding suggests a significant reduction in the perception of care at the PHC level before affecting OPD. Thus, there is urgent need to improve the perception of quality of care at the PHC level with the roll-out of the NHI[36]. These findings were supported by decreased clients newly diagnosed with DM at the PHC level, as increases in the total volume of clients at PHC and those seen by PNs are observed. Thus, an increased volume of patients at the PHC level could have led to an increased workload at the OPD level and compromised the quality of care at the PHC level. Hence, there is a need to improve not only clinical staffing but also the capacity of PNs in PHC facilities for detecting and managing NCDs, specifically DM[37].

7.4.3 Relationship and Interdependencies of Clients Followed Up at OPD with PHC Indicators

The study found that the volume of clients being followed up at OPD was related to and dependent on some PHC indicators. In the causality assessment for OPD follow-up, it was found that increases in PHC clients, newly diagnosed with DM, adults remaining on ART, seen by public MPs, and seen by PNs led to an increase in patients being followed up in the OPD. This finding means that an increase in PHC indicators leads to an increase in workload at the OPD level and can be explained by suboptimal down referral from hospitals to PHC facilities[38]. This sub-optimal down referral is also supported by findings of the short-run causality assessments for PHC indicators, which show an inversely proportional relationship between the volume of patients at the PHC and OPD levels, reflecting the referral mechanism between the two systems. It emphasises the need for higher levels of care not only to down-refer patients but also to improve the perception of care at PHC facilities. Similarly, the short-run causality assessment showed that the volume of patients newly diagnosed with DM at the PHC level positively impacted the volume of patients being followed up in the OPD, which could be because clients with DM are more readily referred to OPD for care. However, the volume of individuals on ART at the PHC level had a negative impact, possibly due to the retention of patients at the PHC level, as ART care represents the majority of headcounts and workload for PNs[39].

7.4.4 Forecast of PHC and OPD Indicators

This thesis found that OPD utilisation and workload will increase by 2025. A forecast of the PHC and OPD indicators to 2025 showed that while PHC indicators would remain relatively the same and marginally reduce to some extent, OPD indicators would significantly increase, except for patients being referred. This relationship means that if the perception of poor quality of PHC facilities continues, it will lead to overutilisation of OPD services. Thus, despite an improvement in the perception of quality of care[36], the current levels of implementation of the NHI pilot programme in the Tshwane district are insufficient to attain the 2030 goal. Thus, it is vital to address challenges at PHC facilities, such as staffing and capacity, to realise UHC goals in South Africa.

7.5 Crosscutting Findings

7.5.1 Importance of Down Referral of Clients from OPD to PHC

The thesis also showed the importance of the down-referral mechanism. The first study found that since the implementation of contracting private MPs in the NHI pilot project, there has been a non-attributable reduction in total PHC headcounts. However, as indicated by the second

study, there was an attributable increase in clients being followed up at the non-emergency OPD level despite a reduction in the number of clients referred and not referred from PHC facilities. Similarly, the third study projected that while the total PHC headcounts would marginally reduce, the OPD follow-up headcounts would increase by two-thirds by 2025. In the absence of an indicator in the DHIS at the PHC level, which measures the volume of clients referred from non-emergency OPD to PHC facilities, these findings show an improvement in the PHC level since the implementation of the NHI pilot project and other co-interventions. However, this will lead to overutilisation of non-emergency OPD if the down-referral mechanism is not strengthened.

7.5.2 Importance of Detection of DM at the PHC Level

The third study found that the detection of new DM clients at the PHC level had an impact on PHC and OPD indicators. Three of the relationships showed that an increase in the number of new DM clients led to an increase in OPD referred, not referred, and follow-up indicators. This relationship suggests MPs, PNs, and clients perceive that the PHC level cannot optimally manage DM as prescribed by referral guidelines[40]. The fourth relationship shows that an increase in total headcounts at PHC facilities reduces the number of new DM clients. This finding suggests a compromise in healthcare quality owing to an increased workload[41].

7.5.3 Effect of COVID-19 on Utilisation of Health Services

In the past 2 years, the COVID-19 pandemic has affected many aspects of human activities, including health services utilisation. Several studies from different countries have shown that during the initial wave of the pandemic, there was a decrease in the utilisation of outpatient services, especially among those attending PHC and non-emergency OPD[42], possibly due to changes in health-seeking behaviour[51,43]. However, many months after the disease, many patients have reported multisystem symptoms and disability due to long-COVID [44]. Hence, increased demand for PHC and OPD care can be expected in the future [54,45]. Conversely, vaccination and other interventions can potentially return the pre-pandemic disease burden.

7.6 Conclusion

The findings of this thesis suggest that contracting private MPs in the NHI pilot project in the Tshwane district did not contribute to positive changes in PHC indicators. However, concurrent interventions implemented in all districts, such as PHC re-engineering and other HIV programmatic shifts, may have resulted in the observed changes. In contrast, MPs contracting may have resulted in a decrease in self-referrals to district hospitals, possibly due to an improvement in the perceived quality of healthcare at the PHC level. Despite a general

reduction in the selected OPD headcounts, follow-up at the district hospital level was high in the Tshwane district, suggesting an increased workload for staff at district hospitals after private MPs were contracted to work at PHC facilities. Confirming the relationship between PHC and OPD indicators, which can be used to plan for the provision of services in the future, the thesis found that by 2025, the utilisation of OPD services would increase by two-thirds, while that of PHC services would reduce marginally.

7.7 References

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8 CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

The previous chapters individually or collectively synthesised the key findings and conclusions from the study on the effect of contracting private MPs of the NHI pilot project on both PHC and OPD indicators and their relationship and interdependencies. Inferences about the effects of other concurrent interventions implemented as part of the NHI pilot project and PHC re-engineering were also made. This chapter presents the implications of the findings on policy, practice, theory, subsequent research, and recommendations on monitoring and strengthening the NHI pilot program implementation. These are divided as per the findings of each study objective and the final one on the cross-cutting findings.

8.2 Effect of contracting private MPs of the NHI pilot project on PHC indicators

As discussed in Chapter 4, contracting private MPs for the NHI pilot project did not affect the PHC indicators. One possible explanation is the limited number of MPs contracted and the limited time spent providing services at public PHC facilities. The implications of the policy of contracting private MP providers in the NHI programme would be that an optimal number needs to be identified in a district to impact PHC utilisation. In the absence of the optimal number of private MPs, other means of increasing the number may be pursued, such as training. Thus, the recommendation is that further research is done to determine the optimal number of MPs that would need to be contracted to influence PHC utilisation.

Notwithstanding the lack of impact of private MPs contracting, there were significant improvements in the delivery of PHC services in the Tshwane and Ekurhuleni districts, attributable to the implementation of other concurrent interventions. There was a reduction in total PHC headcounts, possibly because of improved HIV care, with the resultant increase in adults on ART. This is the first study to indicate reduced PHC utilisation post-implementation of a UHC programme. Before this, many people had claimed or assumed that PHC utilisation would increase as access to care is improved at PHC facilities. As indicated in chapter 5, the reduction in PHC utilisation is not because of a perception of poor quality of care at the PHC level.

As a result, the recommendations for policymakers are to increase the number of private MPs to be contracted and to contract-out services (outsourcing), which divert clients from public to private healthcare providers. This form of contracting would not only decongest PHC facilities but also improve quality, as evidenced by the findings in Chapter 6 regarding DM detection and increased workload[1]. Furthermore, this basic research related to the monitoring of PHC

indicators suggests the need for more sophisticated approaches to collecting, analysing, and interpreting data to monitor the impact of private MPs contracting. Thus, specific indicators in DHIS that monitor the number and time spent by providers would need to be strengthened, as informed by further research. Similarly, the study confirmed that PNs are the major providers of care at PHC and that increase in utilisation of PHCs can potentially compromise the clinical quality of care. Thus, quality improvement measures at PHC should include developing skills, provision of resources, and capacitation of PNs to provide PHC care. This approach could be less expensive than contracting private MPs.

8.3 Effect of contracting private MPs of the NHI pilot project on OPD indicators

Chapter 5 found that contracting private MPs of the NHI project led to a reduction in the OPD self-referral rate as a proxy for quality of care at PHC facilities. Thus, there has been an improvement in the perceived quality of PHC in the Tshwane district, attributable to the contracting of private MPs of the NHI pilot project. Despite this positive finding, there was an increase in the headcounts of OPD follow-ups in the Tshwane district. This finding is corroborated by Chapter 6, where the OPD headcounts are projected to increase by two-thirds by 2025. This increase was attributable to the non-optimal down referral of non-emergency OPD clients to the PHC level. However, there needs to be an indicator in the DHIS to track clients referred from higher levels of care to PHC. Thus, it is recommended that policymakers include an indicator or indicators in DHIS that tracks both emergency and non-emergency clients that are stabilised at the hospital level and down referred for PHC care. Similarly, further research is needed to determine the efficacy and effectiveness of down-referral mechanisms in NHI pilot districts.

In Chapter 5, OPD headcounts not referred to and OPD not referred rates were used as proxies for the perceived quality of healthcare at PHC facilities. The strength of the approach is that the indicators measure the actual utilisation of services compared to surveys that measure the drivers of behaviour. Surveys are still considered an essential data source for measuring the critical drivers for utilisation[2,3]. As part of ICRM, patient satisfaction indicators are based on using the complaints/suggestion box at the facility level, which needs to be monitored[4]. However, there needs to be a standardised approach to collecting, collating, analysing, and developing remedial measures.

Similarly, there may be a staff shortage at the facility level to undertake this task optimally. As such, the recommendation for dealing with this challenge is to set up standardised electronic surveys that are monitored and analysed centrally, possibly at the district level. The importance

of this approach is that it measures patient satisfaction not only from complaints but also from compliments. Thus, research on designing, monitoring, and analysing these surveys would need to be conducted. Similarly, a recommendation is made for individual level studies to determine if the improved perceived quality of care translates into improved clinical care by looking at clinical outcomes.

8.4 Relationships and interdependencies between PHC and OPD headcounts

Chapter 6 found that changes in headcounts of OPD referred, OPD not referred, OPD follow-up, and PHC total headcounts were related and interdependent with new PHC DM clients, PHC clients seen by both public MPs and PNs, and adults remaining on ART at PHC. This finding confirms that there are relationships and interdependencies between PHC and OPD headcounts. The recommendation in this regard would be for policymakers to monitor the performance of healthcare facilities in the provinces, as PHC and OPD continuum of care that is not restricted to physical facilities. Given the challenges of existing DCSTs with similar mandates, an alternative would be to expand and strengthen these teams[5]. Thus, indicators in the DHIS for monitoring the functionality of these teams should be developed and researched to determine their optimal performance.

Chapter 6 also found that detecting new cases of DM at the PHC level was indirectly proportional to the utilisation of services. That is, the higher the number of people accessing services at PHC facilities, the lower the detection of DM. However, there was no such finding between total PHC utilisation and the number of adults remaining on ART, suggesting that the PHC level can manage HIV/AIDS. This finding is supported by many studies and historical milestones in ART care involving the capacitation of professional nurses and PHC teams [6,9,6,7]. However, studies have shown non-optimal care of DM patients at the PHC level for both PNs[8] and PHC staff in general[9]. Thus, the recommendation is to mobilise funding for the treatment of DM at the PHC level and increase the capacity of PNs to provide this service, just as it has been for ART care[10]. Similarly, research is needed to determine the optimal way to implement the increased capacity of PHC teams to provide these services.

8.5 Importance of bi-directional referral mechanisms

The importance of bi-directional referrals was illustrated in chapter 4 (paper 1) and chapter 5 (paper 2). Firstly, paper 1 found that there has been an increase in OPD referred in both the Tshwane district and Ekurhuleni district. Secondly, there was an increase in OPD non-referred and OPD not referred rates in both districts, despite being limited in the Tshwane district due to the implementation of MPs contracting. Thirdly, there was an increase in OPD follow-up in

both districts, which is projected to increase by two-thirds by 2025. Thus, it is essential to put in measures to monitor and control bi-directional referrals between PHC and OPD. Such measures would include sharing referral information weekly/monthly, monitoring the OPD not referred indicators even at the PHC level, developing an indicator in DHIS for PHC referred/not referred from OPD, and optimising the functioning of the DCSTs and capacitation of the PHC teams.

8.6 Cross-cutting conclusions and recommendations

In the literature review section (chapter 2), the limitations of DHIS data were discussed. One of the challenges of this data source is the need for patient-level information. The absence of these data means that determining the quality of care using clinical outcomes would need studies to be done from data collection. Similarly, monitoring bidirectional referrals between PHC and the higher levels of care is challenging. Thus, with the rollout of the NHI, consideration should be given to developing electronic health records and providing a system with patient-level data. This system will enable the clinical provider to understand the risk and causes of emerging diseases timeously. Additionally, the system would allow for improvements in ways of diagnosing patients. Furthermore, it will assist in the planning and evaluating NHI services and improve patient safety.

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APPENDIX 1: TYPES OF PUBLIC HEALTH FACILITIES IN TSHWANE DISTRIC

Sub Districts	Service Provide	Clinic	CHC	District Hospital	National Central Hospital	Regional Hospital	Satellite Clinic	Specialised Hospital	Specialised Psychiatric Hospital	Grand Total
Tshwane 1 SD	Province	15	3	1	1					**20**
	Municipality	2								**2**
	Province Aided	2								**2**
Tshwane 2 SD	Province	12	1	1						**14**
	Municipality						1			**1**
Tshwane 3 SD	Province	4	1	2	1	1		1	1	**11**
	Municipality	9								**9**
	Province Aided	1								**1**
Tshwane 4 SD	Municipality	4					2			**6**
Tshwane 5 SD	Province	3						1		**4**
	Municipality	3								**3**
Tshwane 6 SD	Province	2	2	1						**5**
	Municipality	5								**5**
Tshwane 7 SD	Province	3	1							**4**
	Municipality	3								**3**
Grand Total		**68**	**8**	**5**	**2**	**1**	**3**	**2**	**1**	**90**

APPENDIX 2: PHC FACILITIES IN TSHWANE AND EKURHULENI DISTRICT

District	Sub District Updated	Fac Name	O Unit Type
City of Tshwane	Tshwane Central Health sub-District	Atteridgeville Clinic (Proposed CHC)	Clinic
City of Tshwane	Tshwane Central Health sub-District	Danville Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Hercules Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Eersterust LA Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	East Lynne Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Lotus Gardens Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Stanza Bopape II Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Phahameng Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Mamelodi West Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Nellmapius Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	FF Ribeiro Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Folang Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Pretorius Park Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Gazankulu Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Phomolong Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Saulsville Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Silverton Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Karenpark Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Rosslyn Clinic	Clinic
City of Tshwane	Tshwane South Health sub-District	Lyttelton Clinic	Clinic
City of Tshwane	Tshwane South Health sub-District	Laudium Clinic	Clinic
City of Tshwane	Tshwane South Health sub-District	Olievenhoutbosch Ext 13 Clinic	Clinic
City of Tshwane	Tshwane South Health sub-District	Rooihuiskraal Clinic	Clinic

City of Tshwane	Odi sub-District	Phedisong 1 Clinic	Clinic
City of Tshwane	Odi sub-District	Phedisong 4 Clinic	Clinic
City of Tshwane	Odi sub-District	Phedisong 6 Clinic	Clinic
City of Tshwane	Odi sub-District	Winterveld Clinic	Clinic
City of Tshwane	Odi sub-District	Dilopye Clinic	Clinic
City of Tshwane	Odi sub-District	Eersterus Clinic	Clinic
City of Tshwane	Odi sub-District	Kekanastad Clinic	Clinic
City of Tshwane	Odi sub-District	Ramotse Clinic	Clinic
City of Tshwane	Odi sub-District	Refentse Clinic	Clinic
City of Tshwane	Odi sub-District	Suurman Clinic	Clinic
City of Tshwane	Odi sub-District	Boekenhout Clinic	Clinic
City of Tshwane	Odi sub-District	Sedilega Clinic	Clinic
City of Tshwane	Odi sub-District	Tlamelong Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Daspoort Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Eersterust Prov Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Mandisa Shiceka Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Holani Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Jack Hindon Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Adelaide Tambo Clinic	Clinic
City of Tshwane	Tshwane Central Health sub-District	Bophelong (Region C) Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Jubilee Gateway Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Block JJ Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Block P Satellite Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Block X Satellite Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Maria Rantho Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Soshanguve 2 Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Boikhutsong Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Block TT Clinic	Clinic

City of Tshwane	Odi sub-District	Itireleng Clinic	Clinic
City of Tshwane	Tshwane North Health sub-District	Klipkruisfontein CHC	Community Health Centre
City of Tshwane	Odi sub-District	Kgabo CHC	Community Health Centre
City of Tshwane	Odi sub-District	Temba CHC	Community Health Centre
City of Tshwane	Tshwane Central Health sub-District	Stanza Bopape CHC	Community Health Centre
City of Tshwane	Tshwane Central Health sub-District	Skinner CHC	Community Health Centre
City of Tshwane	Tshwane North Health sub-District	Soshanguve CHC	Community Health Centre
City of Tshwane	Tshwane South Health sub-District	Laudium CHC	Community Health Centre
City of Tshwane	Tshwane Central Health sub-District	Atteridgeville Correctional Service	Correction al Service
City of Tshwane	Tshwane Central Health sub-District	Adelaide Tambo Mobile	Mobile Service
City of Tshwane	Tshwane North Health sub-District	Soshanguve 1 Mobile	Mobile Service
City of Tshwane	Tshwane South Health sub-District	Laudium CHC Mobile	Mobile Service
City of Tshwane	Odi sub-District	Kekana Gardens Mobile	Mobile Service
City of Tshwane	Tshwane Central Health sub-District	Doornpoort Satellite Clinic	Satellite Clinic
City of Tshwane	Tshwane South Health sub-District	Pierre Van Ryneveld Satellite Clinic	Satellite Clinic
City of Tshwane	Tshwane South Health sub-District	Eldoraigne Satellite Clinic	Satellite Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub - District	Daveyton East Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Mary Moodley Memorial Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Alra Park Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Barcelona Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Kemston Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Sonto Thobela Clinic	Clinic

Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Kingsway Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Simunye Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Daveyton Ext Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Daveyton Main Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Duduza Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Lucky Mkhwanazi Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Emaphupheni Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Joy Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Geluksdal Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Dan Kubheka Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Thembelisha Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	White City Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Sead Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Nigel Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Payneville Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	First Avenue Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Calcut Dhlephu Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Phuthanang Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Tsakane Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Lethabong Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Bapsfontein Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Bedfordview Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Crystal Park Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Birchleigh Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Birchleigh North Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Edenvale Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Bonaero Park Clinic	Clinic

Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Kempton Park Civic Centre Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Olifantsfontein Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Itireleng (Region B) Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Spartan Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Erin Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Ethafeni Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Tembisa Health Care Centre	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Tembisa Main Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Winnie Mandela Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Alberton North Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Boksburg Civic Centre Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Brackenhurst Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Dawn Park Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Tswelopele Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Eden Park Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Dukathole Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Elsburg Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Germiston City Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Goba Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Katlehong North Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Khumalo Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Motsamai Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Tamaho Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Moleleki Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Leondale Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Palmridge Clinic	Clinic

Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Reiger Park Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Dresser Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Phenduka Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Vosloorus Ext 28 Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Vosloorus Ext 9 Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Vosloorus Poly Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Zonkizizwe 1 Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Zonkizizwe 2 Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Andries Raditsela Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Vosloorus Ext 14 Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Northmead Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Magagula Clinic	Clinic
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Kwa-Thema CHC	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Esangweni Clinic	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Phola Park CHC	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Ramokonopi Clinic	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Nokuthela Ngwenya CHC	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Phillip Moyo CHC	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Jabulane Dumane CHC	Community Health Centre
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Boksburg Correctional Service	Correction al Service
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Mary Moodley Memorial Mobile	Mobile Service
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Kwa-Thema Mobile	Mobile Service
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Kempton Park Civic Centre Mobile	Mobile Service
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Vosloorus Mobile	Mobile Service

Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Isabella De Villiers Oral Health Clinic	Oral Health Service
Ekurhuleni Metropolitan	Ekurhuleni East Health sub-District	Bakerton Satellite Clinic	Satellite Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Klopperpark Satellite Clinic	Satellite Clinic
Ekurhuleni Metropolitan	Ekurhuleni North Health sub-District	Wannenburg Clinic	Satellite Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Boksburg North Satellite Clinic	Satellite Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Freeway Park Satellite Clinic	Satellite Clinic
Ekurhuleni Metropolitan	Ekurhuleni South Health sub-District	Van Dyk Park Satellite Clinic	Satellite Clinic

APPENDIX 4: COMPREHENSIVE LIST OF DHIS DATA ELEMENTS CONSIDERED

THE NDOH DATA DICTIONARY

The National Department of Health Data Dictionary provides a reference point for selected health information standards to support health care activities within South Africa.It has been developed to support the District Health Management Information Systems (DHMIS) policy in South Africa, and specifically to facilitate data exchange between electronic systems used to support the DHMIS policy.The Data Dictionary provides the most up-to-date version of data set specifications (specifically, data elements, indicators, and data validation rules) and the organisational unit hierarchies.

A data dictionary, or metadata repository, as defined in the IBM Dictionary of Computing, is a "centralized repository of information about data such as meaning, relationships to other data, origin, usage, and format". The term may have one of several closely related meanings pertaining to databases and database management systems (DBMS):

The S.A NDOH data dictionary has been arranged according to the nationally used DHIS 1.4 data files. Kindly choose from the drop-down list above the data file you would like to view.

Collected by clinician

1. Antenatal 1st visits before 20 weeks rate: Women who have a booking visit (first visit) before they are 20 weeks into their pregnancy as proportion of all antenatal 1st visits. Monitors early utilisation of antenatal services. DATA ELEMENTS
2. Antenatal 1st visit coverage: The proportion of potential antenatal clients coming for at least one (booking) antenatal visit. The census number of children under one year factorised by 1.15 is used as a proxy denominator - the extra 0.15 (15%) is a rough estimate to cater for late mi
3. Diabetes client treatment new: Newly diagnosed clients with a fasting blood glucose of > 7mmol/L or random blood glucose >11.1mol/L. This should increase as detection of cases improves.
4. Diabetes client 40 years and older new: Client above the age of 40 years and older who is newly diagnosed with diabetes in the facility. Diagnosis made according to the Diabetes Treatment Guidelines. Count only ONCE when the client is diagnosed with diabetes. Newly diagnosed clients with a fasting blood glucose of > 7mmol/L or random blood glucose >11.1mol/L. PHC and OPD. PHC Comprehensive Tick Register; Tick Register OPD.
5. Diabetes treatment visit: Every visit for routine care by clients 40 years and older on treatment for diabetes. Treatment according to the Diabetes Treatment Guidelines.
6. Hypertension visit by client on treatment: Every visit for routine care by clients on treatment for hypertension: Treatment according to the Hypertension Treatment Guidelines. PHC Comprehensive Tick Register; Tick Register OPD
7. Central Chronic Medicines Dispensing and Distribution (CCMDD) prescriptions prepared: Clients for whom CCMDD prescriptions were prepared during the period (expected collection)
8. OPD headcount follow-up: Client attending a general or specialist Outpatient clinic for follow-up care. EXCLUDE inpatients seen at an outpatient clinic; EXCLUDE cases where a private doctor examines a pregnant woman at his/her private rooms and then refers the client for admission as his/her private patient. This should only be registered as an admission and not as an OPD visit as well. This would include visits to Service Groups like Physiotherapist, Dietician, X-rays, etc., as well as previous ward attendees returning to the hospital for a check-up. Clients can be seen in the emergency unit or in the OPD section of the hospital. Count each client only once for the day irrespective of the number of services provided. INCLUDE clients for follow-up visits at general and specialist Outpatient clinic; INCLUDE visits to Service Groups like Physiotherapist, Dietician, X-rays, etc., as well as previous inpatients returning to the hospital for a check-up. Tick Register OPD.
9. OPD headcount not referred new: new clients attending a general or specialist Outpatient clinic WITHOUT a referral letter from a PHC facility or a doctor. All assessments of pregnant women to determine progression of labour must be registered as an OPD visit. The assessment may take place in the emergency centre or in a specific area and the facility should keep a register of the visits. Clients/patients seen in the OPD/emergency and then admitted should be recorded as an OPD or emergency visit as well as an admission. Outpatients transported by ambulance to another facility and requiring emergency attention at a facility en route must be recorded as an emergency visit en route. Clients can be seen in the emergency unit or in the OPD section of the hospital. Count each client only once for the day irrespective of the number of services provided. EXCLUDE inpatients of the same hospital seen at an outpatient clinic; EXCLUDE new OPD clients with referral letters and those for follow-up visits. Tick Register OPD.
10. OPD headcount referred new: new client attending a general or specialist Outpatient clinic with a referral letter from a PHC facility or a doctor. EXCLUDE inpatients of the same hospital seen at an outpatient clinic; EXCLUDE new OPD clients with referral letters and those for follow-up visits; EXCLUDE cases where a private doctor examines a pregnant woman at his/her private rooms and then refers the patient for admission as his/her private client. This should only be registered as an admission and not as an OPD visit as well. Clients can be seen in the emergency unit

or in the OPD section of the hospital. Count each client only once for the day irrespective of the number of services provided. All assessments of pregnant women to determine progression of labour must be registered as an OPD visit. The assessment may take place in the emergency centre or in a specific area and the facility should keep a register of the visits. Outpatients transported by ambulance to another facility and requiring emergency attention at a facility en route must be recorded as an emergency visit en route. An inpatient at one facility attends a second facility as an outpatient, the second facility must record the attendance as an OPD visit. Tick Register OPD.

11. Patient Experience of Care satisfied responses: number of patient responses that indicated satisfaction with experience of care. Monitors the quality of care as experienced by patients.
12. PHC client seen by private doctor: A PHC client of any age consulted and/or treated by a private doctor on contract for a Primary Health Care curative and preventative service. The service is provided in a public health facility. Each client is counted every time they are seen by a doctor. ONLY clients seen for curative and preventative services must be counted. Monitoring of services rendered by private doctors employed on contract to consult PHC clients in public health facilities in accordance with the NHI objectives to increase doctor coverage. EXCLUDE PHC facilities that do not contracted doctors.
13. PHC client seen by professional nurse: A PHC client of any age consulted and/or treated by a professional nurse for a Primary Health Care service.
14. PHC client seen by public doctor: A PHC client of any age consulted and/or treated by a doctor employed in the public sector for a Primary Health Care curative and preventative service. Curative services entail the diagnosis and/or treatment of clients. This data element should be collected in all PHC facilities with full or part-time doctors. Clients might originally be seen by a professional nurse for a PHC service or may be seen directly by the doctor. XCLUDE clients seen by a Medical Doctor for the completion of grant forms; EXCLUDE cases where a Medical Doctor just renews prescriptions without seeing such clients; EXCLUDE interpretation of TB x-rays or laboratory results without seeing such clients; EXCLUDE client seen by a Dentist; EXCLUDE clients seen by a psychologist; EXCLUDE telephonic consultations with regard to clients between Professional Nurses and Doctors.
15. PHC headcount under 5 years: All individual clients not yet reached five years (60 months) seen for Primary Health Care. INCLUDE any child given individual service(s) during a visit to a health facility; INCLUDE children seen by health professionals of an outreach team; INCLUDE a DOTS visit to the facility (but not to the community, workplace or home); INCLUDE clients who bypass the registration unit and go directly to the pharmacy to collect their own chronic medication (including CDU medication) or clients using fast lines or those to be seen by outreach teams NW: ADD: in the facility , or those to be seen by HIV counsellors; INCLUDE clients seen by a professional nurse appointed by a NPO and seconded to a clinic/service; INCLUDE clients whose medication was collected by a Home Community Based Care (HCBC) worker or family member/friend as a headcount registered at the registration point.
16. PHC private doctor clinical workdays: The actual workdays by private doctors employed on contract in the public sector rendering a general clinical service. Monitoring of services rendered by private doctors employed on contract to consult PHC clients in public health facilities in accordance with the NHI objectives to increase doctor coverage. Workday equivalents: 2 hours or less = 0.25 clinical workday; 3-4 hours = 0.5 clinical work day; 5-6 hours = 0.75 work day; 7-8 hours = 1 clinical work day; 12 hour shift = 1.5 work days; The work day equivalent should be multiplied by the days worked per doctor. The clinical workdays put in by each doctor must be added up.
17. PHC public doctor clinical workdays: The actual workdays by doctors employed in the public sector rendering a general clinical service. EXCLUDE days spend on training courses; EXCLUDE days spend at meetings; EXCLUDE days spend on administrative issues only (not dealing with clients in that time); EXCLUDE days not worked (e.g. leave, public holidays); EXCLUDE Dentist work days; EXCLUDE Psychologist work days; EXCLUDE work days by specialist doctors e.g. Psychiatrist. Work day equivalents: 2 hours or less = 0.25 clinical work day; 3-4 hours = 0.5 clinical work day; 5-6 hours = 0.75 work day; 7-8 hours = 1 clinical work day; 12 hour shift = 1.5 work days; The work day equivalent should be multiplied by the days worked per doctor. The clinical work days put in by each doctor must be added up.
18. Total population: Mid-year estimate of total catchment population.
19. Total population (MedicAid): Mid-year estimate of total catchment population that has medical insurance. This is a rough estimate based on the annual household survey data from StatsSA. For 2005-2007, StatsSA published district estimates. For 2008 onwards the district estimates are a proportional break-down of the published provincial estimates.
20. ART client naive start ART during month – total: Total naive clients who started life-long ART Include the following: - Clients who have never been exposed to ART for more than 30 days in total - Pregnant women enrolled onto life-long ART (Option B+) This also includes clients initiated on life-long tri. Monitors total number of clients started on life-long ART during month. INDICATORS
21. ART client remain on ART end of month – total: Total clients remaining on ART (TROA) are the sum of the following: - Any client on treatment in the reporting month - Any client withouth an outcome reported in the reporting month Clients remaining on ART equals [new starts (naive) + Experienced (Exp) + Transfer in (TFI) + Restart] minus [Died (RIP) + loss to follow-up (LTF) + Transfer out (TFO).

22. Newly diagnosed clients with a fasting blood glucose of > 7mmol/L or random blood glucose >11.1mol/L: This should increase as detection of cases improves.
23. Diabetes new client 40 years and older detection rate:
24. Hypertension treatment caseload: Total number of visits by clients with hypertension diagnosed and on treatment. Case load to reflect the burden on care. This can assist with planning at at all levels.
25. OPD headcount – total: Total clients attending general or specialist Outpatient clinics including new and follow up visits. {OPD headcount referred new}+{OPD headcount not referred new}+{OPD headcount follow-up}.
26. OPD new client not referred rate: New OPD clients not referred as a proportion of OPD new clients – total. Monitors utilisation trends of clients by-passing PHC facilities and the effect of PHC re-engineering on OPD utilisation. Do not include OPD follow-up and emergency clients in the denominator.
27. Patient Experience of Care satisfaction rate: Satisfied responses as a proportion of all responses from Patient Experience of Care survey questionnaires. Monitors patient satisfaction with health services.
28. PHC doctor clinical work load: Average number of clients seen per doctor per clinical work day. This includes doctors employed in the public and private sector. Monitors staff allocation/management and provide indirect indication of quality of client care. Low work load may be due to inefficient staff utilisation, and very high workload indicates too little time spent per client. Do not include delivery service t.
29. PHC private doctor clinical work load: Average number of clients seen per private doctor per clinical work day. This includes doctors employed in the public and private sector. Monitors the extent of effective utilisation of private doctors appointed on contract to consult clients in public se. Monitors staff allocation/management and provides indirect indication of quality of client care. Low work load may be due to inefficient staff utilisation, and very high workload indicates too little time spent per client. Do not include delivery service.
30. PHC professional nurse clinical work load: Average number of clients seen per professional nurse per professional nurse clinical work day. Monitors staff allocation/management and provide indirect indication of quality of care. Low work load may be due to inefficient staff utilisation, and very high workload indicates too little time spent per client. Do not include delivery service time in.
31. PHC utilisation rate – total: Average number of PHC visits per year per person in the population. {PHC headcount under 5 years}+{PHC headcount 5-9 years}+{PHC headcount 10-19 years}+{PHC headcount 20 years and older} + {PHC headcount 5 years and older}. {Total population}. Monitors PHC access and utilisation

APPENDIX 5: ETHICS CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Dr H Mukudu
School of Public Health
Medical School
University

E-mail: mukuduh@gmail.com

CC: Supervisor: Dr J Igumbor <Jude.Igumbor@wits.ac.za>
and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 19/06/2019

REF: *R14/49*

PROTOCOL NO: **M180956** *(This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)*

PROJECT TITLE: *Formative effects of general practitioners supply and demand on primary health care quality and outcomes in Tshwane National Health Insurance pilot district of South Africa*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Dr H Mukudu

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M180956

NAME: (Principal Investigator)	Dr H Mukudu
DEPARTMENT:	School of Public Health Medical School University
PROJECT TITLE:	Formative effects of general practitioners supply and demand on primary health care quality and outcomes in Tshwane National Health Insurance pilot district of South Africa
DATE CONSIDERED:	28/09/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr J Igumbor
APPROVED BY:	CB Penny Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	19/06/2019

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

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **September** and will therefore reports and re-certification will be due early in the month of **September** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

APPENDIX 6: APPROVAL FROM THE NATIONAL HEALTH RESEARCH DATABASE

TSHWANE RESEARCH COMMITTEE: CLEARANCE CERTIFICATE

MEETING: 12/12/2018
PROJECT NUMBER: 91/2018
NHRD REFERENCE NUMBER: GP_201811_007

TOPIC: Formative Effects of General Practitioners Supply And Demand on Primary Healthcare Services Quality and Outcomes in Tshwane National Health Insurance Pilot District of South Africa

Name of the Researcher:	Dr. Hillary Mukudu
Name of supervisors:	Jude Igumbor Kennedy Otwombe Adam Fusheini
Facility:	Tshwane District Health Facilities
Name of the Department:	University of Witwatersrand

NB: THIS OFFICE REQUEST A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE AND

NOTE THAT RESUBMISSION OF THE PROTOCOL BY RESEARCHER(S) IS REQUIRED IF THERE IS DEPARTURE FROM THE PROTOCOL PROCEDURES AS APPROVED BY THE COMMITTEE.

DECISION OF THE COMMITTEE: APPROVED

.....
Ms. Mpho Moshime-Shabagu **Date**..12/12/18
Acting Chairperson: Tshwane Research Committee

.....
Mr. Mothomone Pitsi **Date:** 2018.12.12
Chief Director: Tshwane District Health