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Title: Use of Continuous Quality Improvement to Improve Prevention of Mother To Child Transmission (PMTCT) Programme Performance in Amathole district municipality of Eastern Cape Province, South Africa.

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A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Public Health School of Public Health, University of the Western Cape (South Africa).

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Rationalization of Register

District Clinical Specialist Team

Quality Improvement Team

Consolidated Framework for Implementation Research

Amathole district, Eastern Cape

Declaration of originality

I declare that Use of Continuous Quality Improvement to improve Prevention of Mother to Child Transmission (PMTCT) Programme Performance in Amathole district municipality of Eastern Cape Province, South Africa is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have

been indicated and acknowledged by complete references.

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Date: 23 March 2023

Abstract

Background: Globally, new Human Immunodeficiency Virus (HIV) infections in children reduced by 54% due to implementation of Prevention of Mother to Child Transmission (PMTCT) of HIV since the peak in 1996, increase in Antiretroviral treatment (ART) coverage among children and increase in the proportion of pregnant women receiving ART.

In South Africa, significant progress has been made regarding PMTCT programme geared towards the virtual elimination of new HIV infections in children, which has contributed to 40% reduction of new HIV infection in children. This is due to the massive scale-up and implementation of PMTCT programme across the country. In addition, several initiatives were implemented, such as the National Strategic Plan (NSP), quality improvement initiatives using participatory data-driven approach, on-site monitoring and supervisory support, establishment of District Clinical Specialist Team (DCST), rolled out the District Health Information System (DHIS), and support from the National Department of Health (NDOH) supporting partners. Despite the progress made, South Africa is yet to achieve elimination of MTCT of HIV infection because of gaps in the quality of care at service delivery level and deficiencies in the quality of data due to discrepancies between the data routinely collected at health care facilities, data submitted to district office and sub-optimal use of data for programme planning and monitoring. Key challenges identified include inaccurate or incomplete recording and reporting, lack of understanding of key indicators by healthcare providers and stakeholders, and lack of a systematic process of feedback and monitoring linked to action at all levels of healthcare delivery.

Aim: This study explored the PMTCT data management and reporting challenges and the outcomes of the implementation of continuous quality improvement interventions used to improve and strengthen PMTCT programme performance across four sub-districts in

Amathole district of Eastern Cape Province, South Africa. This was done by exploring the plausible effects on the overall performance of selected PMTCT indicators despite the three significant changes that occurred during the implementation period (S2S programme cut short by 16 months, change in data collection system in DOH facilities through the scale up of ROR, and change in data collection and reporting of Infant PCR test positive rate at six weeks).

Methodology: A mixed-method research approach was used involving 3 phases. (a) The first phase was a descriptive quantitative and quanlitative study, which involved retrospective analysis of data input forms for accuracy and completeness of eight selected PMTCT indicators and correlation and mapping of the three PMTCT source documents; Tally sheet, Antenatal care (ANC) register, and Tick register. In addition, general observation of register completion and data capturing in 27 facilities as well as in-depth interview of 24 facility staff on causes of data discrepancies was done. (b) The second phase involved the use of plausibility assessment to review routine data from the District Health Information System (DHIS) for three PMTCT indicators and comparing performance in the intervention group (112 facilities) following the change ideas tested in the facilities with performance/non-performance in the 52 non-intervention facilities. In addition, the five Consolidated Framework for Implementation Research (CFIR) domains was used to interpret the results. (c) In the last phase, an interpretive qualitative case study was used, which involved in-depth interview of eight district health team members that provides technical assistance to support the implementation of quality improvement programme. The interview was conducted to understand the role played by the DCST in improving PMTCT programme performance in the district. Quantitative data was analysed using the statistical software, STATA and summarized using graphic presentations for the interpretation of findings, while qualitative data was collected for thematic and textual analysis and recommendations were generated.

Findings: The findings were aligned with the three phases. (a) In the first phase, we found inconsistencies in availability and use of the three source documents that were used to report PMTCT indicators. All selected facilities completed the three source documents and consolidated their PMTCT data monthly before reporting to DHIS. Less than half of the facilities (44%), had already started using the rationalised registers. However, they did not transition entirely because they still use other registers, especially the ANC register. Reasons for not displaying facility performance include clinicians not properly completing the clients' information, and a shortage of staff to collect, report, and analyse data (b) In phase two, there was a highly significant increase in the intervention facilities when the baseline was compared to the intervention period for two PMTCT indicators; 5% in 1st antenatal (ANC) visit < 20 weeks rate (p <.001) and 7% in ANC clients' retest rate (p <.001). However, the rate of clients initiated on ART increased by 65% and 66% in supported sites and non- supported sites respectively, both not significant at p >.05, while the infant polymerase chain reaction (PCR) test positive at birth rate in the supported sites remained unchanged at 0.7% and decreased by 0.9% in the non-intervention facilities, both not significant at p >.05). Changes in the indicator performance among the supported facilities and possible reasons for these changes, as well as the ways they influenced programme implementations was referenced using the five constructs of the CFIR. (c) In phase three, our study showed that the DCST significantly enhances the staff's clinical skills, knowledge, and work performance to care for and manage the mother and baby pair. In addition, DCST plays a vital role in providing programme oversight and complements the technical support provided by the DOH managers and the quality improvement programme support by DOH partners. One of such partners was South to South Program for Comprehensive Family HIV Care and Treatment, Stellenbosch University, Cape Town, South Africa (S2S) team which supported data verification to identify

gaps in the PMTCT programme. The work of the DCST is aimed at improving and achieving PMTCT programme desired outcomes.

Conclusion: The findings from this study clearly showed that there was inconsistency in documentation and reporting of PMTCT data and thus data discrepancies still exit. The implementation of the rationalized registers was at different timelines and different implementation phases because some of the facilities staff are comfortable using the old registers. Therefore, it is very important to provide capacity building, supportive supervision and change management to health care workers in order to improve documentation and capturing of the data systems. This will reflect the true performance of the facilities and implement the rationalized registers to scale. In addition, developing, testing, and monitoring change ideas for quality improvement projects are essential to scale up the implementation of CQI with data-driven approach. The use of high-quality data that identifies gaps in service delivery, and inform improvement approaches to ensure that data-driven decision-making and resource are allocated to maximize programme effectiveness and efficiency. Lastly, the District Clinical Specialist Team is a valuable specialty for improving healthcare access and quality because they are highly skilled staff. However, there is need to advocate for a full complement of this highly skilled specialty in order to build the capacity of health care providers and mentor them so that they can provide and improve healthcare access and quality.

Date: 23 March 2023

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Dedication

This dissertation is dedicated to Almighty God for His grace, provision and protection and for seeing me through this project; through Him all things are possible.

To my late father, James Abiodun Oyebanji for the uncompromising principle that guided his life.

To my wife, Mrs. Oluwakemi Oluwafisayomi has been my "course-mate" though not registered for the course and for the magnificent devotion to her family.

To my son, Oluwatofunmi Oyetade Oyebanji and daughter, Oluwatoni Oyewumi Oyebanji for making everything worthwhile.

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Finally, I give gratitude to Almighty God for lifting me up at all times and for strengthening me throughout the programme.

List of manuscripts from this study

	Manuscript title	Journal	Status
1	PMTCT Data Management and Reporting During the Transition Phase of Implementing the Rationalised Registers in Amathole District, Eastern Cape province South Africa.	International Journal of Environmental Research and Public Health	Published on 22 November 2022 https://www.pdfescape.com/open/document/f1a04e15-d50b-4214-b352-2db539a0f104
2	Promoting awareness of the District Clinical Specialist Team in the Amathole District, South Africa: An essential speciality in improving healthcare access and quality	Tropical Medicine and Infectious Disease	Published on 13 December 2022 https://www.pdfescape.com/open/document/be3f5154-5bbc-45b5-a6d5-53fcc0d87812
3	Plausibility Evaluation of PMTCT Programme Performance following the Use of Continuous Quality Improvement in Amathole District, Eastern Cape, South Africa.	Journal of Health & Social Sciences	Yet to be submitted
4	Last mile operational challenges and missed opportunities to eliminate MTCT in rural clinics of Amajuba district, Eastern Cape Province, South Africa	Journal of Health & Social Sciences	Yet to be submitted

Abbreviations

	Abbreviation	Meaning
1	**AIDS**	Acquired Immuno Deficiency Syndrome
2	**ANC**	Antenatal Care
3	**ANM**	Auxiliary Nurse Midwife
4	**APS**	Adherence and Psychosocial Support
5	**ART**	Antiretroviral Therapy
6	**ARV**	Antiretroviral
7	**AZT**	Azidothymidine/Zidovudine
8	**CFIR**	Consolidated Framework for Implementation Research
9	**CHC**	Community Health Centre
10	**CHW**	Community Health Worker
11	**CQI**	Continuous Quality Improvement
12	**DCST**	District Clinical Specialist Team
13	**DHB**	District Health Barometer

14	**DHT**	District Health Team
15	**DHIS**	District Health Information Management System
16	**DHMT**	District Health Management Team
17	**DOH**	Department of Health
18	**EHMIS**	Efficient Health Management Information System
19	**eMTCT**	Elimination of Mother to Child Transmission of HIV
20	**FDC**	Fixed-Dose combination Therapy
21	**HCP**	Health Care Professional
22	**HCW**	Health Care Worker
23	**HIV**	Human Immunodeficiency Virus
24	**HMIS**	Health Information Management System
25	**HIS**	Health Information System
26	**HSS**	Health System Strengthening
27	**ICT**	Information Communication Technology
28	**LMICs**	Low- and Middle-Income Countries

29	**MDGs**	Millennium Development Goals
30	**MDT**	Multi-Disciplinary Team
31	**MMC**	Medical Male Circumcision
32	**MBP**	Mother Baby Pair
33	**MNCWHN**	Maternal Newborn, and Child, Women's Health and Nutrition
34	**MTCT**	Mother to Child Transmission of HIV
35	**MTEF**	Medium-Term Expenditure Framework
36	**NDOH**	National Department of Health
37	**NDP**	National Development Plan
38	**NGO**	Non-Governmental Organization
39	**NHLS**	National Health Laboratory Services
40	**NIDS**	National Indicator Data Set
41	**NSP**	National Strategic Plan
42	**OM**	Operational Manager
43	**OTE**	Opportunities for Transcribing Errors

44	**PCR**	Polymerase Chain Reaction
45	**PEPFAR**	U.S. President's Emergency Plan For AIDS Relief
46	**PHC**	Primary Health Care
47	**PMNCH**	Partnership for Maternal, Newborn & Child Health
48	**PLHIV**	People Living with HIV infection
49	**PMTCT**	Prevention of Mother To Child Transmission of HIV
50	**QI Teams/QIT**	Quality Improvement Teams
51	**RHIS**	Routine Health Information System
52	**ROR**	Rationalization of Registers
53	**RTHB**	Road To Health Booklet
54	**SAG**	South African Government
55	**SDGs**	Sustainable Development Goals
56	**SOP**	Standard Operating Procedure
57	**S2S**	South to South Programme for Comprehensive Family HIV Care and Treatment

58	**UHC**	Universal Health Coverage
59	**UNAIDS**	Joint United Nations Programme on HIV/AIDS
60	**USAID**	United States Agency for International Development
61	**Web DHIS**	Web-based District Health Information Management System
62	**WHO**	World Health Organization

OUTLINE OF THE THESIS

This thesis is subdivided into five chapters.

Chapter 1 is an introduction to the thesis. This chapter provides an overview of four main aspects that contextualise the thesis: (i) an overview of Prevention of Mother To Child Transmission (PMTCT) of HIV programmes and progress made in South Africa; (ii) initiatives implemented by South Africa DOH to eliminate MTCT of HIV infections; (iii) the success of the PMTCT programme in South Africa, and (iv) gaps identified in the PMTCT programme that informed the need to conduct this study. This chapter also includes the lessons learned from Continuous Quality Improvement (CQI) studies implemented in South Africa to strengthen PMTCT. It also include the role played by the District Clinical Specialist Team (DCST) and how the team work together with the district personnel at different management levels to improve and strengthen PMTCT programme performance. The latter part of the chapter states the rationale and significance of the study as well as the description of the conceptual framework guiding the study and ends with a conclusion.

Chapter 2 is the literature review, which is sub-divided into four main sections, namely (i) efforts to reduce maternal, infant and child mortality globally, in Sub-Saharan Africa and in South Africa, (ii.) health system reforms in terms of the Efficient Health Management Information System (EHMIS) for improved decision-making, (iii) the effect of the rollout of the Rationalised Register on documentation and reporting of PMTCT programme data (iv) the District Health Information System (DHIS) data collection process in Eastern Cape (iv) Health Care Workers (HCW) and challenges encountered with routinely collected PMTCT data in the district (v), the implementation of CQI and the support provided by the DCST and

South to South (S2S) programme for Comprehensive Family HIV Care and Treatment to improve PMTCT programme data in Amathole district of Eastern Cape, South Africa.

Chapter 3 focuses on the research methodology used in the study, including the research questions, aim and objectives. This chapter also provides an overview of the study design, recruitment of participants, ethical consideration, description of the data collection tools, data validity and reliability, variable definition and data analysis. The last section gives a brief description of the methodologies used in the research, which include the review and analysis of the quantitative data using routine data from the DHIS for PMTCT indicators. It also includes the qualitative component consisting of in-depth interview of the Health Care Professionals (HCPs) to understanding their experience on how routine PMTCT data elements were collected and reported in the facilities during the transitioning phase of the rationalised registers. In addition, it also includes interview of the quality improvement team members and the district managers to assess their understanding of the interrelationship of PMTCT programme management and the use of data at different management levels to strengthen and improve the PMTCT programme.

Chapter 4 provides an overview of the findings of this study categorized into three parts to align with the objectives of the study (i) data management and reporting of PMTCT programme, effect of rollout of the rationalised register on the documentation and reporting of PMTCT programme data during the transitional period, (ii) plausibility evaluation of selected PMTCT programme indicators following the implementation of CQI, and (iii) interrelationship of DCST and the district health management team to improve healthcare access and quality.

Chapter 5 restates the research questions, summarizes the key findings and guides the discussion of the findings. It also outlined the findings of this study and relates it to the work done by other scholars in published literature.

Chapter 6 details the policy implications, the study limitations encountered while conducting this study, contribution to knowledge and also provides suggested areas that can be explored for future research.

Chapter 7 This section summarizes the recommendations for action based on the findings of this study and conclusions.

CHAPTER 1: INTRODUCTION

1. Background

1.1.1 Mother-to-Child Transmission of HIV

Globally in 2021, there was a 54% reductioin new Human Immunodeficiency Virus (HIV) infections in children, due to the success of the World Health Organization (WHO) HIV programme on Prevention of Mother to Child Transmission (PMTCT) of HIV since the peak in 1996 [1, 2].

Antiretroviral treatment (ART) coverage among children increased from 18% in 2010 to 52% in 2021 and the proportion of pregnant women receiving ART for PMTCT increased from 46% in 2010 to 81% in 2021 [3]. Ninety-nine thousand (99,000) of those that did not have access to effective treatment died due to AIDS-related illnesses [4] and about 40% of the 160,000 children newly infected with HIV were infected during breastfeeding [5]. In some countries, more infant infections occur during the postnatal period rather than during pregnancy or labour because of the difficulty faced in maintaining women living with HIV in care and on effective ART throughout the breastfeeding period. This is also attributed to the reduction in the detection and management of new infections occurring among women while they are pregnant or breastfeeding [5].

Studies have shown that the Mother-to-Child-Transmission (MTCT) rate in mothers that missed being part of the PMTCT intervention programme have MTCT rates between 25% and 35% at 6 months post-delivery. However, most of this can be averted through prevention of vertical transmission of HIV programmes, including early diagnosis of maternal HIV infection, early diagnosis of infant HIV, appropriate feeding practices [with antiretroviral

(ARV) prophylaxis if breastfeeding], and effective treatment and care of infants with HIV infection [6–9].

The study recognized the current terminology of "vertical transmission" as an alternative to "mother-to-child transmission" of HIV, but in order to avoid placing the mothers at the centre of HIV transmission, to reduce stigma and to be consistent with other disease elimination language (WHO 2021), this study adopted the use of the term "mother-to-child transmission" of HIV because the study was conducted during the term PMTCT was still recommended for use.

1.1.2 MTCT in South Africa

South Africa, which is among 22 countries with 90% of the world's HIV positive pregnant women, prioritisinge PMTCT programmes to achieve the goal of elimination of Mother-To-Child Transmission of HIV (eMTCT) [10]. South Africa in 2021, recorded 3,900 deaths among children compared to 51,000 total number of AIDS-related deaths among adults. [4, 11]. Many of these deaths are recorded among infants born to mothers who do not receive PMTCT interventions [4]. The steps taken in these countries are evidenced by the global plan towards the elimination of new HIV infections among children by 2015 and keeping their mothers alive; this is outlined in the 10-point action plan for implementation in the 22 priority countries with low and concentrated epidemics.

In South Africa, significant progress has been made regarding PMTCT programme geared towards the virtual elimination of new HIV infections in children. This can be attributed to the massive scale-up and implementation of the PMTCT programme across the country, following the national roll out in 2002. The scale up plan led to a significant improvement in the MTCT rate at six weeks from 3.6% in 2011, 1.5% in 2016 and 0.9% in 2018 [12-16] as

seen in fig:1 below

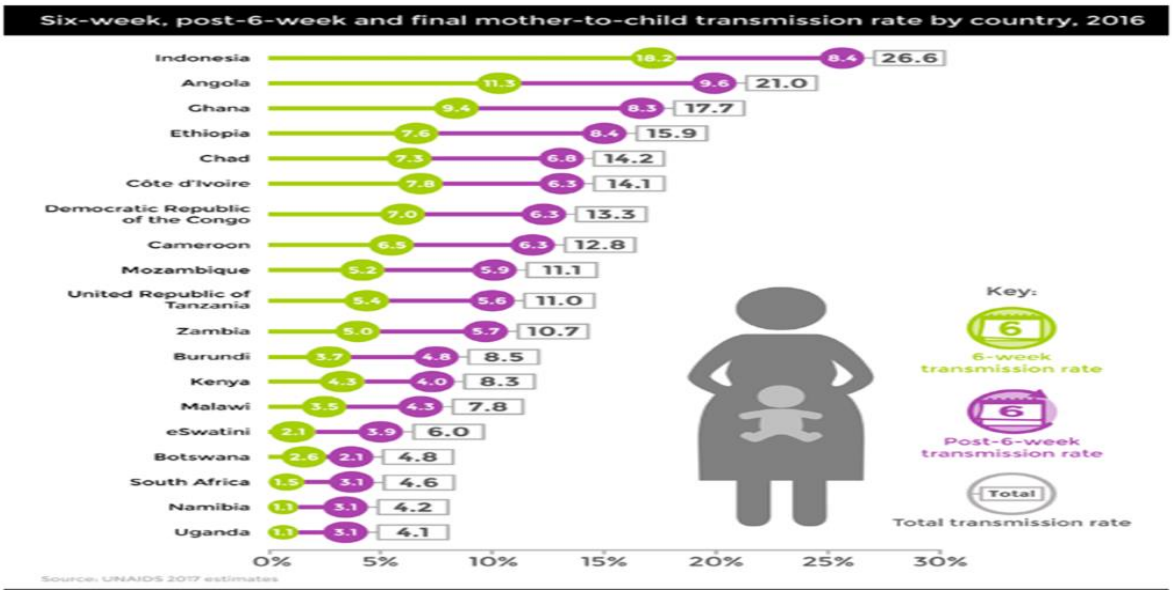


Fig 1: *MTCT transmission rates across 19 countries*

South Africa recorded substantial reduction in the early infant transmission rate at six weeks after delivery from 5.8% in 2009 to 1.5% in 2015 [17,18]. This can be attributed to increased access to effective maternal antiretroviral therapy (ART), and improved infant prophylactic regimens. This was followed by the launch of the project Last Mile Plan (LMP) or eMTCT in 2016 with a specific focus on five key areas: leadership, governance and coordination, integrating PMTCT interventions into routine maternal and child healthcare (MCH) and primary healthcare (PHC), monitoring and evaluation, as well as increased community awareness and involvement [19-21].

In addition to the above, adopting the WHO options in 2011 and 2013, strengthened clinical guidelines for treating HIV in pregnancy, and the introduction of Fixed-Dose Combination (FDC) for pregnant women at the first antenatal visit among others has been instrumental to the great strides made in PMTCT programme in South Africa [21, 22].

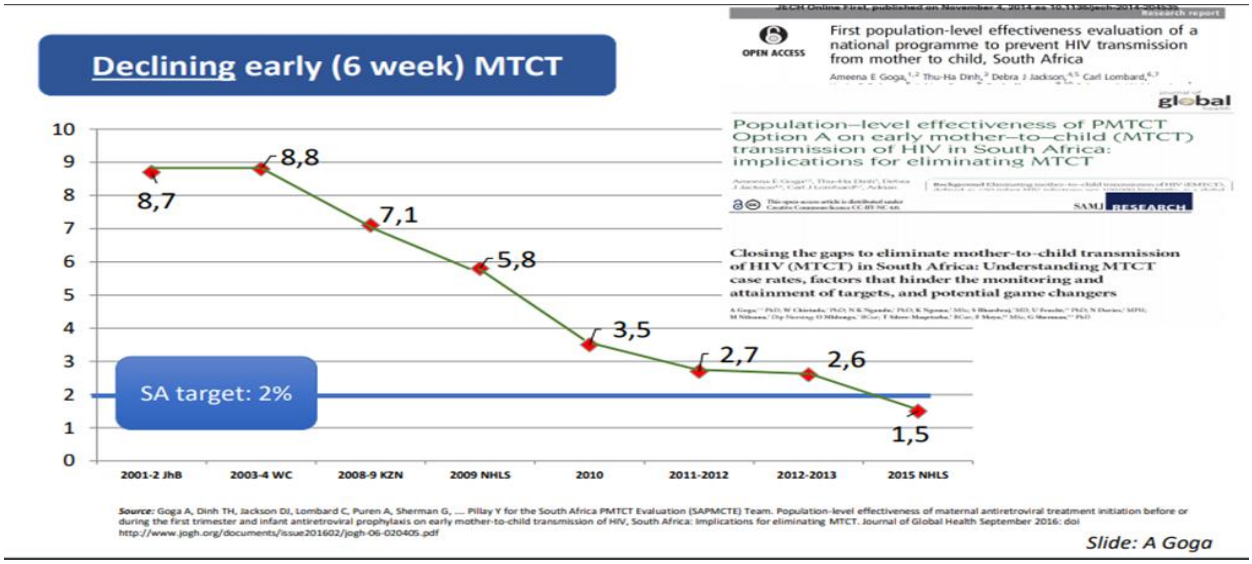


Fig 2: *Trends showing decline in MTCT (6 weeks) from 2001 to 2015*

In addition to the above, the clinical guidelines for treating HIV in pregnancy were strengthened over time. The South African Government (SAG) adopted the WHO Option A recommendations in the 2011 in the PMTCT guidelines, where different ART regimens were provided to mothers based on their immunological profile, then moved to Option B in 2013. Option B recommend that all HIV-infected pregnant and breastfeeding women should be treated with triple ART. In 2015, Option B+ was adopted, which advocates lifelong triple ART irrespective of CD4+ cell count or clinical stage [23]. Daily infant Nevirapine (NVP) prophylaxis for at least 6 weeks' duration has been part of national guidelines since 2010, with infants identified as high risk recommended to either extend daily NVP for 12 weeks or be provided with dual prophylaxis of NVP plus zidovudine (AZT) for 6 weeks [23].

In addition, the introduction of Fixed Dose Combination (FDC) for pregnant women at the first antenatal visit (whether newly diagnosed or known to be living with HIV) but not on ART, the immediate priority for all HIV-positive pregnant or breastfeeding women, with no active TB or contradiction to FDC [Tenofovir/Emtricitabine/Efavirenz (TDF/FTC/EFV)] has

been instrumental to the great strides made in PMTCT programme in South Africa (see table 3 below)

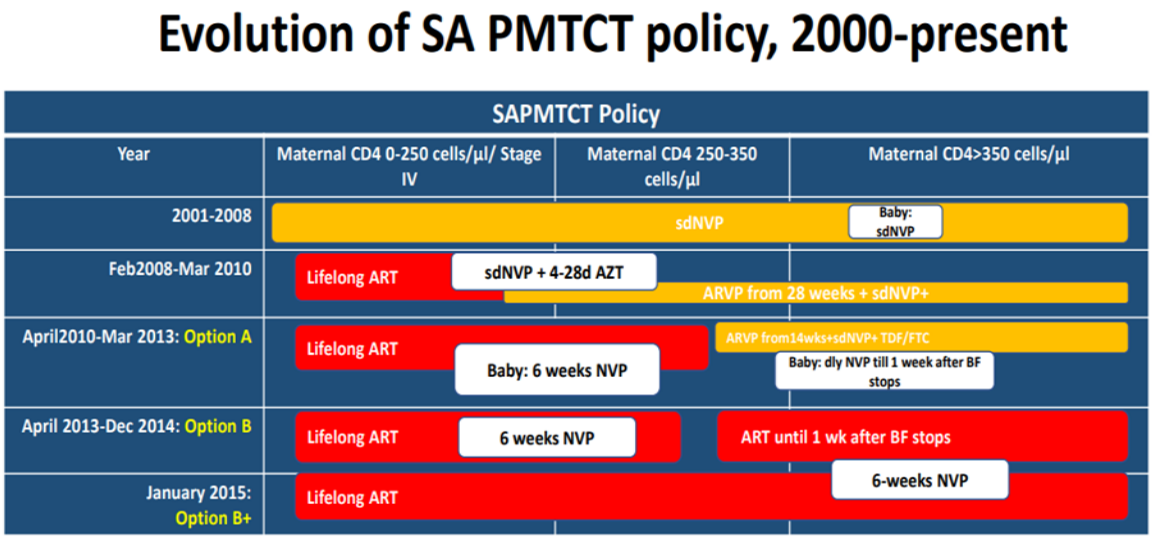


Fig 3. *Evolution of South Africa PMTCT Policy (from 2000 to 2015)*

Although South Africa has made great strides in reducing the mother-to-child transmission of HIV over the past years, there remain several challenges. These challenges include the quality of care at the service delivery level, which is not optimal, resulting in the loss of patients along the care cascade, and a lack of data on the quality of care provided [24, 25]. Some of these challenges were successfully addressed in a quality improvement intervention study conducted by Bhardwaj and others in resource constrained primary health care facilities the Cape Metro District, in Western Cape, South Africa [23]. Bhardwaj et al (2014), study used CQI to strengthen the PMTCT programme by implementing system changes to assist healthcare workers in identifying and improving performance gaps in the PMTCT pathway. As a result, the intervention reported an increase in critical intermediate PMTCT processes indicators, with a 12% increase in antenatal AZT uptake (from 74% to 86%), a 15% increase in PMTCT clients on ART at the time of labour (from 10% to 25%), 41% increases in intrapartum AZT uptake (from 43% to 84%), and 20% increases in postnatal HIV testing (from 79% to 95%). In addition,

following the scale-up of the quality improvement programme in South Africa, Bhardwaj et al. in their study, concluded that since 2011, South Africa has experienced a remarkable improvement across all key indicators in the PMTCT cascade, which contributes to improved quality of care for HIV-infected patients [26].

1.1.3 Policy and Programmes to reduce/eliminate MTCT in South Africa

The Global Plan towards the Elimination of New HIV Infections among Children by 2015 and Keeping their Mothers Alive outlines a 10-point action plan for implementation by the 22 priority countries with low and concentrated epidemics [27,28]. One of the 10-point plans was to improve outcome assessment, data quality, and impact assessment [27,28]. The South Africa National Strategic Plan (NSP) on HIV, STIs and TB 2012 - 2016 set a goal of 'Reducing MTCT to less than 2% at six weeks post-delivery and less than 5% at 18 months of age by 2016 [29]. Building on the NSP 2012 to 2016, NSP 2017-2021 showed that significant progress was made because of targeted services to PMTCT both in prenatal and postnatal periods. This resulted in a positivity rate at birth of 0.59% for infant Polymerase Chain Reaction (PCR) done between April 2018 to March 2019 and 0.74% for infant PCR tests at ten weeks for the same period [30]. Also, the South African National Action Framework for No Child Born with HIV by 2015 and Improving the Health and Wellbeing of Mothers, Partners and Babies in South Africa have as one of the five key strategic objectives in the action framework, strengthening monitoring and evaluation of the PMTCT programme linked to the Maternal, New-born, Child and Women's Health (MNCWH) programme to ensure good data quality at source for Antenatal Care (ANC) and PMTCT programmes [31].

To achieve this goal; several initiatives implemented in SA showed that decentralized planning and monitoring produce results [32-34]. An example of this initiative was implemented in 11 districts of KwaZulu Natal province of South Africa with a primary focus

on the use of data by programme managers to gain an in-depth understanding of data to improve PMTCT coverage and service delivery. This involved implementation of quality improvement (QI) initiatives at health facility level using participatory data-driven approaches and on-site monitoring and supervisory support [35-40].

Secondly, the National Department of Health (NDOH) rolled out the District Health Information System (DHIS) across the country in the year 2000 as the main source of regular information for planning and management of health services to ensure standardisation across the country about the definitions of data elements and data flow policies.

Another initiative of note is the establishment of the District Clinical Specialist Team (DCST) in 2012 by the National Department of Health to support the district management teams in improving maternal child and neonatal health services. Each district has one DCST and each team ideally comprises seven specialists: Obstetrician and Gynaecologist, Advanced Midwife, Paediatrician, Paediatrics nurse, Family Physician, Primary Health Care (PHC) nurse and Anaesthetist. The DCST role involved ensuring that health facilities across all levels are responsible for continuous improvement of quality care and service delivery for effective and efficient delivery of universal healthcare to individuals and communities [42, 43]. The function of the DCST is to improve the quality of healthcare as well as health outcomes for mothers, newborns, and children, as a principal component of strengthening the district health system. DCST members are expected to function as a team and individually within their respective disciplines. They are responsible for the following areas of work: quality of clinical services, clinical training, monitoring, evaluation and improving clinical services. Other responsibilities include supporting district-level organisational activities, health systems and logistics, collaboration, communication and reporting, teaching and research activities [41].

In addition to the above, the NDOH has supporting partners such as South to South Programme for Comprehensive Family HIV Care and Treatment (S2S) in Eastern Cape Province. S2S implemented the eMTCT Quality Improvement collaborative approach based on the Institute for Healthcare Improvement (IHI)'s Breakthrough Collaborative Series [43, 44]. However, despite all these initiatives, we continue to experience discrepancies in PMTCT programme level data at the facility, district and national levels.

1.2 PMTCT Programme in South Africa

This section describes initiatives to strengthen the PMTCT programme in South Africa introduced in the previous section, and the South-to-South Quality Improvement Collaborative Programme towards which this study is directed.

1.2.1 Initiatives implemented by the South African Government to improve PMTCT programme

Several initiatives were implemented in South Africa to improve the PMTCT programme in the country. This includes the implementation of (i) NSP on HIV, STIs and TB 2012 - 2016 and 2017-2022 (as discussed above) [30], (ii) South African National Action Framework for "No Child Born with HIV by 2015, and Improving the Health and Wellbeing of Mothers, Partners and Babies in South Africa". This action framework has five key strategic objectives aimed at strengthening the monitoring and evaluation of PMTCT and MNCWH programmes to ensure good data quality [27]. The implementation of the above as well as the decentralized planning and programme monitoring instituted to focus primarily on the use of data, working with programme managers to gain in-depth understanding of data [30,35]. and the support garnered from the DOH partners contributed greatly to improved programme performance. In addition to the above, the following initiatives were implemented by NDOH.

1.2.1.1 Action Framework for Eliminating MTCT of HIV and the use of 'Cascades' as a performance tracking tool

Between June and November 2011, the NDOH developed an action framework for eliminating MTCT of HIV by 2015 in South Africa. The overarching foundation of the national action framework is the need for evidence-based, accelerated programme scale-up and delivery of quality services with innovation. The framework proposed that data-driven action plans are needed for all the districts and provinces. These action plans could then inform provincial and district-specific work planning, implementation and monitoring. However, pockets of new infections in children under 15 years of age still exist because of transmission during pregnancy and breastfeeding (MTCT). In order to put an end to this by 2030, we need to build on the successes and investments made over the past years [45,46].

Linked to the above is "The 90-90-90 compendium" by Malaza et al (2016) which elaborated on the development and use of programme cascades to monitor programme performance towards achieving the 90-90-90 targets at the facility, sub-district and district levels. The cascade was designed to monitor the performance of the seven key HIV/TB indicators in the continuum of care with tracer indicators for each programme area monitored individually to show its effect on the cascade [47].

Another example is the scale-up of quality improvement initiative led by DOH in collaboration with partners. This was aimed at developing, implementing and monitoring a data-driven intervention to improve facility, district, provincial and national PMTCT-related performance. The initiative recognised that the backbone for this intervention to succeed is a series of critical pathways called the PMTCT cascade that pregnant HIV-positive women need to move through to optimise their health. The intervention was monitored through the

use of process indicators collected routinely as part of the DHIS done in some other countries [48,49].

The results of these interventions led to the improvement seen over a 3-year period (2010 - 2012) in the national key indicators along the PMTCT cascade, which include improvement in early antenatal registration from 37% to 43%, increase of 19% (from 28% to 47%) in antenatal retesting rate for women with a negative result from 2010 to 47% in 2012. Furthermore, one of the districts that showed significant improvement was Lejweleputswa district in Free State province, where the proportion of HIV-positive antenatal women started on ARV therapy improved from 62% in 2010 to 80.3% in 2012, and early antenatal registration improved from 42.8% in 2010 to 54% in 2012 [50].

1.2.1.2 Roll out of District Health Information System (DHIS)

The DHIS was rolled out across the country in the year 2000 as the main source of regular information for the planning and management of health services. In general, there is standardization across the country in terms of the definitions of data elements and data flow policies. One of the primary objectives of DHIS implementation in South Africa is to be able to generate, analyse and disseminate health information in order to facilitate effective policy formulation, management, planning, budgeting, implementation, monitoring and evaluation of health services and program interventions in the health sector. [51].

1.2.1.3 Introduction of DCST

In 2012, South Africa established district-based clinical specialist teams (DCSTs), a re-engineering stream in Primary Health Care (PHC) created to facilitate clinical governance at the lowest levels of the healthcare system. The DCST role involved ensuring that health facilities across all levels are responsible for the continuous improvement of quality care and

service delivery for effective and efficient delivery of universal healthcare to individuals and communities [42]. The DCST Ministerial Report to the South Africa Honorable Minister of Health in 2011 stated that the function of the DCST is to improve the quality of healthcare as well as health outcomes for mothers, newborns, and children, as a principal component of strengthening the district health system. DCST members are expected to function as a team and individually within their respective disciplines. The composition of the DCST and their responsible work areas is detailed on page 10 above. In addition to their roles and responsibilities, the DCST at the district level provides technical expertise to strengthen the effectiveness of the health systems and ensure that mothers, newborns and children are provided with quality healthcare services to reduce maternal and child mortality [41]. The functions of the DCST were aligned with the DOH support partner like S2S to support quality improvement programme initiative, which involves organising and implementing activities to improve access to healthcare services and programme monitoring to improve the quality of healthcare service delivery.

The complementary activities of the DCST include (i) providing clinical training to healthcare professionals (HCPs) to improve their knowledge and ability to deliver the quality of healthcare service, (ii) monitoring and evaluation of maternal, child and women's health programmes by checking the data submitted by institutions to the DHIS and correlating this with the institutional Problem Identification Programme (PIP) data to identify gaps within the datasets, and (iii) ensure the implementation of the four tiers of clinical governance, supporting the strengthening of management systems and provision of supportive supervision to healthcare professionals [41].

1.2.1.4 Rationalization of Registers

The South African National Department of Health (NDOH), in March 2015, launched the implementation of Rationalisation of Register (ROR), which was aimed at reducing the amount of time invested in completing the registers and improve data collecting process so that the health care workers would dedicate more time to improve data quality [41]. This forms part of the Continuous Quality Improvement (CQI) process implemented in the facilities which allows collection and reporting of quality data that is analyzed and used to continuously improve programme performance and the delivery of quality healthcare services. aimed at reducing the amount of time invested in completing the registers and collecting data. In addition, the recommendation of the NDOH to reduce the number of registers from 56 to a maximum of 6 standardized registers was to reduce the burden and time spent by health care workers in completing too many registers used for reporting in the health facility; to also introduce more user-friendly registers, to encourage the facility staff to report quality data and to use data for information management to improve programme outcomes.

1.2.1.4 Partners Support

Many Non-Governmental Organizations (NGOs) partner with the DOH to support and implement quality PMTCT programme aimed at improving programme outcomes. One such partner in Amathole district of Eastern Cape, South Africa is the S2S.

S2S was situated in the department of paediatrics and child health, Stellenbosch University, Cape Town. The organization started working with the Department of Health in Eastern Cape Province in 2013 [44]. The aim of the program was to support the PMTCT program by facilitating the translation and implementation of the eMTCT Action Framework, and institutionalizing quality improvement capacity at health facility, sub-district, district and provincial levels. The support also includes building the capacity of QI teams and managers

in the district and the implementation of QI initiatives to show improvement in PMTCT coverage and service delivery [13, 52] at facility level using participatory data-driven approaches and on-site monitoring and supervisory support.

S2S Quality Improvement Collaborative model was funded by United States Agency for International Development (USAID) to support the Department of Health (DOH) and implemented from October 2015 to May 2017 in three provinces in South Africa; Eastern Cape, Northern Cape and Western Cape, to support the DOH to achieve eMTCT of HIV and improve Paediatric HIV indicators. The support included, providing comprehensive technical, programmatic capacity building and systems to health care facilities, ensuring provision of quality HIV care and treatment services, and integrating and strengthening PMTCT, Paediatric HIV and Adherence and Psychosocial Support (APS) programmes [44]. The eMTCT collborative model was designed to develop, test and share best practices among participating facilities in order to achieve improved health outcomes in maternal and child health. Unfortunately, this support ended in May 2017 due to cut in funding.

1.2.3 South to South Quality Improvement Collaborative Programme

The eMTCT Quality Improvement collaborative approach implemented by S2S in Amathole district, Eastern Cape Province involved the establishment of a shared learning system that brings together a large number of multidisciplinary teams to work together over a defined period (typically 12–18 months); to rapidly achieve significant improvements in processes, quality, and efficiency of a specific area of care, with the intention of spreading successful changes to other sites. The approach also involved the teams gathering at workshops (called Learning Sessions) at regular intervals (every three months in S2S's adapted model) where a theme for improvement along the PMTCT care pathway was introduced and ideas shared. Change ideas were tested in the facilities during the "Action Period" between Learning Sessions and the

impact of these changes was regularly tracked. The teams thereafter adapt and spread existing best practices to multiple settings and achieve dramatic gains in the quality and outcomes of their services [43].

This study commenced in January 2017 with a baseline assessment of the status of PMTCT data management and reporting. This involved the review of both the routine data from the District Health Information System for selected PMTCT indicators and review of the three source documents [Tally sheet, Antenatal care (ANC) register, Tick register] used for collecting and reporting PMTCT data elements in the health facility. The review and data-collecting process coincided with the commencement of the implementation of the rationalised registers during the 2016/2017 (from April 2016 to March 2017) DOH financial year.

In addition, we conducted a plausibility assessment to review routine DHIS data for four selected PMTCT indicators to demonstrate improvement/non-improvement seen prior to implementation of CQI, in comparison with performance after implementation of CQI. However, the three significant changes in programme implementation during the study period were considered, and these included, (i) S2S programme spread phase which was designed for 36 months but only implemented for 20 months (from October 2015 to May 2017); it was cut short by 16 months, (ii) Change in data collection system in DOH facilities with the scale-up of the implementation of Rationalisation of Registers (ROR), where the DOH recommended the use of a maximum of six standardised registers in the facility as against the initial 56 registers used previously for documenting and reporting PMTCT programme data, to improve the quality of data collected and reported, and (iii) Change in the data collection and reporting of one of the indicators was made in April 2016. The infant PCR test positive rate at six weeks was changed to 10 weeks.

The lead researcher was employed by S2S as one of the PMTCT/MNCH/HIV clinical advisor to support the S2S eMTCT quality improvement collaborative model implemented in the three provinces in South Africa (Eastern Cape, Northern Cape and Western Cape), where S2S supported the South Africa DOH. The researcher's key performance areas include (i) to support the National Department of Health (NDOH) and other partners to scale up coverage of comprehensive care and treatment package of services to HIV affected, infected and exposed children and ensure effective management of TB/HIV co-infection, (ii) support the strengthening, development and management of clinical systems related to PMTCT, peadiatrics, maternal, child, and women's health and nutrition, and Sexual and Reproductive Health (SRH) service scale-up (iii) support the implementation of NDOH priorities, such as the strategic plan for Maternal, Newborn, Child and Women's Health (MNCWH), HIV, TB, and STIs and Nutrition in South Africa (iv) use quality improvement techniques to provide technical assistance to provincial and district management teams to improve the quality of service, and (v) actively participate in health systems research on program interventions of PMTCT and HIV/AIDS programming areas.

As part of the S2S team, the lead researcher identified the challenges encountered to document and collect routine PMTCT data and the discrepancies in reporting PMTCT data. This inspired the lead researcher to assess and document the PMTCT data management processes and reporting challenges encountered. In addition, the lead researcher also tracked and monitored the performance of selected PMTCT indicators following the implementation and use of continuous quality improvement interventions aimed at improving and strengthening PMTCT programme performance in Amathole district of Eastern Cape, South Africa.

1.2.3.1 Capacity building of healthcare providers

At the preparatory phase of implementing the S2S eMTCT quality improvement collaborative initiative, baseline assessment was conducted to identify health care professionals training need, including the facility, district and programme managers in order to improve their knowledge about quality improvement and improve the uptake and delivery of quality health services. Between May 2016 and May 2017, S2S conducted 56 sessions of quality improvement coaching for 156 participants, including clinicians and data management staff across the 112 supported facilities. In addition, 128 QI team leaders and some facility managers had refresher training on various quality improvement topics in March 2017. The aim of the capacity building was to improve the skills and performance of individual healthcare providers in using quality improvement methods to improve PMTCT services [44].

1.2.3.2 Development, testing and implementation of change ideas

Following the training on quality improvement, facility quality improvement teams were formed with a base composition of a minimum of clinicians (medical doctors or/and professional nurses) and data capturers. In addition, other cadres like lay counsellors, Community Health Workers (CHWs) and other Health Care WorkeHCWs(HCW) were part of the facility QI team, depending on the staffing structure and availability of facility staff. Five learning sessions were conducted from April 2016 to May 2017, with an average of 40 participants per session. In the fifth learning session, all the participants came together to share various change ideas and best practices with other facilities for scale-up [44].

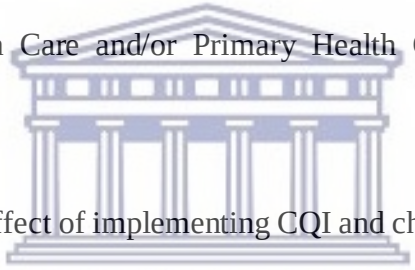
Four PMTCT indicators (ANC 1st visit before 20 weeks, HIV retesting rate, ANC clients retest and PCR at birth for HIV-exposed infants) were selected to test the change ideas and to show how and what the expected change in this study will be, as seen in table 10.

The study compared the improvement/non-improvement seen across 112 intervention sites supported with implementation of CQI interventions ((i) capacity building of HCPs, (ii) testing and implementation of change ideas, and (iii) participatory data-driven review meetings), with 52 non-intervention sites and answer the following questions.

1. Did the implementation of CQI have a positive effect on the four selected PMTCT indicator performance in the 112 intervention sites?

2. Did the 112 intervention group perform differently from the 52 non-intervention group?

For comparative analysis, this study considered 52 non-intervention facilities which are DOH facilities in Amathole district in the same districts where the intervention took place. This comparative groups were not matched or chosen randomly but are facilities in the district comprising Community Health Care and/or Primary Health Care facilities similar to the intervention group.



1. The hypothesis for the effect of implementing CQI and change ideas will improve three indicators (1st ANC visit < 20 weeks rate, HIV retesting rate and ANC initiation on ART rate) more than Infant's PCR test positive at birth rate, because the National Indicator Data Set (NIDS) changed the timing of collecting the infant PCR test positive results around the time of implementing the CQI and change ideas.

   With regards to the comparative group, the hypothesis is that the most improvement in the 1st ANC visit < 20 weeks rate, ANC HIV retesting rate and ANC initiation on ART rate will be seen in the 112 intervention group. The 52 non-intervention group may not show any change in these indicators as the programme implementation had not changed during the study period point.

1.2.3.3 Participatory data-driven review meetings

The use of data review meetings where the facility has routine weekly meetings to analyse data, review and present their performance was key to PMTCT performance improvement. Some facilities had dedicated eMTCT meetings, while in other facilities, the staff utilised existing meetings, such as the multidisciplinary team (MDT) meeting, where a range of health professionals working together in the facility come together to identify and review their facility performance to address the identified challenges. This enabled the team to develop mitigation plans to address underperformance. The facilities review meeting involves data analysis, a graphical representation of selected indicators displayed in the facility waiting for the area, passage wall or the operational manager's office.

1.3 Remaining challenges in the PMTCT programme

Despite the great stride made in South Africa's PMTCT programme over the past years, there remained several challenges to ensuring adequate coverage and service delivery as at the time of conducting this study. These would need to be addressed in order to ensure that eMTCT is achieved. The key challenges identified were gaps in quality of care at the service delivery level, with the loss of patients from processes steps along the care cascade, and deficiencies in the quality of data. In some instances, there was inaccurate or incomplete recording and reporting, a lack of understanding of key indicators by healthcare providers and stakeholders, and a lack of a systematic process of feedback and monitoring linked to action at all levels of healthcare delivery. There were therefore discrepancies between the data routinely collected at health care facilities and submitted to the district office to be used for programme planning and monitoring [53,56].

1.4 Rationale for the Study

South Africa continues to make significant progress with the PMTCT programme because of the tremendous work done, but challenges in obtaining complete and accurate data from facilities to track progress still remains a significant challenge [57]. This was attributed to inadequate monitoring of indicators throughout the system because there has been very little regular and comprehensive verification of the data quality from routine systems.

Published papers evaluating selected aspects of the DHIS [57-59] found significant discrepancies in the completeness and accuracy of data. The main source of inaccuracy lies in the data collection at health facilities with wide discrepancies between data in the source documents and on the summary sheet, rather than the transcription of the data from the summary sheet into the software system [53]. Therefore, to address these issues, there should be continuous efforts to strengthen the Health Information Management System (HMIS) [54,55] including capacity building of data capturers to regularly verify and clean the facility data before reporting to the district level, and to improve the overall reporting system in the district. In addition, the launch and implementation of the rationalized registers by the South African NDOH, in March 2015 forms part of the Continuous Quality Improvement (CQI) process implemented in the facilities which allows collection and reporting of quality data that is analyzed and used to continuously improve programme performance and delivery of quality services.

Review of the District Health Barometer (DHB) for 2014/15 [56] showed that Amathole district municipality recorded improvement in the performance of several indicators such as the ANC 1st visits before 20 weeks rate, which increased from 37.7% to 54.3% between 20012/13 and 2014/15. This performance surpassed the provincial target of 50% but remained below the National target of 70% for 2015/16. The ANC client initiation on ART rate also

increased in the same period (2012/13 to 2014/15) from 61.9% to 95.9% as against the national target of 96% [44].

However, although the massive scale-up of the South Africa PMTCT programme has recorded tremendous success over the past years, there are a number of challenges that need to be addressed to ensure adequate coverage and service delivery in order to achieve the elimination of MTCT. The key challenges identified include gaps in the quality of care at service delivery level and deficiencies in the quality of data. In some instances, there was inaccurate or incomplete recording and reporting, lack of understanding of key indicators by healthcare providers and stakeholders, and a lack of a systematic process of feedback and monitoring linked to action at all levels of healthcare delivery. There were therefore discrepancies between the data routinely collected at health care facilities, data submitted to the district office and sub-optimal use of data for programme planning and monitoring [55, 58].

An implementation approach that can be considered to improve PMTCT performance is the use of QI intervention. Studies conducted in Eastern Cape South Africa have shown the potential of QI to improve PMTCT programming [62,63]. This study, therefore, explores the PMTCT data management and reporting challenges documentsment the implementation of continuous quality improvement interventions used to improve and strengthen PMTCT programme performance across four sub-the districts in Amathole district of Eastern Cape Province, South Africa.

This study piggybacked onto the S2S QI project in Amathole district where three critical CQI interventions were geared towards the delivery of quality healthcare services and achieving measurable improvement in the PMTCT programme (i) capacity building, (ii) development,

testing and implementation of change ideas, and (iii) participatory data-driven review meetings.

The findings of this study are intended to be used to inform and improve the PMTCT data management and reporting system in Amathole district with the potential of replicating it as best practices in other districts.

1.5 Research Aim

The aim of this study was to explore the PMTCT data management and reporting challenges and the outcomes of the implementation of continuous quality improvement interventions used to improve and strengthen PMTCT programme performance across four sub-districts in Amathole district of Eastern Cape Province, South Africa. This study investigated the plausible effects on the overall performance of four selected PMTCT indicators following the implementation of Continuous Quality Improvement and the three significant changes during the implementation period; and used the CFIR domains to interpret the results and determine the intervention sites performed differently from the non-intervention sites.

1.6 Research Questions: In the Amathole district S2S programme

1a) What is the current state of data management and reporting of the PMTCT programme data from the health facilities to the sub-districts and to the district?

1b) What are the causes of data discrepancies between the source documents and the various organisational levels, and what can be done to address them?

2) Was there improvement or non-improvement in the four selected PMTCT indicators in the intervention sites following the implementation of CQI compared to non-intervention sites?

3a) What is the relationship between team members of the health facility Quality Improvement teams and the existing district structure (District Clinical Specialist Team and the District Health Team)?

3b) How is PMTCT data currently used to strengthen the PMTCT programme?

1.7 Research Objectives

The objectives of the study are: In Amathole district S2S Programme

1a) To assess the current state of data management and reporting of PMTCT data from the health facilities to the sub-districts and district using the three source documents (ANC register, tally sheet and input form) for eight selected indicators (five ANC, two postnatal, and one outcome indicator).

1b) To investigate the cause of data discrepancies and what can be done to address them in the facilities that are implementing CQI.

2) To assess the improvement and non-improvement recorded in the four selected PMTCT programme indicators in the intervention site following implementation of CQI in intervention sites compared to non-intervention sites.

3a) To assess the current relationship of the team members of the health facility Quality Improvement teams with the existing district structure (District Clinical Specialist Team and the District Health Team).

3b) To investigate the use of data at the different management levels to strengthen and improve PMTCT programme.

1.8 Conceptual Framework for the Study

1.8.1 What is a conceptual framework?

A conceptual framework represents the researcher's synthesis of the literature on how to explain a phenomenon. It maps out the actions required in the course of the study given the previous knowledge of other researchers' point of view and observations on the subject of research. In addition, a conceptual framework is a structure which the researcher believes can best explain the natural progression of the phenomenon to be studied [64]. It is linked with the concepts, empirical research and important theories used in promoting and systemizing the knowledge espoused by the researcher [65]. It is the researcher's explanation of how the research problem would be explored.

A conceptual framework also presents an integrated way of looking at a problem under study [66] with the framework describing the relationship between the main concepts of a study, arranged in a logical structure to provide a picture or visual display of the researcher's intentions of carrying out the research study. Also, the framework makes it easier for the researcher to easily specify and define the concepts within the problem of the study [67]. Miles and Huberman (1994, p.18) opine that a conceptual framework can be 'graphical or in a

narrative form showing the key variables or constructs to be studied and the presumed relationships between them' [68].

1.8.2. The Importance of Conceptual Framework in Research

Conceptual framework offers many benefits to the research. Grant & Osanloo, 2014, acknowledge that it assists the researcher to identify and construct his/her worldview on the phenomenon to be investigated [65]. It is the simplest way through which a researcher presents his/her asserted remedies to the problem s/he has defined [66,69]. It also accentuates the reasons why a research topic is worth studying, and explains the assumptions of a researcher, the scholars s/he agrees with and disagrees with and how s/he conceptually grounds his/her approach [69]. Akintoye (2015) states that the conceptual framework is mostly used by researchers when existing theories are not applicable or sufficient in creating a firm structure for the study [66].

1.8.3. The Conceptual Framework for this research study

The conceptual framework used in this study was drawn on and adapted from the work done by Boone et al (2008) on data management reporting systems, functional areas and data quality [70]. The framework shows the aim of the study which was to improve PMTCT performance through a two-pronged approach:

i) by improving data quality and use (to identify gaps in care and monitor progress), and

ii) the use of a specific CQI approach involving the implementation of three critical CQI interventions (capacity building of HCPs, development, testing and implementation of change ideas, and participatory data-driven review meetings), geared towards the

delivery of quality health care services in order to achieve measurable improvement in PMTCT programme. (Objective 2a).

Eight data elements were selected for assessment. A retrospective analysis of data reporting and data management for the eight selected PMTCT indicators was conducted through a desk review (objective 1a), followed by an observational study and in-depth interview for the causes of data discrepancies (to address objective 1b). The framework also provided information on the relationship (Objective 3a) between the Quality Improvement Team (QIT) and the existing district structures in the study site namely: The District Health Teams (DHTs), and the District Clinical Specialist Team (DCST) as well as using PMTCT data information for programme management (Objective 3b). (Figure 4).

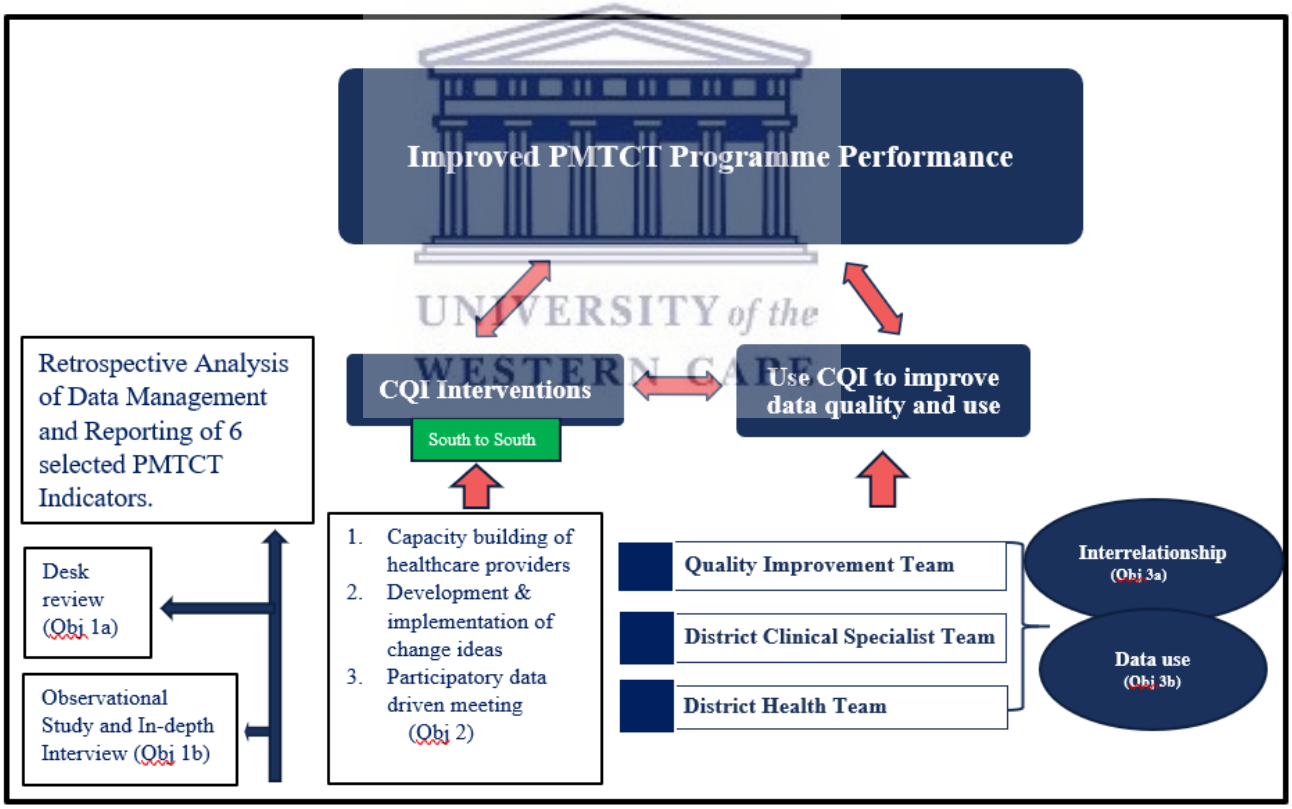


Fig 4: The Study Conceptual Framework for this thesis aimed at improving PMTCT programme

The study was conducted within an existing QI project in which S2S technical advisors were providing QI coaching, mentoring and supportive supervision to the Quality Improvement Team (QIT)s at the facilities. These quality improvement teams worked in collaboration with other existing district structures to strengthen PMTCT programme performance indicators. This was done by conducting capacity building, monitoring the change ideas implemented through supportive supervision, and facilitating data-driven meetings to review the PMTCT dashboard indicators performance. This process contributed to the assessment of the underlying data management and reporting systems used to improve standard PMTCT program-level performance outputs.

Learning sessions were conducted, QI projects implemented, and change ideas and best practices were scaled up across supported facilities.

Additionally, this study also focused exclusively on verifying the quality of reported data, and assessing the underlying data management and reporting systems for standard PMTCT program-level output indicators.

The eight selected key PMTCT indicators included five ANC, two postnatal indicators and one outcome indicator. Four PMTCT indicators (indicators 1, 4, 5 and 7) are considered and linked to both objectives one and two while the remaining 4 indicators (indicators 2, 3, 6 and 8) are linked only to objectives one of this study. (Table 1).

Table 1: The eight selected PMTCT indicators and how they relate to each of the objectives.

	Indicators	Objective 1	Objective 2
1	Antenatal first visit before 20 weeks' rate	✓	✓
2	Antenatal HIV 1st test	✓	X
3	Antenatal HIV 1st test positive	✓	X
4	Antenatal client's HIV re-test rate	✓	✓
5	Antenatal clients initiated on Antiretroviral Therapy (ART) rate	✓	✓
6	Infant 1st Polymerase Chain Reaction (PCR) test around 6 weeks uptake rate	✓	X
7	Infant Polymerase Chain Reaction (PCR) test positive at birth rate	✓	✓
8	Infants initiated on Cotrimoxazole (CPT) around 6 weeks uptake rate	✓	X

In Table 2 below, the four selected PMTCT indicators for objective two are clearly defined by giving the description of each indicator, including its numerator and denominator, as defined in the District Health Information System Database of the South Africa National Department of Health. (Table 2).

Table 2: Indicator definition for the four selected PMTCT indicators (Reference: District Health Information System Database. National Department of Health).

Indicator	Definition
Antenatal visit before 20 weeks rate	**Description:** The proportion of women who have a booking visit (first visit) before they are 20 weeks (about halfway) into their pregnancy **Numerator:** Antenatal 1st (booking) visit before 20 weeks (A first visit by a pregnant woman to a health facility that occurs before 20 weeks after conception) **Denominator:** Antenatal 1st (booking) visit total THUS (Antenatal 1st visit before 20 weeks PLUS antenatal first visit 20 weeks or later)
Antenatal client HIV re-test rate	**Definition:** Antenatal clients retested for HIV as a proportion of antenatal clients tested negative for 1st HIV test done during current pregnancy. **Numerator:** Sum of Antenatal clients' re-test **Denominator:** Antenatal clients HIV 1st test MINUS Antenatal client HIV 1st test positive
Antenatal client initiated on ART rate	**Description:** Antenatal clients on ART as a proportion of the total number of antenatal clients who are HIV positive and not previously on ART **Numerator:** Antenatal client initiated on ART rate **Denominator:** Antenatal client eligible for ART

PCR positive at birth	**Description:** Infants PCR tested positive at birth as a proportion of HIV exposed infants **Numerator:** Infant PCR test at birth **Denominator:** Live birth to HIV positive woman - Infant 1st PCR test positive at birth

Since better data quality used at the facilitates improves the provision of quality service, the study also focused on strengthening data verification, and data management and reporting as part of the CQI implementation process. Different approaches are used to enhance data quality are described in table 3 [70].

Table 3: Data verification, management and reporting system

(a)	**Data verification by**	1. Recounting the reported data
		1. Review the completeness, timeliness and accuracy of data
		1. Compare the facility data with what was reported in DHIS for eight selected indicators
		1. Monitoring and Evaluation (M & E) structure, functions and capabilities

(b)	**System assessment**	1. Data management process (providing feedback to the health facilities on the quality of their reporting: accuracy, timeliness, completeness)
		1. Quality control check of data from paper-based form entered into the computer (double entry, post-data entry verification)
		***Develop action plans to improve service delivery based on the findings.

1.9 Conclusion

This chapter has outlined the progress made in the PMTCT programmes globally and in South Africa in particular. It includes the initiatives implemented by the DOH and other partners to eliminate MTCT of HIV infections, highlighted the gaps identified in the South African PMTCT programme that informed the need to conduct this study, and the lessons learned from CQI studies in South Africa and other countries. The chapter also highlighted the study aim, objectives, significance of the study, the conceptual framework for the study and the list of eight selected PMTCT indicators used to monitor PMTCT programme improvement in Amathole district, Eastern Cape province, South Africa.

The next chapter, the literature review, will examine the effort to reduce maternal, infant and child mortality globally, in Sub-Saharan Africa and in South Africa. It also outlines the standard data collection processes in the district, the effect of the rollout of the rationalised registers on the documentation and reporting of PMTCT programme data, challenges

encountered during data collection and reporting, and interventions to address the identified challenges, including the implementation of CQI as described in the literature.

CHAPTER 2: LITERATURE REVIEW

Chapter two of this doctoral work examines the effort to reduce maternal, infant and child mortality globally, in Sub-Saharan Africa and in South Africa. This chapter also looks at the complete health system reforms in terms of the Efficient Health Management Information System (EHMIS) for improved decision-making. It goes further to discuss the DHIS data collection process in South Africa and in Eastern Cape province. It further investigates the HCW involved in data collection as well as the challenges of routinely collected PMTCT data. In addition, this chapter elaborate more on other associated factors affecting PMTCT data collection as it relates to the objectives of this research study (use of information, quality of care, quality improvement, and stakeholders' relationship).

2.1 Introduction

According to UNAIDS, there were approximately 38.4 million people worldwide living with HIV/AIDS in 2021, the vast majority of whom live in sub-Saharan Africa, where women and girls constitute over half (54%) of all People Living with HIV (PLHIV) [1]. As international HIV agendas increasingly stress advancement toward a generation in which virtually no children are born infected, prevention not only for new-borns but for all women is critical [71-73]. The South African National Development Plan (NDP) 2030 goals adopted by government has its vision for the health sector with the sub-outcomes Medium-Term Expenditure Framework (MTSF) 2014-2019, which include amongst others; reducing maternal, infant and child mortality and complete health system reforms in terms of Efficient Health Management Information System (EHMIS) for improved decision making [70]. Several studies [21,72-75] have highlighted the importance of maternal and child health

interventions as essential to meet the Millennium Development Goals (MDGs) 4, 5, and 6. However, there are challenges in monitoring these interventions due to inaccurate and unreliable statistics [31,72-75].

Amathole district of Eastern cape province, South Africa adopted and implemented the DHIS aimed at ensuring uniformity in the DHIS and addressing challenges emanating from manual data management system. S2S (one of the National Department of Health partners supporting Amathole district) also implemented quality improvement initiatives at health facility level and provided on-site monitoring and supervisory support until May 2017 when the project closed out However, discrepancies still exist in some of the PMTCT programme indicators reported at the health facility, and at different levels (sub-district and district levels) in the district.

The following section will describe the progress and efforts made in achieving the Millennium Develop Goals (MDG), Sustainable Development Goals (SDG), the South Africa Health Management Information System, some of the challenges faced in collecting PMTCT data and lesson learned from the use cohort tool to improve PMTCT programme.

2.2 Reducing HIV-related Maternal, Infant and Child Mortality

An estimated 1.5 million individuals worldwide became newly infected with HIV in 2021, this includes 160,000 children (less than15 years old). Most of these children (49%) live in sub-Saharan Africa and were infected by their HIV-positive mothers during pregnancy, childbirth or breastfeeding [1].

UNAID in 2020 reported that South Africa has the biggest HIV epidemic in the world, with 7.7 million people living with HIV and a prevalence of 19% (ages 15 to 49 year) with 200 000 new infections and 72 000 AIDS related deaths. However, only 71% adults are on

Antiretroviral treatment (ART) as compared to 47% of children while an estimated 12 000 children were newly infected with HIV due to mother to child transmission of HIV in 2017. (UNAID Data, 2020)

In addition, efforts were intensified to save the lives of all mothers and children including those infected by HIV/AIDS by setting up Partnership for Maternal, Newborn & Child Health (PMNCH) in 2005. This is a global health initiative which focused on achieving the MDGs by rapidly scaling-up effective, life-saving interventions in 60 high-burden countries and specifically to reach the MDG goals 4 and 5 targeted at reducing child and maternal mortality. This initiate was launched in September 2005 as the world's three leading maternal, newborn and child health alliances joined forces under the new name of "The Partnership for Maternal, Newborn & Child Health" with the primary focus on accelerating action by both donor and developing countries to achieve MDGs 4 (reduce child mortality) and 5 (improve maternal health) [73].

PMNCH is a multi-constituency partnership hosted by WHO and chaired by Graça Machel as the board chairperson. She describes PMNCH as "a platform for knowledge, advocacy and accountability to improve women and children's health" and seek to achieve universal access to comprehensive, high-quality reproductive, maternal, newborn and child health care. The Partnership plays a central role in facilitating joint action on many fronts geared towards making progress to achieving the United Nations MDGs 4 and 5, to reduce child mortality and improve maternal health, as tracked by the countdown to 2015 initiative, and through support for the Global Strategy for Women's and Children's Health (Global Strategy) and Every Woman Every Child. PMNCH enables members to share strategies, align objectives and resources, and collectively agree on policy interventions [76,77]. PMNCH's work and support to partners is focused on three key strategic objectives: (i) Promotion of knowledge and innovation for action in order to enhance policy, service

delivery and financing mechanisms (ii) Advocacy to mobilize and consolidate resources and greater engagement towards Reproductive, Maternal, Newborn and Child Health RMNCH and (iii) Promotion of accountability for resources and results in order to strengthen monitoring of RMNCH's efforts.

The partnership issues annual reports on progress of commitments from more than 250 stakeholders and estimates that the Global Strategy has leveraged over US$18 billion in new and additional money for women's and children's health [71]. In order to make PMNCH achieve its aim based on the investments, there is need for integrated approach that targets the achievement and monitoring of the core functions and objectives of the partnership by providing oversights on joint work, governance and leadership [71,72,77].

Although, great progress was made in RMNCH interventions, in most Low- and Middle-Income Countries (LMICs), significant demographic and socioeconomic inequalities still exit for interventions as regards maternal health indicators such as antenatal care [71,72,77]. As reported by Amouzou, et al. (2019), at the dawn of the Sustainable Development Goals (SDGs), progress in coverage of RMNCH remains insufficient at the national level and across equity dimensions to accelerate towards Universal Health Coverage (UHC) by 2030 [78,79]. This requires consideration attention if we need to improve PMTCT programme and sustain the gains made in the past.

Globally, different measures have been implemented by the in-country department of health and stakeholders to reduce the number of deaths among mothers and young children. One of such is the eight (8) MDGs launched in 2000 where all the 191 United Nations member states and at least 22 international organizations signed a declaration and pledged to achieve the set goals in 2015. Goals 3, 4 and 5 speak to maternal and child wellbeing; promoting gender and

empower women, reduce child mortality and improve maternal health respectively as seen below [77,78].

2.2.1 Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)

Although the MDGs and SDGs sets of United Nations have different goals, there are lots of similarities between them. The set of goals work towards having a better world and making individual lives more livable [80]. While the MDG 4, 5 and 6 focus on improving maternal and child health especially in sub-Saharan Africa where the need is higher, the SDGs set out goals to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030 [81].

Fig 5: *Millennium Development Goals (MDGs) 1 to 8*

Courtesy: United Nations department of Global Communications

Despite the achievements recorded by implementing the MDGs, available and relevant data at a global level showed that overall, 3 and a half of the 8 targets were achieved when stock of the MDG achievements and progress made three years after the end of the MDG era in 2015 was taken. [78,80].

Although progress was made on the other goals, the progress on maternal and child mortality missed the goals by the largest margins [81]. Over the period (2000 to 2015), maternal and childhood deaths fell by 47% - a laudable achievement, but this fell significantly short of the initial targets, aimed at reducing the under-five-mortality rate by two-thirds (target 4A) and the maternal mortality ratio by three quarters (target 5A), between 1990 and 2015 [78,81,82].

Sustainable Development Goals

Fig 6: *Sustainable Development Goals (SDGs)*

Courtesy: United Nations department of Global Communications

In September 2015, world leaders gathered in New York to adopt the 17 Sustainable Development Goals (SDGs) with 169 targets that was designed to underpin a coordinated global effort to end extreme poverty, fight inequality and injustice, and fix climate change. The SDGs seek to build on the earlier MDGs and to complete what they did not achieve. The importance of the SDGs was to reflect on the past, and understand what worked and what did not in order to inform future interventions [83]. Prominent among the goals is a commitment to ensure healthy lives and promote well-being for all at all ages (Goal 3) by reducing by 2030 the global maternal mortality ratio to less than 70 per 100,000 live births and ending preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as, low as 12 per 1,000 live births and under-5 mortality to at least, as low as 25 per 1,000 live births [83].

As seen internationally, the HIV agendas increasingly stress the advancement towards a generation in which virtually no children are born infected. As well as prevention not only for new-borns but also for all women is critical [84,85].

In addition, the South African National Development Plan (NDP) 2030 goals vision for the health sector [86] also included amongst others; reducing maternal, infant and child mortality and completing health system reforms in terms of an Efficient Health Management Information System for improved decision making (Doherty, T. et al. 2009).

Several studies [77-81] have highlighted the importance of maternal and child health interventions as essential to meet the MDG and SDG goals. However, there are challenges in monitoring these interventions due to inaccurate and unreliable statistics [78].

2.3 South African Health System Reforms for Efficient Health Management Information System

The Global Plan towards the Elimination of New HIV Infections among Children by 2015 and Keeping their Mothers Alive outlines a 10-point action plan for implementation by the 22 priority countries with low and concentrated epidemics. One of the 10-point plans is to improve outcomes assessment, data quality, and impact assessment [16]. It also includes "Strengthening Monitoring and Evaluation of PMTCT Programme linked to the Maternal, New-born, Child and Women's Health (MNCWH) programme to ensure good data quality at source for Antenatal Care (ANC) and PMTCT programmes [16,85].

Studies [86,87] showed that the majority of the challenges in Health Information System (HIS) are centered around completeness, accuracy and timeliness of data, which is critical to achieving the MDGs and SDG [82,83], because of the sub-optimal use of routine data for planning, monitoring, and evaluation [81,83,84]. Another important factors that contribute to poor quality data in resource limited countries include duplicate, parallel reporting channels and insufficient capacity to analyze and use data for decision-making [54,56]. To address these issues, highest priority needs to be placed on data quality assessment jointly conducted by multi-disciplinary team including health managers, data teams and other health professionals so that they will routinely verify, standardize, and improve routine programme data and use it for decision making [88-90]. Also, additional resources need to be channeled into information communication technologies (ICT) to automate data collection, validation, and analysis in order to reduce data collection and reporting errors [91,92].

The South Africa National Development Plan (NDP) included in the vision for 2030, having a generation of under 20's free of HIV, infant mortality of less than 20 deaths per thousand live

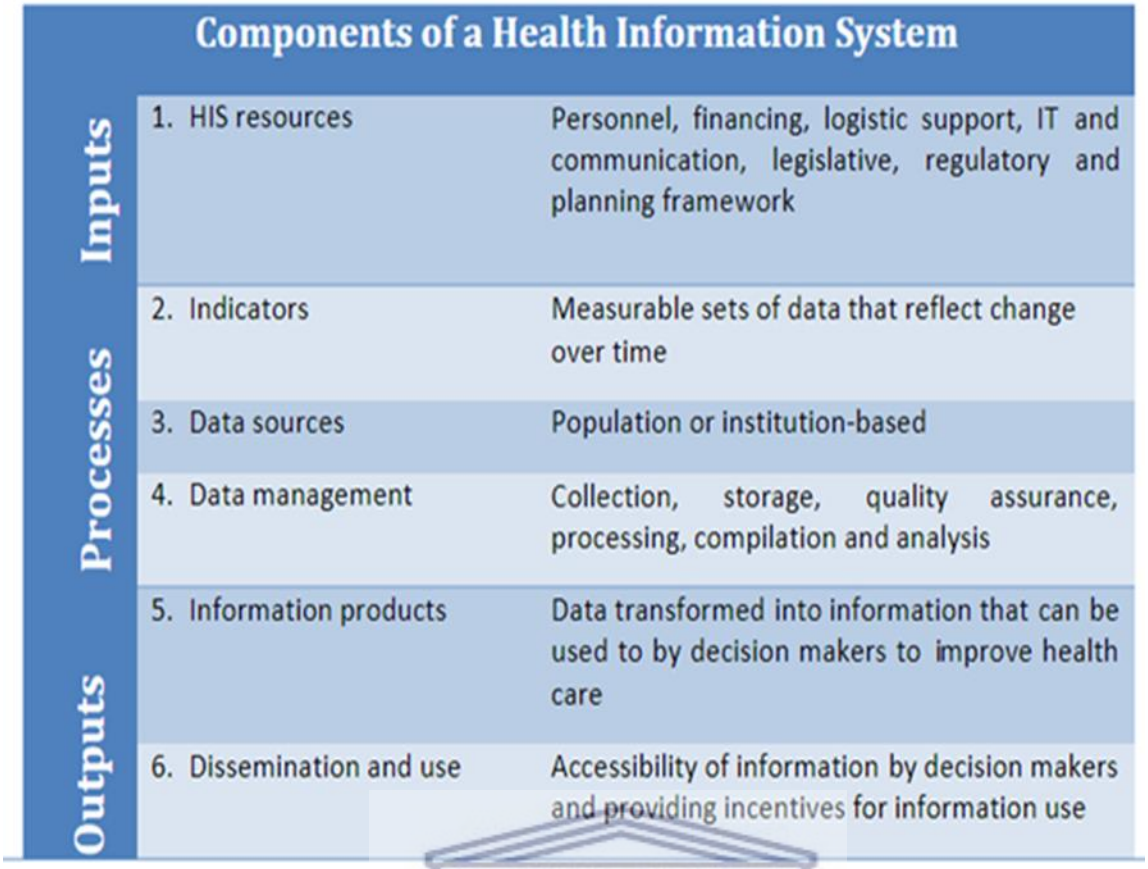
births and under-five mortality rate of less than 30 per thousand. The target for 2030 is average male and female life expectancy at birth increased to 70 years because of the progressive improvement in evidence-based preventive and therapeutic intervention of HIV [86]. One of the action plans in the NDP is to strengthen the health system in order to ensure health for all by doing four things: (i) bringing in additional capacity and expertise to strengthen health system at the district level; (ii) implementing national health information system to ensure that all parts of the system have the required information to effectively achieve their responsibilities; (iii) put in place a human resource strategy with national norms and standards for staffing, linked to a package of care; and (iv) determine minimum qualifications for hospital managers [86].

The above can only be achieved if there is a well-defined plan to provide oversight and accountability to ensure efficiency and effective implementation of the plan as well as provision of access to quality essential health-care services that is safe and affordable for all.

2.3.1 Health Information System as a pillar of WHO Health Systems Building Block

Managing a health system requires various types of information from a variety of sources. The data collected within the health system includes disease surveillance, facility surveys, and routine reporting of health service statistics [93,94].

The Health Information Systems (HIS) aim to ensure the appropriate and effective use of resources to improve the health service performance and the health of the community. Therefore, these systems collect, analyze and convert data into information that will be useful in determining health system actions [51]. Such data must be reliable, accurate and timely. However, few developing countries have the ability to effectively implement such procedures [95].



Components of a Health Information System		
Inputs	1. HIS resources	Personnel, financing, logistic support, IT and communication, legislative, regulatory and planning framework
Processes	2. Indicators	Measurable sets of data that reflect change over time
	3. Data sources	Population or institution-based
	4. Data management	Collection, storage, quality assurance, processing, compilation and analysis
Outputs	5. Information products	Data transformed into information that can be used to by decision makers to improve health care
	6. Dissemination and use	Accessibility of information by decision makers and providing incentives for information use

Fig 7: *Components of Health Information System [95]*

A system is defined as an arrangement of parts and their interconnections that come together for a purpose. A health system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health and function together to be effective. The WHO's Health System Framework [96]

(Source: World Health Organization. Everybody's Business: Strengthening health systems to improve health outcomes—WHO's Framework for Action. Geneva: WHO, 2007, page 3.)

The WHO's framework for health systems strengthening identifies six attributes of a health system (WHO, 2010). The attributes, or building blocks, include a health workforce; health services; health financing; governance and leadership; medical products, vaccines, and technologies; and health information. WHO recommends supporting and strengthening a health system based on the framework below (Figure 9).

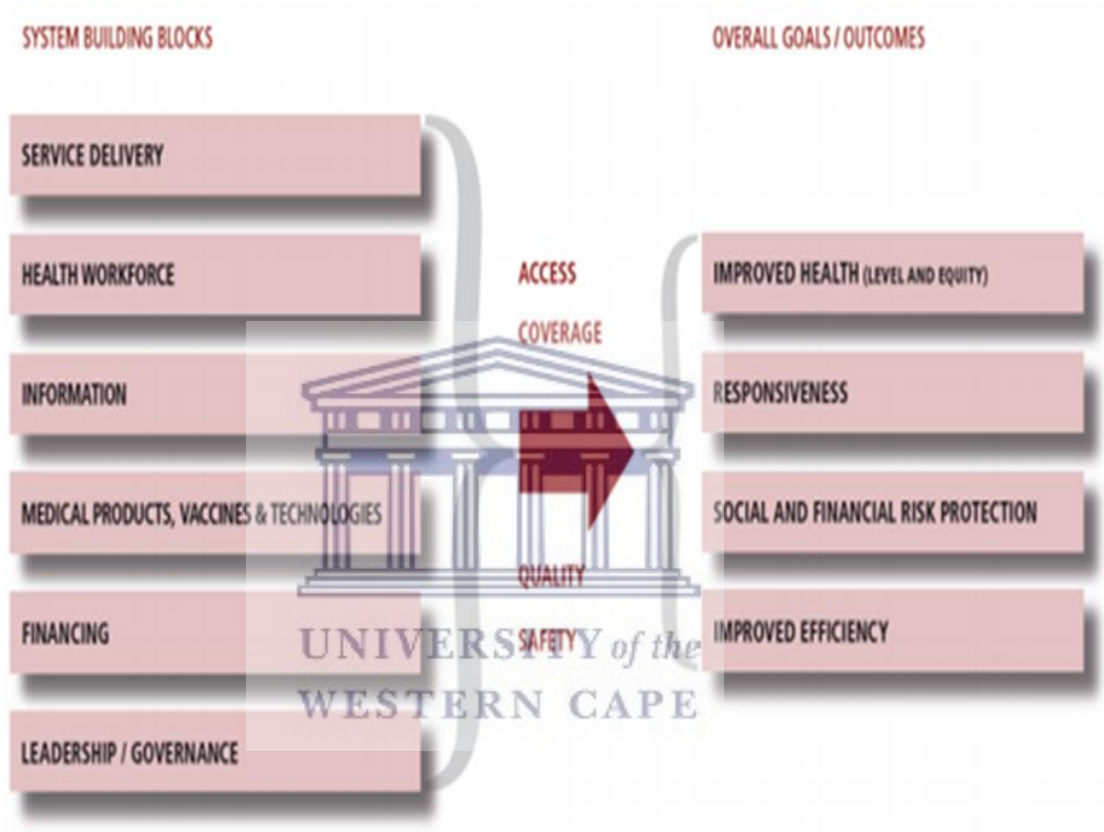


Fig 8: *The WHO's Health System Framework [96]*

*(**Source:** World Health Organization. Everybody's Business: Strengthening health systems to improve health outcomes—WHO's Framework for Action. Geneva: WHO, 2007, page 3.)*

When the health system is strengthened, the six-health system building blocks improves and there are interactions in ways that enable the achievement of more equitable and sustained improvements across health services and health outcomes [96].

While each building block of the WHO framework is important to improving health systems and ultimately health outcomes, quality and timely data from health information systems are the foundation of the health system and this inform decision making in each of the other five building blocks of the health system (AbouZahr & Boerma, 2005) [97].

Health systems, therefore, require quality data from health information systems to plan for and ensure that the workforce is fully funded and equipped with the necessary commodities, infrastructure, resources, and policies to deliver services. Health data are themselves prerequisites to improving each of the other five building blocks [96]. Likewise, the South Africa NDOH advocates for the establishment of programme performance data that will inform decision making at all levels of the health care system.

2.3.2 District Health Information System (DHIS)

The District Health Information System (DHIS) is a national system that collects routine health service utilization data monthly from all public health care facilities in the country [26]. This provides health information that is used to inform policies, priority setting, resource allocation, monitoring of the impact of health programmes, and progress towards goals [26,58].

The DHIS was introduced in South Africa in 1996 and extended to the entire country by 2001. The system is intended to support decentralized decision making and health service management which is also used in several other developing countries in Africa and Asia

[57,58]. The DHIS allows health care workers to analyze their levels of service provision, predict service needs, and assess performance in meeting health service targets [58].

Over the years, improvements in the completeness and quality of data collected through the DHIS have been reported. There have also been reported delays in submission of data due to non-delivery of forms, poor understanding of indicators, unreliable data quality, facility managers not maintaining data summaries, and poor feedback. Importantly, there was little indication that managers were using the information for facility level decision-making [57].

The DHIS consists broadly of two parts: data collection, collation and analysis which occurs in the facility, and DHIS software which processes data. Data is collected routinely on all services provided by a facility, as well as periodically on infrastructure and human resources, as part of the clinic surveys [57]. These are collected by means of a paper-based system of registers, tally sheets, and monthly data collation forms. The collated data are sent monthly to the sub-district or district level where they are entered onto the computer using DHIS software. This is followed by analysis, and submission of the report to the district, provincial and national health departments [57,58]. This separation of data generation and entry of data into the DHIS software is important for the application of data validation and for data analysis and utilization at the clinic. It is expected that regular feedback will be provided to the facility staff by supervisors to assist in data interpretation and use. Clinic staff are also encouraged to discuss their collected data and to graph and display selected indicators.

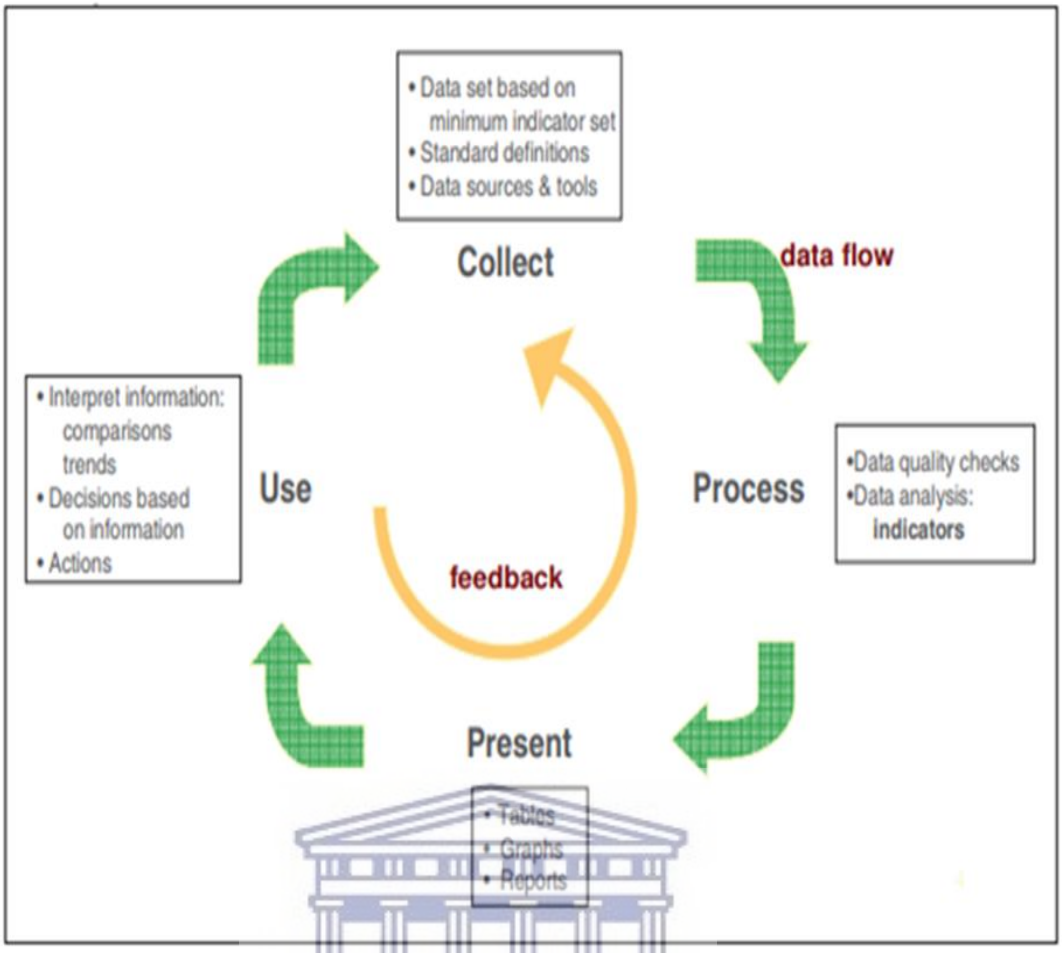


Fig 9: *The information cycle model: a framework of the data-handling process in health facilities* ***Source: A Garrib, N Stoops, A McKenzie, L Dlamini, T Govender, J Rohde, K Herbst (2008).***

Data quality is addressed through mechanisms incorporated into the data collection process and functions within the DHIS software. These include checking of the data for inaccuracies by clinic managers and supervisors, using minimum and maximum expected values for each data element collected, and using the DHIS software. The minimum and maximum values for a data element are calculated on the basis of previous experience at the facility, and outliers are identified and possible reasons for these are accounted for. Rigorous data deep dive is explored to identify inconsistencies and data errors, including programmatic underperformance to institute corrective actions [98].

2.3.3. District Health Information Management System (DHIS) Data Collection Process

The data collection processes start at the clinics and hospitals where data is supposed to be entered directly onto the DHIS if the facilities are equipped with computers. Since some of the health facilities do not have access to a computer, data is collected in paper format from tally sheets and registers onto the monthly data collection forms. These are transmitted monthly to the sub-district level where they are captured into an electronic format (Excel), and then imported into the DHIS at the district level. The data is then analyzed, and reports are generated for the district, provincial and National Department of Health. Hospitals and clinics are encouraged to use this DHIS generated information in their performance-improvement initiatives [58]. Despite all the above systems in place, we still observe challenges in the data collection process and data reported across the health facilities.

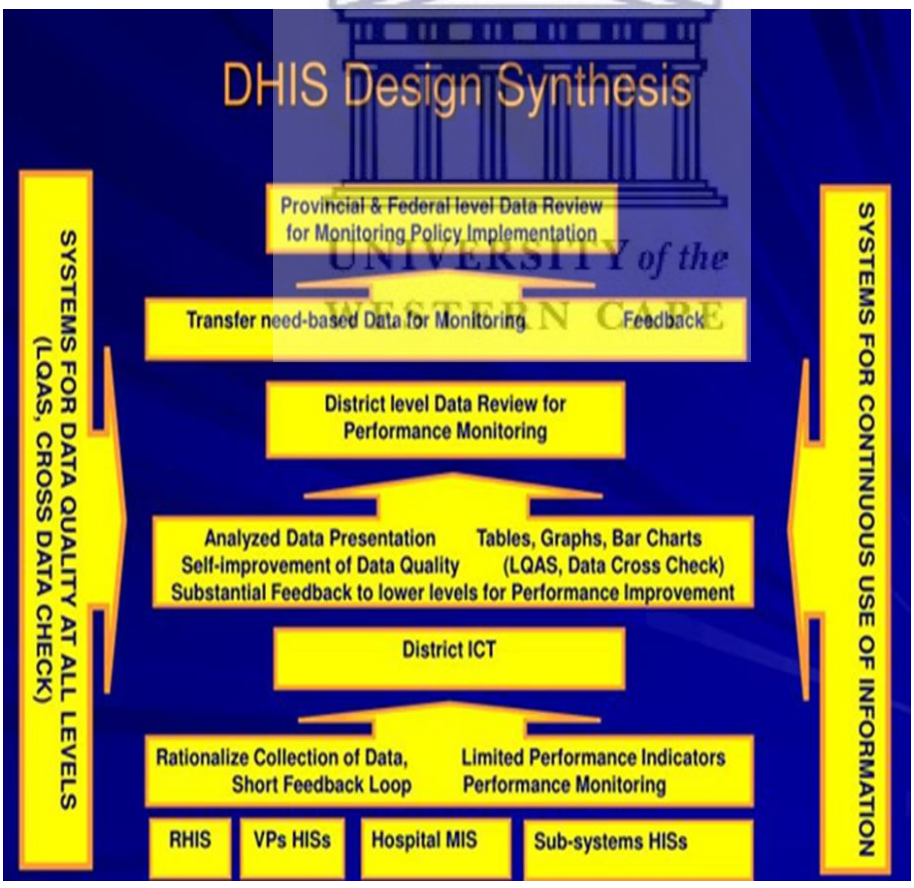


Fig 10: *DHIS Design Synthesis*

2.4 Challenges of Routinely Collected PMTCT data

Several initiatives implemented in SA showed that decentralized planning and monitoring produce results [32-34]. These initiatives were implemented in a few facilities and focused primarily on the use of data and working with programme managers to gain an in-depth understanding of data. Quality improvement initiatives implemented at facility level using participatory data-driven approaches and on-site monitoring and supervisory support have shown improvement in PMTCT coverage and service delivery [13,52].

According to Nicol 2015, one of the challenges of routinely collected data is that at the facility level, there are numerous registers and tally sheets that need to be collated, summarized and sent to the sub-district level [53]. Training is not usually provided for clinic staff involved in data-collection processes, who frequently have very limited data quality checking skills and do not understand the value of the data being collected. They are most often not trained on the programmes care pathways and data monitoring, and as such data captured into the Routine Health Information System (RHIS) may be of low quality.

In the case of the DHIS, data are collected routinely on all services provided at the facility level from the data sources onto a paper-based system of registers, tally sheets, and monthly data collation forms. The collated data are sent monthly to the sub-district or district level where they are entered onto computer using DHIS software and analysed, thereafter, a report is submitted to district, provincial and national health departments [56].

Consequently, there are a number of opportunities for transcribing errors, particularly when these tasks are performed in unconducive environments, like the spaces the nurses work in [54]. Studies have shown that data from the RHIS are inaccurate, and data collection methods are not complete [42,50,56]. In addition, the definition of the data elements themselves may

contribute to the challenge as in many instances; the denominators and numerators are not matched; that is, the numerators are not a subset of the denominators (Nicol 2015).

According to Nicol (2015), as data is collected in paper format at the facility level and then converted to electronic documentation at the sub-district level, there are a number of opportunities for transcribing errors (OTE). However, an extensive review of eight PMTCT data elements showed that the main source of error compromises data integrity was data collation at clinics, before submission to the DHIS [53,56,77].

Another challenge at the facility level is that nurses may forget to capture information on every patient that presents for care as a result of the multiple roles they play. These may lead to over reporting; hence it is difficult to keep accurate statistics, and this does not give a true reflection of care given in the facility. The various collection tools at the facility are also a challenge. These collection tools are sometimes not aligned with the DHIS. There are lots of data elements collected at the facility level that are not captured onto the DHIS [54]. There are also other elements required in the DHIS that are not on the clinic registers. Often clinics experience stock-outs of registers and the nurses are forced to use sheets photocopied from unused pages of old registers, these loose sheets can be misplaced resulting in data loss. At times the writing on the copied sheet may not be legible, making it difficult for the data capturers to read the information on the sheets during capturing. This will also impact on the quality of data collected [77].

Although, limited literature exists on the causes of data discrepancies in the district where this study was conducted (Amathole district, Eastern Cape province), Oyebanji, et al (2022), stated that poor documentation, inadequate training of monitoring and evaluation staff and data entry errors were the three main reasons for data discrepancies [99].

Bhardwaj et al. (2014), in his paper describes the process undertaken by the NDOH, in collaboration with partners, to develop, implement and monitor a data-driven intervention that implements a data-driven decentralised planning and monitoring using quality improvement tools to improve facility, district, provincial and national PMTCT programme [23]. The NDOH used data-driven participatory processes to understand facility-level bottlenecks, to optimise PMTCT implementation and to scale up priority PMTCT actions nationally using visual dashboard and data for action reports. This showed remarkable improvement across all key indicators in the PMTCT cascade over 3 years (from 2011 to 2013). According to the NDoH report of integrated support by Barron et al. (May 2009) in terms of use of information for decision making; managers receive monthly and quarterly summaries of the DHIS data. DHIS data are presented in monthly and quarterly management meetings, but on the whole, the view was that managerial decisions were not data driven. There was "no time to interrogate these reports, to understand the issues and to make recommendations and/or find solutions to the problems identified [24].

Based on the summary report of the national health care facility baseline audit conducted by Health Systems Trust in 2012 in South Africa, a couple of factors mitigates against the better use of information [100]. One of such is poor quality of data collected within facilities and the belief that much of the information lacks credibility. Based on facility audits, the provincial information manager estimated that 65% of facilities provide data of adequate quality [100]. Poor quality is evident in widely differing findings for certain data elements between geographical areas and over time. It arises from poorly designed data collection processes at facility level where there are many different forms and registers scattered across the facility, from which over-stretched or demotivated nurses have to extract data. This however led to the Implementation of rationalization of Registers (RoR) which began on 2 February 2015 in Lejweleputswa District, Free State and was scaled up to other provinces aimed at reducing the

existing number of registers used in Primary Health Care (PHC) facilities to a maximum of six standardised registers, namely: PHC Daily Tick Register plus Headcount Register, TB Registers (for ETR.Net), ART Register (for TIER.Net), Delivery Register, Theatre Register (for Medical Male Circumcision [MMC] and Termination of Pregnancy (TOPs) and Midnight Census Register. Also, lack of capacity at district and provincial level – both in terms of numbers of posts and skills to adequately manage data flow and quality; and limited access to information technology, a defensive attitude to findings of poor performance are some of the contributory factors to lack of data quality. Managers tend to reject data which showed that workloads were lower than assumed or which highlighted inefficiencies [53]. However, Mate et al. (2009) findings that the data was neither complete nor accurate enough to track process performance or outcomes for PMTCT care' supports the notion that staff frequently have that the data is not a true reflection of their work and circumstances [24].

According to Nutley et al. (August 2012), one of the best ways to engage data users and data producers is to improve the use of health data for health systems strengthening by using people in various job functions and at different levels of the health system to collect, analyse, synthesize, interpret, and use data in decision making. The article states that "there is lack of interaction between individuals who design and manage research and information systems that the data producers and the professionals use for program improvement and development. The data users therefore contribute to the breakdown in the decision-making cycle" [101]. When data users and data producers work together, they become more aware of the data collection processes and methods, the available data sources, and the quality of those data. They have the opportunity to address barriers to data use and improve the sharing of data resources. They can also discuss concerns and seek clarification about the data collection process, identify key programmatic questions and link these questions to the data available in

their settings. This can be used to jointly analyse and interpret data to answer programmatic questions.

By understanding who your data users and producers are and linking them to each other's work, ownership of data is clarified, the information cycle is strengthened, data-informed decisions are made, and the value of data in relation to program improvement becomes clear [101]. The top-down design process noted in this paper (with a lack of interaction between data system designers and the data producers), results in a lack of integration between the data for patient management – the key concern of frontline staff – and data for programme management (as evident in the definition of the indicators) - the key concern of programme managers.

An intervention reported in Zimbabwe [102,103] to improve the PMTCT programme using a district approach and regular team meetings was found to be successful in terms of HIV test acceptance. This led to the advocacy for continuous quality improvement interventions using a data driven approach to ensure sustainable local improvements in health programmes [102,103]. These types of interventions use several quality improvements cycles to identify problem areas, using local programme data to set targets and for continuous monitoring throughout the process. Quality improvement studies in developed countries have found that feedback on performance and small group meetings have shown positive effects on changing health workers behaviour [104]. One of only two reviews including studies from low-income countries has also suggested that approaches such as supportive supervision and audit with feedback may be effective in improving health worker performance in these settings [105].

2.5 Other Associated Factors Affecting Routinely Collected PMTCT data

The following four associated factors relates to the research questions which will be answered in this study.

1. Sub-Optimal data Use for Information (research question 1)

Lack of data-driven framework and evaluation tool for integration [106] to address issues encountered by health workers overloaded with numerous data documentation and reporting demands [107].

PEPFAR conducted an evaluation of HSS effectiveness of HIV/AIDS response from 2009-2013 with a focus on incorporation of HSS goals into its prevention, care and treatment portfolios. The findings suggested that although PEPFAR has supported the government of many countries with funding to integrate and strengthen health information systems through continuous support of integration of health information system, by ensuring that data is readily available and data quality is maintained, there is intense need to use data for strategic program planning, resource allocation, and commodities procurement [108]. Data integration and data use to identified programme gaps is critical to define mitigation plans that will be instituted to improve performance and strengthen PMTCT cascade.

2. Quality of Care (research question 2)

The Joint United Nations Programme on HIV/AIDS (UNAIDS) and WHO in 2011 reported that approximately 87% of HIV-infected pregnant women in South Africa received some ART intervention for PMTCT in 2018 [108]. Although South Africa has made significant progress, there are health system weaknesses which has impacted negatively on service delivery access [109], service coverage at different steps of the PMTCT cascade, as well as the quality-of-service delivery. To address these issues, strengthening of the health system is

important to scale up and successfully implement PMTCT programme to scale [110-113]. In addition to this, the workforce in the health facilities need to be well resourced with competent and motivated staff to deliver quality health services that will improve service uptake and treatment adherence by patients [110-112,114]. Another key factor that promotes the provision of quality of care is patient-provider relationship [115,116] utilized for effective management and decision-making during the antenatal period, and uptake of PMTCT interventions [115]. According to Nkonki et al. (2007) and Doherty, et al. (2005) as we continue to focus on increasing the scale up and coverage of PMTCT programme in South Africa, there is need to focus on the quality of care for PMTCT programme [117-119].

3. Continuous Quality Improvement (research question 2)

Doherty and others (2009) implemented a participatory quality improvement intervention to improve PMTCT programme in Amajuba district in KwaZulu-Natal province, in 2006 by conducting initial assessment with district supervisors. The assessment identified weaknesses such as inadequate coverage of training amongst clinical staff, lack of knowledge of protocol, and poor recording systems and continuity of care. This led to the setting of improvement targets for continuous monitoring to support change. The resultant impacts of the intervention averted about 580 new infant infections per year. Several studies [32,119] advocated for the use of CQI interventions utilizing data driven approach to improve health programmes. This includes the use of quality improvement cycles to identify problem, analyze and use data to monitor programme outputs and outcomes. In developed countries, Quality improvement studies showed that feedback on performance and small group meetings have positive effects on changing health workers behaviour [118]. Also, studies in low-income countries, studies showed that supportive supervision, audit and feedback was found to be effective in improving health workers performance in these settings [100].

4. Relationship with other stakeholders (research question 3)

Chiya, et al. (2018) agreed that the stakeholders' experiences in implementation of rapid changes to the South African PMTCT programme is pivotal to the programme evolution and inclined to the various stakeholders involved in PMTCT programme. This includes the patients and health care workers [120]. Kumwenda, et al (2017) corroborate this statement by showing that getting stakeholders involved in PMTCT programme plays a key role. This is evident when Malawi recorded increased uptake in antenatal services after changes were made to the PMTCT programme [121].

In addition, the implementation of a participatory quality improvement intervention in Amajuba district, KwaZulu-Natal province in 2006 reported by Doherty, et al (2009) proved that this intervention provided the opportunity for the management team to review the facility data, know the performance of their facilities and take responsibility to ensure improved facility performance [32]. This is similar to the use of district approach with regular team meetings with manager in Zimbabwe [45] which led to improved HIV test acceptance among PMTCT clients.

2.6 Conclusion

In conclusion, the biggest challenge of routinely collected PMTCT data occur at the facility level and this in turn affect data reported at the district and national levels. This can be attributed to the use of numerous registers and tally sheets used to collate and summarize the data. The main source of inaccuracy lies in the data collection at health facilities with wide discrepancies between data in the source documents and on the summary sheet, rather than the transcription of the data from the summary sheet into the software system [59]. In

addition, inadequate monitoring of the PMTCT indicators through data verification and validation affect the data reported and overall performance of the facility, sub-district, district and national levels.

Research literature also showed significant discrepancies in the completeness and accuracy of DHIS data, and this can be attributed to inaccurate data loaded in the system. It is important to build the capacity of the clinic staff involved in data-collection not only on programmes care pathways, but on data monitoring and data capturing into the Routine Health Information System (RHIS). In addition, other studies [17,33,63] have demonstrated that the implementation of continuous quality improvement using a data driven approach is essential for improving PMTCT programme, and this approach can be replicated in other programme areas. However, this should be complemented with coaching, mentoring, supportive supervision and closely monitoring of the progress for improved programme outputs and outcomes.

This study explores the PMTCT data management and reporting challenges and the outcomes of the implementation of continuous quality improvement interventions used to improve and strengthen PMTCT programme performance across four sub-districts in Amathole district of Eastern Cape Province, South Africa.

CHAPTER 3: METHODOLOGY

3.1 Introduction

Chapter 3 comprise of ten sections, and it focuses on the research methodology and the ethical considerations. The first two sections elaborate on the study design and the study setting; Amathole district, Eastern Cape Province, South Africa where the research took place. The third section describes the phases of the study and the sampling methods used. The fourth and fifth section discussed the data management and data analysis for the thesis, while the sixth section highlights the ethical consideration of the research. The next three sections speak to the survey instruments, the sampling process for the study, the tools for data analysis and methods used and data collection. This chapter ends with a section on the validity and reliability of the study and the conclusion.

3.2 Study Design

A mixed method, cross-sectional design using multiple data collection approaches, including mapping exercise and documents review, in-depth interviews and general observation was used to answer the research questions. Mixed methods research is defined as a class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study to provide better perception of the research problems identified [122,123]. This research method also attempts to legitimize the use of multiple approaches in answering research questions, rather than restricting or constraining researchers' choices (i.e., it rejects dogmatism). It is an expansive and creative, rather than a limiting form of research. It is inclusive, pluralistic, and complementary, and it suggests that researchers take an eclectic approach to method selection and the thinking about and conduct of research [123]. This is quite relevant for this study

because it reflects the viewpoints of the different cadre of staff interviewed, give a voice to them and ensure that study findings are grounded in participants' experiences [123].

According to Johnson and Onwuegbuzie (2004); mixed methods research combines qualitative and quantitative methods in ways that draw on the strengths of both traditions of inquiry. It is a clear step away from the boundaries and practices of those traditions, especially those linked to quantitative methods [123]. Mixed method research (Plano Clark, 2010) was used to answer the research questions above and to view problems from multiple perspectives, compare, validate, and triangulate results and examine processes and experiences along with the outcomes [124].

3.3 Study Setting

The study was carried out in Amathole district municipality in the Eastern Cape Province (one of the seven districts). This province has an estimated population of 982 451 people, with females constituting 53% and males 47% a population density of 46.5 persons per km^2 [125]. The municipality comprises six local municipalities: (i) Mbhashe, (ii) Mnquma, (iii) Great Kei, (iv) Amahlathi, (v) Ngqushwa and (vi) Raymond Mhlaba.

The racial distribution is predominantly made up of Black Africa - 97.2%, Coloured 1.5%, Indian/Asian 0.15% and white 1.0% [126]. The first language in Amathole is Xhosa - 93.6%. with 2.3% English, 2.1% Afrikaans and the remaining 2% made up of other languages [127] (Statistics by place". Statistics South Africa. Retrieved 7 May 2021). The district falls within the lowest socio-economic quintile and is ranked as the fifth most-deprived district in the country with estimated medical scheme coverage of 8.7%, and with more than 90% of people without medical insurance, hence the majority of people in the district use public facilities [128].

According to the Eastern Cape department of health annual report 2017/18, the HIV prevalence among 15 years and older, decreased from 9.9% in 2013/14 to 6.1% in 2017/18 and similarly in Amathole district from 6. 6% to 3.1% respectively [128]. Furthermore, in 2012, Amathole district had an antenatal HIV sero-prevalence of 28.3%, similar to the sero-prevalence rate of Eastern Cape of 28.1% (2015 National Antenatal Sentinel HIV & HSV-2 Prevalence Survey in South Africa). Figure12 below shows the HIV sero-prevalence across South African provinces while figure 15 shows HIV sero-prevalence in Eastern Cape districts.

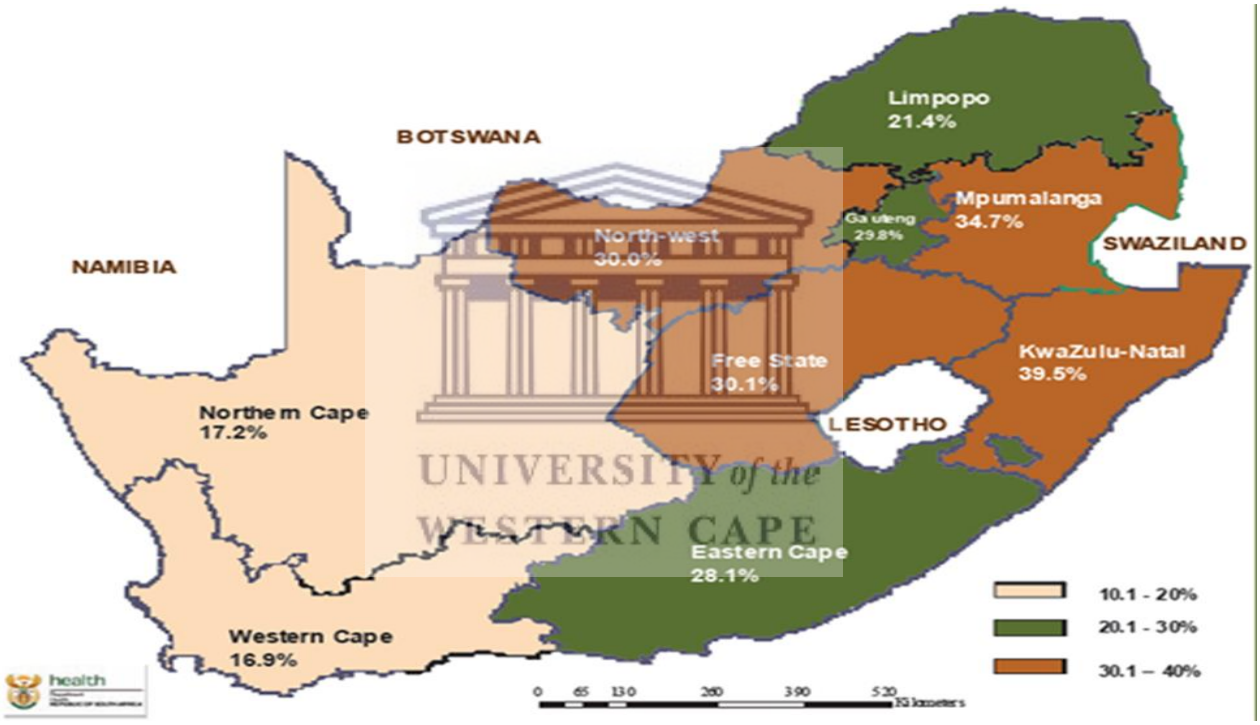


Fig 11. *Map of HIV antenatal survey prevalence by province*

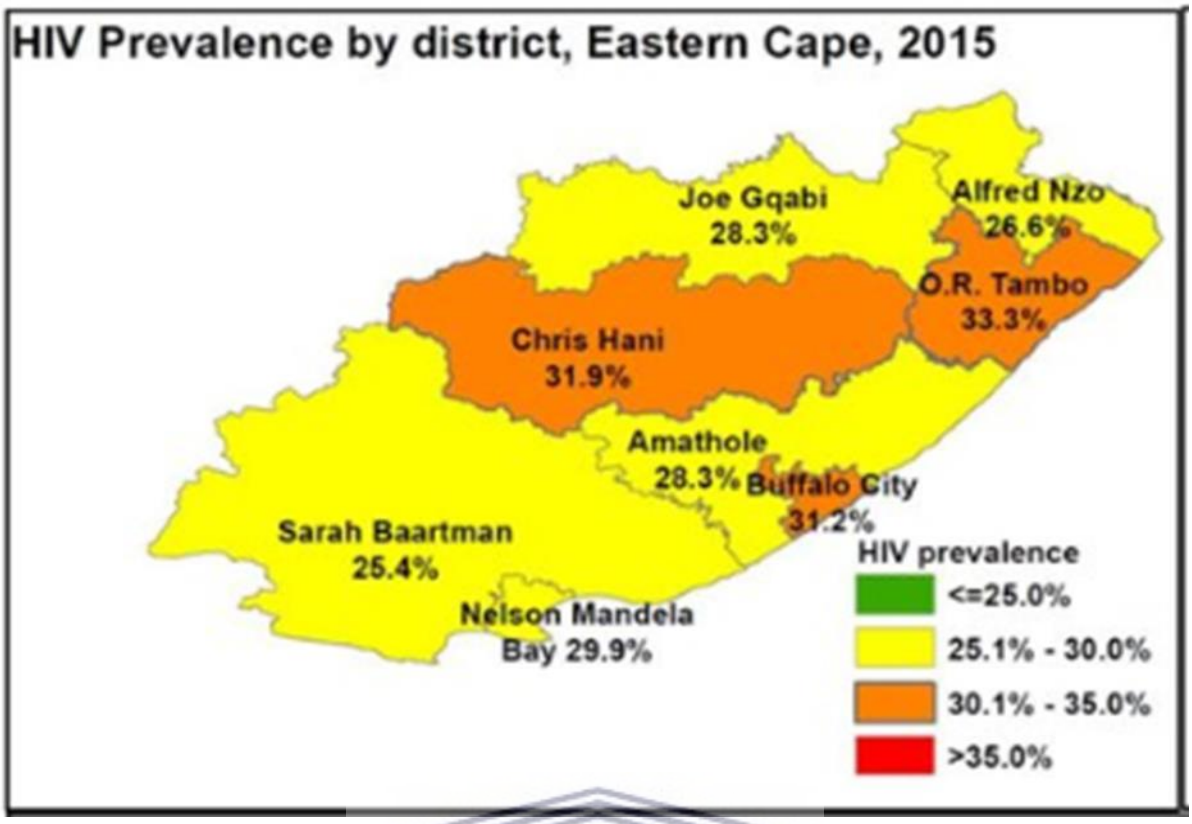


Fig. 12. *Map of Eastern Cape Province HIV antenatal survey prevalence by district*

3.3.3 Study Sites

This research work form part of the S2S eMTCT Quality Improvement Collaborative programme implemented in Amathole district, Eastern Cape province of South Africa. The programme aim was to develop and test change ideas and share best practices with facilities participating in the eMTCT collaborative model to achieve improved maternal and child health outcomes. Facilities in Amathole district were selected for this study because of the long-term working relationship of S2S with the Amathole district DOH. S2S started providing technical assistance through funding from USAID to Mquma sub district (one of the six sub districts in Amathole) from 2012 and scaled up to four sub-districts in from October 2015 to May 2017 when the project closed down.

S2S supported 65% (112 of 173) DOH facilities in Amathole district. The breakdown of the 112 S2S supported facilities include 12 of the 14 Hospitals, all the Community Health Centres (5/5), and 95 of the 154 Primary Health Centres and 7 of 8 Gateway Clinics. A total of 28 facilities were supported in each of the four sub-districts (Amalathi, Mbashe, Mnquma and Nkonkobe sub-districts) from October 2015 to May 2017.

The table below show the distribution of facilities supported by S2S in Amathole district.

Table 4: South to South supported facilities by different facility types supported by S2S

	Name of Sub-district	Hospitals	Community Health Centres	Primary Health Centres	Gateway Clinics	All Health Facilities Supported
1.	Amahlathi	5	0	21	2	28
1.	Mbhashe	1	3	24	0	28
1.	Mnquma	2	1	23	2	28
1.	Nkonkobe	4	1	20	3	28
	Total	**12**	**5**	**88**	**7**	**112**
Proportion of the 112 S2S supported health facilities by facility type		**10.7%**	**4.5%**	**78.6%**	**6.2%**	

The proportional distribution of the S2S supported facilities by type as seen in table 5 showed that nearly 80% of the facilities are PHCs (78.6%), with hospitals comprising 10.7%, Gateway Clinics 6.2% and CHCs 4.5%.

3.4 Phases of the study

The study was divided into 3 phases. An overview of each phase is provided here, followed by methodologic details in the following sections described by each objective.

3.4.1. The First Phase

This phase involved both descriptive quantitative and qualitative study to assess PMTCT data quality in the district. This involved retrospective analysis of data input forms for accuracy and completeness of eight selected PMTCT indicators, correlation and mapping exercise of the three source documents (tick register, ANC register and tick register) from January to December 2016. This phase also includes general observation of register completion and data capturing (to answer objective 1a) and in-depth interview of facility staff to understand the causes of PMTCT data discrepancies, which answers objective 1b.

3.4.1.1 Documents Reviewed

The three source documents used for collecting and reporting PMTCT data were reviewed. The source documents, Antenatal register and the Tick register, and the reporting form, the monthly Data In-put forms that were used for the reporting period, January 2016 to December 2016 (a period of twelve months) were reviewed to assess the quality of data reported and

document the similarities and differences in the PMTCT data elements reported. This was done by using the District Health Information Management standard operation procedure, the National Information Database System (NIDS) and the other NDOH documents such as the ROR and the different resisters as a guide to understand the data elements and its use for data reporting purpose at different service delivery levels. In addition, information on PMTCT data reporting was collected by conducting a mapping exercise of the old and new registers to map each data element in the registers with the appropriate PMTCT indicators that are being monitored on a monthly basis. The intention of doing this was to better understand, identify and correlate the similarities and difference in the registers. The findings were then inputted into excel spreadsheet.

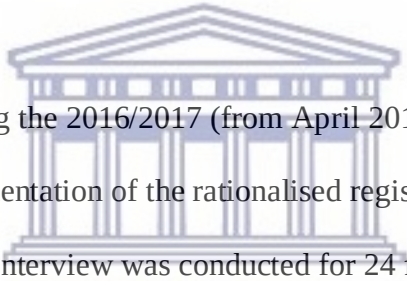
The eight selected PMTCT indicators were as follows:

1. Antenatal 1st visits before 20 weeks rate
2. Antenatal HIV 1st test
3. Antenatal HIV 1st test positive
4. Antenatal clients HIV re-test rate
5. Antenatal clients initiated on ART rate
6. Infant PCR test around 10 weeks
7. Infant PCR test positive at birth rate
8. Infant initiated on CPT around 6 weeks

3.4.1.2 Observational Study

Overt observation of the completion and data capturing of the above source documents by purposively selected nurses and data capturers was done. In this type of observation, the selected participants were made aware of the study before hand and they consent to it, Nurses were observed as they complete and fill in Antenatal register, Tick register and Input forms. The research assistants also checked and documented if all registers were completed to date. Likewise, the data capturers were also observed to monitor the process undertaken to collect and capture PMTCT data and to check the quality of the records and data collected in order to identify the system barriers to data collection. The observed process and the gaps identified such as capturing of wrong information was captured by the research assistants.

3.4.1.3 In-depth Interview



This study was conducted during the 2016/2017 (from April 2016 to March 2017) DOH financial year, when the implementation of the rationalised registers commenced. Following the observation study, in-depth interview was conducted for 24 facility staff (16 Professional Nurses and 8 Data Capturers). The aim was to understand their experience on how PMTCT data elements were collected and reported in the facilities during the transitioning phase of the rationalized registers, and to understand the causes of data discrepancies in their facilities.

Two research assistants were trained on the interview guide and also supported via Skype video calls and telephonically, to address any issue raised while conducting the study. The research assistants made appointment in good time and at the convenience of the respondent to ensure that the interviews did not disrupt the delivery of essential services. In addition, the research assistants ensured that each participant understood and signed the consent form during the interviews. All the participants were informed of the purpose of the study, agreed to participate in the study of their own free will. The participants were comfortable and agreed

.to have the interviews conducted in the English language, Qualitative interviews were conducted in one of the designated rooms in the facilities and the interviews were tape-recorded and transcribed.

3.4.2 The Second Phase

This is the intervention phase where quality improvement projects were implemented, tested, learning and improvement shared and scaled up in line with the Institute of Health Improvement collaborate approach.

In summary, this approach, described in detail previously, enables the establishment of a shared learning system by bringing together a large number of multidisciplinary teams to work together over a defined period (typically 12–18 months), in order to rapidly achieve significant improvements in processes, quality, efficiency of a specific area of care, and with the intention of spreading successful changes to other sites. The approach also involves facility QI teams gathering at workshops (called Learning Sessions) at regular intervals (every three months in S2S's adapted model) where a theme for improvement (in this case along the PMTCT care pathway) was introduced, and ideas shared. Change ideas were tested in the facilities during the "Action Period" between Learning Sessions and the impact of these changes was regularly tracked. Thereafter, the teams adapted and spread existing best practices to multiple settings to achieve dramatic gains in the quality and outcomes of their services [44].

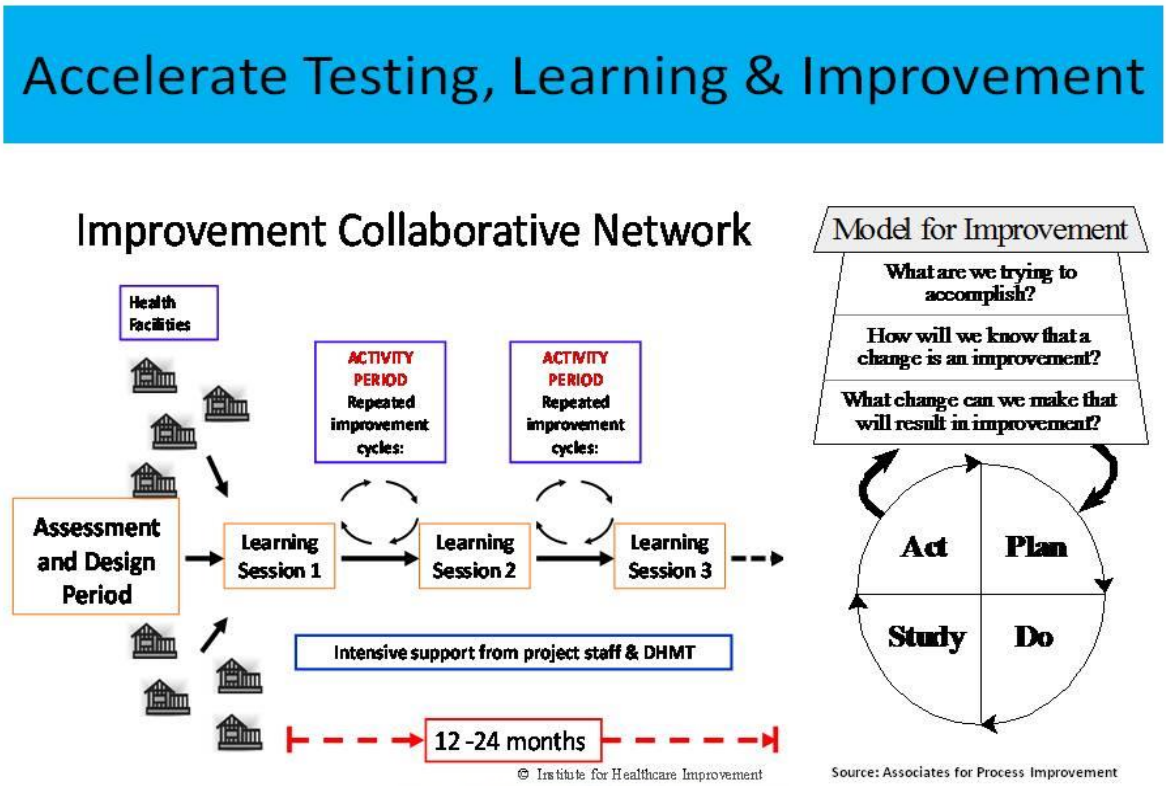


Fig. 13: Institute of Health Improvement collaborate approach: Collaborative approach [43]

This study documented the quality improvement process and monitored the improvement through by tracking and assessing four selected PMTCT indicators (ANC 1st visit before 20 weeks rate, ANC clients initiated on ART rate, ANC clients retest rate and Infant PCR test positive at birth rate) that were linked to change ideas. In addition, this study also compared the degree of proportional change and used the five CFIR domains to interpret the results.

3.4.3 The third phase

This phased involves an interpretive descriptive qualitative study [41] where in-depth interviews were conducted with eight participants consisting of 3 Operational Managers, 2 Professional Nurses, 2 S2S QI Advisors and 1 DHT member. The participants were interviewed to understand the relationship of quality improvement team members at health

facilities with the existing district structures and focusing on the role played by the DCST in the Amathole district to improve PMTCT programme performance.

3.5 Sampling

3.5.1 Objective 1

Sampling of the study sites

Objective 1 involved retrospective analysis of data input forms for accuracy and completeness of eight selected PMTCT indicators and correlation and mapping exercise of the three source documents (tally sheet, ANC register and tick register) from January to December 2016.

A systematic sampling method was used to select 27 facilities (2 CHCs, 23 PHCs, 2 Gateway Clinics) from the 112 facilities (representing 27%) across the four sub districts supported by S2S to select records registers for PMTCT data performance and reporting. The sampling interval and a random starting point was determined using random number obtained from the sampling interval and random starting points.

The sampling size was determined by using the Taro Yamane sample size formula to determine the sample size from 25% of the 112 South to South supported facilities. The formula enabled the researcher to calculate an ideal sample size by giving a desired level of precision and the estimated proportion of the attributes present in the population (95% confidence interval and 5% sampling error).

Formula $\frac{N}{(1 + Ne2)}$

Where,

n = sample size for the research

N = Population under study (25% of the of the health facilities supported by South to South = 28)

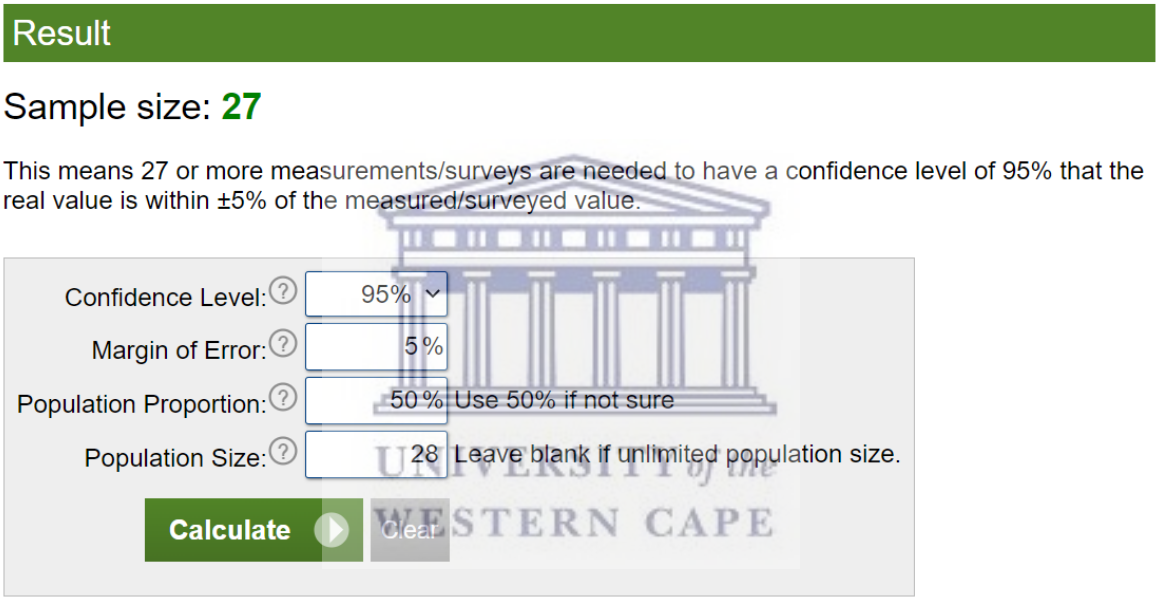
e = the level of precision (95% confidence level = 0.05)

= 28

(1 + 28 (0.05)2

= 27

Sample Size calculation



Courtesy: Taro Yamane Sample Size Calculation Formular.

Sampling of participants

In-depth interviews were conducted with 24 study participants which were purposively selected [16 professional nurses (4 per sub district) and eight data capturers (2 per sub district] across four sub-districts (Amahlathi, Mbhashe, Mnquma and Nkonkobe) of the Amathole district municipality in the Eastern Cape province of South Africa. Purposive sampling method was used to select the participants because they work in the facilities to deliver

PMTCT services and they are involved in PMTCT data collection and reporting for the selected health facilities.

3.5.2 Objective 2

Sampling of the study sites

For objective 2, we used plausibility assessment which involved the review of routine data from DHIS for four selected PMTCT indicators prior to implementation of CQI (April 2015 to March 2016) and comparing the improvement/non-improvement seen one year after CQI implementation (April 2016 to March 2017). The process involved extraction of data from DHIS for 164 facilities in the district (112 S2S supported facilities and 52 facilities not supported by S2S). The study considered the 112 S2S supported facilities as intervention sites because the study piggybacked onto the existing S2S QI project in the four sub-districts (28 facilities in each of Amathole district municipality (Amahlathi, Mbhashe, Mnquma and Nkonkobe sub-districts), while the remaining 52 sites were considered as non-intervention sites. All 112 facilities that participated in the S2S QI project in Amathole district were eligible for inclusion in the study, with the four levels of health care service delivery represented (12 hospitals, 5 CHCs, 88 PHCs and 7 gateway clinics).

Sampling of participants: Not applicable

3.5.3 Objective 3

Sampling of the study sites: Not applicable

Sampling of participants: Objective 3 involved an interpretive case study to understand the role played by the DCST in improving PMTCT programme performance in Amathole district. Therefore, purposive sampling method was used to select eight participants who are members of the quality improvement district teams and providing technical assistance to support the

implementation of quality improvement work across four sub-districts (Amahlathi, Mbhashe, Mnquma, and Nkonkobe) in Amathole district. This includes three Operational Managers (OMs), two Professional Nurses (PNs), two S2S Quality Improvement Advisors, and one member of the District Health Team (DHT).

3.6 Data Collection

The study is a mixed method research so both quantitative and qualitative data were collected.

3.6.1 Quantitative Data

Information on PMTCT data reporting was collected by the lead researcher and this involved the identification of the old and new registers used for reporting PMTCT programme data, reviewing the steps involved in use of the registers for reporting and mapping of the registers. (that is, - to map each data element of the registers with the appropriate PMTCT indicators that are being monitored on a monthly basis to identify and correlate the similarities and difference with the three source documents). Quantitative questionnaire was developed and pre-tested in three facilities (1 CHC and 2 PHCs) to give opportunity to seek clarity where necessary and for the participants to provide their suggestions for quality and understanding of the questions. This was done by using the District Health Information Management standard operation procedure, the National Information Database System (NIDS), other NDOH documents such as the ROR and the different resisters as a guide to understand the data elements and its use for data reporting purpose at different service delivery levels for reporting.

3.6.2 Qualitative Data

Qualitative interviews for in-depth interviews were conducted by two trained research assistants recruited for this study. Both of them were trained on the interview guide and pre-

test of the interview guide was done on two of previous S2S employees (not counted as part of this study). The aim for this was to review the interview guide and provide necessary suggestions that will give opportunity to refine the tool before using it for the selected participants. One of the recommendations from the pilot was that one or two Operational Managers (OMs) should be interviewed. This suggestion was very useful because in facilities where the OMs were interviewed, the QIT members in the facilities were eager to participate in the study because of the buy-in and the directive of their OMs.

For each of the participants interviewed, the research assistants ensured that the content of the consent forms was understood and signed before the commencement of the interviews. This includes that the participants understood the purpose of the study, agreed to participate out of their own free will and that their identity will not be disclosed to anyone. It also gives them the opportunity to withdraw from the study at any time without giving any reason or fear of negative consequences or loss of benefits.

Six field workers were trained on interpretation and completion of the questionnaire as well as data collection. The research assistants trained were selected from the four sub-districts of the study sites (Amahlathi, Mbhashe, Mnquma and Nkonkobe sub-districts) for easy access to the facilities, familiarity and understanding of the study sites and use of the local language. The research assistants were trained one on one and provided with the questionnaire and the list of the facilities (see appendix); remote support was provided through skype video call and telephonically to address issues encountered while collecting the data as required. However, two research assistants could not continue with data collection at the tail end of the data collection process because they were offered better jobs. The researcher negotiated with the remaining four research assistants to assist with completing data collection in the remaining

12 facilities and this was done without any problem. Qualitative data was collected by audio-recording following permission granted by the participants.

3.7 Data analysis

3.7.1 Quantitative data

All the quantitative data including the desk review data were coded and entered into a Microsoft Excel spread sheet and the statistical software, STATA was used for simple descriptive statistics and summarized using graphic presentations for the interpretation of findings. We checked for accuracy/reliability, completeness, timeliness, availability and Integrity/Spot check. Further analysis was done to provide reasons for the causes of discrepancies in PMTCT data and what could be done to address them.

The data analysis involved calculation of percentages and Chi-Square test for p-values to estimate the probability that an observed difference could have occurred just by random chance or if it was due to a relationship between the variables of the study.

3.7.2 Qualitative data

Qualitative data were transcribed verbatim and analysed thematically by identifying, analysing and reporting patterns (themes) within the data based on the approach developed by Braun and Clarke [129]. This includes developing codes based on the emerging themes by reading through the data repeatedly to have a better understanding of the responses and breaking down the themes, re-arranging, categorising and building them up again in a novel way through elaboration and interpretation. Thematic analysis was done during the data analysis and comparative analysis of the quality of routinely collected PMTCT data was done focusing on the eight selected key indicators for reducing maternal and child mortality in South Africa.

3.8 Ethical Considerations

Ethical clearance and approval to conduct the study was obtained from the Biomedical Science Research Ethics Committee of the University of the Western Cape and permission to conduct the study was obtained for the Eastern Cape province Department of Health. Application for research permission contain the description of the study methodology, participants and the relevance of the study to PMTCT program in South Africa. The main ethical issues include the voluntary nature of participation, obtaining informed consent, risk reduction for participants, ensuring confidentiality and privacy of participants and compliance with the institutional ethical approval (Polit and Beck, 2004) [130].

This also involved making sure that the respondents were not seen or heard by others in the process of the interviews and ensuring their privacy. During data collection, administering the questionnaires and interviewing the key informants was done in either the participants offices or other agreed places at their convenience. The participants were informed of the nature and purpose of the study. Since the study was only a descriptive study, no form of physical harm was anticipated to arise. All participants consent to participate in the study and their participation was free and voluntary. A written consent was obtained using the attached consent form (see Annex III). Participants were informed of the nature and intention of the study in their language of choice. The participants were also informed of their right to withdraw from the interview at any stage if they are no longer comfortable. No inducement of any form was used to coerce potential respondents.

The principle of confidentiality requires the researchers to keep all information confidential and protect the identity of the research subjects. In this study, no names were mentioned in the report and information gathered were aggregated. Obvious information that identifies a specific person was not used. Participants were assured of confidentiality and anonymity of

any information provided. The transcriptions of the actual interviews were not released. Record reviews were similarly aggregated to protect the identification of individual facilities.

Finally, the research team ensure that the interviews conducted did not disrupt the delivery of essential services because appointments for interview or data collection were made in good time at the convenience of the respondents. Information acquired through this research project was not shared with participants prior to public dissemination.

3.9 Validity and Reliability

3.9.1 Validity

Validity is the ability of an instrument to measure the variable that it is intended to measure. It is concerned with whether the findings are really about what they appear to be about. Careful design and pre-testing of instruments and the standardization of interview techniques and questionnaires reduce bias due to instrumentation [131]. In this study, the questionnaires and interviews guides were designed in English and the content were verified by the researchers and research assistants for validity in relation to the CQI approach guidelines. In addition, pre-test of the questionnaire and interview guides were done to ensure content and construct validity.

To enhance the likelihood that all the participants answering the questions give a true account, we ensured the following:

(1) Anonymity: the collected information was not shared with people outside the research group;

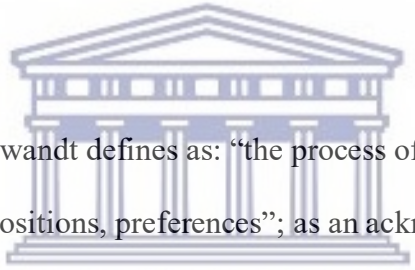
(2) Discretion: apart from the interviewee and the researcher, there was no other people in the room or place where the interviews were conducted; and

(3) Non- judgmental: The use of locally appropriate wording of questions, using terms that were easily understood.

3.9.2 Reliability

Reliability (repeatability) refers to the possibility to replicate (repeat) the observations and is related to the precision of the instrument used for scientific observations [132]. To ensure the reliability, the study instrument was designed in a very clear way, which does not necessitate explanations for the participants. Prior to conducting the study, the questionnaire and interview guide were pre-tested on three DOH staff selected from three facilities (1 CHC and 2 PHCs), not included in the study. The participants were able to respond to the questions without requiring any explanation.

3.9.3 Reflexivity



Reflexivity was defined by Schwandt defines as: "the process of critical self-reflection on one's biases, theoretical predispositions, preferences"; as an acknowledgement that "the enquirer is part of the setting, context and social phenomenon they seek to understand"; and "a means for critically inspecting the entire research process" [133]. For this study, the bias towards the research topic was addressed by appointing two research assistants to conduct the interviews and a data analyst to analyse the data.

3.10 Rigor for qualitative research

3.10.1 Trustworthiness/Credibility

In qualitative design, the researcher seeks believability, based on coherence, insight, instrumental utility and trustworthiness (Morse, J. M. 2015) through a process of verification. The uniqueness of the qualitative study within a specific context precludes its being exactly

replicated in another context. However, statements about the researcher's positions – the central assumptions, the selection of informants, the biases and values of the researcher – enhance the study's chances of being replicated in another setting [134]. To determine the credibility of the finding and whether it matches reality, four primary approaches were used in the study: (1) triangulation – converging different sources of information (interviews, and desk review); (2) member checking – getting feedback from the participants on the accuracy of the identified categories and themes; (3) providing rich, thick description to convey the findings; and (4) external audit – asking a person outside the study to conduct a thorough review of the research and report back (Creswell and Miller 2002).

3.10.2 Confirmability

The concept of confirmability is the qualitative investigator's comparable concern to objectivity. The method of triangulation was used to reduce the effect of investigator bias (Miles and Huberman 2014). Diagrams were used to demonstrate data oriented "audit trail" [68]. This describes how the data eventually led to the formation of recommendations that was gathered and processed during the course of the study.

3.10.3 Transferability

This involves demonstrating the degree to which the findings can be applied to other contexts and settings or with other groups; it is the ability to generalize from the findings to larger populations. It refers to how well the threats to external validity have been managed (Sandelowski 2009). This was achieved through effective training of research assistants and periodic debriefing of fellow researchers and supervisors at every stage of the study. Additionally, there was "thick description" (i.e., detail description) of the research process so the readers can decide for themselves if the results are transferable to their own contexts [137].

3.11 Conclusion

This chapter described the research methods and the ethical consideration used in this study. It also detailed the study design, study setting, selection and recruitment of the study participants. This chapter also described the methodology used to assess the PMTCT data management and reporting challenges and the continuous quality improvement interventions implemented to improve and strengthen PMTCT programme performance.

Chapters 4 and 5 will concentrate on the research findings and discuss the findings of the study.

CHAPTER 4: RESEARCH FINDINGS

4.1 Introduction

This chapter provides an overview of the findings of this study categorized into three parts to align with the objectives of the study. The first part describes data management and reporting of PMTCT programme. This part details the description of the three main source documents used for recording and reporting PMTCT data. It also provides a detailed report of the mapping exercise done with the three-source document, comparing the new registers against the old registers to show how they are used to report PMTCT data elements. In addition, availability of the source documents for reporting PMTCT data in the facilities was assessed and the opinion of the health care providers were explored for the likely causes of PMTCT data discrepancies and what can be done to address the challenges. The second part of the report focused on the plausibility assessment done by reviewing routine DHIS data for the selected PMTCT programme indicators following the implementation of CQI. This was done to compare performance in the intervention facilities (112 facilities) with 52 non-supported facilities where change ideas have been tested. It further detailed the use of the five CFIR domains to interpret the results which includes the relationship of DCST and the district health management team to improve healthcare access and quality, using an interpretive qualitative case study with a focus on the role played by the DCST in improving PMTCT programme performance in the district.

4.2 Data management and reporting of PMTCT programme data

This section describes the three source documents used for collecting and reporting PMTCT programme data (Tally sheet, Antenatal care (ANC) register, Tick register) and documented the similarities and differences in the PMTCT data elements reported following the mapping exercise of the old and new registers with the appropriate PMTCT indicators that are monitored

on a monthly basis. In addition, the section detailed the understanding of the Health Care Professionals (HCPs) experience on how PMTCT data elements were collected and reported in the facilities during the transitioning phase of the rationalised registers, following the in-depth interviews conducted. In addition, the experiences of the 24 study participants which were purposively selected [16 professional nurses (4 per sub district) and eight data capturers (2 per sub district] across four sub-districts (Amahlathi, Mbhashe, Mnquma and Nkonkobe) of the Amathole district municipality in the Eastern Cape province of South Africa about their perspectives on the causes of PMTCT data discrepancies was documented. The participants selected are responsible for documenting and reporting PMTCT data across the 27 facilities selected which includes 2 Community Health centres, 23 Primary Health Care centres, and 2 Gateway Clinics.

The breakdown of the 27 facilities includes 2 CHCs, 26 PHCs, 2 Gateway Clinics as seen in the table below. These facilities represent 29.5% of the PHCs in the district (26/144), 40% of the CHCs (2/5) and 28.6% of gateway clinics (2/8).

The findings of this section were reported by Oyebanji, et al. (2022) [99].

Table 5: List of facilities selected per sub district in S2S supported sites

	Facilities	Sub Districts (SD)	Number of facilities selected from S2S supported sites	Number of facilities supported by S2S per sub district	Proportion of facilities selected out of S2S supported sites
1	Cathcart Town Clinic	Amahlathi	**5**	**21**	**23.8%**
2	Komga clinic				
3	Sttuterheim Town Clinic				
4	Nompumelelo Gateway Clinic				
5	Mooiplaas Clinic				
6	Bolotwa Clinic (Idutywa)	Mbashe	**9**	**24**	**37.5%**
7	Fort Malan Clinic				
8	Gwadana Clinic				
9	Jingqi Clinic				
10	Lota Clinic				
11	Mahasana Clinic				
12	Nqabara Willowvale Clinic				
13	Nyhwara Clinic				
14	Willowvale CHC				
15	Ibika Clinic	Mnquma	**7**	**23**	**30.4%**
16	Macibe Clinic				
17	Ndabakazi Clinic				
18	Nozuko Clinic				
19	Qolorha by the Sea Clinic				

20	Tutura Clinic				
21	Zazulwana Clinic				
22	Debeneck Clinic	Nkonkobe	**9**	**20**	**45%**
23	Healdtown Clinic				
24	Lower Regu Clinic				
25	Midledrift CHC				
26	Mxhelo Clinic				
27	Thozamile Madakana				
28	Msobomvu Clinic				
29	War Memorial Clinic				
30	Victoria Gateway Clinic				

4.2.1 Overview and description of the source documents for reporting PMTCT data

To review the data elements recorded and collected for the PMTCT programme, we analysed the use of three selected DOH source documents available in the facilities for reporting PMTCT data and checked for data reporting alignment. This formed part of the CQI process in the facilities which ensures that quality PMTCT data are collected, reported, analyzed and used for continuously improving programme performance and delivery of quality services.

We found that all the 27 facilities selected for this study agreed to have completed the ANC register, the tick register, and the input forms as part of the CQI initiative. After that, they consolidated their PMTCT data monthly before transferring to the DHIS. The nurses completed the tick registers, followed by daily and weekly data verification using the input form and later give it to the data capturers for capturing into the DHIS [51].

• **Electronic tick register (e Tick register):** This is a source document used for reporting PMTCT data elements. The standardised paper-based register was transitioned to an electronic tick register (e-tick register) in 2017/2018 during the implementation of the rationalised registers. The register is placed in each consultation room for use by each clinician to complete for each patient daily. The e-ticks run on Libre office, a free and open-source office productivity software suite which enables the collation and consolidation of data by the data capturers before capturing onto the web-based District Health Information Software (webDHIS).

• **Antenatal Care (ANC) Register:** The source document that is used to record each visit made by a pregnant woman during the antenatal period is the antenatal register. This register is significant because it is the basis on which the quality of antenatal care is retrospectively monitored during delivery. This register documents all events from the registration of the first ANC visit, subsequent visits, pregnancy risk monitoring, routine preventive services offered during pregnancy, and pregnancy outcome details at delivery.

• **Input form**: The input form is the final form for entering the data into the relevant database. Data from the source documents are collated onto the input forms weekly for reporting into the DHIS using the monthly summary sheet. However, in some cases where there are no input forms, data can still be reported to the DHIS using the monthly summary sheet after data collation. This is done weekly and monthly, after which the data input form is signed off by the facility manager and kept safe under lock in the facility for monitoring and auditing purposes.

Although different data elements are reported using the three source documents listed above, PMTCT data elements may appear in more than one register based on the National Indicator Data Set (NIDS). The NIDS is the minimum number of indicators approved by the NDOH that every public health facility is expected to use to collect, and report based on the facility service package [51]. For this study, we did a mapping exercise of the new registers in order to map

each of the eight PMTCT data elements (that is, match them to the appropriate boxes/tables to see how they are reported across the three source documents). Table 6 shows the official source documents for selected eight PMTCT data elements.

Table 6. Official source documents for selected eight PMTCT data elements.

	Data Element	Indicator Definition	Tick Register	ANC Register	Input Form
I	Antenatal 1st visits before 20 weeks	A first visit by a pregnant woman to a health facility that occurs before 20 weeks after conception to primarily receive antenatal care according to Basic Antenatal Care (BANC). The first antenatal visit is often referred to as a 'booking visit'	X	X	X
II	Antenatal HIV 1st test	Antenatal client who was tested for the first time during her current pregnancy	X	X	X
III	Antenatal HIV 1st test positive	Antenatal clients who tested positive for the first HIV test done during the current pregnancy	X	X	X
IV	Antenatal client HIV re-test	Antenatal clients who tested negative for HIV during an earlier antenatal visit and were re-tested for HIV during the pregnancy	X	X	X

V	Antenatal start on ART	HIV positive antenatal clients who were initiated on ART during their current pregnancy		X	
VI	Infant PCR test around 10 weeks	Infants born to HIV positive mothers who are PCR tested around 10 weeks	X		X
VII	Infant PCR test positive around 10 weeks rate	Infants tested PCR positive for follow up test as a proportion of Infants PCR tested around 10 weeks	X		X
VIII	Infant initiated on CPT around 6 weeks	Children under 15 years who were on cotrimoxazole prevention therapy (CPT) at the time of starting ART	X		X

X indicate that the source document to report the PMTCT data element.

PMTCT data elements are part of the core national indicators used to assess the progress and performance of key services provided in PMTCT programme. Data used for reporting are extracted from the DHIS and National Health Laboratory Service (NHLS). PMTCT data elements are important component used for monitoring and measuring the quality of PMTCT programme and to follow-up and track exposed infants.

From Table 6, we observed that all the three source documents were used to report four of the eight PMTCT indicators (Antenatal 1st visit before 20 weeks, Antenatal HIV 1st test, Antenatal HIV 1st test positive and Antenatal client HIV re-test). In addition, three indicators were reported using two source documents (except the ANC register), while only one indicator (ANC start on ART) was reported using the ANC register alone.

4.2.2. Availability of Source Documents in the Facility

The South African National Department of Health (NDoH), in March 2015, launched the implementation of Rationalisation of Register (ROR), which was aimed at reducing the amount of time invested in completing the registers and collecting data so that the health care workers would dedicate more time to improve data quality, as part of quality improvement process. The rationalised registers implementation commenced during 2016/2017 (from April 2016 to March 2017) DOH financial year, but various facilities started the implementation at different times. Therefore, we conducted a desk review and analysis of the 27 facilities to assess the availability of the source documents in January 2017. The availability of the source documents in the facility is important because they are used for recording, collecting, and reporting PMTCT data at the facility level, and this feeds into the sub-district, district, province, and national reports. In addition, the data is also used to track patients and monitor PMTCT programme performance

Findings from the desk review of the registers showed that all the facilities (100%) had a tick register for reporting, and only 10 of the 27 (37%) had an ANC register, while 23 of the 27 facilities (85%) had an input form that is used to collate PMTCT data (Figure 14). This shows that the tick register is the main source used as a reliable source document for reporting PMTCT data as at the time of conducting this study. Our study also showed that the tick register is readily available for use in each consulting room in the facility compared to other registers because it is easy to use, does not require the HCPs to do a lot of writing like other registers and therefore they spend less time in completing the register.

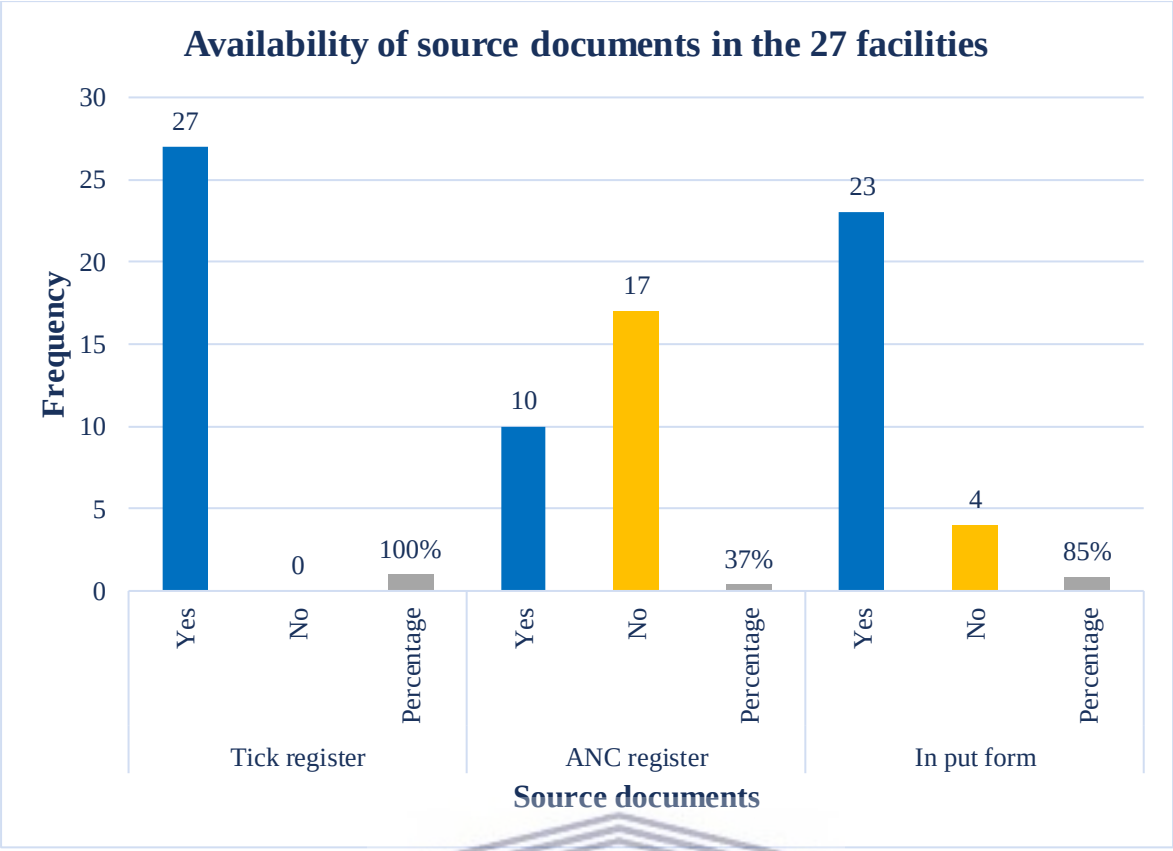


Figure 14. *Availability of PMTCT source documents*

This shows the number and percentage distribution of the three source documents (Tick Register and PMTCT Registers and input forms) across the 27 facilities.

4.2.3. Use of Source Document to Report PMTCT Data during the Transitional Phase of the Rationalised Registers

This section reports on the HCPs experience on how PMTCT data was collected, reported, and used in the facility during the transitioning phase of the registers. It further elaborates on the issues encountered in the health facilities that prevent them from not analysing and displaying data in the facility to show their performance. This study found that PMTCT data management and reporting were challenging during the transitioning phase of implementing the rationalised

registers because of different timelines instituted in the facilities and the non-availability of source documents in some facilities. The big challenge of routinely collected PMTCT data occurs at the facility level, affecting data reported at the sub-district/district and national levels.

From the in-depth interview data, less than half of the facilities confirmed that they had already started using the rationalised registers, while the others still use the old registers because they are more comfortable with it. This shows that the DOH need to set up systems that will assist the health facilities to successfully embrace the change management needed to ensure the use of the rationalized registers. Furthermore, the participants attest to not transitioning entirely because they still use some registers, especially the ANC register, stating that

> *It is a longitudinal register that captures the pregnant woman's journey from start to finish. (Professional Nurse)*

In the Community Health Centres (CHCs) and PHCs, where the tick register was used for reporting, our data shows that the nurses completed the tick registers daily and weekly and used the input form for data verification and collation of data for reporting in the DHIS. Once the data was verified, the data was then given to the data capturers for input into the digital system. Interestingly, all the facilities assessed had at least one data capturer dedicated to capturing PMTCT data in their facility. The excellent coverage of data capturers across the facilities was attributed to support provided to the Department of Health (DOH) by partners which provided additional data capturers to complement the facility staffing structure to improve the data management system. Our data shows that the facility staff work hand in hand to follow the NDoH data collection and reporting process and ensure that data is analysed and captured by the data capturers, verified, and signed off by the Operational Manager before submission.

One facility staff interviewed said,

Yes, we use the tick register in the counselling and consulting rooms. We use the input forms to consolidate the monthly data for reporting. ……. Here, we (nurses) set aside 30 min at the end of the day to consolidate the number and send it to the data capturer for capturing. All registers are collected, and verification is done daily, before data is captured into DHIS. (Professional Nurse)

In agreement with the above, one of the participants stated that

In my clinic, we started using the rationalised registers in December 2016 because we were told not to use too many registers, but we continue to complete the ANC register, input form and tick register, and they are up to date. The other register needs too much writing, but we prefer the tick register for reporting because it is better". (Professional Nurse).

We noticed from the above findings that although a mandate was given to implement and use the rationalised registers, some clinics still hold on to some of the old registers and use them for reporting because they are comfortable using them. However, the tick register remained one of the source documents used for reporting PMTCT data, and the facility staff completed this register according to the Standard Operating Procedure (SOP). This quote by the participants about the preference for using of the tick register over other registers for reporting shows one of the benefits of rationalisation, which is the introduction of a use friendly tick register.

Another respondent stated that

Each consulting room has a tick register. Every time a patient is seen, it is ticked off in the tick register. The nurses tick the services offered to the patients, and the data capturers put this on the input forms before capturing them on the information system.

Everyone is trained on how to complete the registers, and we have daily, weekly, and monthly data reviews. (Professional Nurse)

From the above participants, we deduced that the facility staff were aware of the requirement to document, capture, and report PMTCT data collected according to the NDoH SOP.

4.2.4. Use of Analysed PMTCT Data Reported

Following the data collection and verification, many facilities drew graphs to analyse the data and display the facility's PMTCT programme performance in designated areas in their facility. This forms part of CQI in the facility, which is a continuous process of reviewing the progress made with PMTCT programme and it assist the facility to refine the programme to perform better. Graphical representation of the indicators was displayed either in the waiting area, on the passage wall or in the operational manager's office. This gives a quick and effective way of looking up at the charts to know how the facility is performing against the set targets. Across the facilities, three of the eight selected PMTCT indicators that were predominantly displayed are first ANC visit before 20 weeks, ANC re-test and ANC clients initiated on ART. In some facilities, other non-PMTCT indicators were displayed alongside the PMTCT indicators.

One of the respondents explained:

My facility analyses the data and displays the facility's performance to show what we have achieved with our quality improvement plan. We show data like ANC re-test, ANC clients initiated on ART, ANC first visit before 20 weeks, Isoniazid Preventive Therapy and infants initiated on cotrimoxazole on the walls. (Operational Manager)

Another respondent confirmed that the analysed data were displayed on the facility notice board, but the data analysed and displayed are not limited to PMTCT data elements alone.

One of the data capturers confirmed this statement as well,

> *The graphs displayed on the notice board or in the offices in my facility are in line with the quality improvement plan we implement. Data analysis is done for all programmes and not specific for PMTCT data alone […] like HIV testing, viral load graph and run charts for ANC visits before 20 weeks. (Data Capturer)*

4.2.5. Reasons for PMTCT Data Discrepancies

More than half of the facilities assessed affirmed that data collection and verification is done in their facilities and the facilities display the PMTCT programme performance and review the progress made as part of continuous quality improvement. However, PMTCT data discrepancies still occur in facilities where the factors detailed in Table 7 below have not been addressed as seen in the analysis of the questionnaire administered to the 16 professional nurses and 8 data capturers on their opinion on the reasons for PMTCT data discrepancies.

Table 7. Major reasons of PTMCT data discrepancies.

Inadequate Training of Monitoring and Evaluation (M and E) Staff						
	Group 1 (16 PNs)	**Group 2 (8 DCs)**	**Total**	**Chi-Square**	***p*-Value**	**Remarks**
Yes	13	1	14	10.37142857	0.00128	

No	3	7	10			*p*-value < 0.05 Significant
Total	16	8	24			

Nurses not Documenting Work Done Properly						
	Group 1 (16 PNs)	**Group 2 (8 DCs)**	**Total**	**Chi-Square**	***p*-Value**	**Remarks**
Yes	4	7	11			
No	12	1	13	8.391608392	0.003770	*p*-value < 0.05 Significant
Total	16	8	24			

Missing source documents (ANC, Tick Register & Input Forms)						
	Group 1 (16 PNs)	**Group 2 (8 DCs)**	**Total**	**Chi-Square**	***p*-Value**	**Remarks**
Yes	12	8	20			
No	4	0	4	2.4	0.121335	*p*-value > 0.05 Not significant
Total	16	8	24			

Data entry Error						
	Group 1 (16 PNs)	**Group 2 (8 DCs)**	**Total**	**Chi-Square**	***p*-Value**	**Remarks**
Yes	14	1	15			
No	2	7	9	12.8	0.000347	*p*-value < 0.001 Highly significant
Total	16	8	24			

From our data analysis, data entry error was highly significant at *p-value* < 0.001, while inadequate training of M and E staff and nurses not documenting their work done properly were significant at *p*-value of <0.05, while the participants opinion about missing source documents (ANC, tick register & Input forms) was not significant (*p*-value > 0.05).

4.2.6. Reasons for Not Displaying Facility Performance

Although many of the facilities displaced their facility performance in conspicuous area in the facility, others did not. The two main reasons reported for not displaying facility performance

include clinicians not properly completing the clients' information, especially on the tick register and shortage of staff to collect, report, and analyse data. Facility staff interviewed raised the issue of clinicians not recording or documenting the service rendered properly in the register. Others mentioned instances where the clinicians had recorded incomplete information of the clients they had seen, and this was attributed to the high volume of patients seen daily in the facilities with the low number of HCPs that are available to consult them. In addition, few data capturers affirmed that they are sure that clinicians provide healthcare services to more clients than those indicated or recorded in the register, and that facility performance would improve if the clinicians could tick off the work done on the input forms for every client seen. This finding is in line with the Chi square analysis of the participants opinion about the reasons for discrepancies in PMTCT data reporting, which showed a significant relationship in two categories relating to the reasons for discrepancies in PMTCT data. They are nurses not documenting work done properly at p-value of 0.003770 (p-value < 0.05) and data entry error at p-value of 0.000347 (p-value < 0.001) as seen in Table 7.

Another challenge found at the facility level was that doctors and nurses may forget to capture information on every patient that presents for care as a result of the multiple roles they play (e.g., provision of clinical care and completion of registers) and high volumes of patients they consult. These may lead to under or over reporting. It can therefore be difficult to keep accurate statistics, and this might not give a true reflection of care given in the facility.

The following are quotes from the participants highlighting some of the reasons for poor documentation of records

> *We do [not] display any PMTCT graph although we analyse the PMTCT dashboard monthly […] we do data analysis for all programmes and capture our data on the*

District Implementation Plan (DIP) template. Still, some nurses do not complete their registers very well. (Professional Nurse)

Discrepancies and inconsistencies in PMTCT data collated and reported in my clinic are due to nurses forgetting to tick the register, sometimes resulting in data not corresponding with the work done. We see minor discrepancies in some of the columns in the tick register because the nurses did not tick them or because they did not record properly in the register even when the service was offered. As data capturers, we assumed that the service was provided although it was [not] indicated in the register. This results in challenges in data collection during data capturing at times. (Data Capturer)

From the above statements, we note that the importance of good documentation (recording and reporting of work done) cannot be overemphasised for reporting and representing the work done by the facilities.

In addition, the other point made by the staff interviewed was the staff shortage issue. The perception was that, although they collect, review, and analyse their data, they did not have the capacity to generate nor display the graphs that show their facility performance because they do not have experts assigned to support the facility.

One of the participants states:

We do not display graphs in my clinic because of a shortage of staff and also because we don't have anybody from DOH to do the graph for us. If our partner is not around, we can't do it. My facility has challenges in data collection and data capturing. More hands are needed because the clinic is short-staffed and not properly supported. We also need more support and supervision from the sub-district. (Operational Manager).

4.2.7. Suggested Ways to Address Gaps Identified in PMTCT Data Collected

Following the gaps identified in the facilities, we sought the participants' opinions on possible solutions to address the gaps identified. The following suggestions were made (i) dedicate more time to identify and understand the reasons for the gaps identified in the data collected, (ii) address shortage of staff issue, (iii) provide supportive supervision and (iv) capacity building of staff, especially the data staff. This corresponds to the Chi-square analysis, which suggested that it is important to build the capacity of M and E staff and have designated staff responsible for reviewing data quality at facility and sub district levels with p-values of 0.000347 and 0.045500, respectively (p-value < 0.05) in Table 8 below**.**

Table 8. Participants opinion about what can be done to address PMTCT data discrepancies.

Capacity building of M and E staff						
	Group 1 (16 PNs)	Group 2 (8 DCs)	**Total**	Chi-square	p-value	Remarks
Yes	14	1	15			
No	2	7	9	12.8	0.000347	p-value < .001 Highly significant
Total	16	8	24			
Written guidelines from M and E unit for facility and Sub district for reporting						
	Group 1 (16 PNs)	Group 2 (8 DCs)	**Total**	Chi-square	p-value	Remarks
Yes	14	6	20			
No	2	2	4	0.6	0.438578	p-value > .05 Not significant
Total	16	8	24			
All M and E positions dedicated to data management need to be filled						
	Group 1 (16 PNs)	Group 2 (8 DCs)	**Total**	Chi-square	p-value	Remarks
Yes	15	5	20			
No	1	3	4	3.75	0.52808	p-value > .05 Not significant
Total	16	8	24			
Have designated staff responsible for reviewing the quality of PMTCT data at facility and sub-district level						
	Group 1 (16 PNs)	Group 2 (8 DCs)	**Total**	Chi-square	p-value	Remarks
Yes	14	4	18			
No	2	4	6	4	0.045500	p-value < .05 Significant
Total	16	8	24			

Data analysis of the participants opinion in Table 8 showed that capacity building of M and E staff was highly significant at *p*-value < .001, having designated staff responsible to review the quality of PMTCT data at facility and sub-district level was significant p-value < .05, while the other two factors; having written guidelines from M and E unit for facility reporting and ensuring that all M and E positions are filled and dedicated to data management were not significant *p*-value > .05 .

> *We can correct discrepancies and inconsistencies in data collated and reported during our weekly meeting by ensuring that all gaps are identified during data verification to help us address all discrepancies during our weekly meeting. (Professional Nurse)*

Another participant stated that:

> *I think we can address these challenges by investing more time in improving our data and building the capacity of data capturers, particularly on topics such as PMTCT. We also need to think about the consistent use of the registers, get rid of notebooks and consolidate our [statistics] daily. (Operational Manager)*

Our study showed that the facilities completed the three source documents used for recording and reporting of PMTCT data elements, with preference for the tick register because it is user friendly, which is line with the purpose of scaling up the rationalized registers. However, some of the facilities have not transitioned completely to using the rationalized registers because they are so used to the old registers. In addition, the participants agreed that it is important to build the capacity of HCPs and ensure that they adhere to the health facility policies in order to report quality data. Also, there is need to conduct data verification to constantly check for data

discrepancies, to identify gaps and use it to improve the quality of reported. In addition, it is important to display the PMTCT programme performance and review programme data as part of the continuous quality improvement process in the facilities. Therefore, there is need strengthen the data management support provided to the facilities by addressing the gaps identified in PMTCT data collection process.

4.3 Plausibility evaluation of selected PMTCT programme indicators following the implementation of CQI

The findings reported in this section includes the plausibility evaluation done by reviewing routine DHIS data to compare the improvement/non-improvement seen across 112 intervention sites supported with implementation of CQI intervention (capacity building of HCPs, (ii) development, testing and implementation of change ideas for quality improvement projects, and (iii) participatory data-driven review meetings) by S2S in four sub-districts of Amathole district (28 facilities in each of Amahlathi, Mbhashe, Mnquma and Nkonkobe) with the non-intervention sites (where S2S did not implement CQI). Our findings are based on four selected PMTCT indicators linked to the change ideas implemented which include ANC 1st visit before 20 weeks rate, ANC clients initiated on ART rate, ANC clients retest rate and Infant PCR test positive at birth rate. ANC clients initiated on ART rate was not part of the change ideas implemented during this period because the indicator was performing well but we included the indicator for added comparison.

We compared the improvement and/non-improvement seen prior to the implementation of CQI which involved the review of routine data from the District Health Information System for three PMTCT indicators for the period April 2015 to March 2016 (prior to implementation of CQI) and comparing performance with April 2016 to March 2017 (one year after

implementation). The comparison period was April 2015 to March 2016 (before CQI implementation) and April 2016 to March 2017 (one-year following CQI implementation.

This study documented the implementation process of quality improvement projects in the intervention facilities. In order to implement QI successfully in the facility, the QI teams need to be formed, they need to have regular QI meetings and they must be functional because they are important and required to drive the implementation of the QI projects, including testing of change idea during the implementation/action period and monitoring the improvement as part of the quality improvement collaborative activities. The QI team is composed of clinicians (medical doctor or /and professional nurses), data capturers and other health care professionals such as pharmacist, lay counsellors, community health workers (CHW), etc depending on the decision of the facility management.

Table 9: Proposed change ideas for implementation for three PMTCT indicators

	Indicators	Issues	Change Ideas
1.	**Antenatal first visit before 20 weeks**	Late booking for antenatal care	1. Offered pregnancy test to all women of childbearing ages and initiated on BANC package if pregnant. 2. Nurses go to the South African Social Security Agency to target women for health talk and testing. 3. Use of pregnancy screening tool. 4. Community Health Workers (CHW's) to do health talks on early booking in the community. 5. Professional nurses linked services to the clinic committee to bring women of childbearing age to the facility when they missed their menstrual period.

			6.	Standard Operating Procedure (SOP) to prevent running out of pregnancy test-Pharmacy Assistant changed role.
			7.	Verifying that all patients were offered, tested and counselled for HIV in hospital wards to increase uptake to find pregnant women
8.	**Antenatal retesting rate**	Low rates of antenatal re-testing rate	1. 2. 3. 4. 5.	Daily health education at the facility and community level The lay counsellor did a retest before consultation with the Nurses Created retest diary Data audits are done weekly Utilised outreach teams.
6.	**PCR at birth on HIV-exposed babies**	Low PCR test and missed opportunity of testing HIV exposed babies at birth	1. 2. 3. 4. 5.	Equip all Nurses working in the maternity ward and reinforce the importance of PCR at birth. Communication SOP between hospital and maternity ward to get PCR results before an HIV Exposed Infant (HEI) is discharged and for an assigned staff member to follow up on the PCR results. Hospital laboratory staff will send a PCR list to health clinics Refresher training in Dry Blot Spotting (DBS) No PCR, No discharge

Table 10. Different facility groups and changes in PMTCT indicators

PMTCT Indicator	Facility Group	Baseline April 2015 to March 2016	Intervention Period April 2016 to March 2017	Difference	p-value	Level of significance
1st ANC visit <20 weeks rate	Intervention sites n=112	69%	74%	5%	< .001	Highly significant
	Non-Intervention sites) (n= 52)	76%	67%	- 9%	< .001	Highly significant
ANC client's retest rate	Intervention sites n=112	82%	89%	7%	< .001	Highly significant
	Non-Intervention sites) (n= 52)	88%	75%	-13%	< .001	Highly significant
ART clients initiated on ART rate	Intervention sites n=112	69%	134%	65%	> .05	Not significant
	Non-Intervention sites) (n= 52)	65%	131%	66%	> .05	Not significant
	Intervention sites n=112	0.7%	0.7%	0%	> .05	Not significant

	Non-Intervention sites)				
Infant's PCR test positive at birth rate	(n= 52)	1.5%	2.6%	0.9% >.05	Not significant

We further grouped the changes observed in the PMTCT indicator values into five categories, comparing the baseline (April 2015 to March 2016) and the intervention (April 2016 to March 2017), as well as the 112 S2S facilities where the S2S quality improvement projects with the 52 non-S2S supported facilities where the S2S quality improvement project was not implemented (Table 11).

1. Intervention facilities where the indicator improved with a high statistically significant result.
2. Non-intervention facilities where the indicator improved with high statistically significant result.
3. Intervention facilities where the indicator rate increased with a not statistically significant result.
4. Non-intervention facilities where the indicator rate increased but with no statistically significant result, and Intervention facilities where indicator showed no change and with no statistically significant result

We then examined programmatic changes in each of these facility groupings to theorise possibly explanations for the changes (Table 11).

Table 11 shows the observed changes in the intervention facilities following the implementation of some of change ideas in table 10 by the CQI teams in the facilities. The results of the implementation were tracked for improvement/non-improvement.

Table 11: Interpretation of the observed changes in the intervention facilities using the Consolidated Framework for Implementation Research Domains and Descriptions

Damschroder, et al. (2009), states that Consolidated Framework for Implementation Research (CFIR) is a comprehensive implementation science framework developed to provide guidance for effective implementation of evidence-based practices from design to evaluation. It has 39 constructs divided into five domains (i) intervention characteristics (ii) outer setting (iii) Inner setting (iv) characteristics of individuals and (v) process of implementation. The CFIR domains are highlighted in the table below, on page 147 under discussion of findings for research question 2 and page 150 under interpretation of results using the Consolidated Framework for Implementation Research.

Changes Observed	Indicator	change Ideas Implemented	CFIR domain	Description
Intervention facilities where PMTCT indicators improved with a high statistically significant result	**1st ANC visit <20 weeks rate in 112 facilities**	Demand creation in-facility and community by conducting health talks to offer pregnancy test to all women of childbearing ages, promote early ANC booking	**Implementation process** (Engagement)	Attracting and involving individuals in implementation and use of intervention through social marketing, education, role modeling, training
	ANC client's retest rate in 112 facilities	Verifying that all patients were offered, tested and counselled for HIV in hospital wards to find more pregnant women	**Implementation process** (Executing)	Carrying out or accomplishing the implementation according to plan
		Increased awareness through daily health education in the facility, screening and retesting of eligible clients by lay counsellors		
		Monitoring of clients that fell through PMTCT cascade by monitoring the	**Implementation process**	Degree to which a scheme/method of behavior and tasks for implementing

		use of retest register through weekly data audits	(Planning)	an intervention are developed in advance
	1st ANC visit <20 weeks rate in 52 facilities	Because CQI was not implemented in these facilities, the activities continued as usual	**Intervention characteristics**	Perceived difficulty of implementation reflected by duration, scope, radicalness, disruptiveness, centrality, intricacy, and number of steps required to implement.
Non-intervention facilities where the indicators decreased but with a high statistically significant result.	**1st ANC visit <20 weeks rate in 52 facilities**	Because retest register was not used like in intervention sites where it was used to improve and monitor ANC clients retest rate.	**(Complexity)**	
	ANC client's retest rate in 52 facilities	Decrease in non-S2S implementation sites attributed to non-implementation of CQI. Improved ANC clients retest rate because lay counsellors ensured that eligible ANC clients were retested before going for consultation	**Outer settings**	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting
	1st ANC visit <20 weeks rate in 52 facilities, and ANC client's retest rate in 52 facilities	The decline in both indicators (1st ANC visit < 20 weeks rate and ANC clients retest rate) is compounded by the implementation of ROR. Monitoring tools developed could not be implemented because ROR discouraged use of additional tool	**(External policy and incentives)**	
1st ANC visit <20 weeks rate in 52 facilities	**ANC clients initiated on ART rate in 112 facilities**	Increase of 65% (from to baseline to intervention period), attributed to NDoH's advocacy for early ANC booking and UTT campaign which ensured that all HIV-positive clients who were not on treatment are recalled and fast-tracked for ART initiation	**Outer settings** (External policy and incentives)	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting
Non-intervention facilities where the	**ANC clients initiated on**	CQI not implemented, but NDOH UTT guideline implemented, which ensured that all HIV-positive clients	**Inner settings** (Access to	Ease of access to digestible information and knowledge about the intervention and

indicator rate increased but with no statistically significant result	**ART rate in 52 facilities**	who were not on treatment were recalled and fast-tracked for ART initiation. Increase of 66% (from baseline to intervention period)	knowledge and information)	how to incorporate it into work task
	Infant PCR test positive at birth rate in 52 non-intervention facilities	Situation in non-intervention sites remains the same because was change idea was not implemented (e.g. capacity building, SOP not monitored). More children were infected with HIV through MTCT at birth and infant PCR test positive rate at birth increased by 0.8%	**Outer settings** **(External policy and incentives)**	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, and public or benchmark reporting
Intervention facilities where PMTCT indicator showed no change in the baseline and during the intervention period and with no statistically significant result	**Infant PCR test positive at birth rate in 112 facilities**	Change ideas implemented; capacity building of professional nurses working in maternity ward.	**Implementation process** (Planning)	Degree to which a scheme/method of behavior and tasks for implementing an intervention are developed in advance
		SOP developed to remind clinicians to ensure that all HEI have their PCR results and are managed appropriately before discharging them	**Intervention characteristics** (Adaptability)	Degree to which a scheme/method of behavior and tasks for implementing an intervention are developed in advance
		Indicator not affected because it does not involve intensive follow-up but rather a broker approach to supportive supervision by S2S	**Characteristics of individuals** (Knowledge and beliefs about the intervention)	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.

4.5 Relationship of DCST and the district health management team to improve healthcare access and quality.

In 2012, South Africa established the DCST, as re-engineering stream in PHC created to facilitate clinical governance at the lowest levels of the healthcare system. The DCST role involved ensuring that health facilities across all levels are responsible for the continuous

improvement of quality care and service delivery for effective and efficient delivery of universal healthcare to individuals and communities [42]. This is one of the quality improvement initiatives instituted by the DOH to support and provide programme oversight for activities implemented aimed at improving access to healthcare services and improved quality of healthcare service delivery.

This section gives detailed findings of the qualitative case study that was used to understand the role played by the DCST and how they work together with the district health teams to improve PMTCT programme performance in the district. Additionally, the findings include the narratives of eight participants [three Operational Managers (OMs), two Professional Nurses (PNs), two S2S Quality Improvement Advisors, and one member of the District Health Team (DHT)] who are members of the quality improvement district teams and providing technical assistance to support the implementation of quality improvement work in Amathole district municipality in the Eastern Cape province of South Africa. We report on their understanding of the relationship of the DCST with the district health team and their support for PMTCT programme in the district.

The findings of this section were published on 13 December 2022 in the Tropical Medicine and Infectious Disease Journal, with the title "Promoting Awareness of the District Clinical Specialist Team in the Amathole District, South Africa: An Essential Specialty in Improving Healthcare Access and Quality". The findings of this section were reported by Oyebanji, et al. (2022) [136].

4.5.1 Socio demographic Characteristics of the Respondents

1. Participants' Age Group

Three out of the eight participants interviewed (37.5%) were aged 45-49 years, followed by two participants aged 40–44-year-old. The other three participants fall into the age group of

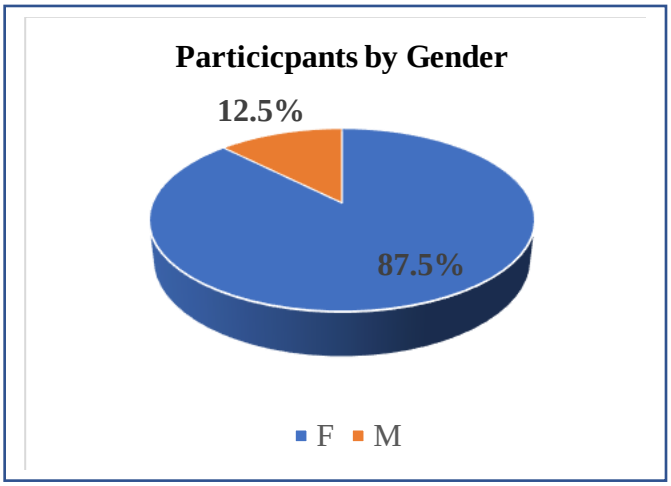
30-34, 50-54 and 55-60 year respectively. The mean age (± standard deviation, SD) of the participants interviewed was 45.88 (±7.18). This showed that most of the employees were in the fourth decades of life (Table 12).

Age	Frequency	Percentage
30-34	1	12.5%
35-39	0	0.0%
40-44	2	25.0%
45-49	3	37.5%
50-54	1	12.5%
50-55	0	0.0%
55-59	0	0.0%
55-60	1	12.5%
Total	8	100.0%

Table 12: Participants' age group

Participants' Gender

The chart below showed that almost all the participants were female, that is 7 out of the 8 participants (87.5%)



Educational Qualification

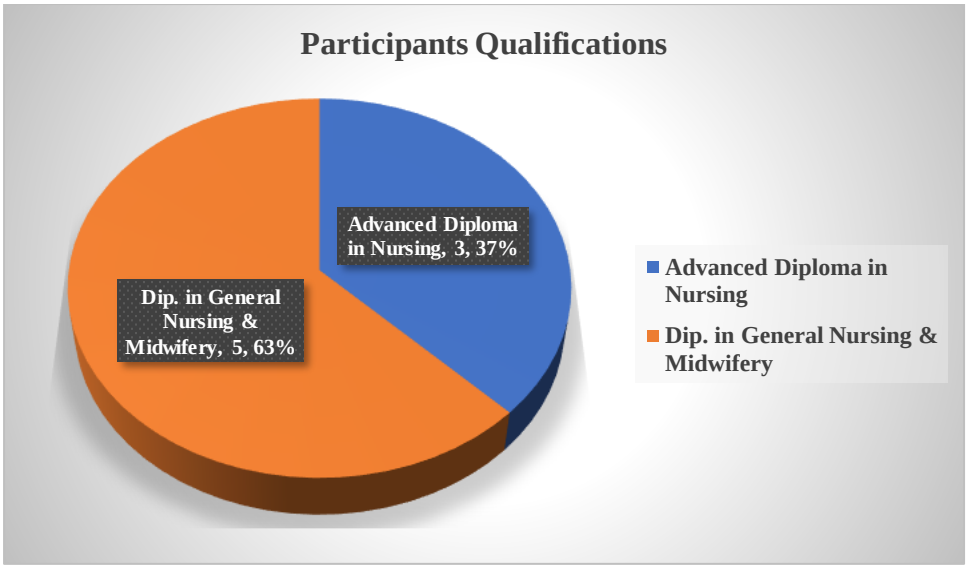


Fig 16: Participants' qualification

More than half of the participants interviewed (63%) have diploma in both general nursing and midwifery qualification while 37% have only advance diploma in nursing qualification.

2. Years of Employment in the Facility

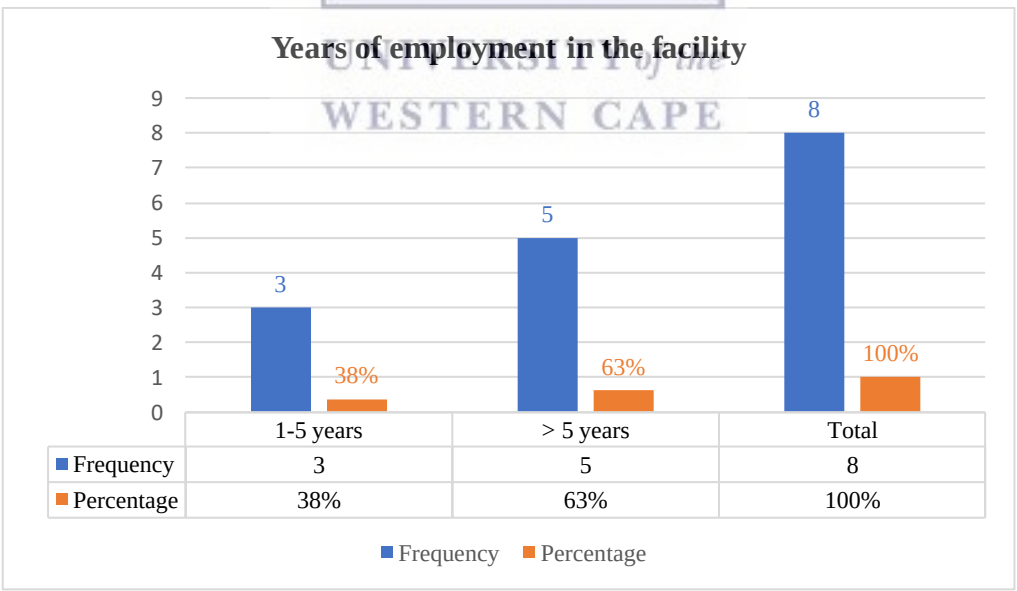


Fig 17: Participants' years of employment in the facility

More than half of the participants (63%) had been in the facility for more than 5 years, while 38% had been working in the facilities between one and five years.

Most interviewees (87.5%) were females in their mid-forties and had been at their respective facilities for at least five years. The mean age of the participants was 45.0 years. The findings of this study were discussed based on three themes : (1) capacity building, which was done mainly by facilitating PMTCT in-service training, conducting one-on-one coaching, mentoring and clinical audit as they conduct supportive supervision visits and based on the identified need, (2) programme performance oversight and monitoring, using facility data to monitor PMTCT programme performance and guide the technical support required and, (3) technical support for programme implementation to ensure that performance improvement plans identified are implemented accordingly.

4.5.2 Capacity building

One of the key roles of the DCST is to ensure that clinicians in the district have current clinical knowledge, guidelines, protocols, and Standard Operating Procedures (SOPs) and have clinical skills that will empower them to provide quality health care services to their clients. The DCST provided continuous training to the working staff, which kept them abreast of the latest developments in clinical care and addresses the dynamic changes in the guidelines from time to time.

Our data showed that Amathole District, like many other rural districts in South Africa had high staff turnover, resulting in the loss of valuable knowledge and skills transferred to newly recruited staff who are employed to fill the vacant positions but need to be trained so that they can become successful in their new role. To address this, the DCST trained new staff on new guidelines and policies, which assisted in integrating them into the health care system. The participants reported that the DCST play a significant role in clinicians' one-on-one

consultation, which enhances their clinical skills, knowledge, and work performance to care for and manage the mother and baby pair for improved PMTCT programme performance in their facilities.

> *"The DCST assist in conducting workshops and in-service training on PMTCT related topics. In my clinic, we were trained on proper management of mother and child care. They support us to implement PMTCT protocol and make sure that we are practising and adhering to the guidelines."* (Professional Nurse).

> *"I see the role of the DCST in mentoring and coaching us to make sure we implement PMTCT guidelines."* (District Health Team Member).

> *"My clinic has challenges …. some of them are new on the job because many staff leave for better jobs. The DCST assisted by training the staff when we called them."* (Professional Nurse).

As reported by the participants, it is imperative that ongoing coaching and mentoring is essential for both the new staff who are expected to perform well in a new job with new responsibilities, as well as to update the knowledge of the existing staff members. Furthermore, capacity development by the DCST and the district health team ensures that NDOH national guidelines, protocols, and SOPs are implemented accordingly to meet the changes in the PMTCT guidelines for better clinical outcomes as recommended by the World Health Organization (WHO) [137].

In addition to the training and coaching of clinicians in the district hospitals, the participants confirmed that the DCST members work with the district team to conduct supportive supervision at the lower-level facilities (community health centres, primary healthcare centres and gateway clinics). Furthermore, the DCST role complement CQI work done by the district

team in the facility as they coached the clinicians on managing routine clinical functions such as conducting clinical audits. These clinical audits were tailored toward assisting the facilities in identifying gaps in PMTCT performance and to improve the quality of care provided to the mother and child. For example, one of the participants stated that:

> "*I think the DCST supported us to conduct clinical audits to identify areas of weakness in our clinic. They know the nurses that need help and support them to perform their work*." (District Health Team Member).

4.3.3 Programme performance oversight and monitoring

The participants confirmed that the DCST plays a significant role that is complementary to the work done by the DOH managers and supporting partners such as the S2S quality improvement advisors in tracking MTCT programme performance. This involves providing programme oversight and monitoring of PMTCT programme to achieve the desired outcomes. Our findings showed that the DCST support the facilities by using data to identify facilities that are performing poorly, and this informs their decision to schedule facility support visits to plan their supportive supervision visits. This is done through consultative engagement with the DOH management, facility CQI team and DOH partners which is essential for better understanding of the challenges, seeking inputs and collecting information that will assist in formulating the improvement plans for better outcomes. The CQI team play a key role in developing, implementing and supporting the different quality improvement projects. The strong relationships that the DCST have built with the different stakeholders and having worked closely with them over time made consultative engagement to plan for programme performance and oversight and monitoring work smoothly. The resultant effect leads to a well-formulated performance improvement plan that is put in place and monitored to address the challenges contributing to poor performance and to achieve better outcomes.

"*They assist us a lot. They help us to see where we are not doing well in terms of our indicators. They also monitor the use of guidelines and see that we manage our patients properly. When we encounter any challenge with our patients, we reach out to them by calling them on phone, and they provide more information and education on how to handle them*" (Professional Nurse).

"*In my sub-district, the DCST check and cross-check our data when they do their support visits. When there is a reoccurring problem, they assist us and help the staff to understand the issues for not performing well. I know that the DCST organise meetings to analyse data. They also help to review strategies to track patients that are lost to follow-up, for example, tracing of mothers and children who are HIV positive but missed their clinic appointments so that they can be managed according to the DoH protocol* (Quality Improvement Advisor).

The quote above is from one of the CQI members and it re-emphasized how the DCST assist the CQI teams to understand their data, analyze the data and use it for information management to improve patient care,

Another thing they assist us with is supporting us to manage cases that are complicated. They advise us whenever we call on them to help us and they support us to plan properly" (Operational Manager).

Our data showed that, in addition to ensuring that the guidelines are implemented accordingly, the DCSTs are also available to assist clinicians with managing difficult patients by providing specialised support to the HCPs. The DCST coach the junior doctors and nurses and provide clinical support on management of PMTCT programme and overall maternal and child health. This support is very important especially in rural areas like Amathole district, where there is lack or sub optimal number of skilled staff due to high staff turnover rate and inability to retain

the staff. In addition, the DCST work is critical in Amathole district because of the long distance/travel time to the health facility coupled with terrain where the roads are not so good, and this makes it difficult for the patients to get to the health facility. First, this technical assistance empowers the HCPs to manage their patients appropriately. Secondly, it also helps to build the confidence of the HCPs who are now better equipped to handle such patients in the future. For example, the participants alluded to the fact that the DCST ensures that women get tested early in pregnancy and treated for HIV. They also ensure that women are closely monitored (virally suppressed on treatment), and the mother-baby pair who missed their clinic appointment brought back to care and managed accordingly to prevent HIV transmission. This support complements the work of the provincial and district health team as well as the support partners. One of the participants stated that:

> "*We have seen improvement in early booking, monitoring and recording of viral load in pregnant women that are HIV positive in the clinics I support, because we use the guidelines. We also make sure that the mothers are tested early and tested more than once during the antenatal period. and we started on ARVs as soon we can. We do not have any record of new infections in newborns because of the support we have received from the DCST. The teams come to our clinic to support us to do our work better …. by assisting us with any challenge we encounter. They also advise us on how we can do our work better."* (Professional Nurse)

4.5.4 Technical support for programme implementation

The participants confirmed that the DCST complemented the technical support offered by DoH partners, such as S2S quality improvement advisors, to implement and monitor the change ideas generated during the learning sessions.

*'We (the facility team, DCST and Quality Improvement Advisor) develop a quality improvement plan together to address the challenges identified that is not making us to do well. They (DCST) join our monthly data clarification and data cleaning meeting to follow up with the change ideas we have from the S2S quarterly learning sessions, where we also learn about the best practice from other clinics (*Quality Improvement Advisor*).*

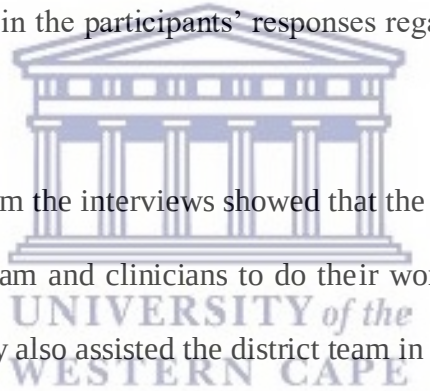
According to the participants, one example of the support provided by the DCST to complement the S2S technical advisors in monitoring the implementation of quality improvement change ideas in the facility is the tracking and tracing of the mother-baby pair (MBP). The DCST used their checklist to ensure that the MBP is traced and returned to care to continue their medication. They also ensue that the MBP attend the clinic for follow-up whenever they miss their appointment. This is very important especially during breastfeeding, to prevent mother-to-child HIV transmission.

"*Here, the DCST helps us every time we call…. they help in tracing children who became HIV positive. Even if the child was not delivered here or the child was delivered in a nearby facility, the DCST assist in tracing the child and therefore we are able to initiate the children on ARVs [Antiretroviral therapy] as soon as possible. In my opinion, the DCST assist us to track those that are lost to follow up which is important in our work*." (Professional Nurse).

One of the strategies to improve programme performance is to use data for information management. This was another change idea implemented by the facility quality improvement team, where they set aside 30 to 60 minutes weekly to review their facility performance using the programme data. As confirmed by the participants, the DCST leverage this opportunity to provide technical expertise and delve into the PMTCT performance of the facilities during their site visits.

"*I see that the DCST assist us to analyse different clinic PMTCT data. The DCST provide support and guidance to the manager on different challenges that he/she experiences. They also help us to see where we are not doing well in terms of our indicators*." (District Health Team Member).

The participants agreed that in addition to the technical support provided by the DCST, they also provided additional support for data verification and data analysis purposes to identify gaps in the PMTCT programme; this gave a better understanding of the challenges that might hinder performance. Our data showed that the technical support provided by the DCST team also assisted the facilities in looking at their data in a better way, enabling them to improve their performance. This was evident in the participants' responses regarding the additional support provided by the DCST.



An overview of the findings from the interviews showed that the overall work of the DCST is to support the district health team and clinicians to do their work better and to improve the health systems. In addition, they also assisted the district team in providing quality health care services to the community, especially in caring for mothers and children. The participants concluded that the interaction between the DCST, the CQI teams, the district health team and the DoH management team helped to improve clinical governance and programme performance. This is because of the DCST leadership role and the technical assistance to HCWs to support programme implementation, aimed at improving the health systems for better-quality care across all disciplines. These are aligned with the core functions of the DCST which includes training, programme monitoring and clinical governance to enhance and strengthen the district health system., which also complements the continuous quality improvement initiatives implemented by S2S.

From the participant's responses, the relationship of the district teams, supporting partner such as S2S and CQI teams with the DCST helped provide the necessary support to improve the quality of health services offered within the facilities. They also ensured that clinicians adhered to the implementation of the NDoH guidelines for better clinical outcomes for the clients.

In addition, one of the professional nurses stated that

"The DCST guide us to compare the previous month's data with the current one, to see if we are doing well or not. For example, we will be able to know how many newly positive pregnant women we have in the clinic, and we can compare with those that are already on ARVs and those that are pregnant. When the pregnant mother delivers, we will know the babies that are exposed to HIV and how many new babies or children are infected with HIV".

As alluded to by the clinicians, the other key role of the DCST is the technical support provided to the district team to use the facility data in identifying underperforming facilities. Thereafter, remedial actions developed to improve the facility's performance and to guide the joint supportive supervision. This support complements the work done by the S2S quality improvement advisors supporting the facilities that is geared towards ensuring that quality improvement plans are monitored to achieve the desired outcome. This finding correlates with the expected role played by the DCST which is to use their technical expertise to support programme monitoring.

*"We work well with them (DCST), although we do not have all the positions filled in the district. They (DCST) are part of our data meeting and data review meeting every Tuesday and at the end of the month, where we identify gaps in our performance and work together to improve them". (*Operational Manager*).*

Over and above this, the relationship of the team is also seen clearly in the programme performance review meetings held at the facility and the district levels. These meetings assist in identifying the best-performing facilities and using the lessons learned to scale up the best practices in underperforming facilities. Additionally, the weekly touch base meeting between the DCST and the district management team serves as an opportunity to disclose challenging areas that need to be addressed to improve programme performance.

As alluded to by the participants, the relationship of the DCST with the district health team also ensured the effective implementation of PMTCT protocols. This begins with prioritising nurses that need to be trained urgently, for example, the Nurses Initiated on Antiretroviral Treatment (NIMART) trained in different units for upcoming training [138,139].

In summary, our findings of this study show that the role of the DCST is important in continuous quality improvement and in the provision of quality PMTCT service. This is made possible because of the critical role the DCST play in assisting HCPs at different levels to address challenges encountered and to train and mentor the staff on the PMTCT programme so that they can function at their best. They also work with the existing provincial and district teams as well as the DOH supporting partners to provide services as stipulated in the national guidelines and use data to define and inform the technical support and supervision they provide to the facilities.

4.5.5 Key Lessons Learned

The following are key lessons from the participant's standpoint on the relationship of the DCST with the existing provincial and the district health management teams, as well the supporting partners to improve healthcare access and service delivery.

1. The DCST collaborate well with the existing district health teams at different levels. This is important to identify facilities performing poorly, formulate mitigation plan and provide supporting supervision to improve programme performance

2. The role of the district health team and DOH supporting partners is complemented by the DSCT to provide technical assistance, programme oversight and to monitor PMTCT programme performance

3. The DCST are highly skilled staff that support the provision of quality health service delivery. The improving HCPs knowledge of new/updated guidelines by conducting training and supportive supervision, similar to the support provided by the provincial and district as well as the DOH supporting partners

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CHAPTER 5. DISCUSSION AND INTERPRETATION

5.1 Introduction

This chapter discusses the findings of this study interprets the findings and discusses the strengths and limitations of the study. It also outlined the contribution of the study to the body of knowledge while relating these to the work done by other scholars as published in the literatures.

This study explores the PMTCT data management and reporting challenges and the outcomes of implementation of continuous quality improvement interventions used to improve and strengthen PMTCT programme performance across four sub-districts in Amathole district of Eastern Cape Province, South Africa.

Objective 1: This study recorded challenges in PMTCT data management and reporting during the transitioning phase of implementing the rationalised registers. This is as a result of different timelines instituted in the facilities and the non-availability of source documents in some of the facilities. The main issue identified was data collection and reporting at the facility level with discrepancies between the source document and the summary sheet, which affects the quality of data reported at the sub-district, district, provincial and national levels.

Objective 2: Two of the four selected PMTCT indicators had high level of significance at both the intervention and non-intervention sites (1st ANC visit < 20 weeks rate and ANC clients retest rate), while the remaining two (ART clients initiated on ART rate and Infant's PCR test positive at birth rate) were not significant at both the intervention and non-intervention sites.

Objective 3: The role of the district health team and DOH supporting partners complements the support provided by the DSCT, which includes technical assistance, programme oversight

and to monitor PMTCT programme performance. The DCST are highly skilled staff that work jointly with the existing district heath team and DOH supporting partners. They provide capacity building and work with the facility teams to identify gaps and implement remedial actions to improve performance and delivery of quality health service.

5.1.1 Research question 1

The following are key findings from research question 1

All the 27 facilities (100%) assessed had a tick register for reporting, and only 10 of the 27 (37%) had an ANC register, while 23 of the 27 facilities (85%) had an input form to collate PMTCT data. In addition, this study found inconsistencies in availability and use of the three source documents to report the eight selected PMTCT indicators. Furthermore, less than half of the facilities had started using the rationalised registers and more than half of the facilities assessed still use the old registers because they are more comfortable with it. However, the tick register remained one of the source documents used for reporting PMTCT data, and the facility staff completed this register according to the Standard Operating Procedure (SOP). Many facilities drew graphs to analyse the data and display the facility's PMTCT programme performance in designated areas in their facility as part of the CQI plan to review the progress made with PMTCT programme indicators. The two main reasons for not displaying facility performance include clinicians not properly completing the clients' information especially on the tick register and shortage of staff to collect, report, and analyse data.

Important factors to consider in order to address the gaps identified in PMTCT data collected include (i) dedicating more time to identify and understand the reasons for the gaps identified in the data collected, (ii) addressing the shortage of staff, (iii) providing supportive supervision and (iv) capacity building of staff, especially the data staff.

5.1.2 Discussion of research question 1 findings

In order to address the challenges of data collection and reporting, the District Health Management Information System (DHMIS) Policy of 2011 [52] was designed to provide comprehensive, timely, reliable, and good-quality routine data. To accomplish this, nurses must complete daily tally sheets at the facility for all clients and submit weekly tally sheets (input forms) to the data capturers for them to manually collate the data elements into weekly summary sheets. This data is then compiled into a monthly summary sheet and signed off by the facility manager (Fig.12) [140].

Causes of data discrepancies and how facilities are addressing them

Poor quality data collection in the facilities in widely differing findings arises from lack of adequate training, using poorly designed data collection tools where many different forms and registers scattered across the facility, from which over-stretched or demotivated nurses have to extract data [57].

From the participants' responses, poor documentation, inadequate training of M and E staff and data entry errors were the three main reasons for data discrepancies. This shows that there is a need to address these challenges in order to achieve the purpose of the ROR, which are to improve data quality and inconsistencies in reporting by empowering the health professionals and ensuring that they complete the registers correctly, collate data and report them appropriately. From our findings, capacity building of health professionals, institutionalizing change management and monitoring the implementation of the rationalised registers are essential factors required for successful scale up plan as seen in studies from other countries. This was demonstrated in Indian by Antara Foundation, where a similar project in partnership with the Ministry of Health in Rajasthan, Indian, was implemented in 2017 through the Akshada programme [141]. This project focused on the rationalisation of the Auxiliary Nurse

Midwife (ANM) service delivery register, which was designed to be user-friendly with a clear role for the users, and at the same time focused on meeting the government reporting needs. The overall goal was to reduce the workload of the ANM without losing essential information and create more time for healthcare workers to provide quality service delivery [142]. Young et al. (2013), [143] conducted a retrospective analysis of matched test results from Mozambique's PMTCT HIV testing programme. One of the reasons for discrepancies in data was incorrect entry or transcription of data during data collection or when ANC visits were captured centrally. The study thus recommended that double entry of data and automatic transcription of results be implemented to address this issue [144]. In like manner, a study conducted in Kenya on PMTCT data accuracy found that nurses admitted that they sometimes forget to record the services provided to patients [58], this finding is similar to what was found in this study. Specifically, nurses reported that despite recording the woman's HIV status in a client-held booklet provided during the first visit to ANC, they did not record whether prophylaxis was provided or not.

Addressing gaps identified in PMTCT data collection

According to the participants interviewed, more time needs to be dedicated to identifying the gaps in data collection and providing staff to fill vacant positions, especially in facilities located in the rural areas where it is difficult to retain skilled staff and ensure that the full staff complement according to the establishment list is in place. These staff also require training and supportive supervision to enable them close the gaps in accurately documenting PMTCT services. The participants specifically highlighted the need for the facilities to be adequately staffed with data capturers and to support PMTCT data collection. In their article, Mutshatshi et al. (2018), agree with this statement, stating that it is problematic if records are not kept satisfactorily within the facilities [142]. In addition, the authors recommended that there is a

need for continuous training of clinicians and follow-up to address challenges encountered in order to improve patient management and care.

Possible solutions to address data discrepancies

The main point for addressing data discrepancies is to hold everybody in the facility responsible for documenting and accounting for all the work they have done. The facility need to also review the facility-level data and ensure that quality data is submitted to the sub-district and district levels. This finding is in line with the recommendations in the data management section of the National PMTCT 2019 guidelines published by the South African by NDOH [143], where clinicians are required to document all clinical findings, results, and decisions clearly in the source documents such as the maternity case record, adult clinical record (ART stationery) for HIV positive women, and in the Road to Health Booklet (RTHB) for the HIV-exposed infant [53]. Likewise, the facility level standard operating procedure for district health management information system [51] states that health care providers (nurses, doctors, and other health professionals) are responsible and accountable for ensuring that there is high-quality data in individual patient files and that routine data are collected and collated using the standardised registers and other appropriate data collection tools. In addition, all health care providers must record individual patients' data in the patient retained records during or directly after each patient consultation [51]. In addition, the importance of having a good system in place to collect and report good quality data cannot be over emphasized as part of the continuous quality improvement process at all levels of health care delivery. Therefore, there is need to address the gaps identified in PMTCT data collection process. There is need to scale up quality improvement initiative led by DOH in collaboration with partners which was aimed at developing, implementing and monitoring a data-driven intervention to improve the quality of facility, district, provincial and national PMTCT data collection and reporting process. For this intervention to work better, efforts should be made

to ensure that a series of critical pathways called the PMTCT cascade is followed, where the journey of a pregnant HIV-positive women is monitored as she moves through the different stages on antenatal care in order to receive appropriate care and treatment for themselves and their newborns [35,146]. This is monitored through the use of process indicators collected routinely as part of the DHIS as done in some other countries [48,89–91]. Additionally, data quality needs to be addressed through mechanisms incorporated into the data collection process and functions within the DHIS software. These include checking of the data for inaccuracies by clinic managers and supervisors, using minimum and maximum expected values for each data element collected, and using the DHIS software. The minimum and maximum values for a data element are calculated on the basis of previous experience at the facility, outliers are identified and possible reasons for these are accounted for. Rigorous data deep dive is explored to identify inconsistencies and data errors, including programmatic underperformance to institute corrective actions [98]. Lastly, WHO [147] highlighted the importance of validating and improving the national PMTCT programme data. One of the recommendations made was to measure the impact of PMTCT programmes using retrospective or prospective cohort data linked to PMTCT intervention data and programme using ANC or birth cohort [146]. Two examples that described the use of birth cohort reporting were documented in Kenya and Malawi where the facility used the HIV exposed infant longitudinal follow-up register to monitor infants by birth-month cohorts up to 24 months as well as the use of reporting forms to follow up HIV-exposed infant, respectively [148]. Our study has shown that the implementation of the rationalized registers has raised the awareness about the importance of institutionalizing a good system that will ensure that the facilities are reporting good quality data and using the data to improve performance as part of continuous quality improvement. In order for this to be done successfully, there is need to address the causes of PMTCT data discrepancies such as building the capacity of the clinic

staff involved in data collection and implementation of change management process. This will ensure that the changes made about the transitioning of the registers from 56 to 6 is implemented and the health care professionals accept the use of registers. This can be done by adequately preparing and supporting them with the necessary steps they need to undergo for the change to be successful and ensuring that there is a monitoring process post implementation.

5.1.3 Research question 2

The following are key findings from objective 2

We compared the indicators performance at baseline with the performance during the intervention period and found out that,

there was an increase of 5% (from 69% to 74%) and 7% (from 82% to 89%), highly significant at $p < .001$, for two of the selected PMTCT indicators (1st ANC visit < 20 weeks rate and ANC clients retest rate), at the intervention sites. A decrease of -9% (from 76% to 67%) and -13% (from 88 to 75%), and highly significant at < .001 was reported at the no-intervention sites.

Also, although there was an increase of 65% (from 69% to 134%) and 66% (from 65% to 131%) for ART clients initiated on ART rate was recorded at both the intervention and non-intervention sites respectively, this was not significant at $p > .05$. The proportionally increase of more than 100% recorded during the intervention period as compared with the baseline assessment was because of the implementation of Universal Test and Treat (UTT)/same-day ART initiation policy. This increased the pool of patients eligible for enrolment on ART as this prevent the need to delay ART initiation and HIV patient management patients that could be seen per day. Whereas, for the Infant's PCR test positive at birth rate, there was no change (both remained at 0.7%) at the intervention and non-intervention sites, which was not

significant at p> .05. However, at the non-intervention sites, there was an increase of 0.9% (from 1.5% to 2.6%) but not significant at p> .05.

Three of the five CFIR domains (engagement, executing and planning) aligns with the results of changes observed in the intervention facilities. The description of the domains is detailed below.

Intervention characteristics

i. Adaptability: The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.

ii. Complexity: Perceived difficulty of implementation reflected by duration, scope, radicalness, disruptiveness, centrality, intricacy, and number of steps required to implement.

Outer settings

External policy and incentives: A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.

Inner settings

Access to knowledge and information: Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work task

Characteristics of individuals

Knowledge and beliefs about the intervention: Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.

5.1. Discussion of research question 2 findings

From the above findings, we observed a significant change in some of the selected PMTCT indicators (as seen above) but not others in the context of a variety of changes that occurred during the intervention phase both within the intervention and external to the intervention.

The above findings are closely linked with the study done by Bhardwaj et al. (2014), which describes the process undertaken by the National Department of Health, in collaboration with partners, to develop, implement and monitor a data-driven intervention [24]. The National Department of Health used decentralised planning and monitoring with quality improvement tools to improve the facility, district, provincial and national PMTCT programme [35]. In addition, a data-driven participatory approach was used to understand the facility-level bottlenecks, optimise PMTCT implementation and scale up priority PMTCT actions nationally using a visual dashboard and data for action reports. This showed remarkable improvement across all key indicators in the PMTCT cascade from 2011 to 2013. Examples of improvements seen include increase in early antenatal registration from 37% to 43%, and the antenatal retesting rate for women with a negative result on the first antenatal HIV test increased from 28% in 2010 to 47% in 2012 [35].

In addition, several initiatives implemented in South Africa showed that decentralised planning and monitoring produce results [22,24,25,64]. An example of this initiative was the implementation of quality improvement initiatives in seven primary care facilities in KwaZulu Natal province of South Africa, with a primary focus on the use of data by programme managers to gain an in-depth understanding of data to improve PMTCT coverage and service delivery [32,148,149].

Similarly, Doherty et al. (2009), implemented a participatory quality improvement intervention to improve the PMTCT programme in the Amajuba district in KwaZulu-Natal

province in 2006 by conducting an initial assessment with district supervisors [22]. The evaluation identified weaknesses and set improvement targets for continuous monitoring to support change. The intervention averted about 580 new infant infections per year. Furthermore, several studies [32,148,150] advocated for the use of CQI interventions utilising a data-driven approach to improve health programmes, such as the use of quality improvement cycles to identify a problem and analyse and use data to monitor programme outputs and outcomes. In developed countries, quality improvement studies showed that feedback on performance and small group meetings positively affect changing health worker behaviour [148,150]. In contrast, supportive supervision, audit and feedback in low-income countries were found to be effective in improving health worker performance in these settings [148,149].

A data driven district approach supported with regular team meetings was instituted to improve HIV test acceptance for PMTCT programme in Zimbabwe [151] . This led to the advocacy for continuous quality improvement interventions using a data-driven approach to ensure sustainable local improvements in health programmes [32]. Continouous quality improvement was implementedto identify problem areas, using programme data to set targets, developed mitigation plan and implemented and monitored the progress made over time. Quality improvement studies in developed countries show that feedback on performance and small group meetings positively affect health worker behaviour [147, 151]. One of only two reviews that included studies from low-income countries has also suggested that supportive supervision and audit with feedback may be effective in improving health worker performance in these settings [148].

In addition, Yotebieng et al. (2017), [152] also reported on continuous quality improvement interventions implemented to improve long-term outcomes of antiretroviral therapy in women who initiated therapy during pregnancy or breastfeeding in the Democratic Republic of

Congo. The interventions involved using participatory data-driven approaches at the facility level, reviewing PMTCT indicators by the QI teams, sharing experiences, identifying gaps in the service delivery, and developing a new priority action plan for the next quarter in a cycle of 18 months. In addition, on-site monitoring and supervisory support were provided for long-term retention in care. This process sustained virological suppression among pregnant and breastfeeding women who started lifelong ART in the MCH clinics. At the end of the intervention period, the author reported that the CQI interventions improved long-term outcomes of lifelong ART in MCH clinics [152].

Interpretation of results using the Consolidated Framework for Implementation Research

As this was an implementation study of a quality improvement programme to improve coverage of eMTCT indicators, we will use the Consolidated Framework for Implementation Research (CFIR) [153,154] to further discuss our results found in Table 3. The use of this framework examines implementation results across five constructs which influence any programme implementation: i) Intervention characteristics, ii) Inner Setting, iii) Outer Setting, iv) individuals involved and v) Implementation process for which influences effective programme implementation because they with each other.

Table 11 describes the five domains, the characteristics of CFIR [153,154] as it relates to the possible reasons for the observed changes in the intervention facilities (Table 3). Our study described the five CFIR domains with different constructs related to each domain.

i. Intervention characteristics: Adaptability, Complexity

ii. Inner setting: Access to knowledge and information

iii. Outer setting: External policy and incentives

iv. Individuals involved: Knowledge and beliefs about the intervention

v. Implementation process: Engagement, Executing, Planning

I. Intervention characteristics: There are different characteristics of the intervention that need to be considered to successfully implement an intervention. The first major domain of CFIR is intervention characteristics which can be complex and requires a process of engagement to ensure that it has been adapted and not resisted by the individuals or organization, and this will assist the organization to achieve success in implementation of the programme.

a) **Adaptability:** In the 112 intervention sites, the infant PCR test positive at birth rate showed no significant change at baseline and during the intervention period, both at 0.7%. The number of infants PCR test done doubled during the intervention period (2977 compared to 1189) and the infants PCR test positive were three times more than the baseline (22 compared to 8). The use of the HEI SOP to ensure that the PCR tests were done on HEI, results are reviewed by clinicians and exposed infants are managed accordingly before discharged from the facility maintained the infants PCR positive test rate on a low rate compared to the increase of 0.9% recorded in the 52 non-implementation sites (from 1.5% at baseline to 2.6% during the intervention period). This is because the intervention was not adapted, spread or implemented in the 52 non-intervention sites.

b) **Complexity:** None implementation of change ideas in the 52 non-implementation sites such as HIV retest register to improve and monitor ANC clients retested according to the national guidelines, This was due to the scope of this study to ensure that they do not fall through the led to a decline of 9% (from 76% to 67%) for 1st ANC visit less than 20 weeks rate compared to a significant increase of 5% (from 69% to 74%) in the intervention sites.

II. Outer setting: The second domain of the CFIR is the outer setting which includes the economic, political, and social context within which the organization. We considered the effect of the external policy and incentives on two of the selected indicators for this study

External policy and incentives: Two indicators in the 52 non-intervention sites, 1st AC visit < 20 weeks rate and ANC client's retest rate showed high statistically significant decrease respectively (9%, from 76% to 67% and 13%, from 88 to 75%) compared to the rates in the intervention sites because the intervention in the 112 facilities was not spread to the 52 non-intervention sites.

III. Inner setting: Representing the third domain of the CFIR is Inner setting, the third major domain of the CFIR includes features of structural, political, and cultural contexts through which the implementation process proceeds and requires

Access to knowledge and information: The only indicator that showed not significant increase at baseline and during the intervention period in both the intervention and non-intervention sites is the ANC clients initiated on ART rate. This is due to the advocacy of the NDOH for implementation of UTT and the knowledges of the HCPs to incorporate this into their routine work. There was increase of 65% (from 69% to 134%) in the 112 intervention sites and 66% (from 65% to 131%) in the 52 non-intervention sites due to implementation of same-day ART initiation guidelines.

IV. Individuals involved: This is the fourth domain of the CFIR which is the individuals involved in the intervention's implementation. For this study, we consider the Knowledge and beliefs about the intervention

Knowledge and beliefs about the intervention: Following the HCPs capacity building on national guidelines and HEI SOP, more infant PCR tests were done and there was increased

awareness and urge to identify positive infant and manage them accordingly. This does not require intensive follow up but rather a broker approach to supportive supervision

V. Implementation process: This involved a change process required for successful implementation of an intervention as designed. The following three domains will be considered for this study

a) Engagement: Creating demand and engaging relevant stakeholders in the facility and community by conducting health talks to ensure that all eligible childbearing age pregnant women are booked early for ANC. This study recorded an improvement in the 1st ANC visit < 20 weeks rates in the 112 intervention facilities because of the appropriate individuals were involved and capacity building of the HCPs was done.

b) Executing: In the 112 intervention facilities, there was a 7% increase (from 82% to 89%) in the ANC client's retest rate because of implementation of the change ideas that were implemented according to plan by ensuring that pregnant women eligible to retest were found in the facilities and conducting verification of clients offered, tested and counselled for HIV.

c) Planning: Changes ideas were planned in advance, adapted and refined to improve PMTCT indicators in 112 intervention sites. This was as a result of the development of HIV retest registers designed to improve retesting among eligible pregnant women. This also ensured effective monitoring of pregnant women so that they do not fall through the PMTCT cascade. In addition, capacity building of HCPs and the development and use of HEI SOP was done to ensure that the PCR tests are done on HEI Infant PCR test positive at birth.

5.1.6 Research question 3

The following are key findings from research question 3

This study found that more than half of the of the study participants (63%) have diploma in both general nursing and midwifery qualification while 37% have only advance diploma in nursing. More than half of the participants (63%) had been in the facility for more than 5 years, while 38% had been working in the facilities between one and five years.

The relationship of the district teams, supporting partner such as S2S and CQI teams with the DCST assisted in providing the necessary support to improve the quality of health services offered in the facilities. This also assist the DCST to collaborate and work well with the district quality improvement team. Also, the DCST play an essential role in improving healthcare access and quality by providing capacity building, programme performance oversight and monitoring as well as technical support for programme implementation for better clinical outcomes for the clients. In addition, the DCST complements the work of the DOH managers and supporting partners such as the S2S quality improvement advisors by providing support to track PMTCT programme performance, use data to identify facilities that are performing poorly, ensure that the guidelines are implemented accordingly, and make themselves available to assist clinicians with managing difficult patients. This informs their decision to schedule facility support visits to plan their supportive supervision visits.

Also, the study recorded high staff turnover, resulting in the loss of valuable knowledge and skills transferred to newly recruited staff who are employed to fill the vacant positions but need to be trained so that they can become successful in their new role.

5.1.7 Discussion of research question 3 findings

More than half of the study participants had been working in the facility for more than five years and willing to support quality improvement work. This is similar to the findings by

Hashish et al. (2020), which stated that middle-aged nurses tend to display positive attitudes toward evidence-based practice and quality improvement [155].

The participants' responses on their understanding of the role of the DCST and their engagement with the district teams at different management levels is geared toward achieving a common goal of improving and strengthening PMTCT programme performance in the Amathole district of Eastern Cape Province, South Africa. A good relationship with all stakeholders (DoH and partners) plays a significant role in complementary activities by the DCST which the participants felt was a valuable specialty for improving healthcare access and quality as alluded by the study participants. The participants' view about the role of the DCST is aligned with the functions stipulated in the ministerial report submitted to the Honorable Minister of Health in 2011 [31], with the overall function of improving the quality of healthcare to achieve a better outcome for mothers, newborns, and children. The themes from the participants were categorised into three, building the capacity of HCPs, oversight of programme performance and monitoring and providing technical support for programme implementation. In addition, their role is cross-cutting and complements the quality improvement work done by the S2S quality improvement advisors to ensure that the change ideas are implemented and monitored for improved performance.

Supporting clinical governance

The DCST has a crucial role in clinical governance by ensuring that the facilities maintain and improve the quality of care especially for the mother and child. Our study found that the DCST provide leadership and guidance for technical support on implementation of the guidelines and protocols. They also provide adequate training to ensure that the HCPs care for their clients and offer quality care to respond to their needs. This finding agrees with Oboirien et al. [156, 157] who showed that the role of DCST is to improve clinical governance at the

system-wide level. Stonehouse et al. (2013), also affirmed that clinical governance ensures that roles are recognised with clear lines of responsibility and accountability for clinical services rendered [158]. This corroborates the participants' opinion that the DCST play important role in improving the quality of patients care in the facilities. This is done by ensuring the implementation of quality improvement programmes with clear policies for managing risks and procedures to identify and manage poor performance among professionals [158]. This finding shows how the role of the DCST is critical in providing guidance, leadership and support to the district team to improve programme performance. Likewise, Biyani et al. (2018), indicated the seven components of clinical governance: clinical effectiveness, clinical audit, risk management, education and training, patient and public involvement, information, and staff management [159] which are activities that the DCST conduct in the district. These activities clearly show that the DCST roles are broad and interconnected with other stakeholders in the facilities, sub-districts, districts and provinces. Our study found that there is a need to work with all stakeholders for successful implementation of clinical governance and for the DCST to be successful in their role, the staff need to be available for training on guidelines, policies and procedures to improve their knowledge, competencies, and skills. These will strengthen the health system and lead to better performance at all levels towards achieving Universal Health Coverage (UHC) by 2030 [79].

Although, the DCST played a critical role in clinical governance [31], there is not a full complement of these high-skilled specialists in the Amathole district. Therefore, it is vital that the DCST roles are filled, and that the implementation of the programme is monitored closely and regularly evaluated.

Relationship of DCST with District Health Management Team (DHMT)

Stakeholders' management and relationships are essential for better coordination of public health activities, and it is essential for collaboration and cooperation to jointly perform better. In addition to improving clinical governance, the DCST also supports programme performance monitoring aimed at improving systems and providing better care across all disciplines, not only the one catering for mothers, newborns, and children. Our study found that there was good working relationship between the DoH and DOH partners such as S2S. The multidisciplinary team approach helps to look at issues in a more comprehensive way, get things done quickly and put a monitoring system in place. Our finding agrees with Hunter et al. (2019), which conclude that partnership in public health is very important because most improvements recorded in health are not just the consequences of government interventions but a result of collaborated actions from the individuals, communities, organisations and others that jointly worked together [160-162].

Lastly, the DCST also conducted supportive supervision and facilitated the integration and coordination of staff for programme monitoring, and improvement as gathered from the participants narratives. Therefore, supportive supervision is essential for improving the health service provision for mothers, newborns and children, and will strengthen the South African district health system. In addition, the expected role of the DCST stipulates that they need to implement the four tiers of clinical governance, support the strengthening of management systems and provide supportive supervision to health professionals [41]. Supportive supervision involves guiding, monitoring and coaching of HCPs to ensure the delivery of quality healthcare services, and promote teamwork [163] which is a critical part of the DCST work. This involves training and guiding the facility teams, with the goal of improving their performance and continuously provide high-quality care to the mother and child and all the clients accessing care in their facility.

Use of data to monitor programme improvement

The studies conducted by Singer et al. (2016), [164] and Sibanda et al. (2022), [165] stated that good leadership is the key to promoting the use of data and facility performance so that the supervision they provide to the facilities is tailored to address the challenges identified for improved programme performance [166]. The narratives from this study highlighted the need for the facilities to meet each month as a team to review facility data. As a result, the facility performance trends are compared from month to month. As alluded to by the participants, the DCST and the district health team joined the data review meetings and used their technical expertise to help the facility team to use data to identify underperformance and jointly develop an improvement plan and monitoring processes. This kind of support can be used in poor resource limited setting and remote area in Sub-Sahara Africa, especially where there is lack of access to specialized skills to support the HCPs and coach the junior doctors and nurses. It can also be used for other programmes other than maternal and child health.

It cannot be overemphasized how important data is to information management since healthcare workers are overburdened with many demands for data documentation and reporting [108], especially if there are no data-driven frameworks and evaluation tools for integration [167]. This leaves them no time to address healthcare workers' day-to-day problems that influence their performance. However, the supervisors are better placed to use the findings/report to guide their supportive supervision and provide the required actions to improve facility performance. Therefore, data integration and use are critical in identifying programme gaps to design mitigation plans that will be implemented to improve performance and strengthen the PMTCT cascade.

A study by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) concluded that its support for government healthcare systems through the use of CQI teams at facility level

facilitated continuous integration of health information systems, ensuring that data is readily accessible and data quality is maintained. The study showed that it is essential to use data to plan strategies, allocate resources, and procure commodities [108]. This is similar to what we found in our study which showed that the use of data is essential for planning, especially for human resources for health, training need and planning for joint supportive supervision as demonstrated by the support provided by the DCST.

As found in this study, the technical guidance provided by the DCST, the district health team and the S2S quality improvement advisors during the facility review meeting in which the previous month's data was compared with the current one to assist the facility to identify gaps in service delivery and improve the facility performance. Nutley et al. (2013), [101], states that one of the best ways to engage data users and data producers to improve the use of health data for health systems is to use people in various job functions and at different levels of the health system to collect, analyse, synthesise, interpret, and use data in decision making. However, if there is no interaction between individuals who design and manage research and information systems, it leads to a breakdown in the programmatic decision-making cycle by the data users [101]. Therefore, if data users and producers work together, they become more aware of the data collection processes and methods, as well as available data sources, and data quality. In addition, the data users have the opportunity to address barriers to data use, improve the sharing of data resources, discuss concerns, seek clarification about the data collection process, identify key programmatic questions, link these questions to the data available in their settings, and jointly analyse and interpret data to answer programmatic questions [103]. This approach was used in the quality improvement programme and the DCST in our study to support the facility to use their data to improve their performance as they go for their supervision visits.

CHAPTER 6: POLICY IMPLICATIONS AND FUTURE RESEARCH

6.1 Policy implications

6.1.1 Rationalization of registers

This study found that despite the implementation of the rationalisation of registers, inaccuracy in the data collection at health facilities, with discrepancies between data in the source documents, attributed to clinicians not reporting all the work done and also due to inadequate monitoring of the PMTCT indicators through data verification and validation.

We recommend that the South Africa DOH should have a system in place to build the capacity of HCPs that are involved in data collection on data monitoring and data capturing. Review of facility-level data is also recommended to ensure the quality of data before reporting, and deep-dive analysis should be done on programme care pathways to ensure reporting of quality data. In addition, continuous coaching, mentoring, and supportive supervision should be put in place for both old and newly employed staff to keep them up to date with the relevant changes in guidelines for improved programme outputs and outcomes.

6.1.2 District Clinical Specialist Team

This study shows that the role of the DCST is important in improving the quality and service provision of the PMTCT programme is critical to assist the team at different levels to address challenges encountered. The DCST play a significant role in training and mentoring of staff so that they can function at their best. They also work with the team to provide services as stipulated in the national guidelines and use data to inform the technical support and supervision they provide to the facilities. However, their roles and responsibilities cannot be fully achieved without having a full component of this specialized care of staff. They also need to have good working relationship with both the quality improvement team and district health teams. In addition, there should be adequate funding to fund and support the position of the DCST and

ensure that they are well renumerated enough to stay in poor resource areas where they are most needed and retained. This will enable them to institutionalize clinical governance at the lowest level of the health system, support HCPs in providing quality health services, and have guiding procedures, protocols and policies to support programme implementation.

6.2 Study limitations

The following limitations were encountered while conducting this study.

Our study was conducted in Amathole district of Eastern cape province, South Africa, which is one of the 52 district municipalities in South Africa; therefore, our participants perspectives are only limited to the district.

The study was conducted in only 27 (2 CHCs, 23 PHCs, 2 Gateway Clinics) facilities across four sub districts. These facilities represent 29.5% of the PHCs in the district (26/144), 40% of the CHCs (2/5) and 28.6% of gateway clinics (2/8). A large-scale study that will involve more facilities will give good representation of implementation of in the district. In addition, the 14 hospitals in the district were excluded from this study because of the poor data quality.

For objective 2, we used plausibility assessment which involved the review of routine data from the DHIS to monitor four of the eight selected PMTCT indicators (Antenatal 1st visit before 20 weeks' rate, Antenatal client's HIV re-test rate, Antenatal clients initiated on ART rate and Infant PCR test positive at birth rate. The other four indicators (Antenatal HIV 1st test, Antenatal HIV 1st test positive, Infant 1st PCR test around 6 weeks uptake rate and Infants initiated on Cotrimoxazole around 6 weeks uptake rate) were not assessed because of incomplete datasets in the facilities assessed. The above was attributed to inconsistent recording of the birth PCR and positive PCR results because significant number of PCRs done in the hospitals where not transcribed when the babies are down referred to the CHCs and PHCs from the hospital. This study also found that some of the clinicians were not initiating HIV exposed infants on cotrimoxazole around 6 weeks as prophylaxis and if done, clinicians do not get documented, or not captured on the system for reporting. A further study that will use plausibility assessment to look at other indicators to examine the full PMTCT cascade is recommended.

Because the district did not have a full complement of the DCST and none of the four team members (out of the ideal seven specialists) was available to be part of this study due to competing priorities, their views about their roles and responsibilities were not explored. Therefore, we suggest that DCST could be interviewed for diversity of views and an in-depth understanding of issues surrounding programme implementation and improvement in the near future.

6.3 Future research

This section provides suggested areas that can be explored for future research

1. It will be important to conduct a waiting time survey in the health facilities to assess how the use of the rationalized registers has reduced the waiting time, improve health care workers work and job satisfaction. This should also be linked to the patient's satisfaction before and after the implementation of the rationalized register. This will inform future planning for effective programme planning

1. Conduct in-depth interview with members of the DCST in other districts and provinces of South Africa to have a better understanding and perspectives of the best way to attract these highly skilled specialists and make their roles and responsibilities have a huge impact on programme. In the future, it would be beneficial if a study could be conducted to hear from DCST in other districts and provinces for a better understanding and perspective of attracting these highly skilled specialists and ensuring their roles and responsibilities inform programme performance.
2. A further study that will use plausibility assessment to look at other indicators PMTCT indicators to examine the full PMTCT cascade is recommended.
3. Conduct a study to explore how donor funding can be used effectively and efficiently to leverage on other programmes, and to strengthen the programme outputs and outcomes, and how this can be sustained in future beyond donor funding.

6.4 Contribution to knowledge

This study demonstrated that the implementation of continuous quality improvement starts with having the quality improvement teams in place and having regular quality improvement meetings. This will ensure that change ideas are tested, monitored and scaled up, which is essential for providing good quality health care service that will achieve the best PMTCT outcome and improve PMTCT programme performance.

For successful implementation of CQI, a data-driven approach should be implemented, and it is important that participatory data driven review meetings are held regularly. To achieve this, it is important to build the capacity of the HCPs to understand the importance of documenting and reporting quality data and to understand the patients care pathways for better programme outcomes

Furthermore, development, testing and implementation of change ideas should be monitored closed through shared learning to ensure that best practices and scaled up. In addition, strong leadership, oversight and motivation of the QI team by the facility management team will ensure that the staff are supervised to implement and monitor the change ideas with fidelity. These are essential components for ownership and achieving the best results from QI activities are sustainability

This study explored the effect of the rollout of the rationalised register on documentation and reporting of PMTCT programme data and concluded that if it is implemented as planned, it has the potential of improving the quality of the PMTCT programme data because it reduces the

amount of time spent in completing the registers and collecting data. This is as a result of the reduction in the number of registers they have to complete in the facility from 56 to 6. This was done to improve the quality of data collected and reported because of the reduction in the amount of time invested in completing the registers and collecting data. Hence, this reduces the workload of the HCPs, gives the health care workers more time dedicated to document the work done properly, more time to complete the registers diligently and having time to analyze their data and focus on data quality. This is part of the CQI process put in place by the South Africa DOH to improve data collection, data reporting and ensuring that data is analyzed and used to continuously improve programme performance and delivery of quality services. As attested by one of the participants interviewed, "the registers are easy to use, does not require the health care providers to do a lot of writing like other registers" - therefore they spend less time completing the register. This finding can serve as a guide to the benefits of implementing the rationalized registers in other programmes. Furthermore, this study showed that the implementation of the rationalized registers raised the awareness about the importance of institutionalizing a good system that will ensure that the facilities are reporting good quality data and using the data to improve performance as part of continuous quality improvement.

The study has clearly promoted the awareness of the role of the District Clinical Specialist Team as a valuable specialty for improving healthcare access and quality in one of the rural districts in South Africa. These highly skilled, multidisciplinary staff support the health facilities to provide quality health care service by providing technical support, capacity building to health care providers across the district, including junior doctors and nurses through face to face, telephonic consultations and by making themselves readily available even on weekend. The nature of their job involves traveling in the remote areas that may need long travel time because of the terrains, and from one facility to the other and across the

district to assist where the need arises especially in emergencies and complicated cases. This made them to have extensive hand-on experience of what is happening across the district. Since the establishment of the DCSTs in all health districts in 2013, there has been no study to explore the relationship of the DCSTs with existing Quality Improvement Teams in the district, their understanding of CQI and the expected support of the DCST to the district. This study showed that DCST play a critical role in improving the quality and service provision of the PMTCT programme. They also assist the health care professionals at different levels to address challenges encountered, train and mentor the staff, among other responsibilities. Therefore, it is important to motivate for full complement of staff in each district of South Africa and share the lessons learned with other resource limited countries for possible adoption.

Lastly, this study brought out the power of synergy and collaboration. It leveraged on available resources for effective and efficient programme implementation, because this study piggy backed onto the existing S2S PMTCT CQI project in 112 facilities, across 4 sub-districts in Amathole district to assess the contextual aspects of PMTCT data quality and use in the district.

CHAPTER 7. RECOMMENDATIONS AND CONCLUSIONS

7.1 Recommendations

Based on the findings of this study, the following are recommended for action:

1. Capacity building of both clinicians and data staff led by DOH and supported by the partners to ensure that the DOH written procedures, guidelines, SOPs are implemented with fidelity. This need to be followed up by supportive supervision to monitor the documentation of service delivery and address the data reporting discrepancies at different levels.
2. To ensure that continuous quality improvement is implemented with fidelity, management supervision and oversight are two essential factors that can ensure that change ideas are implemented, and that quality improvement activities are sustained. It is recommended that health facilities have continuous quality improvement team/multidisciplinary team that will ensure the implementation of change ideas, coach and mentor the health care professionals, provide leadership and monitor the progress made and take ownership of the programme for sustainability of the quality improvement interventions.
3. It is important to urgently conduct human resource audit across the facilities to identify gaps in the current staff establishment and fill the gaps to full complement as soon as possible. This will ensure that clients are provided with utmost care, and it will enable the staff to implement quality improvement projects.
4. The DCST do not have full complement of staff, as at the time of this study, only four DCST members are in place instead of the ideal seven specialists team comprised of: Obstetrician and Gynecologist, Advanced Midwife, Pediatrician, Paediatrics nurse, Family Physician, PHC nurse and Anesthetist). It is very important to explore the best

way to attract these highlight skilled staff across all districts in South Africa, especially in remote and rural community where their skills are highly needed so that they can provide their expertise support to the facilities, sub-districts and the district, health care professional, save life's and improve programme performance.

Therefore, it is recommended that more funding should be allocated to recruit and retain the DCST to be able to institutionalize clinical governance at the lowest level of the health system and support HCPs in providing quality health services and have guiding procedures, protocols and policies to support its implementation.

5. In addition, it is recommended that in-depth interview should be conducted with members of the DCST in other districts and provinces of South Africa to have a better understanding and perspectives of the best way to attract and retain these highly skilled specialists and make their roles and responsibilities have a huge impact on programme performance.

7.2 Conclusion

The overall findings of this study are summarized according to the 3 objectives.

1. The findings from this study clearly showed that there was inconsistency in documentation and reporting of PMTCT data and thus data discrepancies still exit. It is very important to provide capacity building and supportive supervision to health care workers, especially the clinicians and the data capturers in order to improve documentation and capturing of the data systems and to reflect the true performance of the facilities.
2. Implementation of the rationalized registers has the potential of improving PMTCT data quality because it reduces the amount of time spent in completing the registers and collecting data. This will ensure that the facilities are reporting good quality data and using the data to improve performance as part of continuous quality improvement.
3. The District Clinical Specialist Team is a valuable specialty used for improving healthcare access and quality because they are highly skilled staff. They provide continuous support to the health facilities by providing technical assistance and capacity building to health care providers across the district to ensure that quality health care service is provided. However, the impact of the DCST will be felt more in the facility if we have a full complement of staff in the DCST team to provide more support.
4. Implementing CQI with a data-driven approach and having a monitoring process in place is essential, to focus on the use of high-quality data that will identify gaps in service delivery and inform improvement approaches. This is essential and key to ensure that data-driven decision-making and resource are allocated to maximize programme effectiveness and efficiency.

5. Lastly, linked to objective 2 is objective 3 findings that showed the relationship of quality improvement team with the existing structures, and the use of data to strengthen PMTCT programme**,** the findings showed that CQI not only drives the facilities to ensure the delivery of quality services and track performance of indicators, but it is recommended that it can be used beyond the HIV/AIDS programme for continuous improvement.

CHAPTER 8: REFERENCES

1. UNAIDS. (2022). *Global HIV statistics 2022 fact sheet*.

2. UNICEF. (2022). fast fact - 2021. Global Statistics. *Unaids.*

3. UNAIDS. (2022). *Donor Government Funding for HIV in Low- and Middle-Income Countries.*

4. UNAIDS. (2021). *AIDSinfo* | UNAIDS. http://aidsinfo.unaids.org/.

5. UNAIDS. (2021). *'Start Free Stay Free AIDS Free': 2021 progress report.*

6.White AB, Mirjahangir JF, Horvath H, Anglemyer A, Read JS. (2014). Antiretroviral interventions for preventing breast milk transmission of HIV.*Cochrane Database Syst Rev. 2014 Oct 4;(10):CD011323. doi: 10.1002/14651858.CD011323.*

7. Namukwaya, Z.; Mudiope, P.; Kekitiinwa, A.; Musoke, P.; Matovu, J.; Kayma. S. (2011). The impact of maternal highly active antiretroviral therapy and short-course combination antiretrovirals for prevention of mother-to-child transmission on early infant infection rates at the Mulago National Referral Hospital in Kampala, Uganda, January 2007 to May 2009. *J Acquir Immune Defic Syndr.; 56:69–75.*

8. World Health Organization. (2016). Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach, 2nd ed

9. Wariki, WMV; Ota, E.; Mori, R.; Wiysonge, CS.; Horvath. H.; Read. JS. (2017). Interventions for preventing mother-to-child HIV transmission: protocol of an overview of systematic reviews. *BMJ Open. 2017 Jun 21;7(6): e014332. doi: 10.1136/bmjopen-2016-014332. PMID: 28637726; PMCID: PMC5623404.*

10. Goga, A.; Chirinda, W.; Ngandu, N.; Ngoma, K.; Bhardwaj, S.; Feucht, U.; Davies, N.; Ntloana, M.; Mhlongo, O.; Silere-Maqetseba, T.; Moyo, F.; Sherman, G. (2018). Closing the gaps to eliminate mother-to-child transmission of HIV (MTCT) in South Africa: Understanding MTCT case rates, factors that hinder the monitoring and attainment of targets, and potential game changers. *SAMJ, Vol. 108, (3 Suppl 1)*

11. https://www.statista.com/statistics/281396/countries-with-highest-number-of-aids-deaths/

12. National Department of Health, South Africa. The Last Mile Plan for EMTCT. (2016). . http://www.emtctthelastmile.co.za/ (accessed 14 June 2022).

13. Goga, A.; Chirinda, W.; Ngandu, N.; Ngoma, K.; Bhardwaj, S.; Feucht, U.; Davies, N.; Ntloana, M.; Mhlongo, B.; Maqestseba, T.; Moyo, F.; Sherman, G. (2018): Closing the Gaps to Elimimate Mother To Child Transmission of HIV (MTCT) in South Africa: Understanding MTCT case rates, factors that hinder the monitoring and attainment of targets, and potential game changer;

14. National Department of Health, South Africa. (2019). National Consolidated Guidelines for the Prevention of Mother to Child Transmission of HIV (PMTCT) and the Management of HIV in Children, Adolescents and Adults. Pretoria

15. South African National AIDS Council. (2016). South Africa National Strategic Plan on HIV, STIs and TB 2017 – 2022

16. UNAIDS. (2015). Countdown To Zero. Global Plan Towards the Elimination of New HIV Infections among Children by 2015 and Keeping their Mothers Alive (2011-2015).

17. National Department of Health, National Action Framework for PMTCT. No child born with HIV by 2015 and improving the health and wellbeing of mothers, babies and partners in South Africa, 2012- 2016. *http://www.sanacws.org.za/af/resource-*

centre/download/4feac9f1ef9ca-version-dec-15th-actionframework-emtct-5-pdf (accessed 19 August 2022).

18. World Health Organization. (2015). Global Monitoring Framework and `strategy for the Global Plan Towards the Elimination of New HIV Infections Among Children by 2015 and Keeping their mothers alive. Available from: *http://www.who.int/hiv/pub/me/monitoring_framework/en/* (accessed 14 June 2022).

19. South African National AIDS Council. (2011). South Africa National Strategic Plan on HIV, STIs and TB 2012– 2016. *https//www.sanac.org.za/wp-content/uploads/2016/05/NSP-MTR-Full-Report-2012-2016-FINAL.pdf* (Accessed 11 May 2022).

20. South African National AIDS Council. (2016). South Africa National Strategic Plan on HIV, STIs and TB 2017 – 2022. *https//www.sanac.org.za/wp-content/uploads/2021/05/NSP-MTR-Full-Report-2017-2022-FINAL.pdf* (Accessed 11 May 2022).

21. Doherty, T.; Chopra, M.; Nsibande, D.; Mngoma, D. (2009). Improving the coverage of the PMTCT programme through a participatory quality improvement intervention in South Africa. *BMC public health. 2009 Dec;9(1):1-9. DOI: 10.1186/1471-2458-9-406.*

22. Republic of South Africa. The National Development Plan 2030. (2012). The provision of affordable access to quality health care while promoting health and wellbeing. *http://www.gov.za/issues/national-development plan-2030)*

23. Day, C.; Hedberg, C.; Ijumba, P.; Day, C.; Ntuli, A. (2004). South African Health Review: Health indicators. 2003/2004. *Durban: Health Systems Trust. https://www.hst.org.za/publications/Pages/South-African-Health-Review-2004.aspx* (accessed 11 May 2022).

24. Bhardwaj, S.; Barron, P.; Pillay, Y.; Treger-Slavin, L.; Robinson, P.; Goga, A.; Sherman, G. (2014). Elimination of mother-to-child transmission of HIV in South Africa: rapid scale-up using quality improvement. (2014). *South African Medical Journal. 27;104(3):239-43. DOI: 10.7196/samj.7605.*

25. Mwaniki, MK.; Vaid, S.; Chome, IM.; Amolo, D.; Tawfik, Y. (2014). Improving service uptake and quality of care of integrated maternal health services: the Kenya Kwale district improvement collaborative. *BMC Health Serv Res.; 14:416. doi: 10.1186/1472-6963-14-416*

26. Colbourn, T.; Nambiar, B.; Bondo, A. (2013). Effects of quality improvement in health facilities and community mobilization through women's groups on maternal, neonatal and perinatal mortality in three districts of Malawi: MaiKhanda, a cluster randomized controlled effectiveness trial. *Int Health.;5(3):180–195. doi: 10.1093/inthealth/iht011*

27. Osibo, B.; Oronsaye, F.; Alo, OD. (2017). Using small tests of change to improve PMTCT services in Northern Nigeria: experiences from implementation of a continuous quality improvement and breakthrough series program. *J Acquir Immune Defic Syndr. 2017;75 Suppl 2: S165–S172. doi: 10.1097/qai.0000000000001369.*

28. Larson, E.; Mbaruku, GM.; Cohen, J.; Kruk. ME. (2020). Did a quality improvement intervention improve quality of maternal health care? Implementation evaluation from a cluster-randomized controlled study. *Int J Qual Health Care. 2020;32(1):54–63. doi: 10.1093/intqhc/mzz126.*

29. Karamagi, E.; Sensalire, S.; Muhire, M.; Kisamba, H.; Byabagambi, J.; Rahimzai, M. (2018). Improving TB case notification in northern Uganda: evidence of a quality improvement-guided active case finding intervention. *BMC Health Serv Res. 2018; 18:954.*

30. National Department of Health South Africa. Ministerial Task Team: District Clinical Specialist Teams in South Africa. (2012). Ministerial Task Team Report to the Honourable

Minister of Health. *https://www.yumpu.com/en/document/view/4538285/district-clinical-specialist-teams-in-south-africa-department-of-health*

31. National Department of Health. (2012). National launch and induction of the district clinical specialists' teams. *W. report. Pretoria. https://www.researchgate.net/publication/292992064*. Accessed on 2 September 2022

32. National Department of Health South Africa. (2020). Quality Improvement Guide: Quality Improvement – the key to providing improved quality of care. *https://www.knowledgehub.org.za/system/files*. Accessed on 2 September 2022

33. The Institute for Health Improvement. Science of Improvement. *https://www.ihi.org/resources/Pages/HowtoImprove/ScienceofImprovementHowtoImprove.aspx* (accessed 17 August 2022).

33. South to South. (2013). An evaluation of three Quality Improvement Learning Collaborative programmes that aim to improve HIV/TB primary health care services to maternal, infant, child, and adolescent population

35. Dehnavieh, R.; Haghdoost, A.; Khosravi, A.; Hoseinabadi, F.; Rahimi, H.; Poursheikhali, A. (2019). The District Health Information System (DHIS2): A literature review and meta-synthesis of its strengths and operational challenges based on the experiences of 11 countries. *Health Inf. Manag. J., 48, 62–75.*

36. Jinabhai, CC.; Onwubu, SC.; Sibiya, MN.; Thakur, S. (2021). Accelerating implementation of District Health Information Systems: Perspectives from healthcare workers from KwaZulu-Natal, South Africa. *SA J. Inf. Manag., 23, a1435. http://dx.doi.org/10.4102/sajim.v23i1.1435.*

37. Kiberu, VM.; Matovu, JK.; Makumbi, F.; Kyozira, C.; Mukooyo, E.; Wanyenze, RK. (2014). Strengthening district-based health reporting through the district health management information software system: The Ugandan experience. *BMC Med Inf. Decis. Mak., 14, 40.*

38. Begum, T.; Khan, SM.; Adamou, B.; Ferdous, J.; Parvez, MM.; Islam, MS.; Kumkum, FA.; Rahman, A.; Anwar, I. (2020). Perceptions and experiences with district health information system software to collect and utilize health data in Bangladesh: A qualitative exploratory study. *BMC Health Serv. Res., 20, 465.*

39. Nicol, E.; Bradshaw, D. (2010). Maternal, newborn and child survival: Data challenges: Reflections on the Millennium Development Goals-profile. *South Afr. Health Rev., 2010, 73–78.*

40. Nielsen, P. (2013). Advancing health information systems: Experiences from implementing DHIS 2 in Africa. Available from: *https://www.who.int/woman_child_accountability/ierg/reports/11_Nielsen_HISP.pdf.* (Accessed on 24 July 2021)

41. South African National Department of Health. Rationalisation of Registers (ROR). (2017). Available online: *https://www.gov.za/sites/default/files/gcis* (Accessed on 17 August 2022).

42. Nicol, E.F. (2015). Evaluating the Process and Output indicators for Maternal, Newborn and Child Survival in South Africa: A Comparative Study of PMTCT Information Systems in KwaZulu-Natal and the Western Cape. Ph.D. *Dissertation, Stellenbosch University: Stellenbosch, South Africa*.

43. Massyn, N.; Peer, N.; Padarath, A.; Barron, P.; Day, C. (2015). District Health Barometer 2014/15. Durban: Health Systems Trust. *https://www.health-e.org.za/wp-content/uploads/2015/10/Complete_ DHB_2014_15_linked.pdf* (accessed 10 August 2022)

44. Massyn, N.; Padarath, A.; Peer, N.; Day C. (2019). District Health Barometer 2018/19. Durban: Health Systems Trust. *https://www.health-e.org.za/wp-content/uploads/2019/10/Complete_ DHB_2018_19_linked.pdf* (accessed 10 August 2022)

45. Youngleson, M.; Nkurunziza, P.; Jennings, K.; Arendse, J.; Mate, K.; Barker, P. (2010). Improving Mother to Child HIV Transmission Programme through Health System Redesign: Quality Improvement, Protocol Adjustment and Resource. *PLoS ONE 5(11): e13891. https://doi.org/10.1371/journal.pone.0013891*

46. Uwimana, J.; Mathole, T.; Behroozi, F.; Youngleson, M.; McLoughlin, J.; Zarowsky, C.; Hausler H. (2013). Improving integrated antenatal TB/HIV care using continuous quality improvement supported by a cohort tool linked to the antenatal register, in a rural district of KwaZulu-Natal, South Africa.

47. Ciaranello, AL.; Perez, F.; Keatinge, J. (2012). What will it take to eliminate pediatric HIV? Reaching WHO target rates of mother-to-child HIV transmission in Zimbabwe: a model-based analysis. *PLoS Med.;9(1): e1001156-e1001156. 10.1371/journal.pmed.1001156.*48. Penazzato, M.; Bendaud, V.; Nelson, L.; Stover, J.; Mahy, M. (2014). Estimating future trends in paediatric HIV. *AIDS. 28(suppl 4): S445–S451. 10.1097/QAD.0000000000000481.*

49. Malaza, A.; Smith, J.; Mdaka, N.; Haynes. R.; Shezi, S. (2016). The 90-90-90 Compendium: An introduction to 90-90-90 in South Africa. *Volume 1. Durban: Health Systems Trust.*

50. Stringer, E.; Chi, B.; Chintu, N. (2008). Monitoring effectiveness of programmes to prevent mother-to-child HIV transmission in lower-income countries. *World Health Organization. ;86(1):57-62.*

51. Rawizza, HE. (2012). Toward eliminating pediatric HIV infection, improving retention in the PMTCT care cascade. Medscape.

52. South African National Department of Health. (2016). District Health Information System Management Standard Operating Procedures: Facility Level. Available online: *https://www.knowledgehub.org.za/system/files* (accessed on 17 August 2022).

53. Voce, A.; Bhana, R.; Monticelli, F.; Makua, M.; Pillay, Y.; Ngubane, G. (2013). District clinical specialist teams. *South African health review. 2013 Jan 1;2013(1):45-58.*

54. South African National Department of Health. (2014). Handbook for District Clinical Specialist Teams. Pretoria: National Department of Health.

55. National Department of Health, South Africa. (2016). The Last Mile Plan for EMTCT. Pretoria: NDoH. *http://www.emtctthelastmile.co.za/* (accessed 14 June 2022).

56. Gaga, S.; Mqoqi, N.; Chimatira, R.; Moko, S.; Igumbor, JO. (2012). Continuous quality improvement in HIV and TB services at selected healthcare facilities in South Africa (2021): *Southern African Journal of HIV Medicine;22(1):1-1. DOI: 10.4102/sajhivmed. v22i1.1202.*

57. Larson, E.; Mbaruku, GM.; Cohen, J.; Kruk, ME. (2020). Did a quality improvement intervention improve quality of maternal health care? Implementation evaluation from a cluster-randomized controlled study. *Int J Qual Health Care. 2020;32(1):54–63. doi: 10.1093/intqhc/mzz126.*

58. National Department of Health. (2015). National Consolidated Guidelines for the Prevention of Mother to Child Transmission of HIV (PMTCT) and the Management of HIV in Children, Adolescents and Adults. Pretoria: NDoH. *https://www.health-e.org.za/2015/07/02/guidelines-national-consolidated-guidelines-for-pmtct-andthe-management-of-hiv-in-children-adolescents-and-adults/* (accessed 17 August 2021).

59. Violari, A.; Cotton, MF,.; Gibb, DM.; Babiker, AG.; Steyn, J.; Madhi, SA. (2008). Early antiretroviral therapy and mortality among HIV-infected infants. *New England Journal of Medicine; 359(21):2233-44. DOI: 10.1056/NEJMoa0800971*.

60. World Health Organization (2009). PMTCT strategic vision 2010-2015: preventing mother-to-child transmission of HIV to reach the UNGASS and Millennium Development Goals: moving towards the elimination of paediatric HIV. *https://apps.who.int/iris/bitstream/handle/10665/44268/9789241599030_eng.pdf* (Accessed 11 May 2022).

61. World Health Organization (2015). Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV. World Health Organization. *https://www.who.int/publications/i/item/9789241509565* (Accessed 11 May 2022).

62. Mate, KS.; Bennett, B.; Mphatswe, W.; Barker, P.; Rollins, N. (2009). Challenges for routine health system data management in a large public programme to prevent mother-to-child HIV transmission in South Africa. *PLoS One. 2009 May 12;4(5): e5483. DOI: 10.1371/journal.pone.0005483.*

63. South African National AIDS Council. (2016). South Africa National Strategic Plan on HIV, STIs and TB 2017 – 2022. *https//www.sanac.org.za/wp-content/uploads/2021/05/NSP-MTR-Full-Report-2017-2022-FINAL.pdf* (accessed 11 May 2022).

64. Camp, WG. (2001). Formulating and Evaluating Theoretical Frameworks for Career and Technical Education Research. *Journal of Vocational Educational Research, 26 (1), 27-39.*

65. Grant, C.; Osanloo, A. (2014). Understanding, Selecting, and Integrating a Theoretical Framework in Dissertation Research: Creating the Blueprint for 'House'. *Administrative*

Issues Journal: Connecting Education, Practice and Research, Pp. 12-22 DOI: 10.5929/2014.4.2.9

66. Akintoye, A. (2015). Developing Theoretical and Conceptual Frameworks. *Jedm.oauife.edu.ng>uploads>2017/03/07* (accessed 2017 February 22)

67. Gavin, D. (2016). Using Theoretical or Conceptual Frameworks in a Scholarly Study. Center for Workplace Diversity and Inclusion Research. *University of Phoenix*.

68. Miles, MB.; Huberman, MA.; Saldana, J. (2014). Qualitative data analysis: A Method Sourcebook. *3rd ed. Thousand Oaks, CA: SAGE*.

69. Adum, D.; Hussein, EK.; Adu-Agyem, J. (2018). Theoretical and Conceptual Framework: Mandatory Ingredients of Quality Research. *International Journal of Scientific Research 7(1):438-441*

70. Boone, D.; Ba Huy. R., Pervihac, C. (2008). Routine Data Quality Assessment Tool (RDQA): Guidelines for Implementation for HIV, TB and Malaria programs. Measure Evaluation.

71. World Health Organization. (2014). "Reaching Every Woman and Every Child through Partnership". The Partnership for Maternal, Newborn and Child Health. *Switzerland,*. *www.phmch.org*

72. Fassil, H.; Borrazzo, G.; Greene, J.; Jacobs, T.; Norton, M.; Stanton, M.; Kuo, N.; Rogers, K.; Pearson, L.; Chaiban, T.; Banerjee, A.; Kuruvilla, S.; Seaone, M.; Starrs, A.; McCallon, B.; Germann, S.; Mohan, A.; Bustreo, F.; Fogstad, H.; Mishra, C. (2017). Realizing The Promise of The Partnership for Maternal, Newborn and Child Health. *Health Policy and Planning, Volume 32, Issue 7, September 2017, Pages 1072–1076, https://doi.org/10.1093/heapol/czx018*

73. National Department of Health South Africa. (2016). National Report for the Mid-Term Review of the Strategic Plan for Maternal, Newborn, Child and Women's Health (MNCWH & N) and Nutrition in South Africa 2012-2016

74. Amouzou, A.; Jiwani, S.; Mohnsam da Silva, I.; Carvajal-Aguirre, L.; Maïga, A.; Vaz, L. (2019). Closing the inequality gaps in reproductive, maternal, newborn and child health coverage: slow and fast progressors. Countdown 2030 Coverage Technical Working Group. *BMJ Global Health, Volume 5, Issue 1*

75. Barros, AJD.; Ronsmans, C.; Axelson, H. (2015). Equity in Maternal, Newborn, and Child Health Interventions in Countdown to 2015: A Retrospective Review of Survey Data from 54 countries. *The Lancet 2012;379: 1225–33.doi:10.1016/S0140-6736(12)60113-5*

76. National Department of Health South Africa. (2014). Maternal, Newborn, Child and Women's Health and Nutrition dashboard including CARMMA and MDG countdown indicators. MNCWH & N dashboard 2014/1.7

77. Nicol, E.; Bradshaw, D. (2010). Maternal, newborn and child survival: Data challenges: Reflections on the Millennium Development Goals-profile. *South Afr. Health Rev, 2010, 73–78.*

78. UNAIDS. (2015). The Millennium Developmental Goals report: 2015 Progress Chart

79. Michel, J.; Tediosi, F.; Egger, M.; Barnighausen, T.; McIntyre, D.; Tanner, M. (2020). Universal health coverage financing in South Africa: wishes vs reality. *Journal of Global Health Reports. 2020 Jul 21;4: e2020061. doi:10.29392/001c.13509*

80. International Labour Organization (2015). Millennium Development Goals.

81. Mulaudzi, FM.; Phiri, SS.; Peu, DM.; Mataboge, ML.; Ngunyulu, NR.; Mogale, RS. (2016). Challenges experienced by South Africa in attaining Millennium Development Goals

4, 5 and 6. *Afr J Prm Health Care Fam Med;8(2), a947. http://dx. doi.org/10.4102/phcfm. v8i2.947*

82. Hannah, R.; Max, R. (2018). Now it is possible to take stock - did the world achieve the Millennium Development Goals?

83. UNAIDS. (2018). Global HIV Overview Nov 2018: *https://www.hiv.gov/federal-response/pepfar-global-aids/global-hiv-aids-overview* (accessed on 17/03/2019)

84. United Nations Department of Economic and Social Affairs. (2021). The Sustainable Development Goals Report. *https://unstats.un.org/sdgs/report/2021/*

85. Department of Statistics, Republic of South Africa. (2019). Sustainable Development Goals (SDGs): Country Report 2019- South Africa.

86. South Africa National Planning Commission. (2012). National Development Plan 2030

87. Evaluation of PEPFAR: Strengthening Health Systems for an Effective HIV/AIDS Response. Committee on the Outcome and Impact Evaluation of Global HIV/AIDS Programs Implemented Under the Lantos-Hyde Act of 2008; Board on Global Health; Board on Children, Youth, and Families; Institute of Medicine. Washington (DC): *National Academies Press (US); 2013 Jun 27.*

88. Mate, KS.; Bennett, B.; Mphatswe, W.; Barker, P.; Rollins. N. (2009). Challenges for routine health system data management in a large public programme to prevent mother-to-child HIV transmission in South Africa. *PLoS One. 2009, 4 (5): e5483-10.1371/journal.pone.0005483.*

89. Garrib, A.; Stoops, N.; McKenzie, A.; Dlamini, L.; Govender, T.; Rohde, J.; Herbst, K. (2008). An evaluation of the District Health Information System in rural South Africa. *S Afr Med J. 2008, 98 (7): 549-552.*

90. World Health Organization. (2022). Inequality Monitoring in Sexual, Reproductive, Maternal, Newborn, Child and Adolescent Health. A Step-by-Step Manual; *World Health Organization: Geneva, Switzerland, 2022. ISBN 978-92-4-004243-8 2022.*

91. Hamilton, E.; Bossiky, B.; Ditekemena, J.; Esiru, G.; Fwamba, F.; Goga E. A.; Kieffer, M. P.; Tsague, LD; van de Ven, R.; Wafula, R.; Guay, L. (2017). Using the PMTCT Cascade to Accelerate Achievement of the Global Plan Goals. *JAIDS J. Acquir. Immune Defic. Syndr. 2017, 75, S27–S35. https://doi.org/10.1097/QAI.0000000000001325 2022.*

92. de la Torre, C.; Johnson, S.; Schmale, A. (2019). Using DHIS2 Software to Track Prevention of Mother-to-Child Transmission of HIV: Guidance (Version 2); MEASURE Evaluation, University of North Carolina at Chapel Hill: Chapel Hill, NC, USA.

93. Begum, T.; Khan, SM.; Adamou, B.; Ferdous, J.; Parvez, MM.; Islam, MS.; Kumkum, FA.; Rahman A.; Anwar, I. (2020). Perceptions and experiences with district health information system software to collect and utilize health data in Bangladesh: a qualitative exploratory study. *BMC Health Services Research volume 20, Article number: 465.*

94. Ferguson, L.; Grant, AD.; Ong'ech, JO.; Vusha, S.; Watson-Jones, D.; Ross, DA. (2012). Prevention of mother-to-child transmission of HIV: Assessing the accuracy of routinely collected data on maternal antiretroviral prophylaxis coverage in Kenya. Sex. Transm. Infect, 88, 120–124.

95. Kebede, D.; Zielinski, C.; Mbondji, P.; Piexoto, M.; Kouvividila, W.; Lusamba-Dikassa, P. (2014). The way forward – narrowing the knowledge gap in sub-Saharan Africa to strengthen health systems. *Journal ListJ R Soc Medv.107(1 Suppl); PMC4109347*

96. Witter, S.; Palmer, N.; Balabanova, D.; Mounier-Jack, S.; Martineau, T.; Klicpera, A.; Jensen, C.; Pugliese-Garcia, M.; Gilson, L. (2019). Health system strengthening Reflections on its meaning, assessment, and our state of knowledge. *https://doi.org/10.1002/hpm.2882*

97. World Health Organization. (2008). Framework and standards for country health information system. Health Metric Network. Available from *http://www.healthmetricsnetwork.org*

98. World Health Organization. (2010). Health Systems Framework.

99. Oyebanji, OG.; Jackson, J.; Mathole, T, (2022). PMTCT Data Management and Reporting during the Transition Phase of Implementing the Rationalised Registers in Amathole District, Eastern Cape Province, South Africa. *Int J Environ Res Public Health. 2022 Nov 28;19(23):15855. doi: 10.3390/ijerph192315855. PMID: 36497931; PMCID: PMC9736313.*

100. English, R.; Masilela, T.; Barron, P.; Schönfeldt, A. (2011). Health Information Systems in South Africa. *South African Health ReviewVol. 2011, No. 1. https://hdl.handle.net/10520/EJC119082*

101. Johnson, J L.; Adkins, D.; Chauvin, S. (2020). Qualitative Research in Pahramacy education. A Review of the Quality Indicators of Rigor in Qualitative Research. *Am. J. Pharm. Educ. 2020, 84, 7120.*

102. Health Systems Trust. (2012). National Health Care Facility Baseline Audit: Summary Report.

103. Nutley, T.; Reynolds, H. (2013). Improving the use of health data for health system strengthening. *Glob Health Action 2013, 6: 20001 - http://dx.doi.org/10.3402/gha.v6i0.20001*

104. Garnett, G.; Hallett, T.; Takaruza, A.; Hargreaves, J.; Rhead, R.; Warren, M.; Nyamukapa, C.; Gregson, Simon. (2016). Providing conceptual framework for HIV prevention cascade and assessing feasibility of empirical measurements with data from East Zimbabwe: a case study. *Lancet HIV 2016, Julz 3, (7), 297-308.*

105. Musarandega, R.; Robinson, J.; Sen, PD.; Hakobyan, A.; Mushavi, A.; Mahomva, A.; Woelk, G. (2020). Using the critical path method to rollout and optimise new PMTCT guidelines to eliminate mother-to-child transmission of HIV in Zimbabwe: a descriptive analysis

BMC Health Services Research volume 20, Article number: 1042 (2020)

106. Findlay, M.; Rankin, NM.; Shaw, T.; White, K.; Boyer, M.; Milross, C.; De Abreu Lourenço, R.; Brown, C.; Collett, G.; Beale, P.; Bauer, JD. (2020) Best Evidence to Best Practice: Implementing an Innovative Model of Nutrition Care for Patients with Head and Neck Cancer Improves Outcomes. *Nutrients. 2020 May 19;12(5):1465. doi: 10.3390/nu12051465. PMID: 32438607; PMCID: PMC7284331.*

107. Rowe, A.; de Savigny, D.; Lanata, C.; Victora, C. (2005). How Can We Achieve and Maintain High-Quality Performance of Health Workers in Low-Resource Settings? 366:1026-1035.

108. Gonzalo, JD.; Caverzagie, KJ.; Hawkins, RE.; Lawson, L.; Wolpaw, DR.; Chang, A. (2018). Concerns and responses for integrating health systems science into medical education. *Acad Med. 2018; 93:843–849.*

109. World Health Organization. (2010). Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies.

110. PEPFAR. (2017). Supporting an Integrated Response to TB and HIV. *https://www.cdc.gov/globalhealth/countries/southafrica/pdf/pepfar.pdf* (accessed 12 June 2021).

111. Sprague, C.; Chersich, M. F.; Black, V. (2011). Health system weaknesses constrain access to PMTCT and maternal HIV services in South Africa: A qualitative enquiry. *AIDS Res Ther; 8:10. [http://dx.doi.org/10.1186/1742-6405-8-10]*

112. Delva, W.; Draper, B.; Temmerman, M. (2006). Implementation of single-dose nevirapine for prevention of MTCT of HIV – lessons from Cape Town. *S Afr Med J 2006;96(8):706-709.*

113. Nkonki, LL.; Doherty, TM.; Hill, Z. (2007). Missed opportunities for participation in prevention of mother-to-child transmission programmes: Simplicity of nevirapine does not necessary lead to optimal uptake, a qualitative study. *AIDS Res Ther 2007; 4:27. [http://dx.doi.org/10.1186/1742-6405-4-27*

114. Mulenga, C.; Naidoo, JR. (2017). Nurses' knowledge, attitudes and practices regarding evidence-based practice in the prevention of mother-to-child transmission of HIV programme in Malawi. *Curationis. 2017 Apr 12;40(1): e1-e8. doi: 10.4102/curationis. v40i1.1656.*

115. Stringer, EM.; Ekouevi, DK.; Coetzee, D. (2010). Coverage of nevirapine-based services to prevent mother-to-child HIV transmission in 4 African countries. *JAMA 2010;304(3):293-302. [http://dx.doi.org/10.1001/jama.2010.990]*

116. Nkonki, LL.; Doherty, TM.; Hill, Z. (2007). Missed opportunities for participation in prevention of mother-to-child transmission programmes: Simplicity of nevirapine does not necessary lead to optimal uptake, a qualitative study. *AIDS Res Ther 2007; 4:27. [http://dx.doi.org/10.1186/1742-6405-4-27]*

117. McIntyre, J.; Lallemant, M. (2008). The prevention of mother-to-child transmission of HIV: are we translating scientific success into programmatic failure? *Curr Opin HIV AIDS 2008; 3:139-145. [http://dx.doi.org/10.1097/COH.0b013e3282f5242a]*

118. Barry, OM.; Bergh, AM.; Makin, JD. (2012). Development of a measure of the patient-provider relationship in antenatal care and its importance in PMTCT. *AIDS Care 2012;24(6):680-686. [http://dx.doi.org/10.1080/09540121.2011.630369]*

119. Nkonki, LL.; Doherty, TM.; Hill, Z. (2007). Missed opportunities for participation in prevention of mother-to-child transmission programmes: Simplicity of nevirapine does not necessary lead to optimal uptake, a qualitative study. *AIDS Res Ther 2007; 4:27. [http://dx.doi.org/10.1186/1742-6405-4-27]*

120. Audureau, E.; Kahn, JG.; Besson, MH.; Saba, J.; Ladner, J. (2013). Scaling up prevention of mother-to-child HIV transmission programs in sub-Saharan African countries: a multilevel assessment of site-, program- and country-level determinants of performance.

BMC Public Health volume 13, Article number: 286 (2013)

121. Doherty, T.; Chopra, M.; Nsibande, D. (2009). Improving the coverage of the PMTCT programme through a participatory quality improvement intervention in South Africa. *BMC Public Health 2009;5(9):406. [http://dx.doi.org/10.1186/1471-2458-9-406]*

122. Chiya, HW.; Naidoo, JR.; Ncama, BP. (2017). Stakeholders' experiences in implementation of rapid changes to the South African prevention of mother-to-child transmission programme. *Afr J Prm Health Care Fam Med. 2017;10(1), a1788. https://doi.org/10.4102/phcfm.v10i1.1788*

123. Kumwenda, W.; Kunyenje, G.; Gama, J.; Chinkonde, J.; Martinson, F.; Hoffman, I.; Hosseinipour, M.; Rosenberg, N. (2017). Information management in Malawi's prevention of Mother-to-Child Transmission (PMTCT) Program: Health workers' perspectives. *Malawi Med J. 2017 Dec; 29(4): 306–310.*

124. Agency for Healthcare Research and Quality, U.S. Department of Health and Human. (2013). Mixed Methods: Integrating Quantitative and Qualitative Data Collection and Analysis While Studying Patient-Centered Medical Home Model. *AHRQ Publication No: 13-0028-EF*. *http://www.ahrq.gov/*

125. Doyle, L.; Brady, AM.; Byrne, G. (2009). An Overview of Mixed Methods Research. *Journal of Research in Nursing 2009 14: 175.*https://doi.org/10.1177/1744987108093962

126. Plano Clark, V.; Ivankova, N. (2015). Mixed Methods Research: A Guide to the Field. Sage Publications, Inc.

127. Eastern Cape Department of Health Annual Report 2014/15

128. www.amatholedistrict municipality.gov.za (accessed on 30 August 2022)

129. Harsh, S. (2011). Purposeful Sampling in Qualitative Research Synthesis. Qualitative Research Journal, vol. 11, no. 2, pp. 63-75. 2011. DOI 10.3316/QRJ1102063.

130. Braun, V.; Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology. 2006 Jan 1;3(2):77-101. ISSN 1478-0887* Available from: *http://eprints.uwe.ac.uk/11735*

131. Polit, DF.; Beck, CT. (2012). Nursing research: Generating and assessing evidence for nursing practice (8th ed.). Philadelphia: *Wolters Kluwer Health/lippincott Williams & Wilkins.*

132. Creswell, J.; Miller, D. (2010). Determining validity in qualitative inquiry. *Theory into Practice, 39 (3), 124-130. https://doi.org/10.1207/s15430421tip3903_2.*

133. Schwandt, TA. (2015). Dictionary of Qualitative Inquiry. *Dict Qual Inq. 2015;7:281–306. DOI: https://doi.org/10.4135/9781412986281*

134. Rai, V.; Betsworth, A.; Beer, C.; Ndukwe, G.; Glazebrook, C. (2011).Comparing patients' and clinicians' perceptions of elective single embryo transfer using the attitudes to a twin IVF pregnancy scale (ATIPS). *J Assist Reprod Genet. 2011 Jan;28(1):65-72. doi: 10.1007/s10815-010-9484-6. Epub 2010 Sep 23.*

135. Morse, JM. (2015). Critical Analysis of Strategies for Determining Rigor in Qualitative Inquiry. *Qual Health Res. 2015 Sep;25(9):1212-22. doi: 10.1177/1049732315588501. Epub 2015 Jul 16. PMID: 26184336.*

136. Oyebanji, O.G.; Mathole, T.;Jackson, D. (2022), Promoting Awareness ofthe Role of the District Clinical Specialist Team in the Amathole District, South Africa: A Valuable Specialty in Improving Healthcare Access and Quality. Trop. Med. Infect. Dis. 2022, 7, 436. https://doi.org/10.3390/tropicalmed7120436

137. Sandelowski, M. (2010). What's in a name? Qualitative description revisited. *Research in Nursing Health. Volume33, Issue1, February 2010. Pages 77-84 https://doi.org/10.1002/nur.20362*

138. World Health Organization. (2015). Tracking universal health coverage: first global monitoring report. World Health Organization. *http://www.who.int/healthinfo/universal_health_coverage/reprt/2015/en?* (Accessed October 23, 2021).

139. Nigam, A.; Housing, R.; Golden, B. (2016). Explaining the Selection of Routines for Change during Organizational Search. *Administrative Science Quarterly, Volume 61, Issue 4. https://doi.org/10.1177/0001839216653712*

140. Smith, M.; Saunders, R.; Stuckhardt, L.; Michael, M. (2013). Committee on the Learning Health Care System in America. *Institute of Medicine; Committee on the Learning Health Care System in America. Washington: National Academies Press*

141. Gourlay, A.; Wringe, A.; Todd, J.; Michael, D.; Reniers, G.; Urassa, M.; Njau, P.; Kajoka, D.; Lema, L.; Zaba, B. (2015). Challenges with routine data sources for PMTCT programme monitoring in East Africa: Insights from Tanzania. *Global Health Action 2015, 8, 29987. https://doi.org/10.3402/gha.v8.29987*

142. The Antara Foundation: Rationalisation of Registers. Available online: *https://www.antarainternational.org›rationalised-registers* (accessed on 17 August 2022).

143. Mutshatshi, TE.; Mothibat, .TM.; Mamogobo, PM.; Mbombi, MO. (2018). Record-keeping: Challenges experienced by nurses in selected public hospitals. *Curationis 2018, 41, 1–6.*

144. Young, PW.; Mahomed, M.; Horth, RZ.; Shiraishi, RW.; Jani, IV. (2013). Routine data from prevention of mother-to-child transmission (PMTCT) HIV testing not yet ready for HIV surveillance in Mozambique: A retrospective analysis of matched test results. *BMC Infect. Dis. 2013, 13, 96.*

145. National Department of Health. (2019). National Consolidated Guidelines for the Prevention of Mother to Child Transmission of HIV (PMTCT) and the Management of HIV in Children, Adolescents and Adults; NDoH: Pretoria, South Africa.

146. Maphumulo, WT.; Bhengu, BR. (2019). Challenges of quality improvement in the healthcare of South Africa post-apartheid: A critical review'. *Curationis 2019, 42, 19012. https://doi.org/10.4102/curationis v42i1.1901 2022*

147. World Health Organization. (2022). Consolidated HIV Strategic Information Guidelines: Driving Impact Through Programme Monitoring and Management. Available online: *https://www.who.int/publications/i/item/consolidated-hiv-strategic-information-guidelines* (accessed on 20 November 2022).

148. World Health Organization. (2015). A Short Guide on Methods—Measuring The Impact of National PMTCT Programmes Towards the Elimination of New HIV Infections Among Children by 2015 and Keeping Their Mothers Alive.

149. Franco, LM.; Marquez, L. (2011). Effectiveness of collaborative improvement: Evidence from 27 applications in 12 less developed and middle-income countries. *BMJ Qual Saf 2011; 20:658–65.*

150. Rowe, AK.; Rowe, SY.; Peters, DH.; Holloway, KA.; Chalker, J.; Ross-Degnan, D. (2018).

Effectiveness of strategies to improve health-care provider practices in low-income and middle-income countries: a systematic review.

https://pubmed.ncbi.nlm.nih.gov/16168785/#:~:text=Lancet%20Glob%20Health.%202018%20Nov%3B6(11)%3Ae1163%2De1175.%20doi%3A%2010.1016/S2214%2D109X(18)30398%2DX.%20Epub%202018%20Oct%208.

151. Shah, A. (2019). Using data for improvement. BMJ. 2019 Feb 15;364:l189. doi: 10.1136/bmj.l189. DOI: 10.1136/bmj.l189

152. Flott, KM.; Graham, C.; Darzi, A.; Mayer, E. (2017). Can we use patient-reported feedback to drive change? The challenges of using patient-reported feedback and how they might be addressed. *BMJ quality & safety, 26(6), 502-507.*

153. Yotebieng, M.; Behets, F.; Kawende, B,.; Ravelomanana, NL.; Tabala, M.; Okitolonda, EW. (2017). Continuous quality improvement interventions to improve long-term outcomes of antiretroviral therapy in women who initiated therapy during pregnancy or breastfeeding in the Democratic Republic of Congo: design of an open-label, parallel, group randomised trial. *BMC health services research. 2017 Dec;17(1):1-7. DOI: 10.1186/s12913-017-2253-9.*

154. Damschroder, LJ.; Aron, DC.; Keith, RE.; Kirsh, SR.; Alexander, JA.; Lowery, JC. (2009). Fostering implementation of health services research findings into practice*: a*

consolidated framework for advancing implementation science, 2009 Aug; 7 4:50 doi:10.1186/1748-5908-4-50

155. African Health Initiative Partnership Collaborative for Data Use for Decision Making. Barriers and Facilitators to Data Use for Decision Making: The Experience of the African Health Initiative Partnerships in Ethiopia, Ghana, and Mozambique. *Global Health Science and Practice. https://www. ghspjournal.org* (accessed 14 October 2022).

156. Hashish, A.; Aly, E.; Alsayed, S. (2020). Evidence-Based Practice and its Relationship to Quality Improvement: A Cross-Sectional Study among Egyptian Nurses. *The Open Nursing Journal. 2020 Dec 2;14(1).*

157. Oboirien, K.; Harris, B.; Goudge, J.; Eyles, J. (2018). Implementation of district-based clinical specialist teams in South Africa: Analysing a new role in a transforming system. *BMC health services research. 2018 Dec;18(1):1-4.*

158. Oboirien, K.; Goudge, J.; Harris, B.; Eyles, J. (2019). Can institutional entrepreneurship strengthen clinical governance and quality improvement: a case study of a district-based clinical specialist team in South Africa. *Health Policy and Planning. 2019 Nov 1;34(Supplement_2): ii121-34.*

159. Stonehouse, D. (2013). Clinical governance: it's all about quality. *British Journal of Healthcare Assistants. 2013 Feb;7(2):94-7.*

160. Biyani, P. (2018). The 7 pillars of clinical governance [Internet]. Dental notebook; 2018. Available from: *https://www.dentalnotebook.com/7-pillars-clinical-governance/* (accessed 12 June 2021).

161. Hunter, RF.; de la Haye, K.; Murray, JM.; Badham, J.; Valente, TW.; Clarke, M. (2019). Social network interventions for health behaviours and outcomes: A systematic review and meta-analysis. *PLoS medicine. 2019 Sep 3;16(9): e1002890.*

162. Marks, L. (2007). Managing for Health. Hunter DJ, editor. *New York: Routledge; 2007 Feb 1.*

163. Gurland, BJ.; Cheng, H.; Maurer, MS. (2010). Health-related restrictions of choices and choosing: implications for quality of life and clinical interventions. *Patient Relat Outcome Meas. 2010 Jul; 1:73-80. doi: 10.2147/prom. s11842*

164. Nkosi, PH.; Horwood, CM.; Vermaak, K.; Cosser, C.; Haskins, L. (2009). The role of clinic supervisors in clinical supervision in primary health care services in KwaZulu-Natal. *S Afr Fam Pract. 2009;51(5):408-12.*

165. Kagawa, SM.; Dressler, W.; George, S. (2016). NIH Expert Panel. Culture: The missing link in health research. *Soc Sci Med. 2016 Dec; 170:237-246. doi: 10.1016/j.socscimed.2016.07.015. Epub 2016 Jul 18. PMID: 27542574.*

166. Sibanda, EL.; Webb, K.; Fahey, CA.; Kang Dufour, MS.; McCoy, SI.; Watadzaushe, C. (2020). Use of data from various sources to evaluate and improve the prevention of mother-to-child transmission of HIV programme in Zimbabwe: a data integration exercise. *Journal of the International AIDS Society. 2020 Jun;23: e25524.*

APPENDICES

APPENDIX I

DATA COLLECTION TOOLS FOR RESEARCH OBJECTIVE 1

	1A. DESK REVIEW CHECKLIST			
	What is the current state of data management and reporting systems of PMTCT data from the health facilities to the sub-districts and to the district, what are the causes of discrepancies and what can be done to address them?			
	Reporting period: This is the period for which the PMTCT data is being reviewed **From:** **To:**			
Questions		**Response**		**Researcher's note**
	Are the following source documents available in your facility?			
	1. PMTCT register			
	1. In put forms			
	1. Tick registers			

	Is the health facility reporting on the data elements for the 8 selected PMTCT indicators? Yes No (Check the number reported in each of the source document)	**Sources**			**Researcher's note**
		Tick Register	**PMTCT Register**	**Input form**	
	1. Number of antenatal 1st visit before 20 weeks				
	2. Antenatal HIV 1st test				
	3. Antenatal HIV 1st test positive				
	1. Number of antenatal clients HIV re-test				
	1. Number of antenatal clients initiated on ART				
	1. Number of Infant PCR at birth				
	1. Number of Infant PCR test positive at birth				
	1. Number of Infants initiated on CPT around 6 weeks uptake				

	Review source documents: Recount the number recorded in the Tick register, In put forms, and PMTCT register for the 6 selected indicators and calculate result verification for each				
	Questions	**Response**			**Researcher's note**
	Are there updated National PMTCT guidelines and SOPs in your facility?				
	National Consolidated Guideline for the prevention of mother-to-child transmission of HIV (PMTCT) and the management of HIV in children, adolescents and adults (NDOH, Apr 2015)				
	National HIV Counselling and Testing Policy Guidelines (NDOH, May 2015)				

	Written procedure or algorithm for provision of CTX to HEI's			
	SOP for provision of PITC in maternity			
		Required	**Actual**	**Researcher's note**
	Are there adequate human resources to deliver PMTCT services as planned?			
	If yes, how many per cadre of staff?			
	1. Doctors			
	1. Clinical Nurse Practitioner (CNP)			
	1. Professional nurses			
	1. Facility Information Officers			

	1. Data Capturers			
	Total			
		Required	**Actual**	**Researcher's note**
	Are there adequate staffs to offer PMTCT services?			
	How many of the health professionals were trained on PMTCT within the review period of one year? List per cadre of staff			
	1. Doctors			
	1. Clinical Nurse Practitioner (CNP)			
	1. Professional nurses			
	1. Facility Information Officers			
	1. Data Capturers			

	Total number of health professionals trained			
	Tick the list of trainings/on-site coaching they have undergone		**Researcher's note**	
	National Consolidated HIV Guidelines			
	Maternal Health & PMTCT			
	Peadiatric HIV & TB			
	PICT/HTS			
	PMTCT data validation and verification			
	Others (please specify)			
	List on-going mentoring activities			

	Is there adequate information system to track the progress of PMTCT services?		**Researcher's note**
	SOP that defines key PMTCT indicator		
	Tier.Net patients monitoring system		
	Training of health facility staff		
	How are the above used to track PMTCT indicators?		
	Describe partners support on the use of data for PMTCT program performance		
	Are there adequate M & E staffs for PMTCT data capturing and reporting?		**Researcher's note**
	Number of Facility Information Officer (FIO)		
	Number of Data capturers (DCs)		

	Is PMTCT data verification and validation done monthly?		
	Does the health facility use the PMTCT data for information management? **Discuss PMTCT data during monthly meeting and use the information to improve service delivery?**		

1B. OBSERVATIONAL STUDY
The above desk review checklist will be combined with general observation of the health care professionals:
1. How the nurses are completing/filling the PMTCT register, tick register and Input forms 2. To check all the registers are up to date (record completion of 6 selected PMTCT indicators in a table for each source documents) 3. To check if there any displays of analyzed data e.g. graphs
1. How the data capturers are collecting and capturing PMTCT data 2. To check the quality of the records and data collected, whether it is captured well and it is up to date 3. To check if they are any gaps or wrong information captured

1C. Interview guide for the causes of PMTCT data discrepancies and what can be done to address them

		Response		Researcher's note
	Questions			
	Does your facility record discrepancies in the 6 selected PMTCT data reported at the sub-district and district level in the reporting period?			
	In which of the 8 selected PMTCT data elements did the facility record			

	discrepancies during the reporting period?			
	1. Number of antenatal 1st visit before 20 weeks			
	2. Antenatal HIV 1st test			
	3. Antenatal HIV 1st test positive			
	1. Number of antenatal client's HIV re-test			
	1. Number of antenatal clients initiated on ART			
	1. Number of Infant PCR at birth			
	1. Number of Infant PCR test positive at birth			
	1. Number of Infants initiated on CPT around 6 weeks uptake			
	In your opinion, what are the major causes of PMTCT data discrepancies from your facility to the sub-district and district level?			

	1. No sufficient training of M & E staff			
	1. Nurses not documenting work done			
	1. Missing source document			
	1. Data entry error			
	1. Others:			
	What can be done in your facility to address these discrepancies?			
	What do you think can be done at the sub-district and district to address these discrepancies?			
	Is there a written procedure to address late, incomplete, inaccurate, and missing reports; including following-up with sub reporting levels on data quality issues?			
	If Yes, how well is it being implemented? What are the barriers?			

	Is there clear instructions provided by the M&E Unit on how to complete PMTCT data collection and reporting forms/tools			
	As the M & E Unit identified a standard source document (e.g., Tick register, In put form, PMTCT register, etc.) to be used by all health care professionals at service delivery points to record PMTCT service delivery.			
	Has the M & E Unit provided written guidelines to the facility and sub-district office for reporting on: what they are supposed to report on, how reports are submitted, who reports should be submitted to, when reports are due?			
	Are all M & E staff positions dedicated to data management systems are filled?			
	Are there designated staff responsible for reviewing the quality of data (i.e., accuracy, completeness and timeliness) at the facility and sub-district level?			

APPENDIX II

OBJECTIVE 2 CQI

OBJECTIVE 2 SURVEY QUESTIONNAIRE

How will implementation of Continuous Quality Improvement approach to improve PMTCT indicators?

Dear participant

My name is Oyebola Oyebanji. I am a 46-year-old student at the University of The Western Cape, South Africa. As part of a PhD thesis, I am gathering data on using continuous quality improvement approach to improve PMTCT programme indicators using a cohort data tool. The following questionnaire is not traceable to individual participants and your employers will not have access to your answers. Even so, it is important that you do not write your name or personal information on this copy. Answer by tagging the appropriate boxes

1. Are you a man or woman
2. How old are you? …….

3. What is the name of the health facility you are working?

.....

4. How long have you been working in this facility? .....

5. What is/are your qualifications?

.....

6. Have you been involved in Continuous Quality Improvement work in this facility? Yes No

7. Do you have Quality Improvement (QI) team in your health facility?

Yes No

8. If yes, what is the composition of your QI team? (List the number of cadre of staff)

- Doctors ……
- Operational Manager ……..
- Clinical Nurse Practitioners ……..
- Professional Nurses …….
- Pharmacists ……
- Facility Information Officer …….
- Data Capturers …….
- Others ……..

9. How often do you have CQI meetings in your facility?

Weekly Monthly Not Regular No Meeting

Others (Please specify)

…….

10. Do you have a standardized agenda for your CQI meeting? Yes No

11. Do you keep record of minutes of your CQI meetings? Yes No

12. Have you been trained on the use of the CQI tool? Yes No

13. Describe how the CQI tool has helped you to improve your PMTCT programme data

……

……

……

…..

14. Describe the process you use to identify gaps in PMTCT programme data in your health facility (e.g. meeting, data review, discussion, etc)

……

……

……

…….

15. What are the benefits of using the CQI tool?

1. Improved PMTCT data performance
2. Better understanding and interpretation of PMTCT data
3. Identify PMTCT data gaps and institute remedial actions
4. Improved PMTCT service delivery
5. Improved the level of accountability and responsibility
6. Others (Please specify)

……

……

APPENDIX III

OBJECTIVE 3 IN DEPTH INTERVIEW GUIDE
What is the relationship of health facility quality improvement team members with the existing district structure and how is PMTCT data for information management used to strengthen PMTCT program?

1. Describe in your own word your understanding of Continuous Quality Improvement
2. Explain the improvement your you had seen in PMTCT indicators after implementation of CQI approach in your facility
1. What is the role of the District Clinical Specialist Team (DCST) in PMTCT programme?
1. Describe how the PMTCT programme coordinate with the existing structures: DCST, District Health teams (DHTs) and the health facility
1. How does the PMTCT programme deal with data quality issues?
1. What are the challenges in PMTCT programme service delivery?
1. What specific strategies do you think will strengthen PMTCT programme in your health facility, sub-district and district?
1. Does the facility routinely analyze data to assess data quality?

   Yes No

   If yes, how is this done

   ……

……

….

1. What do you think are the causes of PMTCT data discrepancies at the facility and sub-district level?

1. How can PMTCT data be used for information management in your health facility, sub-district and district?

APPENDIX IV

1.0. Summary table of methods and tools for research objectives

Objectives	Methods	Data Collection Methods	Persons responsible
Objective 1			
1A) To assess the current status of data management and reporting of PMTCT data from the health facilities to the sub-districts and district	Quantitative	Desk review	Researcher and 2 Research Assistants
1B) To investigate the cause of data discrepancies and what can be done to address them	Qualitative	Observation and In depth Interview guide	Researcher and 2 Research Assistants
Objective 2			
To assess the implementation Continuous	Qualitative	In depth interview	Researcher and 2 Research Assistants

Quality Improvement approach to improve PMTCT program output indicators	Quantitative	Survey Questionnaire	Researcher and 2 Research Assistants
Objective 3			
To assess the current relationship of quality improvement team members at health facilities with the existing district structure, and the use at the different management levels of PMTCT data for strengthening PMTCT program.	Qualitative	In depth interview	Researcher and 2 Research Assistants

APPENDIX V

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E-mail: soph-comm@uwc.ac.za

CONSENT FORM

Title of Research Project: Use of Continuous Quality Improvement to Improve Prevention of Mother to Child Transmission (PMTCT) Programme Performance in Amathole district, Eastern Cape, South Africa.

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve, and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

Participant's name……..

Participant's signature…….

Date……

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

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INFORMATION SHEET

Project Title: Use of Continuous Quality Improvement to Improve Prevention of Mother to Child Transmission (PMTCT) Programme Performance in Amathole district, Eastern Cape, South Africa.

This is a research project being conducted by Oyebola Oyebanji at the University of the Western Cape. We are inviting you to participate in this research project because of your involvement in Continuous Quality Improvement (CQI) for improving Maternal, Newborn and Child, Women's Health and Nutrition (MNCWHN) programme in Amathole district.

The purpose of this research project is to improve Prevention of Mother To Child Transmission programme performance (a subset of the Maternal, Newborn and Child, Women's Health and Nutrition programme data) and the quality of PMTCT data in Amathole district municipality, Eastern Cape Province of South Africa using a Continuous Quality Improvement (CQI) approach.

If you agree to participate, you will be asked to share your experience in CQI to improve MNCWHN programme performance data indicators. In this discussion, all answers or opinions are correct. I shall take notes and tape-record only if you allow me to. The discussion might take one hour or less.

The researchers undertake to protect your identity and the nature of your contribution. Your confidentiality is guaranteed as your name will not appear on any report, and your identity will not be revealed to others. Your individual answers will not be shared or presented in any way that would identify you as the source. With this understanding, the collected information would be analyzed and compiled into a thesis to fulfill part of the requirement for PhD in the School of Public Health in the Faculty of Community and Health Sciences, University of the Western Cape, South Africa.

If we write a report or article about this research project, your identity will be protected.

In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child abuse or neglect or potential harm to you or others. In this event, we will inform you that we have to break confidentiality to fulfil our legal responsibility to report to the designated authorities.

There may be some risks from participating in this research study.

Although, all human interactions and talking about self or others carry some amount of risks; We will nevertheless minimise such risks and act promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

This research is not designed to help you personally, but the results may help the investigator learn more about delivery of improved clinical care of PMTCT programme. We hope that, in the future, other people might benefit from this study through improved understanding of the use of continuous quality improvement to strengthen PMTCT programme performance.

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

This research is being conducted by Oyebanji at School of Public Health, Faculty of Community and Health Sciences, at the University of the Western Cape. If you have any questions about the research study itself, please contact Oyebola University of the Western Cape, South Africa, Tel: +27817128479, E-mail address: drbolaoyebanji@yahoo.com

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

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19 January 2017

Dr OO Oyebanji
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM/17/1/23

Project Title: Use of continuous quality improvement to improve prevention of mother to child transmission (PMTCT) programme performance in Amathole District, Eastern Cape, South Africa

Approval Period: 15 December 2016 – 15 December 2017

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

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

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

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

PROVISIONAL REC NUMBER -130416-050

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06 June 2018

Dr O Oyebanji
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Faculty of Community and Health Science

Ethics Reference Number: BM17/1/23

Project Title: Use of continuous quality improvement to improve prevention of mother to child transmission (PMTCT) programme performance in Amathole District, Eastern Cape, South Africa

Approval Period: 23 May 2018 – 23 May 2019

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

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Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER -130416-050

APPENDIX VIII

Eastern Cape Department of Health

Enquiries: Makoda Xokwe
Tel No: 040 608 0856
Date: 06 June 2017
e-mail address: makoda.xokwe@echealth.gov.za
File No: 043642 1409

Dear Dr. O. Oyebanji

Re: Use of Continuous Quality Improvement to improve Prevention of Mother to Child Transmission (PMTCT) Programme Performance in Amathole district, Eastern Cape, South Africa. (EC_2017RP44_732)

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.
2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall receive or not collect any information which can be used to link the participants.
3. The Department of Health expects you to provide a progress on your study every 3 months (from date you received this letter) in writing.
4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.
5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

SECRETARIAT: EASTERN CAPE HEALTH RESEARCH COMMITTEE

APPENDIX IX

Province of the
EASTERN CAPE
HEALTH

Room 111 Floor • Old Medical Centre Building • 19 St James Road • Southernwood • East London
Private Bag X 9015 • Bhisho • 5605 • REPUBLIC OF SOUTH AFRICA
Tel.: +27 (0)43 707 6786 • Fax: +27 (0)43 707 6043 • Website: www.ecdoh.gov.za

Dr. O. Oyebanji
04/12/2017

RE: REQUEST FOR APPROVAL TO CONDUCT A RESEARCH STUDY IN AMATHOLE HEALTH DISTRICT

RE: USE OF CONTINOUS QUALITY IMPROVEMENT TO IMROVE PREVENTION OF MOTHER TO CHILD TRANSMISSION (PMTCT) PROGRAMME PERFORMANCE IN AMATHOLE HEALTH DISTRICT, EASTERN CAPE, SOUTH AFRICA (EC _2017RP44_732)

In view, of the above subject request, the Office of the District Manager at Amathole Health District acknowledges your request and is gladly granting you permission to conduct your research.

Please be advised that:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the ECDoH in writing.
2. That the results of the subjects matter must be presented to the District Manager and the Team.
3. Your research must not, by any means violate people's rights and cultures.
4. You must maintain confidentiality of their identities and shall not collect any information which can be used to link the participants.
5. Your research must not contravene with the policies of the Department of Health.
6. Must not in anyway be harmful be harmful to the reputation of the Department nor dent its image.

We wish you a very successful result with your adventure.

Yours in service delivery.

Mrs. S. Gede
DM: Amathole District
Together, moving the health system forward

04/12/2017
Date:

Fraud prevention line: 0800 701 701
24 hour Call Centre: 0800 032 364
Website: www.ecdoh.gov.za