# TITLE: QUALITATIVE ASSESSMENT OF THE UTILISATION OF TIER.NET HEALTH INFORMATION AMONG FACILITY AND PROGRAMME MANAGERS IN EKURHULENI DISTRICT, GAUTENG.

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Keywords

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HIV/AIDS

Information

Knowledge

Routine health information system

TIER.net

Declaration

I declare that this thesis entitled "*QUALITATIVE ASSESSMENT OF THE UTILISATION OF TIER.NET HEALTH INFORMATION AMONG FACILITY AND PROGRAMME MANAGERS IN EKURHULENI DISTRICT, GAUTENG.*" is my own work. It has not been submitted for any degree or examination in any other university and that all the references I have used or quoted have been acknowledged.

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Date: 29 September 2017

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Abstract

Background

The South African National Department of Health (NDOH) developed TIER.net - a three-tiered health information system to improve the quality of routine data collection and for the proactive information-driven management of the HIV/AIDS care and treatment programme. Current quarterly reports indicate inefficiencies in the national HIV/AIDS treatment programme, which point to high proportions of patients on antiretroviral therapy (ART) lost to follow up, low proportions of patients with viral-load tests done, and numerous instances of drug and commodity stock-outs. This means that even though information generated from TIER.net is readily available to facility managers and programme coordinators in the HIV and AIDS/ Sexually Transmitted Infection/TB (HAST) programme, the information is not effectively used to inform programme planning, implementation and monitoring. The current study evaluated the use of information generated from the TIER.net information system among facility and programme managers in the Ekurhuleni District, Gauteng Province by considering technical, behavioural and organisational factors that influence use.

Methodology

An explorative and evaluative qualitative study was conducted in the Ekurhuleni District. Three HAST coordinators and nine facility managers were interviewed individually. Thematic content analysis was used and themes were categorised based on the Performance of Routine Health Information Systems (PRISM) framework into technical, behavioural and organisational determinants.

Results

Behavioural and organisational determinants in particular shaped the culture of information use for both facility managers and HAST coordinators. Even though TIER.net provided good-quality information the technical determinant alone did not guarantee use of the information for decision making. The behavioural determinant appeared to be a barrier to information use in this study. There was general absence of a culture of information use, characterised by an inability of HAST coordinators and facility managers to analyse, interpret and use information to inform decision making. At an organisational level, there was minimal or no enforcement of the District Health Management Information System (DHMIS) policy resulting in facility managers not prioritising information analysis, interpretation and

use as their core function. Poor information support to facility managers, was also viewed as a barrier to information use.

It is recommended that behavioural and organisational barriers, which included inadequate human resources, skills and capacity, should be effectively addressed to improve use of information for decision making in the HAST programme. Strategies need to be put in place to improve the skills and competences of facility managers and HAST coordinators in analysing, interpreting and using health information. Rigorous monitoring and enforcement of the District Health Management Information System (DHMIS) policy and the related standard operating procedures are also recommended to ensure use of information to inform decision making.

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List of acronyms and abbreviations

AIDS   Acquired Immunodeficiency Syndrome

ART   Antiretroviral therapy

CHC   Community Health Centre

DHIS   District health information system

DHMIS   District health management information system

DOH   Department of Health

EMM   Ekurhuleni Metro Municipality

HAST   HIV and AIDS/Sexually Transmitted Infection/TB

HIS   Health information system

HIV   Human Immunodeficiency Virus

HSS   Health systems strengthening

ICT   Information and communications technology

IT   Information technology

MDR TB   Multi-drug resistant tuberculosis

NDOH   National Department of Health

NIDS   National Indicator Data Set

NSP   National Strategic Plan

PEPFAR   President's Emergency Fund for AIDS Relief

PHC   Primary Healthcare

PRISM   Performance of Routine Information Systems Management

RHIS   Routine health information system

SLA   Service-Level Agreement

SOP   Standard operating procedure

TB   Tuberculosis

WHO   World Health Organization

XDR TB   Extreme drug resistant tuberculosis

Definition of Key Terms

A *decision* refers to an instance of decision making and is defined as "a specific commitment to action (usually a commitment of resources)" (Mintzberg et al., 1976).

Decision making is the act of engaging with decision processes.

A *facility manager* denotes a manager of a primary healthcare facility which, in this setting, can be a clinic, community day centre or community health centre.

A *health system* is defined as "The people, institutions and resources, arranged together in accordance with established policies, to improve the health of the population they serve, while responding to people's legitimate expectations and protecting them against the cost of ill-health through a variety of activities whose primary intent is to improve health" (WHO, 2000).

A *health information system (HIS)* is defined as "A system that integrates data collection, processing, reporting and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services" (WHO, 2004).

Knowledge is understood to include facts or information that was applied or made actionable, which is acquired through experience and learning, in addition to formal teaching. It may be explicit and/or tacit in varying degrees (Webster, 2011).

Routine health information system (RHIS) is any system of data collection, distribution and use that provides information at regular intervals (periods of less than one year) and that is produced through routine mechanisms to address predictable health information needs (Aqil et al., 2009).

Chapter 1. Introduction

1.1 Background

1.1.1 HIV/AIDS treatment programme in South Africa

South Africa has the largest number of people living with the human immunodeficiency virus (HIV) in the world. In 2016 Statistics South Africa estimated that 7 million people were living with HIV (Stats SA, 2016). In response to the epidemic, the South African government introduced the Antiretroviral Therapy (ART) programme roll-out in April 2004. ART, when taken correctly, is life-saving, improves the quality of life, and also reduces the incidence of infection (Fairall et al., 2008). Initially only adults, adolescents and pregnant women with a CD4 count[a] of 200 cells/mm^3 or less or those diagnosed with World Health Organization's (WHO) stage 4[b], irrespective of CD4 count were eligible for ART initiation. Since then, the response to HIV and ART management evolved as the National Department of Health (NDOH) began to understand the nature and impact of the epidemic.

In 2010, the government made policy changes to expand access to treatment and care (NDOH, 2010). The ART initiation eligibility criteria for pregnant women changed from CD4 count at 200 cells/mm^3 to 350 cells/mm^3. In addition, people co-infected with HIV and TB with CD4 of 350 cells/mm^3 were included as the eligible. People with multi-drug resistant (MDR) or extreme drug resistant (XDR) tuberculosis (TB), irrespective of CD4 count, were also eligible for ART HIV-exposed infants who test positive at birth were also eligible for ART initiation. In 2012, the eligibility criteria were changed for the general population and all HIV-positive clients with a CD4 count of 350 cells/mm^3 were initiated on ART. The criteria also specified that all children under five years, irrespective of CD4 count, should be initiated on ART. Further changes were made in 2015 to include HIV-positive persons with a CD4 count of 500 cells/mm^3 or less, and all clients with WHO stage 3 and 4 infections became eligible for ART initiation. The criteria were also expanded to include ART initiation to clients with tuberculosis (TB), irrespective of TB type and CD4 count, as well as to all pregnant and breastfeeding women. HIV-positive clients with Hepatitis B also became eligible for ART initiation irrespective of CD4 count and WHO staging (NDOH, 2010; NDOH; 2012; NDOH, 2015).

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[a] CD4 cells are immune system cells that come under attack from the HI virus. A low CD4 count indicates that the immune system is compromised. The CD4 count is therefore a measure of the progression of the infection.
[b] The World Health Organization (WHO) has a staging system for AIDS illness which ranges from Stage 1 (less severe) to Stage 4.

According to the National Strategic Plan (NSP) 2017-2022, the rapid scale-up resulted in a four-fold increase in the number of people initiated on ART. As a result, South Africa has the world's largest ART programme, with approximately 3.7 million people estimated to have received ART by June 2016 (NDOH, 2016). The table below indicates the changes chronologically.

Table 1.1 Changes in ART eligibility criteria from 2004 to 2015

2004 ART initiation eligibility Criteria	2010 ART initiation eligibility Criteria	2012 ART initiation eligibility Criteria	2015 ART initiation eligibility Criteria
CD4 count of less <200 irrespective of WHO clinical stage	CD4 count of less < =200 cells/mm3 irrespective of WHO clinical stage	All adults and adolescents with CD4 count of less <= 350 cells/mm3	All adults and adolescents with CD4 count of less <= 500 cells/mm3
WHO stage IV irrespective of CD4 count	WHO stage IV irrespective of CD4 count	WHO stage IV irrespective of CD4 count	WHO stage III and IV irrespective of CD4 count
	MDR/XDR patients irrespective of CD4 count	MDR/XDR patients irrespective of CD4 count	All types of TB irrespective of CD4 count
	CD4 count of less <= 350 cells/mm3 in Pregnant women and in patients with TB/HIV	CD4 count of less <= 350 cells/mm3 in Pregnant women and in patients with TB/HIV	All pregnant and breastfeeding women irrespective of CD4 count
		All children under 5 years irrespective of WHO clinical stage and CD4 count	All patients with Hepatitis B virus

Adapted from ART guidelines NDOH, 2010; NDOH; 2012; NDOH, 2015

With the expansion of the number of people accessing ART, monitoring and reporting of patient outcomes became important to both clinicians and ART programme managers at all health care levels. Given that ART care is a long-life therapy the suggested method of monitoring key progress indicators such as retention in care, loss to follow up, viral-load completion and suppression is through cohort monitoring based on the patient's ART start date, reported at standard treatment durations. A paper based system was used for this monitoring and reporting but proved to be cumbersome as it was time consuming and labour intensive. This indicated a need for a robust health information system to monitor and address all the issues that were emanating from the expansion of the ART programme (Osler, et.al., 2014; Osler and Boulle, 2010).

1.1.2   Health information system in South Africa

Health information is the crux of the WHO's six building blocks of health systems strengthening (HSS) (WHO, 2010). WHO identified the six building blocks that contribute to HSS as the health workforce; health services; health financing; governance and leadership; medical products, vaccines, and technologies; and health information (Figure 1.1). Health information can be strategically applied to support decision making and monitor the performance of each of the other five areas. Without good quality, readily available information the other building blocks cannot be improved. Improving the Health Information System (HIS) is thus central in improving the health system. The generation and application of health information enables health managers to utilise information for better policy making, planning, implementation, monitoring and evaluation of health programmes (Cibulskis and Hiawalyer, 2002). Numerous studies have identified the importance of strengthening the national HIS to generate reliable and accurate public health information as a means to improve the performance of health systems (delivery of quality healthcare services) which ultimately leads to improved health outcomes (improved population health) (Chaulagai et al., 2005; Mutale et al., 2013).
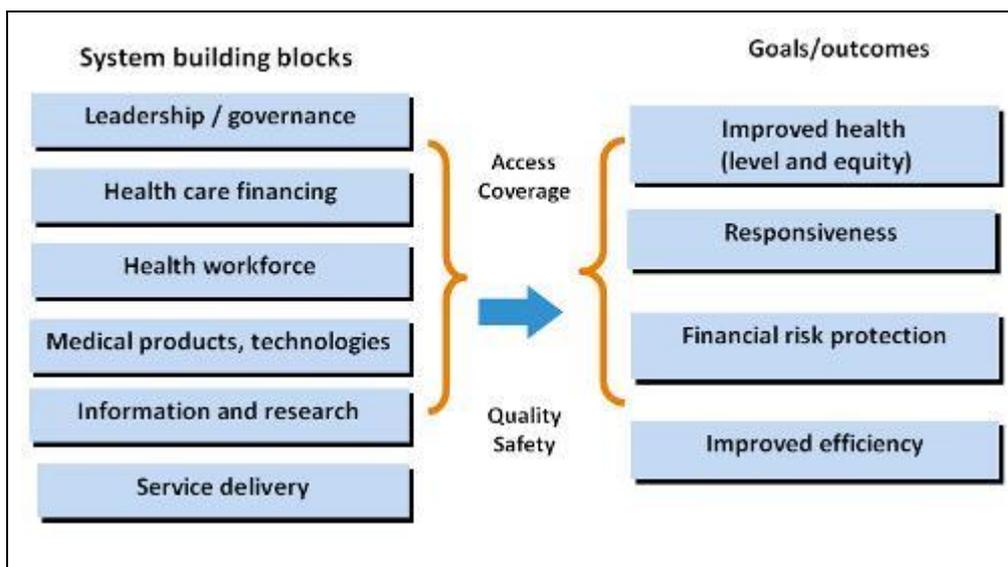
Figure 1.1 The WHO Health Systems Framework

Source: WHO (2010)

The strategic priority of the NDOH is to improve access to health and health outcomes for all (DoH, 2014). To accomplish this, the Minister of Health, Dr Aaron Motsoaledi, has amongst others, identified the need to build a culture of evidence-based health practices (DoH, 2014). The HIS has been identified as the vehicle to drive this shift towards a culture where information drives clinical decisions and outcomes. The HIS allows for reliable, accurate and timely routine data to be collected, analysed and converted into information that can be used in decision making to improve coverage, continuity, and quality of healthcare services by better planning, monitoring and evaluation. These efforts are conducted to improve health service performance and ultimately to improve the health of the community (Mutale et al., 2013; Kawale, 2011).

1.1.3   Monitoring of the ART programme in South Africa

The three-tiered ART monitoring HIS was developed by the University of Cape Town in collaboration with NDOH (Boulle, 2010), and approved in 2010 by the National Health Council (Osler and Boulle, 2010). The rationale for its development was to improve the quality of routine data collected at ART service points to comply with the NDOH reporting requirements and to improve both patient and ART programme monitoring and management. The first tier (T1) is a paper-based ART register system and is regarded as fit for use in facilities

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with less than 500 patients on ART. The second Tier (T2) is an electronic version of the ART paper register and is used in facilities with more than 500 but less than 2,000 ART patients. The last Tier (T3) is a fully electronic medical record software and this is recommended for use in facilities with more than 2000 ART patients. However, currently sites with more than 2,000 patients on ART are on TIER 2 as the TIER 3 system is still in a pilot phase. The three systems work independently. Each tier produces the same nationally required monthly enrolment and quarterly cohort reports. At the end of each reporting cycle (monthly and quarterly) the information from these data sources are aggregated into a single database.

TIER.net allows for timely, relevant, and accurate information to be generated and used. The NDOH has prescribed fixed reporting times to ensure timely reporting. To achieve data accuracy and consistency a website portal was developed demonstrating the correct data-collection process, collation and use at all levels. Users were trained and training materials were standardised and circulated to all healthcare facilities. In addition, to improve capacity as well as the quality of data collection and processing, human resources were made available, in the form of data capturers and data clerks. To reduce information overload, only core data elements and indicators relevant and useful for monitoring HIV and ART services are captured and reported and these were defined in the National Indicator Data Set of 2013 (Osler and Boulle, 2010). These activities will enable policy makers and ART programme managers to make necessary changes within the programmes' components and enable them to identify determinants of successes or failures of implemented programmes.

1.2 Problem statement

Several challenges regarding the use of information generated from TIER.net have been experienced by facility managers and HAST coordinators. Quarterly reports submitted to the NDOH indicate that provinces are consistently reporting poor performance on critical indicators. High proportions of ART patients lost to follow-up, poor monitoring of the immunological and virological status of patients on ART, ARV drug stock-outs, and unnecessary drug toxicity have been observed in most provinces (NDOH, 2013). The District Health Information Management System (DHIMS) (National Department of Health, 2011) policy and the national standard operating procedure for the monitoring of ART mandates that facility managers ensure that data collected by their respective facilities are reviewed during their monthly management meetings. In addition, remedial interventions should be

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implemented to improve service delivery, patient management and programme performance where the data show inadequate performance.

Information generated from TIER.net if acted upon can provide a solution to most of the problems noted above. However, the challenge seems to be with the use of information generated from TIER.net as the basis for informed decision making in planning and management at facility and programme levels. In many districts, including Ekurhuleni, the link between information production and use does not exist. Information is not optimally utilised by facility and programme managers to identify performance gaps, make plans, monitor progress and inform decisions to improve ART patient and programme management. The current practice is that data are used only to populate reports and not to drive decisions and programme improvements. It is also not clear why the facility managers and HAST coordinators are not using this information to manage the ART programme.

Research question

What is the culture of TIER.net health information use among facility and HAST programme managers in Ekurhuleni district?

Sub-questions

- When and how do healthcare managers in the Ekurhuleni District use the information generated from TIER.net to manage ART programme?
- What factors influence the utilisation of TIER.net information by managers?

1.3 Thesis outline

Chapter 2 Literature review explores and reviews what is known in the health management literature about the role of HIS in supporting decision making and the link between information and action. It also reviews frameworks for evaluating factors affecting information use, including behavioural, technical and organisational factors. Chapter 2 concludes with a summary highlighting the theoretical framework that will be used in this study.

Chapter 3 describes the methodology used as well as the aim and objectives of this study. This chapter details the study design, population, sample method and sample size, including the characteristics of the study sites and the facility and health personnel surveyed. The chapter

also describes the data entry and the analysis processes for each of the objectives, and concludes with a section on the scope and the limitations of the study.

Chapter 4 describes the findings of the study in relation to technical, behavioural and organisational determinants of the use of health information derived from TIER.net by healthcare managers.

Chapter 5 discusses the major findings of the current study in relation to the literature, and provides recommendations for future research and practice.

Chapter 2. Literature review

2.1 Health information system

The health information system (HIS) has been defined in the literature as a system for generating information for decision making (Lipperveld et al., 2000; Health Metrics Network, 2008). HIS are designed to provide information needed for management, to inform decision making and lead to action. Ideally a well-functioning HIS generates information that can be used for at least four distinct but related purposes: strategic decision making; programme implementation or management; monitoring of outcomes or achievements; and, evaluation of what works and what does not (Evans and Beaglehole, 2003). Therefore, it is well understood that a good HIS should present and disseminate information in appropriate formats for all audiences (Health Metrics Network, 2008; Abouzahr and Boerma, 2005).

For the propose of this study, the HIS is defined as "A *system that integrates data collection, processing, reporting and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services"* (WHO, 2004).

The ultimate goal of an HIS, is to increase the availability, accessibility, quality of health information produced and used to guide and monitor the planning and implementation of health programmes and related services to achieve strategic health goals at all levels of healthcare (Bhana, 2010; Paschal, 2007).

Various authors have pointed out that an effective HIS is one that defines data elements, processes, and procedures for collection, collation, presentation, and standardisation of the information to allow statistical analysis and comparisons to be made between facilities, districts and provinces, and, ultimately, uses the information produced for decision making and action (Abouzahr and Boerma, 2005: Lipperveld et al., 2000, Health Metrics Network, 2008).

The health information required for management varies at different health-system levels, as these different levels are tasked with different decisions requiring different information (Abouzahr and Boerma, 2005; Health Metrics Network, 2008). At health-facility level, clinicians need client-level information to provide the appropriate treatment to the right client at the right time for effective clinical management. At the same level, facility managers also need consolidated information which includes information on service-delivery coverage and quality, and resource management (drugs and supplies, human resources and finance). This

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information is used to assess whether the health services meet the needs and demands of the patients who access and uses these health care services. District managers need information for tracking the performance of the facilities in their districts and to plan new services and service improvements. Health planners at national level need information for designing effective treatment protocols and programmes, while policy makers at national level need information to design policies that make better use of scarce resources (Health Metrics Network, 2008).

2.2 Use of health information

For the purpose of this study, the use of information is defined as the analysis, synthesis, interpretation, and review of data as part of a decision-making processes, regardless of the source of data (Nutley and Reynolds, 2013). This definition is derived from the Health Information Cycle model (Health Metrics Network, 2008). This model systematically describes how data are handled and applied in each stage of the cycle to ensure timely generation of relevant and useful information. Data-collection processes involve the collection of essential data sets that are available in a programme data set. Once the data are collected they are processed. This brings together vast amounts of data into a format that can be analysed. These data are then analysed into indicators that are presented in formats such as graphs, tables, maps and figures. Data analysis enables the identification of patterns, thereby creating information. The information generated can then be used to inform decision making and to take action. The Health Information Cycle Model is presented in the Figure 2.1 below.
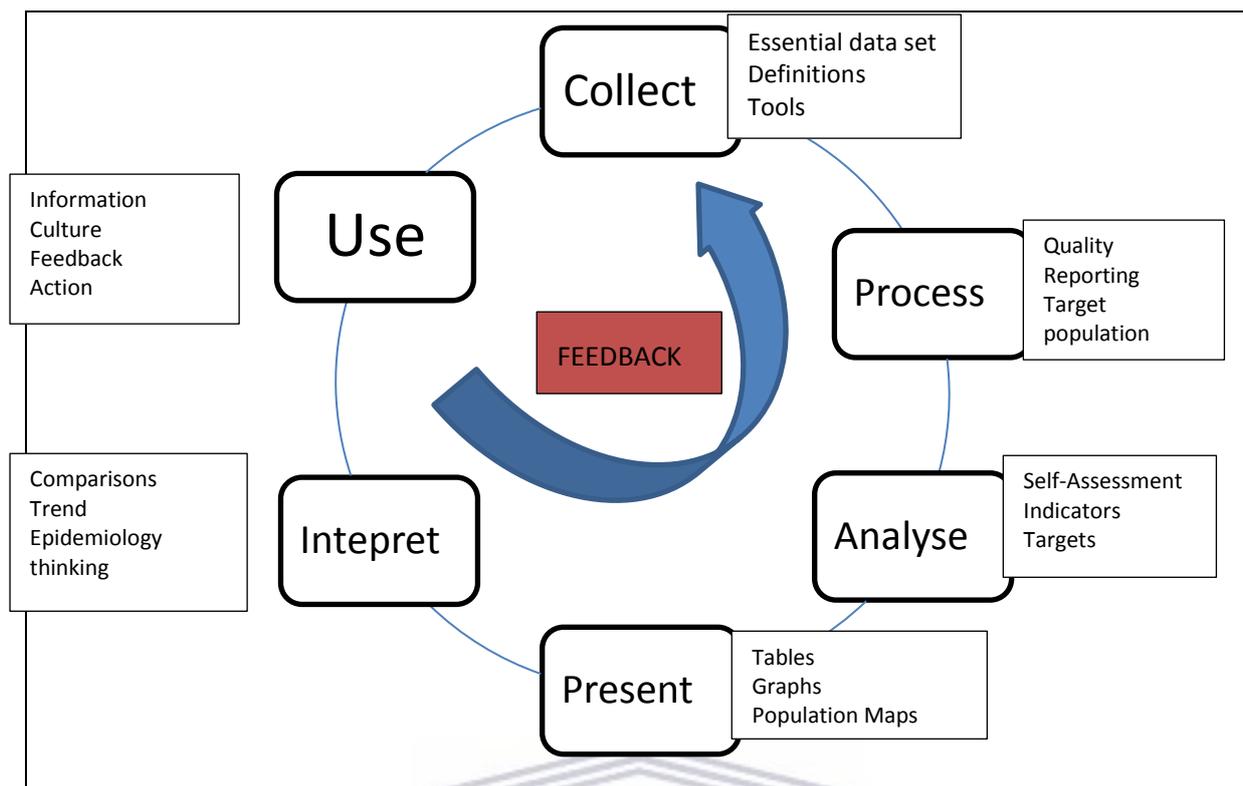
Figure 2.1 Health Information Cycle Model

Source: Health Metrics Network (2008).

For information to be used, it must first be presented in a usable format, and then interpreted and used to inform decisions. During the planning stages, health managers use the information to align available resources with the requirements of the community to be served (Bhana, 2010; Cibulskis and Hiawalyer, 2002). With regards to monitoring and evaluation, health managers use information to ascertain whether their plans are implemented and advancing in an acceptable manner as well as to determine whether the implemented strategies are effective (or not) (Paschal, 2007). In essence asking the questions: "Are we doing the right things?" and "Are we doing the right things the right way?" information can be used to increase accountability within an organisation and allow the public or donors to determine whether they are obtaining value for money (Abouzahr and Boerma, 2005). Information that is collected over time can help managers to learn what works and what doesn't, thereby providing valuable know-how, leading to improved efficiency (Cibulskis and Hiawalyer, 2002).

Using collected information to take action is an essential end product of the activities performed in the HIS. A properly designed HIS ensures that information transmitted is relevant not only for higher-level decision making but also to manage the daily operations of the health-

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facility (Lippeveld, 2000; Nolen et al., 2005). However, in many countries, including South Africa, there is a prevailing practice where data are collected and passed up the reporting channels to fulfil the reporting requirements rather than to support decision making and actions at the lower levels where the information is generated and required the most. A study done to assess the HIS in South Africa revealed that although the collection and dissemination of HIS-generated data was adequate, the use of information to inform resource allocation, implementation and action was inadequate (English et al., 2011). The HIS in most countries is mostly 'data driven.' This means that data collection and processing is prioritised rather than the use of information generated to inform decision making at lower levels of healthcare. Most countries measure the success of the HIS by how much information the system can handle, how quickly it can generate the reports and the extent to which the system can produce quality information. However, the success of the HIS should be measured by how much action has been taken, using information generated from the HIS, to improve health system performance (Lippeveld, 2000). The Health Metrics Network (2008) argues that HIS performance should be measured by the use of information to improve health system performance, to respond to emergent threats, and to improve health, rather than measuring its performance by the quality of data produced.

The HIS literature emphasises the concept of information and information use, without overtly including knowledge in its key theoretical bases and conceptual frameworks. Knowledge refers to relevant and objective information gained through experience. The combination of analysis and interpretation of the information sources, experience and intuition adds insight that is turned into value-adding knowledge that can be used to inform decision making (Kennerley and Mason, 2008). These activities are important as they are enablers to convert raw data into meaningful information and knowledge that is crucial for decision making.

The concept of knowledge was formally included in the transforming data framework set out by the Health Metrics Network (2008). This framework extends the Information Cycle Model by introducing the concepts of evidence and knowledge. In this framework, evidence must be formatted for presentation in order to be turned into knowledge. It is then ready to be used to influence plans and decisions. The model includes evidence as a step in the transformation of information to knowledge. However, the HIS literature warns that information on its own does not improve service delivery. An organisation uses information strategically in three areas: to

make sense of changes in its environment; to create new knowledge for innovation; and, to make decisions about courses of action.
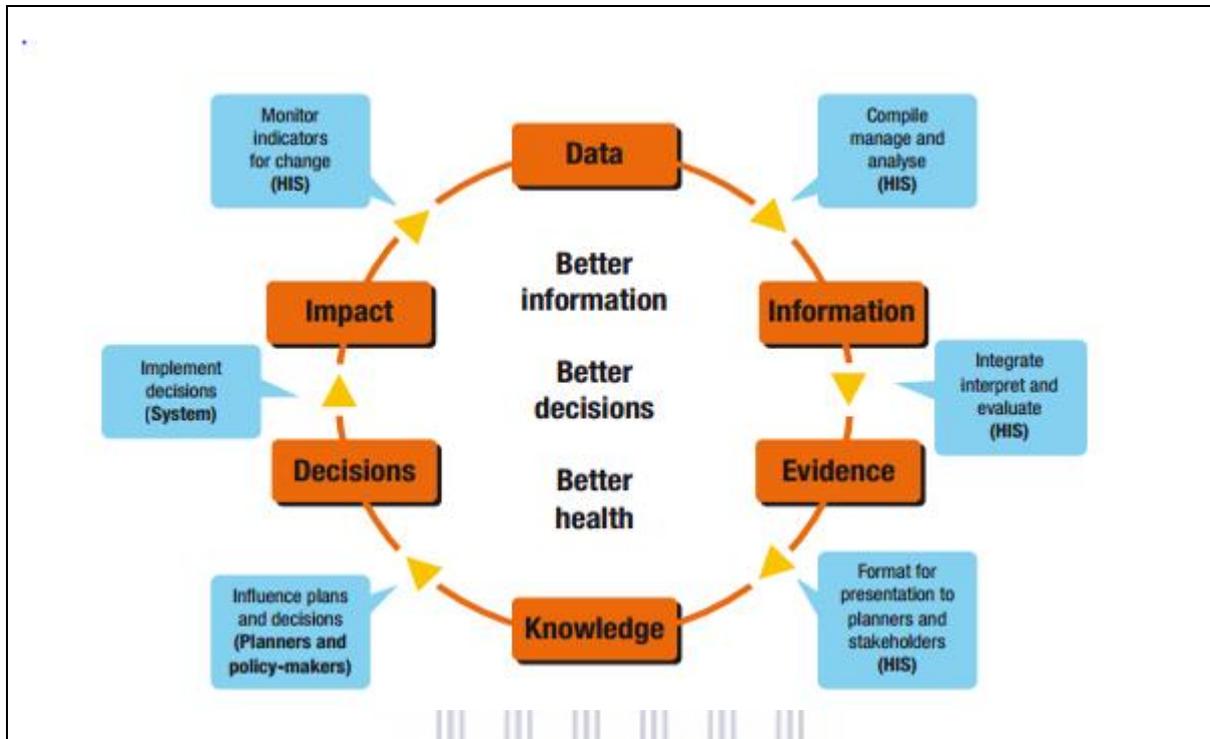
Figure 2.2 The inclusion of knowledge in transforming data into information and evidence cycle
Source: Health Metrics Network (2008).

2.3 Routine health information system

A Routine health information system (RHIS) is any system of data collection, distribution and use that provides information at regular intervals and that is produced through routine mechanisms to address predictable health information needs (Aqil et al., 2009). As a system, it is composed of inputs, processes and outputs or performance, which, in turn, affects health-system performance and consequently leads to better health outcomes. RHIS can consist of various data sources which may be collected over regular time periods (e.g. monthly, quarterly, annually) including information related to clinical service delivery (e.g. clinical registers) and medicine, laboratory and other diagnostic services record systems. It can also include routine administrative record systems (e.g. time sheets) and human resource and financial-management information systems. The success of any RHIS is based on a defined performance, RHIS performance is defined as the system that produces high-quality routine health information where there is effective and continuous use of this routine health information for decision

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making (Aqil et al., 2009, Lippeveld, 1997; WHO, 2000). Therefore, without assessing use of information, it is difficult to know whether a RHIS is meeting its intended objectives, improving evidence-based decision making, and, consequently, leading to better health-system performance.
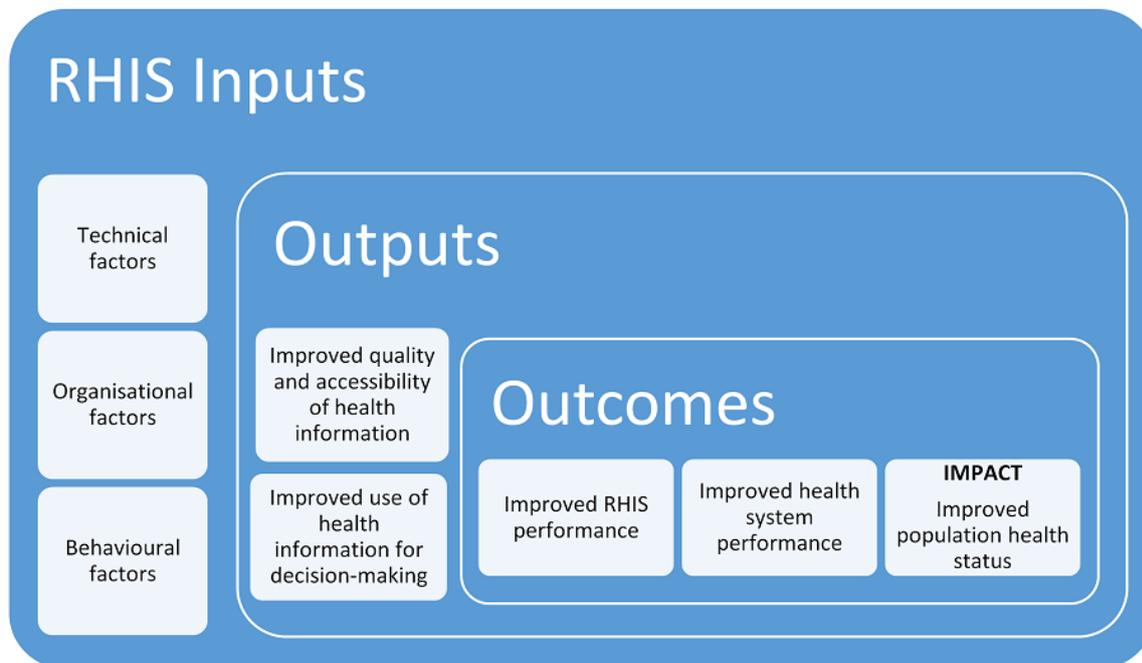
Figure 2.3 1: Relationship between inputs and impact in RHIS performance
Source: Leon et al. (2015)

Traditional approaches in RHIS performance assume that once data are collected and analysed they will be used. The assumption of the 'ideal' information decision-making relationship is that good-quality data generated by information systems will be transformed into information that is useful. This, in turn, will be used to make informed decisions to drive the organisation in the right direction leading to improved functioning and better use of resources. In the long term, the information can be regularly demanded, analysed, synthesised and reviewed, and knowledge will be applied and used for decision making, planning and policy making. However, recent studies done in low-income countries showed that RHIS were not producing the intended results (Garrib et al., 2008; Chaulagai, 2005; Sultan, 2011; Loveday et al., 2011). Garrib et al. (2008) evaluated the district health information system in rural KwaZulu-Natal in South Africa and found that there was a good understanding of the data collection and collation process, but that utilisation of data and feedback to clinics rarely occurred. Similarly, in Kenya and Tanzania use of locally collected information for planning and management purposes was

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very poor (Odhiambo-Otieno, 2005). Information utilisation for decision making about patients and daily operational management at health-facility level has been seen to be very limited and leaves a lot to be desired.

The evaluation of RHIS has been more focused on the internal, i.e. technical determinants with very minimal consideration of how organisational and behavioural determinants affect the performance of RHIS (Aqil, 2008). RHIS need to be complemented by a set of behavioural factors acting at the level of the individual data collectors and users of information as well as organisational factors which create an enabling environment for using and sustaining RHIS. The Performance Routine Information System Management (PRISM) framework elaborates on these factors.

2.4 Performance Routine Information System Management Framework

The PRISM framework is based on a holistic and integrated approach to health interventions, systems thinking, and modelling (Aqil, 2008). In order to understand the PRISM framework, it is necessary to first understand the underlying logical framework. The logical framework is defined as both a methodology and a tool that provides an overview of a project's goal, activities and anticipated results. The logical framework provides a structure that helps to specify the different components (resources), activities, and desired results of the project. The framework also assists in understanding the cause-and-effect relationship between available resources, planned activities, and desired changes or results.
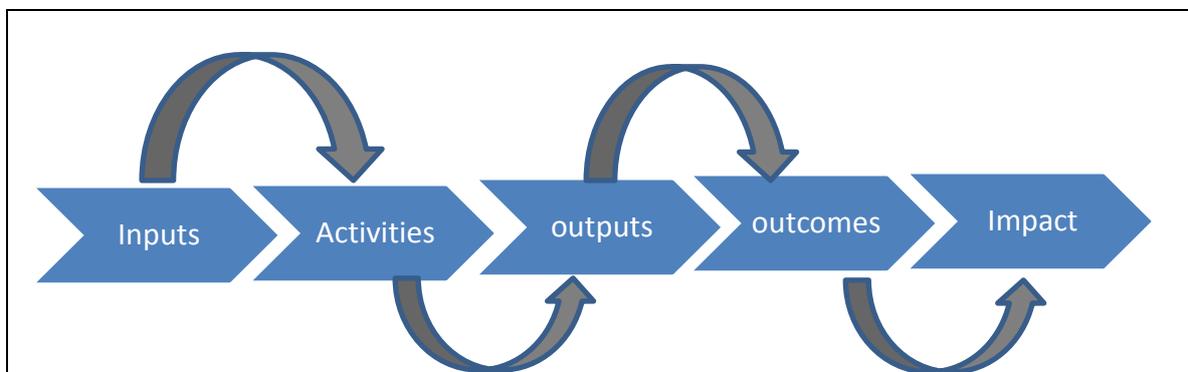
Figure 2.3 2: Logical framework

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The PRISM framework is an evidence-based framework used to evaluate the performance of routine health information performance based on two objectives the RHIS intends to achieve which are to produce high-quality routine health information and effective and continuous use of this information for decision making (Aqil, 2009). A good RHIS needs to function well technically and people need to be able to feed sound raw data into it so as to extract useful synthesised information. The PRISM framework identifies three determinants: *technical*, *organisational* or *behavioural* elements - that influence and shape RHIS performance and also represent areas for improving RHIS performance. It has been identified as the only framework that has empirically tested the relationships between these three determinants (Aqil et al., 2009; Leon et al., 2015).

The PRISM framework states that RHIS performance is affected by RHIS processes, which, in turn, are affected by technical, behavioural and organisational determinants (Figure 2.3). It shows that behavioural determinants have a direct influence on RHIS processes and performance. Technical and organisational determinants can also affect RHIS processes and performance directly or indirectly through behavioural determinants (Aqil et al., 2009). The PRISM framework delineates the direct and indirect relationships of the determinants on RHIS performance and measures their relative importance. The framework also opens opportunities for assessing the relationships among RHIS performance, health system performance, and health status (Aqil et al., 2009; Foreit and Moreland, 2006). It is well established in the literature that the technical, behavioural and organisational PRISM determinants can be used to assess opportunities and identify barriers to effective data utilisation using the PRISM assessment tools (Aqil et al., 2009; Aqil et al., 2008; Hotchkiss et al., 2010; Nicol et al., 2013; MEASURE Evaluation, 2010). These tools provide a structured way to assess the quality and use of information produced from the RHIS. Once barriers and opportunities have been identified, strategies to improve data utilisation can be developed and implemented.
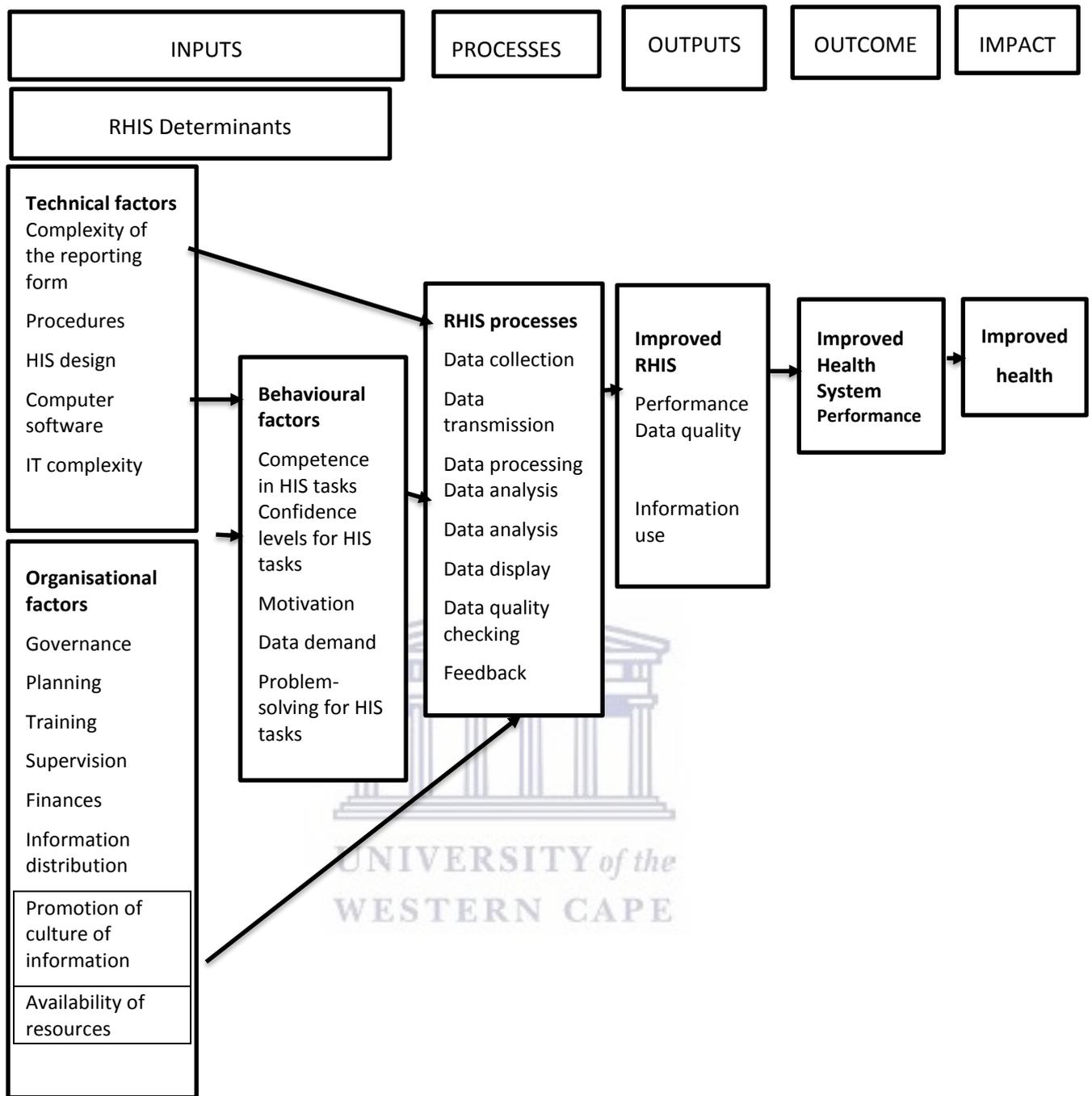
Figure 2.3 3 : PRISM framework

 Source: Aqil et al. (2009).

2.4.1   Behavioural determinants

The PRISM framework emphasises the importance of not only looking at the traditional technical ability of the individuals collecting and using the information as the most significant determinant of information use (Aqil et al., 2009). The framework also recognises that the existence of data-collection tools and the availability of the information generated from the RHIS is insufficient to ensure use of the information by users. As previously stated, information on its own does not improve service delivery. Information and an information system need to be complemented by a set of human behavioural factors acting at the level of the individual data collectors and users. The PRISM framework therefore identified the need to examine the significance of the behavioural aspects of the individuals collecting and using the information. The behavioural aspects noted in the PRISM framework include attitudes towards generation and use of information of the healthcare workers; their operational knowledge, competence and skills to use the information generated; and their motivation and problem-solving skills. Failure to address behavioural aspects can hinder the use of information for decision making.

2.4.1.1 Attitudes

The PRISM framework emphasises that the attitudes as well as the perceptions of the health worker collecting and/or using the information is key to successful RHIS performance. Bhana (2010) also alluded to this and states that the use of routine information for planning, monitoring and evaluation is influenced by the perceptions of the personnel who generate and use the HIS information. It has been noted that when the users of information have positive experiences and are exposed to positive messages about the benefits of using information in the decision-making process, the more likely they are to use information generated (Foreit et al., 2006). Regular use of information in decision making generates demand for quality information and this reinforces the processes of use of information in decision making (Nutley, 2012).

In low- and middle-income countries the responsibility for performing RHIS lies heavily with clinic personnel, mainly nurses, who are primarily responsible for providing healthcare services to patients and from whom routine health data are derived (Lovedale et al., 2006). This cadre of staff see patients and compile monthly statistics. These multiple responsibilities may

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interfere with the time they allocate to RHIS processes. Health care workers tend to value the provision of healthcare to patients over RHIS processes. Health managers do not view RHIS processes and utilisation of information as their primary task, their primary task is ensuring service provision (Lippeveld et al., 2006). The RHIS processes are not seen by facility managers and nurses as being immediately relevant to service delivery (Gashaw, 2006). This creates a negative attitude, as clinicians and health workers perceive RHIS as a useless activity or a waste of time that could be used for care provision. Negative staff attitudes are detrimental to the quality of the information generated (Health Metrics Network, 2008).

Nutley et al. (2013) noted that when users have positive experiences using information for decision making, this contributes to the generation of additional data and a continued commitment to improving the quality of data and continued information use. The relationship of improved information, demand for data, and continued information use creates a cycle that leads to improved health programmes and policies (Nutley et al., 2013). As part of an effort to improve demand and information use, the Data Demand and Information Use Cycle for strengthening the use of health information in decision making has been proposed (fig.2.3.4).
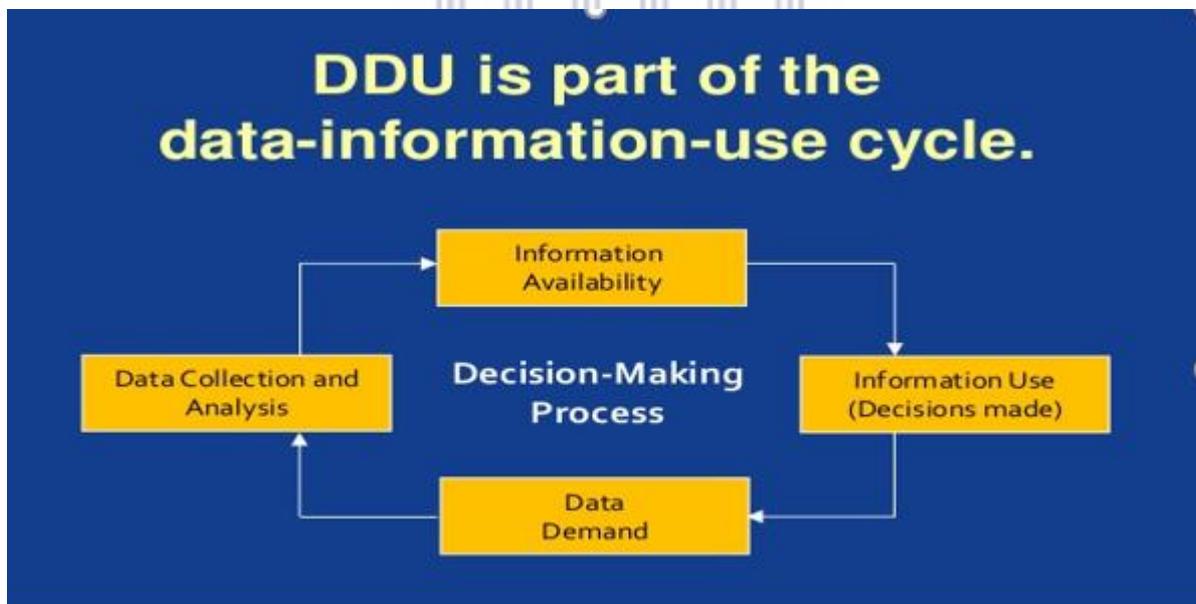
Figure 2.3 4: Data demand and information use cycle for strengthening the use of health information in decision making

Source: Foreit et al. (2006).

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When the health workers who are responsible for using the information do not recognise the potential benefit of the information then efforts undertaken to improve the quality of the information generated also decrease. Poor-quality information demotivates the users and results in information not being used to inform decisions (Lippeveld, 2000; Aqil et al., 2010).

There is a view by practitioners and researchers working on RHIS that when HIS users of health information are motivated, confident and competent in performing RHIS tasks, and when they understand their role in providing information for decision making, they have increased chances of using the information generated from the HIS (Hotchkiss et al., 2001; Health Metrics Network, 2008; RHINO, 2001).

2.4.1.2 *Lack of operational knowledge on how to use information (competence)*

Lippeveld (2000) and Pascal (2007) state that the availability of high-quality information does not guarantee appropriate use in decision making. The person who is meant to use the information needs to have the necessary knowledge and skills to use the information, in order to appreciate the value of the information. Chaulagai (2005) noted that there was a deep-routed traditional thinking that collecting data was only to fulfil reporting requirements and the managers were not aware of the other possible uses of information. This demonstrated that these managers did not understand the potential value of the information they had at their disposal. This created a missed opportunity to use this information to improve healthcare service delivery. Sultan (2011) noted that the lack of skilled, competent and trained human resources to use the information generated from the information system contributed to poor performance of the HIS in Ethiopia. Health managers in Busia District in Uganda reported that they had limited skills in using information and confirmed that decision making in their facilities was not based on data (Kalyowa, 2001). In addition, the majority of the health managers spent less of their time on focused HIS work.

2.4.1.3 *Technical knowledge and skills*

General skills in numeracy which involves the ability to understand and use numbers in daily life to perform a particular task, statistical knowledge and monitoring and evaluation are basic prerequisite skills for managers at lower levels (Loevinsohn, 1994). These skills enable healthcare managers to make sense of the available information for evidence-based decision

making (Loevinsohn, 1994; Aqil et al., 2010). The knowledge and skills that are needed for data processing, analysis, interpretation and problem-solving are usually not given due attention, this has an impact on the ability to use information (Health Metrics Network, 2008). A study conducted by Nicol et al. (2013) demonstrated that numeracy skills were weak amongst facility level staff in South Africa (Nicol et al., 2013). Loevinsohn (1994) concluded that the lack of such skills weakens the managers' ability to use information to improve service delivery.

In rural KwaZulu-Natal, South Africa, Garrib et al. (2008) found that, despite a good understanding of the data-collection and collation processes, there was little analysis, interpretation and utilisation of data at facility level by facility managers. Abouzahr and Boerma (2005) also noted the underdeveloped capacity to understand, analyse and interpret, and use information within the programmatic context at lower levels of healthcare by healthcare workers. In Tanzania, Kimaro and Twaakyondo (2005) found that most health workers failed to understand the purpose of collecting data and there was little evidence of use of information at facility or district level. Even when the information was made available and its quality had improved considerably, there was little improvement in its use in rationalising decisions.

Aqil et al. (2010) summarised that in many developing countries lack of basic monitoring and evaluation skills (which includes data collection, collation, analysis, interpretation, and use) was cited as a key obstacle to producing quality data and using it for decision making. He also cited that the majority of the study population indicated the need to build capacity in data analysis, interpretation and use of data. It is evident that the availability of these competencies facilitates the use of health information in decision making.

2.4.2 Technical determinants

The technical determinants are defined as all the factors related to the specialised know-how and technology to develop, manage and improve RHIS processes and performance (Foreit and Moreland, 2006). Technical factors affect the performance of the RHIS at all levels. A RHIS without a sound technical design, clear norms and standards, as well as well-trained people with adequate information-technology skills cannot give a comprehensive picture of health-system performance and cannot produce the information needed for making decisions (Aqil et al., 2009). The precursor for utilisation of information is the production of good-quality

http://etd.uwc.ac.za

information. This requires facilitating conditions such as availability of appropriate and reliable information technology, software design that meets the user requirements, and information systems with knowledge of the health-system environment.

2.4.2.1 Availability of information technology

Information technology equipment such as computers, internet connectivity, and power supply influences the use of information by healthcare managers. Aqil et al. (2010) reported that the lack of an information-technology infrastructure reduces the staff's ability to access the data and delays the reporting and analysis process. Manual data collection and analysis increases frequency of data errors and contributes to poor data quality. This limits the staff's ability to make effective decisions. The Health Metrics Network (2008) emphasises that information technologies can improve the amount and quality of the data collected, and communications technology can enhance the timeliness, analysis and use of information. Therefore, a communications infrastructure is needed to fully realise the potential benefits of information that may already be available.

2.4.2.2 Information-system design

Information-system design plays a major role in determining information use (Aqil et al., 2010). For the purpose of this study, information-system design will focus on the software used to develop the information system. The purpose of this software is to help information users to access information easily and assemble it to understand how the pieces of information fit together to create the larger picture. Ascertaining how well the software achieves its intended purpose necessitates measuring its usability. Usability, also known as the user's perspective of software quality, refers to the quality of a user's experience when interacting with the software (Bevan, 1999; Seefa, 1999). It is about effectiveness, efficiency and the overall satisfaction of the user. A well-designed software includes the combination of the factors such as intuitive design, ease of learning, efficiency of use, memorability, error frequency and severity, and subjective satisfaction. These factors are summarised and explained in Table 2.3 below.

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Table 1.3: Factors influencing success of information system software

Factor	Definition
Intuitive design	A nearly effortless understanding of the architecture and navigation of the site
Ease of learning	How fast a user who has never seen the user interface before can accomplish basic tasks
Efficiency of use	How fast an experienced user can accomplish tasks
Memorability	After visiting the site, if a user can remember enough to use it effectively in future visits
Error frequency and severity	How often users make errors while using the system, how serious the errors are, and how users recover from the errors
Subjective satisfaction	This indicates the extent to which the user likes the software during operation
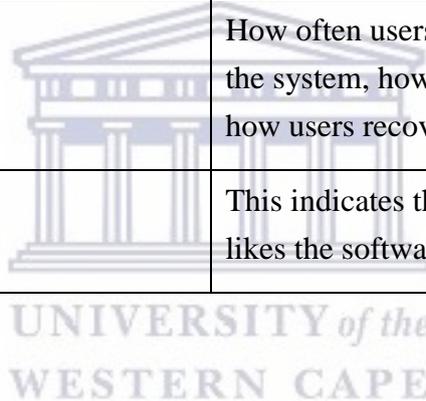
In essence, for software to be used it should be functional, reliable, efficient and the information display should be aesthetically pleasing (Bevan, 1999; Seefa, 1999). When software does not process data properly and in a timely manner, and resulting analyses do not provide meaningful conclusions for decision making, the use of the information is affected. Complicated and difficult reporting procedures have been mentioned as being a contributing factor to poor information utilisation as it leads to poor information accuracy and completeness which decreases the manager's motivation to analyse and use the information (Shagake, 2014; Aqil et al., 2010).

Lind and Lind (2005) recommend that users should be involved in the design and development process of HIS. Design is often done by technical information experts who are not familiar with the roles and responsibilities of the information users on the ground, resulting in a mismatch between what the users need and what the system is designed to produce. A study of the district HMIS after health-sector reform in Kenya suggests that one of the problems

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encountered was that key district staff were not involved in the development and implementation of the district HMIS and that consequently, the HMIS did not support strategic and operational management functions (Odhiambo-Otieno, 2005). The information produced from these scenarios becomes useless and the HIS adds no value.

2.4.3 Organisational determinants

Most writing in RHIS literature views organisational factors as critical in influencing the use of information for decision making (Aqil et al., 2009; Aqil et al., 2008; Garrib et al., 2008). The PRISM framework postulates that RHIS performance is affected directly or indirectly by organisational factors through behavioural factors. Organisational factors such as leadership, planning, management support, supervision, and culture have a direct influence on RHIS processes and performance.

Organisational factors include the promotion of a culture of information, such as emphasis on data quality, use of information, evidence-based decision making, feedback from staff and community, a sense of responsibility, empowerment and accountability, promoting problem solving, and incentives or reward for use of information (Health Metrics Network, 2008). Aqil et al. (2009) further noted RHIS governance, use of quality performance standards, planning, training, availability of finance, and supervision as additional organisational factors that contributes to the use of information for decision making.

Different authors hold different opinions regarding the organisational determinants that influence the use of information for decision making and on how to promote the use of formal information from the HIS. According to Aqil et al. (2009), the factors that contribute to successful use of information include human and financial resources, management support supervision and leadership, while Chaulagai et al. (2005) note that in Malawi, information use was limited because of a lack of accountability within the health-system hierarchy, and to the community. They also argue that a lack of performance management and incentives, and inadequate human resources to manage and use data, and to manage the health services were influential factors. Other studies in South Africa, Kenya and Tanzania noted the importance of factors such as supervision, management, and leadership as key to the successful use of information for decision making (Odhiambo-Otieno, 2005). Gladwin (2003) claims that an intervention to improve the HIS in Uganda was not successful because of the lack of alignment

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in a partially implemented decentralised management structure; the existing management style, tools and processes; and, the lack of support for training and supervision.

Leadership is needed to drive the shared values and culture of use of information within an organisation. This is achieved by setting a good example at the top. If senior management seeks information and uses it openly then the importance of information is reinforced throughout the organisation (Cibulskis and Hiawalyer, 2002). If the leadership fails to promote evidence-based decision making and the use of information for transparency and accountability then a culture of information is unlikely to be fostered (Kawale, 2011). Kamadjeu et al. (2015) highlighted leadership issues as one of the challenges faced with the adoption and sustainability of an electronic healthcare record in Cameroon.

Lorenzi et al. (1997) in their study on future directions in evaluation research, argue that people and organisational factors have been overlooked in HIS implementation, and maintain that these factors determine HIS successes or failures. These include motivation, culture and leadership, arguing that leadership involvement and ownership is crucial for the successful implementation of HIS and use of information for decision making.

Research done by Aqil et al. (2010) revealed that information use becomes very weak when organisational culture does not promote performance target monitoring (performance-based culture and incentives for performance), advocacy and sharing success stories. Similarly, in a study conducted in Uganda and Kenya lack of organisational support to analyse, disseminate and interpret data was viewed as a major constraint by key informants for healthcare managers to use information to improve decision making (Odhiambo-Otieno, 2005).

The absence of an information culture has been widely associated with the lack of information use in decision making particularly at the lower levels of the health-services system (Braa and Hedberg, 2001; Lippeveld, 2001). There is a view by some researchers that there is an existing information culture but the nature of this culture is problematic. They describe a data-collection culture with a focus on upward reporting, rather than local use of information to inform action at the point where the information is generated. Curry and Moore (2003) propose that the information culture has to be supported by the organisational culture. They suggest that, when the philosophy and practice of an information culture become the norm, it becomes embedded in an organisational culture, and becomes self-supporting. This is supported by Chaulagai et al. (2005) who concluded that a culture of evidence-based decision making is established when

collection, analysis and use of information becomes fully accepted as part of the culture in the entire health sector.

The use of information in decision -making is seen to create more demand for information, and to actively reinforce the culture of information use (Nutley and Reynolds, 2013). This is also the case when information leads to transparency and accountability (Health Metrics Network, 2008). In particular, managers need to model the use of information to subordinate managers and staff, communicating through their actions that information is needed and relied upon (Kimaro and Twaakyondo, 2005). In other words, if a culture of information is promoted by top leadership, personnel are likely to imitate it. Campbell (2003) also emphasises that follow-up of evidence-based decisions to see whether they have been implemented is another factor to promote on-going information use. Odhiambo-Otieno, (2005) stresses the importance of senior managers in modelling and promoting information use, demonstrating through action that information use is important. The author emphasises that senior managers need to promote the use of information in evidence based decision making for transparency and accountability, if this is not evident, it reduces the likelihood of adoption of culture of information use within the organisation.

In other words, if a culture of information is promoted by top leadership, this culture is more likely to be cascaded to all levels of the organisation. Perceived lack of use of information for quality decisions, therefore, is a cause of concern. Hence it is importance to understand the factors that influence information use. These findings provide a better understanding of the impact of organisational factors on the implementation of HIS.

2.4.4   The evaluation of culture of information use in South Africa

Rohde et al (2008) reviewed the role of information in decision making for primary health care settings. The authors reported that facilities are facing a growing reporting burden and suggested that regular reviews of data sets be done in order to identify and exclude elements and indicators that are no longer useful and include new more appropriate indicators. (Rohde, et al., 2008) The growing reporting burden due to the growing number of indicators may lead to managers with a reporting role spending less time on data analyses and use. The evaluators found that data was however not used for implementation and action. Their results indicate that managers at health administrative offices at national, provincial and district levels did not use health information for health service delivery

management, continuous monitoring or periodic evaluation. These results were in keeping with the findings of Garrib et al. (2008). In their evaluation of the DHIS in ten clinics in a rural district of South Africa, Garrib and colleagues found that although facilities spent a large amount of time on collecting and ensuring data quality, facilities had little understanding of the usefulness of data and that data was not used to inform targets or monitor plans. Data was not discussed at staff meetings or analysed by the staff members. Several reasons have been highlighted in the literature for the insufficient use of information for planning and management purposes, and for decision making. Burn and Shongwe (2004) highlight the insufficient use of information by hospital managers to manage services delivery at the hospital level. They attribute these inadequacies to the managers' lack of skills to use information generated for use. All these findings suggest that despite the routine collection of data in all South African public health facilities, just a handful of the information is used by decision makers.

2.4.5   The evaluation of TIER.net information system and its utility

The purpose of the ART three Tier system was to create a uniformed ART Monitoring and Evaluation system, that will enable to report from primary sources the numbers of patients on ART, their response to ART treatment and to monitor the program outcomes using routine data (White, 2016). The introduction of the strategy included the establishment of a new and reduced dataset reported monthly and quarterly (Hennessey, 2012). This qualifies TIER.net to be classified as a RHIS. The strategy standardises the collection of key ART indicators and is supported by the District Health Information System (Osler,2014). Prior to the introduction of the strategy, ART data were not locally available, were of limited completeness and quality, were not centrally available, and were not locally available for decision-making.

The study conducted by White (2016) demonstrated that with the introduction of TIER.net information system the data became available at the facility to support patient management, decision-making, and program improvement. However, the was evidence that the use of data were not adequately supported. This highlighted the need for health system strengthening success measures related to information systems to incorporate the use of data at all levels, and not just the submission of data. In addition, the study acknowledge that the comprehensive SOPs that articulate roles and responsibilities and describe expectations served as a reference document and assist to strengthen accountability. This was viewed to improved data quality. It

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was reported that facilities that were adherent to the ART SOP had the complete and credible data, however it was reported that the use of information generated was still sub-optimal at facility level.

2.5 Rationale for the research

There is widespread acknowledgement of the importance of a strong RHIS for effective and efficient health systems and the challenges associated with achieving this. The large number of studies and systematic reviews available, focused mostly on the technical aspects of strengthening HIS, especially information technology infrastructure and processes for improving the production of good quality data. The PRISM framework suggests that to identify suitable interventions for RHIS performance improvement, not only for technical determinants need to considered, but also behavioural and organisational factors. The framework notes the importance of behaviour and organisational determinants on the RHIS performance especially use of information generated form RHIS. There have been no studies that have investigated impact that the behavioural and organisational factors have on RHIS performance (information use) in Ekurhuleni district. This study investigated whether organisational and behavioural factors had an influence on use of information generated from TIER.net by facility managers and HAST coordinators in Ekurhuleni District. The knowledge gained by exploring the current data use practises and the factors that shape information use can aid in finding and implementing better ways to improve the current and future information use practices.

2.6 Summary

This literature review focused on three major components: (1) Defining the HIS and its relevance in healthcare management; (2) the use of information produced from the information system; and, (3) the evaluation of technical, behavioural and organisational barriers and enablers that impact on the use of health information frameworks. In addition, the chapter reviewed a broader body of literature which assisted in developing the conceptual framework that guided this research.

Chapter 3. Methodology

The aim of this chapter is to provide an overview of the methodology used in this study. It includes the aim and objectives of the study, the study design, study population, sample methods and sample size, characteristics of the study sites, health facility and health information personnel surveyed, information about the in-depth interviews, observations at facilities, and ethics considerations.

3.1   Aim of the study

The aim of the proposed study was to evaluate the use of information generated from TIER.net information system by healthcare managers in Ekurhuleni District in Gauteng Province.

3.2 Objectives of the study

The objectives of the study were as follows:

- To describe the current use of information generated from TIER.net by healthcare managers in the Ekurhuleni District for ART programme management.
- To explore the factors influencing utilisation of information by managers.

3.3 Study design

An exploratory and evaluative qualitative design was adopted. This was defined as the initial research into a hypothetical or theoretical idea to understand the nature of the problem, and an attempt to lay the groundwork that will lead to future studies (Creswell, 2003). This method allowed the researcher to gather insight into the factors influencing data utilisation by the participants.

3.4 Description of research setting

Ekurhuleni District in Gauteng is the fourth-largest municipality in South Africa with a population of 3 178 460. It is a densely populated, urban area of 1975 km² with a population density of 1609 persons/km², compared to the provincial average of 680 persons/km². According to the 2013 mid-year population estimate, the overall Gauteng population had grown

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by 2.74% and contributed to 25% of the country's population, with 24.3% (772 368) younger than 15 years and 4% (127 139) 65 years and over. Based on this, Ekurhuleni has also experienced rapid population growth which is expected to continue, fuelled in part by migration. Some of these migrants are from other provinces in South Africa, while the greatest proportion of them came from outside the country (Ekurhuleni District Health Plan, 2014).

In Ekurhuleni 77.4% of households are in formal dwellings (Household Survey 2013), compared to 78.6% in Gauteng. Ekurhuleni has the second-highest concentration of households living in informal dwellings after the City of Johannesburg, although there has been a decrease since 2008. The large numbers of informal and 'other' dwellings have important implications for the district including increased risk of TB and MDR TB, pneumonia and other infections due to the combination of poor housing and overcrowding (Ekurhuleni District Health Plan, 2014).

The percentage of Gauteng's population reliant on public healthcare was 84% in 2014 and 92% in 2015. On average, a person using public healthcare in Ekurhuleni will visit a healthcare facility, be it one of the six (only one district hospital) hospitals or 96 primary healthcare (PHC) facilities, 1.8 times per annum. In Ekurhuleni, the leading causes of death are ranked as follows; HIV 102.5%; lower respiratory tract infections 91.6%; TB 87.3%; cerebrovascular accidents 77.7%; ischaemic heart conditions 77,5%; hypertension 52,8%; diabetes 39,6% followed by chronic obstructive pulmonary disease at 36,5% (Ekurhuleni District Health Plan, 2014).

In the Ekurhuleni District, the local and provincial authorities offer healthcare services and both these management structures are responsible for service delivery. The province, through the district management, has a service-level agreement with the Ekurhuleni Metro Municipality (EMM) to manage one health post and 13 mobile health services, 79 primary health centres, and one community health centre. While the province through the District Management Structure manages two mobile health services, four primary health centres, six community health centres and one district hospital. All services are reported under the district health management. Each government sphere has its own management structure. These two government levels meet on a monthly and quarterly basis to discuss high-level management and strategic issues. The list of PHC facilities per sub-district as at 31 March 2014/15 is shown in Table 3.1.

Table 3.1: Description of healthcare facilities in Ekurhuleni

Sub-Districts	Health Posts		Mobiles		Clinics		Satellites		CDC		CHC		Standalone MOU		District Hospitals	
	LG	P	LG	P	LG	P	P	P	LG	P	LG	P	LG	P	P	P
E1	1	0	0	0	12	0	0	0	0	0	0	1	0		0	0
E2	0	0	4	1	14	1	0	0	0	0	0	2	0		0	0
N1	0	0	0	0	11	0	0	0	0	0	0	0	0		0	0
N2	0	0	5	1	14	1	0	0	0	0	1	0	0		0	0
S1	0	0	0	0	13	1	0	0	0	0	0	1	0		0	1
S2	0	0	4	0	15	1	0	0	0	0	0	2	0		0	0
	1	0	0	0	79	4	0	0	0	0	0	0	0		0	0
District total	1		15		83		0		0		7		0		1	

Source: Ekurhuleni District Health Plan 2014 Document

The district is further divided into six sub-districts namely: Ekurhuleni South 1, Ekurhuleni South 2, East 1, East 2, North 1 and North. The HIV prevalence among the population attending antenatal clinics was estimated at 31% in 2013 (Massyn et al., 2013). The district has achieved significant gains in increasing the number of HIV-positive clients initiated on ART. This number increased from a total of 9829 adults and children on ART in April 2010 to 200 084 in April 2016.

Currently there are 96 facilities providing ART services and their cumulative number of clients on ART is listed in the table below.

Table 3.2 Total number of clients on ART by year

All facilities	2010	2011	2012	2013	2014	2015	2016
Adult remaining on ART at end of the month - total	9 829	33 246	102 392	132 253	157 137	173 796	200 084

Source: Ekurhuleni DHIS 2016

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The information flow from the facility to the district is stipulated on the District Health Management Information System (DHMIS) (National Department of Health, 2011). The patient-level data are collected at the point of service which includes mobiles, satellite clinics, health posts, clinics, community centres and hospitals. At health-facility level the patient-level data are collected during each patient visit, these data are validated, processed and aggregated. The facility-specific reports are generated and submitted to the sub-district office. At this level, all facility reports generated from facilities belonging to that sub-district are further aggregated to form one sub-district level report which is submitted to the district level. Similar aggregation takes place for all sub-districts reports forming a district report. Once the district-level report is generated it is submitted to provincial level and eventually to national level. It is expected that at each level data are reviewed at the level's monthly review meeting and remedial interventions are implemented where required.

3.5 Study population and sampling

The study population constituted different cadres of health managers in the public-health sector working in the Antiretroviral treatment, and HIV and AIDS, Sexually Transmitted Infection (HAST) programme at Ekurhuleni District and East, North and South sub-district levels. The study population also included facility managers from facilities that provide ART services and have been implementing TIER.net for at least a year. The list of staff, designations and geographic location was obtained from the district human resources office.

The inclusion criteria were HAST coordinators currently working at the district and facility managers who had been working in facilities that were providing ART services and were on phase-6 TIER.net.[c] Mobile, health post, and satellite clinics were excluded, as these types of facilities are mostly linked to the nearest healthcare facility and their data are submitted and reported under that facility.

The sampling method used for HAST coordinators was purposeful sampling as the EMM has two HAST coordinators in each sub-district and the Provincial DOH has one in each district - in total there are 15 HAST coordinators for the entire district.

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[c] Phase-6 Tier.net: Live site (facility) and site able to produce Monthly and Quarterly reports from the electronic TIER.net information system

Cluster sampling was used for facility managers based on the size of the facility they were managing (number of patients remaining in ART care). By the end of February 2015, there were 85 healthcare facilities that were officially signed off and using TIER.net. Ten facility managers were randomly selected to participate in the study. Five facility managers were selected from the 67 small-size facilities and the other five facility managers were selected from the 18 large facilities. A list of small and large facilities was drawn from TIER.net, and an automated random-generator system was used to select five small-size and five large-size facilities.

3.6 Data collection

Data collection was done through semi-structured, face-to-face interviews. An interview guide (Appendix A) was used to maintain consistency between interviews. The interviews were digitally recorded to ensure that all responses were captured and then transcribed in full.

In total, nine out of ten facility managers and three out of five HAST coordinators from Ekurhuleni District were interviewed. This was due to the fact that the data-collection process reached saturation. As the study was going on, the interview responses from both facility managers and HAST coordinators became repetitive and no additional new information was obtained. No one refused to participate in the study or withdrew participation during the course of the interview. The interview sessions with the facility managers were 45 minutes to an hour long and the interviews with the HAST coordinators lasted between 30 to 40 minutes.

3.7 Data analysis

Thematic content analysis was used to analyse the data collected from the interviews (Aun and Clarke, 2012). Themes were categorised based on the PRISM framework namely: technical, behavioural and organisational determinants. The analysis of technical determinants focused on the availability of an information-technology infrastructure; the structure and design of information generated from TIER.net; the information-flow process; the technical knowledge and skills of the individuals processing and using the information; and, the usability of the information generated. Behavioural determinants included an analysis of information demand, motivation, confidence, task competence, and problem-solving skills. Organisational factors

included an analysis of the level of promotion of a culture of information use for health performance management generated from TIER.net.

Interviews were recorded (with the consent of participants) and transcribed. The researcher read the transcripts to be familiar with the data as well as to identify potential themes or patterns. Transcripts were analysed for main themes and coded according to themes using ATLAS ti. software. During the first phase of analysis, the researcher performed an initial scanning of the data, to search for words or phrases used by the participants linking them to the predefined codes. Using thematic analysis, codes were attached to all transcripts, then clustered together to form the broader themes and sub-themes. The focus of the coding was mainly guided by the interview schedule and the themes were to large extent derived from the literature reviewed and the theoretical background of the research questions. During this process, additional themes emerged from the interviews that were not initially included in the interview schedule. These themes were also explored.

The researcher then generated a list of items or codes that were reoccurring from the data set thereby identifying important features of the data that might be relevant to answering the research question. The researcher combined codes to create overarching themes. The researcher checked the potential themes against the data set, to determine if the themes tell a convincing story of the data, and identified those themes that answered the research question. During this process, the researcher needed to refine, split, combine, or discard certain themes. The researcher defined and refined existing themes that were presented in the final analysis while developing a detailed analysis of each theme to be presented. Following this, the researcher wrote the final report based on the themes that make meaningful contributions to answering research.

3.8 Rigor

Rigor was ensured by paying attention to credibility and trustworthiness. Credibility was achieved by applying correct sampling methods, including randomising the population to ensure an equal opportunity for each individual to participate. Credibility was enhanced by clearly describing the context, setting and themes used for the study and by ensuring that data collected covered all themes and the codes were built in and applied as intended. Participants' recognition of findings was used to ensure credibility not only for verification of the data but for confirming that the data captured were correct (Graneheim and Lundman, 2004).

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Trustworthiness refers to the extent to which findings can be transferred to other settings or groups. To increase possibility of transferability of findings, a clear and distinct description of context, selection, and characteristics of participants, data collection and analysis was provided (Graneheim and Lundman, 2004).

3.9 Ethics considerations

The principles of ethics were applied to this study. The study was carried out after acquiring permission from the Ekurhuleni Research unit responsible for approving studies to be conducted in the district. The University of the Western Cape Biomedical Research Ethics Committee granted permission for the study's execution once they were satisfied that the study conformed to acceptable scientific norms and standards. The information sheet with the definition, purpose, and benefits of the study including any risk and inconvenience this study may cause was narrated and provided to the participants. Written consent was requested from the participants. Participant anonymity was safeguarded by not using their designation and referring to all as 'managers' and 'coordinators.' This was applied consistently throughout all the stages of data collation, analysis, storage and publication. To achieve fairness, prospective participants were informed that they had the right to withdraw at any time and could refuse to provide information. To achieve non-maleficence and beneficence the study rendered minimal harm to the study population. The only harm was in terms of the manager's time taken to complete the interview. The interviews were conducted during working hours which potentially prevented the managers from conducting other activities. The risk was limited by scheduling the interview appointments during less-busy periods. Potential harm was outweighed by the benefit of the study to the managers as the results of the study will assist in improving the managers' understanding of barriers to information use. By understanding these barriers, strategies to improve information use can be developed to enable managers to use information to improve the quality of care provided to the patients and improve health outcomes.

Chapter 4. Results

4.1 Description of study participants

All 12 participants had formal qualifications, five participants had a diploma in nursing, six participants had a degree in nursing and one had specialised training in advanced psychiatric nursing (Table 1). There was no significant difference in the level of education between the HAST coordinators and facility managers. They had between two and 10 years of experience working in primary healthcare services. Also, there was no meaningful difference in the number of years in the position between the facility managers and HAST coordinators.

Table 4.1. Respondent's demographic characteristics

	Facility manager	HAST Coordinator	Total
Number of participants	9	3	12
Years in current position Less than 3 3 – 4 5 and more	4 3 2	2 0 1	6 3 3
Education level Diploma in nursing Degree in nursing Others (Specialised training)	4 4 1	1 2 0	5 6 1

4.2 Description of themes and subthemes

The interview responses were categorised into three main themes and eight sub-themes according to the multidimensional determinants of the PRISM conceptual framework. The PRISM determinants (technical, behavioural and organisational) were used as the main themes.

Table 4.2 Indicates research themes, sub-themes and codes derived from the managers and HAST coordinators' responses.

Table 4.2 Research themes, sub-themes and codes.

Themes	Sub-themes	Codes
Technical determinants	System and software design	Paperless system
		Provide relevant information
		Timeliness of information
		User-friendly system
	Technical proficiency (information technology skills and knowledge of the users)	Unable to operate the system to generate reports
		Computer literacy skills
Behavioural determinants	Confidence in performing the HIS tasks	Dependence on someone else
		Not their primary task
		Regular practice or use of the system
	Motivation towards RHIS-related tasks	Potential benefits derived from the system
		No time for data-related tasks
		Staff workload
		Knowledge of the content of the reports generated from the system
	Skills and competences towards performing RHIS tasks	Skills to interpret the reports
		Skill to analyse the reports
		Skills to draw graphs/data visualisation
Organisational determinants	Supporting environment	Resources to perform HIS task
		Human resources
		Support visits
	Culture of information use	Standard operating procedures
		Policies
		Information review meetings and purpose
		Access to information
	Evidence-based decision making	Communication and feedback

4.3 Technical determinants

Technical determinants are defined as all the factors related to the data-collection process, including the tools and technologies used to develop, manage and improve RHIS performance. With reference to technical determinants, two sub-themes emerged from the evaluation responses, namely system software design and the technical proficiency of the users. The technical computer software design aspect investigated the functionality and manner in which the system creates access to the information, while proficiency of the users examined the ability of the users to use the software to develop, manage and improve RHIS function.

4.3.1   System software design

The TIER.net system software design is responsible for processing and conveying the information to the users, therefore the software used should be designed so that it satisfies the user requirements in terms of functionality and aesthetics. The common thread from the interviews in relation to the functionality was that TIER.net software design was usable and allowed relevant cadres of staff to perform and accomplish intended tasks. The issues that were reported by facility managers relevant to software design included relevance and timeliness of information produced, user-friendliness, and a paperless system.

In general facility managers viewed the computer software used in TIER.net to be efficient in meeting their data-collection and collation needs. They expressed having a positive experience with the paperless register used for collecting ART patient information. They mentioned that the transition from paper-based ART longitudinal registers to the electronic TIER.net system provided them with an easy method of retrieving patient and programmatic information. They expressed that TIER.net allowed them to automatically generate information without manually going through each patient folder or cumbersome longitudinal ART paper registers.

> *"The system has relieved us from manual pulling out of information from registers more especially now that we are in Tier phase-6 we don't use paper registers anymore. This helps because when senior district leadership need information or when we prepare reports at the end of the monthly, we don't have to go through all patient files to see how many of them started ARV treatment. One just clicks and gets the data as quick as possible. It takes you less than 5 minutes to get that information". Participant 7 – Facility manager*

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Both facility managers and HAST coordinators reported that the system produced reports which, in many instances, provided relevant and insightful information that they could use to effectively manage the ART programme. They also indicated that the system produced relevant information useful to the healthcare providers and clinicians for day-to-day patient management. Facility managers mentioned that the reports generated from TIER.net provided information that allowed clinicians to effectively manage patients on ART by monitoring the appropriate clinical and immunological responses to ART treatment. This enabled clinicians to identify patients who were not achieving desired outcomes and to take corrective actions to improve patient outcomes. Moreover, it was mentioned that TIER.net produced information on the ART drug regimen that the patient is on, and all side-effects are recorded and updated to ensure that clinicians provide optimum management of ART patients.

> *"The reports provide information for us to look at the ART initiation and see how many CD4 counts were done in a particular month and from those how many were initiated on ART. For those that were not initiated, we want to find out why they were not initiated. It also helps us to see if the patients were lost to follow up, as we are dealing with mobile communities. We also had a problem with Aluvia, I wanted to know exactly how many patients are on Aluvia in my facility, I asked my data capturer to run a report and he gave me the number of those patients". Participant 5 – Facility manager*

Most facility managers viewed timeliness of information as the availability of information for use and reporting on a specific or agreed deadline. All facility managers mentioned that the value of TIER.net was that it can produce timely patient and programme information when needed. They expressed that the ART information on TIER.net was to a certain degree up to date and available when needed. Most of the facility managers stated that the information was readily available for them in most cases to submit reports on time and according to set deadlines. All managers viewed this as the most helpful and important function of the system as it assisted them to meet the reporting deadlines. One facility manager explained how the system had enabled him to submit reports to the sub-district information office on time.

> *"TIER.net helps a lot, when we compile our stats at the end of the month it makes life easier. We are able to generate reports and our reports are submitted on time. To tell you the truth I felt wow, when we have to submit we don't stress anymore because we*

just generate the data and there are a lot of reports that you can generate, you just need to follow the steps, and it was easy for me". Participant 6 – Facility manager

All the managers reported that the TIER.net system was easy to learn and user friendly. With regards to aesthetics, TIER.net software was designed in a manner that mimicked the paper-based ART clinical stationary. Also, the manner in which the information is structured and displayed on the computer screen allows for easy navigation from one step to the next. This has made it easy for the managers to navigate, as concise information is displayed on the screen at a certain point in time.

"The system is very user friendly though it needs one to be trained thoroughly on it. It's easy to work with once you know it. During the training, I was immediately comfortable and familiar with the system. I never had to guess what the next step was going to be, honestly if you know your clinical stationary, it is intuitive and it becomes easy for you to navigate and also the screens are easy to read''. Participant 7 – Facility manager

4.3.2   Technical proficiency

The second aspect that was linked to technical determinants for use of information was the technical proficiency of the users to handle tasks related to generating and using information. Two issues were identified; these were the computer-literacy levels of the users and well as the technical ability of the users to generate the TIER.net outcome reports. All participating managers were asked about their computer literacy skills. They reported that they had received computer training and they viewed themselves as computer literate and proficient in using computers. They also viewed their computer skills as adequate for performing the tasks that require computer use. With regards to technical ability to generate reports, different sentiments were expressed by the facility managers and HAST coordinators. The majority of respondents indicated that they had limited skills and knowledge on how to operate and use the system efficiently. Both facility managers and HAST coordinators were trained on the TIER.net system as a prerequisite of implementing the system in their respective health facilities, giving an impression that managers were capacitated to operate and generate information from the system. Despite the training received, participants reported that they did not know how to generate reports. One facility manager reported that she attempted to generate the reports but did not know how. Facility managers therefore delegated responsibility for generating the

information from TIER.net to their data-capturing and clerical staff. Both facility managers and HAST coordinators stated that they depended on data capturers to draw the reports. Almost all managers reported that when data capturers were not on duty, managers were unable to obtain the reports.

"No, I don't know how to draw the reports, I don't have much practice, I have been trained for 5 days but training without frequent exposure on what you have been trained on sometimes you forget what you have been trained on because you are not always on computer due to the demand of the patients in the consulting room. The problem is the time to practise. I have never practised it; I had one or two lessons. The last time I had it, it was when the system was introduced, you know with the computer if you are not practising you lose what you know. I would use TIER definitely. It has a lot of reports. I am very lucky that I have a very well-informed DC [data capturer] who assists me. Even if I don't know which reports to run he will assist me with running reports. We need to be orientated on the system so that we are able to work the system on our own. At the moment, I depend on Aurum (Partners) Data monitors for them to draw the reports for me." Participant 9 – Facility manager

The inability to generate reports appeared to be more pronounced mong HAST coordinators. They mentioned that they were not even aware of the reports that can be generated from TIER.net.

"I can do a bit of data entry but I cannot manipulate it. My skills with TIER are poor, I can't generate reports. But I understand it. Even other nurses in the facilities that I supervise do not have knowledge of TIER.net or the reports for that matter, I don't want to lie, I know my nurses cannot operate TIER and they cannot go to the screen and operate TIER. I was trained on how to use the system. I cannot say that my staff is comfortable in collecting and generating data. I cannot say my staff is able to use data, I'm not happy, I feel that I am not entirely happy about their skills with TIER.net." Participant 4 – HAST coordinator

4.4 Behavioural determinants

Behavioural determinants play a pivotal role in influencing the quality of the information, and the manner and extent to which the facility managers and HAST coordinators use or fail to use the information generated from TIER.net. In this study, behavioural determinants were divided into two categories. The first category dealt with assessment of the actual skills of the facility managers and HAST coordinators. The skills were measured in terms of competence in RHIS tasks, which included defining the indicators, data analysis, data presentation, data interpretation, problem-solving skills using the available data, as well as using data for management. The second category dealt with perceived skills which involved intangible concepts such as assessing the participant's confidence level for RHIS tasks, the motivation to perform RHIS-related tasks, and the knowledge of or rationale for including certain types of information in reporting forms.

4.4.1 Competence in performing HIS tasks

The formulation and interpretation of the competences in performing the HIS tasks included the ability to define and calculate the indicators; read and interpret the reports generated from TIER.net; the skills and competence to analyse the data from the reports; competence in drawing and reading the graphical presentations of the data; as well as competence in using the information generated from the system for decision making. When managers and HAST coordinators were given the report as part of the exercise to define indicators and data elements generated from TIER.net, there was a vast difference amongst participants in the manner that they understood and defined the indicators and the data elements used to monitor the ART programme. There was no common understanding of indicators amongst the participants despite the availability of the indicator dictionary. Varying indicator definition narratives were given by both facility managers and HAST coordinators when either defining the indicator as a whole or when breaking down the indicator into the numerator and denominator. The participants either included or excluded some constituents of the denominator or of the numerator. A facility manager responded as follows when asked to define the meaning of any of the indicators generated from the TIER.net:

> *"no mhhmm I do not know all the indicators, I can maybe think of the viral-load suppression, If I am not mistaken you check at 6 months, let's say now we are in July if the patient started medication in Feb, they must be checked if viral load is suppressing,*

so that how many patients we have initiated in February. The upper one is the… what is it again (Numerator) viral loads over initiated six months ago. Then you will get the percentage of viral-load suppression. that will inform you that the ARV programme is working if you get 100% or 90% and 90 % of them they must be suppressed."
Participant 9 – Facility manager

One facility manager stated:

"I am not confident about numerators and denominators of the TIER indicators, we will appreciate it we could get more in-service training on them" Participant 6 – Facility manager

The description given by the facility manager above demonstrated an incorrect understanding of how the indicator was formulated. In this case, the manager used the numerator definition of one indicator and the denominator definition of a different indicator. Quotes like this indicate a lack of understanding of the indicator definition and make it unlikely that the report, containing indicators, would be used by managers.

TIER.net produces a variety of reports that could be of value to facility managers and HAST coordinators for the effective day-to-day management of the health facility and patient management. In order for these reports to add value, managers need to be able to read and understand their content. When facility managers were given an exercise to ascertain their knowledge of the content of the report generated from TIER.net system, it was surprising that only two facility managers were competent (demonstrated understanding of the report), and could explain and fully engage with the report content. These facility managers were also able to interpret and narrate the report content. However, some of the respondents were unable to read and explain the contents of the ART monthly report. Furthermore, two of the managers could not read the report. In addition, some respondents were unable to recognise the standard ART cohort report and were not aware of the existence of this report. They stated that they had never seen the reports nor had they been provided with the reports. The explanations given by two participants were:

"I do not know this report. I cannot read this report from the paper. It is not the same as the one that we generate from our system. It doesn't look like the way that it appears

on the screen. Can you please show me on the system? I think it is different from the one I know." Participant 5 – Facility manager

 "I have not seen this and I do not receive this on monthly basis not on my side. No-no-no I have never seen it. Who is responsible for giving it to me? The data capturer has never given this report to me …. we don't use this report in our stats." Participant 6 – Facility manager

The ability of facility managers and HAST coordinators to conduct data analysis, a process that assists with uncovering useful information to support decision making, was also assessed. Information supplied during the interviews suggested that the concept of data analysis was not understood by respondents. This explains why it was not done at facility level. When the managers were asked to define their understanding of data analysis and its purpose, it was clear that a number of facility managers and HAST coordinators were not clear about what data analysis was about or what it aimed to achieve. On two occasions respondents confused data analysis with data interpretation and used these two terms interchangeably.

> *"Data interpretation is the same as analysis and the same as rechecking the data." Participant 8 – Facility manager*

The responses suggest that data analysis was not routinely done at facility level by facility managers. For example, some managers mentioned that they were not engaging with the information generated from TIER.net as much as they would like and that information was reported to higher levels without being interrogated to see if the data makes sense or is a true reflection of facility performance. Facility managers mentioned that they did not analyse the data because they do not know how to and do not have sufficient skills and competence to analyse and interrogate the data. Respondents expressed that they were not trained on data analysis and expressed a need for training to improve their skills. One HAST coordinator stated:

> *"Half yes and half no. Yes, because the data elements that are contained in that report I am very familiar and I know them. No because as for the translating the raw data into some form of information I am clueless. In the sense that if someone comes to me as says this particular facility is under performing in this indicator I can understand it but as for me looking at the data and picking it up I will not be able. It is still a challenge*

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and I normally require someone to analyse and interpret the report for me." Participant 4– HAST coordinator

The programmatic information that is generated from the facility TIER.net can be presented graphically or in a table format. It can also be manually extracted, summarised and presented as health indicators in graphical format, allowing facility managers and other clinical staff to track indicator performance over time, show indicator trends over time, and distribution by age and gender. But the chart-production functionality of TIER.net appeared to be grossly underutilised in almost all facilities. Although the data were readily available at facility level, facilities relied on the information officers at sub-district and district level to prepare graphs and send the graphs to the respective facilities. This meant that facilities had a limited say in which indicators should be graphically presented for them to monitor. Facility-specific performance graphs were displayed on the facility manager's notice boards or on the walls in almost all facilities. However, the graphs that were displayed showed only two quarters of data for each indicator displayed. Secondly, bar graphs were used to display facility performance. Thirdly, because a shorter run of data was displayed, there were no trend lines or median lines indicated on the charts.

An interesting observation at the time of the interviews was that managers were well aware of the facility targets of other health programmes but they were not aware of the targets for the indicators generated from TIER.net. The graphs that were displayed did not include target lines although other programme graphs did. The managers explained that they do not create their own charts. The charts were created at the sub-district information office and managers are only responsible for printing and displaying the charts in their facilities.

Two respondents mentioned that:

"I can enter the data on Excel when the tables are already prepared, but I have been asking some of my colleagues to show me how to do the graphs on Excel but I cannot start from scratch on the computer." Participant 9 – Facility manager

"I cannot do the graphs, they are sent to us from the information office and all I do is to put the graphs into the PowerPoint slides so that they can be presented to the facilities during the HAST reviews. They provide us with performance of the two quarters to compare. I think what we are doing is just too basic and it is not even strategic." Participant 4 – HAST coordinator

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4.4.2 Confidence in performing the HIS tasks

Confidence in performing HIS-related tasks increases the chances that the tasks will be performed. Facility managers indicated that they were not comfortable and confident in performing HIS-related tasks. This included confidence in analysing; computing trends from bar charts; interpreting data; and, explaining findings and their implications for the programme using information generated from TIER.net. This could explain why some managers were reluctant to answer questions related to definition of the indicators; explaining the content of the results generated from the TIER.net report; and explaining the meaning of the health-indicator graphs displayed on the wall. One participant explained that:

> *"I cannot say I am comfortable with analysis and interpreting the data. I have never done it. People are not conversant with the analysis, I can tell you that much." Participant 3 – HAST coordinator*

It also emerged that all but one facility managers were dependent on data capturers in their facility to do all data-related functions, as this cadre of staff were able to draw and read graphs. The majority of facility managers reported that they had neither capacity nor skills to perform graphical presentations. The HAST coordinators interviewed expressed the same sentiments stating that:

> *"I can speak for the majority of the coordinators. We are not good with data display. We want to be able to compare facilities and districts using graphs but I cannot. I would like to be capacitated on that. We need to be able to easily generate reports that show trends and draw conclusions about programme progress." Participant 2 – HAST coordinator*

4.4.3 Motivation towards use of information

From the results of the study, factors that motivated or hindered managers to use information were brought to light. One of the factors that contributed to managers using the information generated from the TIER.net was the perceived benefit derived from using the system as it provided useful information. According to the respondents this made them want to engage more with the system.

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"It's effective when it comes to us managing patients, but I must be open that we are operating through our data capturers. Through the help of our DC, when we do our assessments, it becomes easy for us to manage data. So, we use it more nowadays. Information generated helps us to know how many drugs/medications we need to order, where we need to train our staff. TIER.net tells us how many clients are in our programme and we can take it from there." Participant 7 – Facility manager

Another indicator used to measure motivation was the participant's willingness to continue using the system. Most managers mentioned that even though they experienced some challenges with using information, they were willing to get help and resolve the issues. In this case, all participants reported wanting to continue using the system as they perceived value derived from the system in managing the ART programme.

"I would use TIER.net definitely. It has lot of reports that one could run and analyse; they help in making plans and giving feedback to the staff. We don't have the time to do that, but if I had extra support and enough staff I would certainly do that." Participant 11- Facility manager

A recurring pattern apparent in this study was the need for coaching and mentoring on generating, analysing, interpreting and understanding the TIER.net reports by most managers. Most participants stated that they needed additional training or refresher training because they could not remember how to run and read the reports. One expressed this as follows:

"We need to be orientated on the system so that we are able to work the system on our own especially with understanding the reports and reading graphs. At the moment, I depend on Aurum (Partners) Data monitors for them to draw and explain the reports for me." Participant 12 - Facility manager

The following section provides an understanding of the propensity of participants towards performing HIS-related functions. It was compiled from the responses indicating that data-related functions including analysis, presentation, and use were not prioritised. Whilst everyone agreed and understood that these were valid and important activities, in practice few participants were prioritising them. All managers described the primary barriers to use of

information as competing priorities, work load, and staff shortages. Facility managers had to perform management and administrative duties whilst also providing clinical services. In most cases managers gave patient care priority over managerial and administrative duties. They felt that high workload (described as patient to clinical practitioner ratio) and shortage of nursing staff were the main reasons for not prioritising data-related functions. This view was shared by all facility managers. One said:

> *"As a facility manager, you know that there are things that we are supposed to do. We are supposed to be checking clinical records, running the reports on TIER analysing them, making plans and giving feedback to the staff and evaluation of our performance. But we end up not doing them because we do other things that are not our responsibility. Due to the shortage of staff, we don't have the time to do that, but if I had extra support and enough staff and this is frustrating." Participant 9 – Facility manager*

To support the concerns around staff shortages and competing priorities, one facility manager commented:

> *"They say we must review our own data at the clinic but we do not have time. It is a challenge because you know on such a date we will have a review you must go through your data in preparation for the review, but, you need to attend to the patients before they start complaining about long waiting times and you will attend to the data later. Before you know the date for the review is here. We haven't analysed our data then you get surprised when you see your clinic data presented." Participant 9 – Facility manager*

Facility managers and HAST coordinators were asked how they were using the data, all facility managers reported that they were using the information to make decisions related to budgeting, staffing, drug procurement and medical supplies. Some facility managers reported that they used data to make decisions on service delivery, monitor progress and assess performance of the facility in terms of meeting targets, identifying problems with service delivery, and improving clinical outcomes. The use of information was different for HAST coordinators as there was no indication that they were using data generated from TIER.net to inform their supportive supervision to facility managers or to inform the technical assistance required at facility level. This was a common thread from all respondents, one HAST coordinator stated:

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"To be honest, we do not use data to inform our visit, you cannot say I went to that clinic because of this data. Usually we just visit and when you are there you see what the problem is. We cannot really plan what we are going to do. No, we cannot plan. The only programme that we use data for is the TB programme because there we do have access to the data. We do not look at the data before we go to the clinics to support." Participant 3 - HAST coordinator

When the relationship between self-reported data use and other variables such as competency with analytic tasks and interpreting the contents of the TIER.net report by facility managers and HAST coordinators was compared, a discrepancy between these variables was discovered. The previous quote regarding use of information by managers suggests that managers are aware of the possible use of information. However, the responses from the data analysis, presentation, and interpretation section highlighted conflicting results. Responses demonstrated that the majority of managers and coordinators were unable to read, analyse, interpret and present the data. It was therefore surprising that facility managers reported extensive use of information generated from the TIER.net system if they do not understand the contents, including indicator definitions, of the report from which information is extracted.

Coupled with this was the frequency at which the information on patients who have missed early and late clinic visits as well as patient's due for viral load testing was generated at facilities. The frequency of generating this information should allow for immediate action to be taken by following up on these patients and bringing them back to facilities to ensure their retention in ART care, however, processes to react to these alerts were not being implemented effectively. Poor data analysis and interpretation of the reports limited the value of this information.

4.5 Organisational determinants

The healthcare workers responsible for collecting and using the information generated from TIER.net work in healthcare organisations. These organisations set a tone and shape, cultivate and influence the manner in which the information is used within the organisation. Feedback from the interviews with facility managers and HAST coordinators assisted in gaining insights regarding the role that the organisation plays with specific reference to practices such as a supportive environment, culture of data use, values, and rules set for the use of evidence in

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decision making. Participants described these factors as directly and indirectly influenced by the leadership.

4.5.1   Supporting environment

In order for the health information generated from TIER.net system to be used in decision making by facility managers, the sub-district, district and national DOH ART directorate leadership need to support the process of acquiring, analysing and using the information at facility level. The organisational systems need to support a culture of data-informed decision making, ensuring that information is communicated, shared, and used in decision making throughout the organisation.

From this study, the perception of the role played by organisational leadership in providing resources that promote information use in decision making was good concerning hardware and internet access. All facility managers reported that they had computers and a regular telephone line but limited internet connectivity. Access to electricity was reported to be very high. Things were different when it came to human resources. Most participants felt that leadership did not value information use in decision making because they failed to provide adequate data-related staff (data capturers) where they were needed the most. The facility managers and HAST coordinators stated that data capturers who were skilled, experienced and properly paid by supporting partners had their contracts terminated and no effort was made to retain them. Instead this cadre was replaced by less-skilled and lower-paid personnel through a different funding mechanism which was not sustainable.

The facility managers and HAST coordinators felt that they were required to work hard to convince district and provincial management to improve investment in human capital and financial resources related to information management and monitoring and evaluation tasks and functions. One facility manager voiced dissatisfaction with this. saying:

> "*The only challenge is that we don't have a permanent DC. We had one contracted and they were well-paid by Aurum. When Gauteng provincial leadership took over, they terminated their contracts and the EPWP [Expanded Public Works Programme] brought new people who are inexperienced and they are not paid very well. You cannot expect these people to stay for long. They will leave and then what? When the DC is not here we get a backlog and it becomes a mess that the facility cannot handle. The facility is regressing now from where we were, we are going back. It's a mess. Errors*

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are introduced, overlooked, and left uncorrected. We need a full-time DC, and they know that but we need to still convince them." Participant 7 – Facility manager

The other aspect of support related to the support that facility managers receive from HAST coordinators. HAST coordinators are mandated to provide technical assistance, guidance, and support supervision to the facility managers at least once a month. This is to assist the facilities to improve their performance. However, the narrative clearly shows that HAST coordinators' visits to facilities are typically not informed by the performance of the facility as the HAST coordinators report not using relevant information to inform these visits. Moreover, none of the HAST coordinators discussed facility performance using HIS information, nor gave feedback from their supervisory visit. This implies that arbitrary visits to facilities were made to tick the compliance box and to fulfil requirements rather than to improve service delivery. This, questions the value of support visits and the quality of the supervision.

> *"To be honest, we do not use data to inform our visit. You cannot say I went to that clinic because of this data. Usually we just visit and when you are there you see what the problem is. We cannot really plan what we are going to do, no we cannot plan. The only programme that we use data is the TB programme because there we do have access to the data. We do not look at the data before we go to the clinics to support." Participant 4 - HAST coordinator*

Lack of communication and collaboration between those who generate the information (HIS staff) and those in decision making (facility managers and HAST coordinators) was viewed as a major challenge by participants. The HAST coordinators were particularly concern about the poor working relationship between the two entities.

> *"We do not have a relationship with data. Programme is something else and data is something else, which is a worrying factor. Whenever you are involved in any programme the decisions taken should be informed by data but data is one person and we are another person. We have no synergy and we want that synergy. There is no system set for us to follow to get the data. If there are issues that we pick up, they will wait till the next review. We need a way of addressing issues between information and programme people. People are just doing what they need to do to tick the box. It becomes data belongs to the data people and programme management belongs to programme people: their data and our programme." Participant 4 - HAST coordinator*

One of the facility managers also alluded to this saying:

> *"There's a communication problem. Programme managers and information people are not talking together. We send all our monthly reports there but you will find individual HAST coordinators and sometimes programme managers coming into our facilities and requesting the same information that you submitted to the information office, and you will be like I have sent it. It gets to you that we are repeating ourselves too much that there is no communication up there." Participant 8 – Facility manager*

4.5.2   Culture of information use

Specific information policies, standard operating procedures (SOP) and interventions aimed at improving the use of information produced by information systems are needed to ensure that healthcare managers are using the information system and its products effectively. It was encouraging to hear from the facility managers that the ART TIER.net standard operating procedures and the DHMIS were available in their facilities and they were aware of these documents. However, facility managers and HAST coordinators felt that the 'how' part on information use was not clearly defined in the documents and clear guidance on how to improve data-informed decision making at facility level was lacking. This is in contrast to the DMHIS policy. The SOP states that "*All facility managers shall ensure that data collected by their respective facilities are reviewed during their monthly management meetings, and that remedial interventions are implemented to improve service delivery where the data shows inadequate performance*". It emerged that although the SOP and the DHMIS policy speak about the use of information at point of collection, it does not specify 'how' this information should be used. Facility managers felt that they were not empowered to use information in managing the health services.

The majority of participants felt that analysis and direct utilisation of health data/information were left for higher levels and their duty was only collecting and passing the data to the next level.

The district conducts quarterly HAST review meetings aimed at reviewing the performance of the entire district. These meetings seek to encourage information use and enhance data quality while stimulating self-assessment by measuring indicator performance against set targets as

well as sharing lessons learnt and best practices. Facility managers and HAST coordinators are mandated to attend these meetings. At these meetings information is prepared by the information team and presented to the audience. When study participants were asked about the value of these meetings there was a mixed bag of responses. Some managers felt that the HAST review meetings were beneficial. One facility manager responded by saying:

> *"When we go to the quarterly reviews that is only when we see where our shortfalls are, where can you improve, when you go to the quarterly review we see if we have reached our target? It gives you an idea how have you done in that quarter, looking at the graphs." Participant 8 – Facility manager*

Some managers stated that the meetings were not achieving the intended purpose and, because of this, were not beneficial. Respondents felt that some of the imperative issues and challenges raised time and again by managers, which hinder them from performing, were not discussed despite evidence presented. Moreover, action plans and resolutions taken in the previous quarter's meeting were not reviewed nor followed up on. One HAST coordinator mentioned that:

> *"It becomes an attack between HIS and us (coordinators) as well as facility managers and senior district leadership. Sometimes we want to respond to the questions but when you respond you sound defensive because they know our issues but our managers do not address them but they expect us to perform. Sometimes when I go to the reviews I feel like it is a waste of time. Is it necessary to attend all the reviews as the presentations are not interesting? Sometimes when you ask why we are collecting the information because during the reviews you find out that the information is never there, it is always incorrect. Why are we collecting it then?" Participant 9 – Facility manager*

The processes of providing feedback on the submitted reports were not implemented, making it difficult for staff to understand the importance of collected data not only for improving their own performance but also for the programme as a whole. Facility managers reported that they did not receive regular feedback nor regular evidence-informed supervision from their supervisors. Facility managers also mentioned that feedback to the data collectors and recorders at their facilities in terms of the analysed data and its usage was nearly entirely lacking. The most consistent form of feedback comes only when there were information discrepancies when the facility would be requested to address the data-quality issues at hand.

According to the respondents, meetings were viewed as playing an important role in decision making as they created a platform to discuss issues pertaining to efficient running of the facility. The respondents were probed about the nature of the meetings that facility managers held with their subordinates. This was intended to establish whether during these meetings facility managers used data generated from TIER.net to review programme performance. Different views emerged in this regard. A few respondents mentioned that their discussions were data informed and some were under the impression that they were not. From those that viewed their meetings as data informed, one facility manager mentioned that:

> *"We hold monthly meetings, to share general information and discuss issues that we are experiencing as team members. These meetings provide a platform to express issues that the facility is experiencing and with other team members we try to solve the issues, or answer the questions that other team members had. We have not addressed or discussed targets or performance. We are planning to do that." Participant 1 – Facility manager*

4.5.3   Evidence-based decision making

Sustainable and visible use of information by healthcare managers at senior level to drive programmes, improve service delivery, and inform decision making promotes the use of information by lower-level managers. When there is transparency and an understanding of how the senior managers use the information collected from TIER.net, facility managers will value the collection process and put more effort into ensuring that the collected data are used. Lack of clarity on the use of information generated from programme data in decision making at higher levels was a reported challenge by facility managers. This arose from district and provincial senior leadership failing to make programme decisions based on the information provided by facilities. Facility managers reported a number of examples where the senior district leadership allocated budgets, human resources and commodities to facilities which were not in line with the information that the facility managers submitted to the leadership. In one instance, a facility that had a low patient head count or volume was allocated a higher budget than a facility with a high patient head count or volume:

> *"They do not look at the information, I doubt if they do. Some of the decisions they make are not in line with the information we send them. Why are we getting a lesser*

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budget when we see 7000 patients a month, Kempton Clinic sees about 4000 and they are far above us when it comes to budget they do not look at the numbers. The Benoni Clinic and Bedford View do not see a lot of patients, when you go to that clinic they always have a full staff complement." Participant 1 - Facility manager

Facility managers did not have a clear knowledge or sense of what the information was used for by the senior district leadership. It appeared as if there was no transparency from the senior managers regarding how they use the data. One facility manager commented:

"I think but I am not sure they use it to budget so that they can know how much budget we need and how much medication they can procure." Participant 11 – Facility manager

Information must be made readily available to all relevant stakeholders, thereby enabling an opportunity for conversation and dialogue. Not having data available or accessible inhibits effective decision making. There were mixed views regarding the availability of information. All facility managers expressed that they had unlimited access to the information and it was readily available on request. However, the demand for information appeared to be lacking. This was contrary to the experience of the HAST coordinators. A common thread through the various narratives of the HAST coordinators reflected challenges with accessing TIER.net data. One of the participants mentioned that access to information was a challenge and that there was no clear mechanism for them to access facility reports. Accessing the report required 'going through hoops' and was not always easy. This is a comment from a respondent:

"No, I do not have TIER on my computer, I have to ask the data capture to generate the report for me. If she is not here I cannot generate the report and I cannot access the data. I have a demo version that was installed during the training. We do not have the data. How are we supposed to support the clinic"? Participant 4 - HAST coordinator

This chapter analysed the study data using the theoretical constructs of the PRISM framework namely technical, behavioural and organisational, which were used as the main themes. These theoretical constructs addressed the two-interrelated primary research question, which seek to determine the how information generated from TIER.net was used by facility managers and HAST coordinators, and to determine the factors influencing the use or non-use this

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information for decision making. Drawing from the data collected in interviews and on observation, it was uncovered that technical determinants positively contributed to use of information as TIER.net was an easy to use information system and it produced good quality information. However, behavioural factors such as skills and competences towards performing RHIS tasks, staff workload and competing priorities as well as organisational determinants such as lack of supportive supervision, poor enforcement information policy and related standard operating procedures and poor culture information contributed to the non-use of information generated from TIER.net by facility managers and HAST coordinators in this setting.

Chapter 5. Discussion

This chapter provides a discussion of the findings of the study conducted to ascertain the use of information generated from TIER.net information system by facility managers and HAST Coordinators in the Ekurhuleni District. The chapter has been organised according to the study objectives. The first part describes the current use of information generated from TIER.net by healthcare managers in Ekurhuleni district for ART programme management and the second part explores the factors influencing the utilisation of information by managers.

5.1 Using data for reporting

This study found that traditional thinking of collecting data only for reporting purposes still exists and remains deeply rooted in almost all the participants. Similar findings were reported by Chaulagai et al. (2005), Nutely (2014) and Aqil et al. (2008). Sibande (2011) also reported that health managers at health centre, district and provincial levels generally regarded the health information system purely as an upward reporting system, and not as a system that might support them in their own work. Most facility managers in the current study considered submission of reports the ultimate and the most significant function of the TIER.net health information system.

However, facility managers appeared to miss the very purpose of the RHIS which is to provide the information that can help track the performance of both patient's response to ART interventions and that of the facility's ART programme. This appeared to be due to fact that when the information system was introduced, focus and emphasis was placed on the first part of the information cycle which involved mainly data collection and compilation of health-service activities. In this respect, facility managers ensured that the data collected was complete, accurate and timely, and reported at the next level. The information was collected with the sole purpose of transmitting it upwards to meet requirements. In this study, the benefit of using the TIER.net information for planning, managing and evaluating healthcare delivery level was not realised. In addition, the managers of the lower-level units did not consider themselves as beneficiaries of the information generated from TIER.net and failed to use it to support decision-making. A study by Kowanga found similar results where managers merely produced and submitted programme information upwards which contradicted strengthening managers' capacity to use information.

A lot has been written about the positive contribution that the availability of good quality and trustworthy information has on the use of information for decision making and resource allocation (Aqil, et al., 2009; Lippeveld, 2000). In this study, both facility managers and HAST coordinators pride themselves for having an information system that produces good quality information. However, the availability of quality information did not appear to influence the use of information for decision making. It can therefore be said that for this study availability of good quality information as a stand-alone did not translate to information use and this supports Nutley and Reynolds (2013) who noted that the existence of quality information is not sufficient to guarantee that the information will be use. This also supports the findings of the study done in India, where there was a notable improvement in the quantity and quality of information generated by health systems, however, decision makers continued to struggle with using information for making decisions (Moreland et al.,2009). It however disputes the hypothesis that states that good quality information improves the use of information which will in turn improves the quality of information resulting in further and greater use of information for decision making (Braa et al., 2012).

Also, this study found that very few facility managers understood their facilities performance on the ART programme despite the TIER.net capability of producing automated graphs and visual displays. The main idea behind automated graph display and visualisation is to assist facility managers at a glance to be able to generate insightful patterns, view their performance and identify problematic areas effortlessly (Moreland et al., 2009). However, this function was under-utilised and this led to the non-use of TIER.net information for managing day-to-day activities in some facilities. This meant that although the information was readily available at facility level, it had limited use in producing knowledge that can be translated and used for health-system decision making as the data were not analysed and interpreted for use. This appears to be a common phenomenon with the development of an information system in the development space as numerous studies concur with these results. Moreland et al., (2009) investigated the use computers daily for data analysis and presentations in India, from their study the authors concluded that very few health managers who participated in the study used computers to analyse and present the information generated from the information systems. Similar, it was also reported that District health management team members were unused to drawing, interpreting, presenting graphs using District Health Information software as their skills were underdeveloped prior to the data- use workshops in Zanzibar (Braa et al., 2012).

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One wonders, if the decisions made by facility managers and HAST coordinators were not based on the information generated from TIER.net, what informed these decisions and planning? It appeared that facility managers drew on existing and individual experience-based knowledge in these instances as they were not using the information generated from RHIS.

5.2 Timely Access to health information

Timely Access to information has been seen to influence and guide decision making. It was encouraging to note that all facilities were able to meet their reporting deadlines and were sending information to the sub-district health information office as mandated by the DHIMS policy. There was evidence to prove that, there were well-defined channels and processes for the upwards movement of the flow of information, with limited use of information for patient and programme management. Nutley (2013) noted that information users were unable to access the information that they needed in a timely manner as it is often locked in reports and data bases that were not accessible. Moreover, Aqil et al. (2009) added by stating that information users need to be able to access and share the information whenever they need to ensure that information is used in decision making, and not be limited to access the information only after the reporting or dissemination process.

In this study, it was clear that several HAST coordinators lacked physical access to TIER.net information system. They did not have access to the reports as they did not have TER.net software despite the fact that they had computers. In instances where the HAST coordinators needed this kind of information, they had to wait until the end of the four months (quarter and one additional month) for the cohort reports to be generated at district level or go to the respective facility to access the TIER.net report. This resulted in diminished use of TIER.net information by these coordinators. Lack of awareness of what information was available was also noted. Most of the coordinators were not aware of the TIER.net reports and they never received the information that could assist them in performing their required tasks, despite the availability of such information. Lack of knowledge about the existing information sources and limited access findings from this setting is comparable to the findings of both Harrison and Bakari (2008) conducted with 10 district and national-level health professionals working in the public and private sectors of the Tanzanian health system and that of Harrison (2010), where majority of respondents cited lack of access to information sources as a major constrain to information use.

HAST coordinators are required to provide supportive supervision to each facility at least once a quarter. Additional supervision visits are based on the reported performance status of the facility, as facilities performing poorly on certain indicators require more robust mentoring and supportive supervision. HAST coordinators did not have access to the TIER.net data to make those decisions and this suggests that the coordinator's facility visits were not based on the TIER.net data. This illustrates that there was a gross under-utilisation of information to inform facility visits. Coupled with this was the fact that the HAST coordinators who needed to plan and conduct these visits were not in a position to utilise information as they did not have access to the information needed to inform those visits.

5.3 Supportive supervision

Lack of regular systems to provide supportive supervision to the users of information at facility level has been identified to negatively affected the perceived importance information use (Hotchkiss et al., 2010). Harrison and Bakari (2008) report that poor systems for supportive supervision weakened information use in Tanzania. HAST coordinators provide supportive supervision to facility managers to ensure that the ART programme is implemented according to the guidelines and to provide oversight concerning the quality of the ART programme. This enables HAST coordinators an opportunity to provide in-service training; mentorship; identify bottlenecks with the implementation of the programme; and, develop remedial actions to improve ART programme service delivery. This has been happening to a large extent on the programmatic aspects of programme, but the information aspect of the programme has been neglected and has not been as rigorous as that of the programmatic aspect. The lack of support from the information management side was also characterised by poor understanding of the DHIMS policy and related SOP's, poor access to information especially for HAST coordinators and prioritising reporting than using information for action.

This study has shown that the RHIS supervision was very low and that HAST coordinators were not providing supervision to facility managers to ensure that facility managers were analysing, interpreting and using the information for programme management. This was not surprising as HAST coordinators also did not have adequate skills to analyse, interpret and use information. It is also clear from this study that the TIER.net supervision was heavily President's Emergency Fund for AIDS Relief (PEPFAR)-partner driven focusing mainly on data capturing and processing, and less on analysis, interpretation and use of this information.

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To a certain extent partners provided these types of services (analysis, interpretation and use of information) to facility managers to try to remedy the problem of skills shortages, but this temporary fix also created dependency on partners rather than capacitating the managers to be able to do these tasks themselves.

Nutley and Reynolds (2013) argue that without specific policies, guidance and interventions aimed at improving the use of information for decision making, district health systems will not be able to meet the needs of the population they serve. This holds true for this setting, although the DHMIS policy and related SOP were available, they were not enforced. The DHMIS policy and the related SOP stipulate that analysis, interpretation and use of information generated from TIER.net at facility level are the key responsibilities of facility managers. However, it is clear from the study that these activities were not done and have not been enforced first by facility managers to their staff members and there was no enforcement of this policy to facility managers by their supervisors. The lack of supervision and enforcement of the DHIMS policy by HAST coordinators to the facility managers contributed in poor use of information by both facility managers and HAST coordinators. In addition, interventions aimed at improving use of information implemented by both DOH and PEPFAR partners were uncoordinated and weak as a result their impact on promoting the use of information was minimal.

5.4 Resource constraints

Inadequate supply of human resources is a major challenge in improving use of information of absenteeism have also been seen as another common problem resulting in facility managers taking on service-delivery roles and doing clinical work to avoid patients complaining about long waiting times. In this study, this challenge was found to grossly reduce the time that facility managers have available to perform their managerial duties. It was evident that facility managers had insufficient time for conducting data-related tasks due to competing priorities and staff shortages, as they prioritised service delivery and patient care functions over data analysis, interpretation and use of information for proactive planning and resource-management responsibilities. Similar results were found in Botwsana (Ledikwe et al., 2014) and in South Africa (Garrieb et al., 2008) where the workforce is highly burdened by HIV/AIDS related services, health care providers often sacrificed generation and use of strategic information activities because they needed to prioritise health care provision to patients as well as other competing priorities. Kimaro and Nhampossa (2007) also alluded to

the fact high staff turn -over and heavy workload were also associated with unsustainable functioning HIS and poor use of HIS products for decision-making at lower levels of the health care system in their comparative case analysis of the HIS in Mozambique and Tanzania in 2007.

5.5 Skills

Health-sector reforms focus on the decentralisation of mandate and decision-making power to facility managers. This process has introduced changes in role and responsibilities of facility managers that requires a concerted effort to increase the ability of facility managers to conduct analysis, interpret and use the information to inform planning and decision making. The introduction of TIER.net was intended to bring about an informational approach to facility and programme management by promoting and supporting the use of information at a point of collection. From this study, it was evident that facility managers and HAST coordinators were not actively using information for decision making due to the lack of needed technical skills. Managers displayed little familiarity with the data elements, indicators, and reports generated from TIER.net, and it could be concluded that they did not understand the content of the reports generated from TIER.net. Indicators were all predetermined and well defined in the NIDS by NDOH, however most facility managers and HAST coordinators were not conversant with the indicators. Also, managers' skills to link facility plans, targets and indicators were lacking. Despite managers reporting that they were using the information to inform facility plans and daily management of facilities, it was un-clear how they were using the information as some of them had an incorrect understanding of indicator numerator and denominators.

Also, explicit from the study was the inability of both facility managers and HAST coordinators to analyse, interpret and use the data generated from TIER.net. As a result, the utilisation of this information was minimal at facility level with greater dependence on sub-district level. Little or no attention was paid to analysis, interpretation and utilisation of data for evidence-based decision making, planning and taking action at facility level despite the fact that TIER.net provided an opportunity for these functions to be performed.

This has potentially negative and serious implications regarding the quality of decisions made by facility managers and HAST coordinators. This significantly reduced the effectiveness of health information systems in improving the delivery of health service. This finding was similar to that of Gladwin (1999) who concluded that managers of health units in low-income countries

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experienced problems with data collection, processing and analysis. The lack of capacity for information generation and analysis at facility level by facility managers was also consistent with the other research findings (Odhiambo-Otieno and Odero, 2005; Garrieb et al., 2008). The results of this study were also consistent with those of Harrison and Moreland (2009), in their study they found out that there was a lack of analytic and information use skills in most of the health managers that participated in their study and this was the most commonly reported constraint. Aqil (2008) also found out in his study that the capacity to analyse, interpret and use information was limited in 120 health managers in Uganda and this factor impended the use of information. This finding is also in line with that of Burn and Shongwe's (2004) report on developing and use of indictors in hospital service management, where they identified that there was insufficient use of information by hospital managers to manage service delivery at the hospital level. These highlighted impediments were attributed to managers' lack of skills to use information.

The DHMIS mandates that managers, as part of their key responsibility, must analyse, interpret and use the information at the level of generation. However, there was no evidence of this being done by either facility managers or HAST coordinators. Furthermore, there was no evidence of this being monitored and enforced by those who supervise facility managers and HAST coordinators. Little or no effort has been made to ensure that all managers were trained on data analysis, interpretation and use of information.

Building capacity of information users is core to the sustainability of information use in decision making. Trainings on information use should be tailor made to enable the information users to analyse, interpret and the information in the programmatic context (Nutley and Reynolds, 2013). Almost all the participants were trained on how to use, nonetheless they were still unable to use the information generated from TIER.net. It is expected that when individuals are trained on the information system they become competent to perform RHIS tasks. This study has, however, shown that facility managers and HAST coordinators were not sufficiently competent in performing certain RHIS functions, especially analysis, interpretation and use of information despite TIER.net training. This finding is consistent with that of Nicol et al. (2013) who noted that RHIS training had limited influence on competence in RHIS tasks which include analysis, presentation and use of information for decision making. On the other hand, this finding disproves the findings of the study which use data collection and feedback training workshops to improve use of information. In this study the analysis, presentations and information skills were enhanced following the training workshops (Mpatswe et al., 2012).

Respondents indicated that they were reluctant to use information generated from the system as they felt that the training that they received had not adequately explained the concept of management and decision making based on information. An explanation that can be provided is that there is limited training on data interpretation and use of information as the training was based mostly on data collection and processing but not on analysis and interpretation of the reports and use of information for decision making. It is concerning that training did not yield the desired effect. The study highlights the need for improved skills and knowledge. Training should be reassessed to ensure that it includes sections that emphasise the analytic, interpretation, and use of available information at facility level.

It was encouraging to see that in facilities where facility managers were conversant with the content and were able to interpret the TIER.net reports there was interrogation of the reports generated and these reports were also acted upon. The list of patients that are due for viral-load monitoring, the list of patients that were expected to attend the facility to pick up medication, and those who were lost to follow up were generated on a regular basis by data capturers and submitted to facility managers. This suggests that when facility managers understand the content of the reports, they are able to act on the information provided by TIER.net. What appeared to be lacking was the ability of some managers to convert this information to action.

5.6 Limitations of this study

The limitation of the study is the sample size, the study was based on one district, focussing on a purposive sampled HAST coordinators and randomly sampled facility managers. Although this allowed for in-depth study of information use and factors affecting its use, it was limited to the lower level of health care staff, it would have been beneficial to understand these dynamics at all management levels within the district to have a full picture of information use.

TIER.net is implemented in all facilities in Ekurhuleni and this study provided a snapshot of the use of information and the factors affecting its use by facility mangers and HAST coordinators in Ekurhuleni District. The results highlighted similar results to the quarterly reports provided by the District DOH to other sub-districts and facilities in Ekurhuleni highlighting poor performance of ART indicators which can be linked to poor utilisation of information to manage and improve ART programme performance. Therefore, it can be

safely assumed that similar problems and challenges identified in this study may also apply in other facilities within Ekurhuleni District.

Chapter 6. Conclusions and Recommendations

This chapter provides conclusions and recommendations drawn from the study. The conclusions and recommendations are discussed separately.

6.1 Conclusions

6.1.1   Technical determinants

This study clearly demonstrated that the use of information technology, in this case TIER.net information system improved the generation and availability of good quality ART patient level and programme information to facility managers. However, the was a noted gap in converting this good quality information into sound and significant evidence that informs facility managers decision-making. Therefore, it can be said for this study that technical factors were not viewed as a barrier to information use and as stand-alone, technical factors were not sufficient to guarantee information use by facility managers and HAST coordinators.

There was a clear process for the generation of information from TIER.net and upward flow of information to the sub-district and district level, but limited evidence existed to prove information use at facility level for planning, resource allocation and day-to-day management of the facilities.

6.1.2   Behavioural determinants

The findings revealed that even though facility managers were enthusiastic and motivated, they lacked basic competencies to analyse, interpret and use the information. This study demonstrated that motivation did not translate to use of information, as the managers were motivated but competence was absent.

The study also showed that although training on the TIER.net was provided to facility managers and HAST coordinators, the participants were not sufficiently skilled in data analysis, presentation and using information generated from TIER.net. Training was very scanty on the basic use of information for facility managers. The findings suggest that there is an association between technical skills and information use which also suggests that improving analytical skills of facility managers and HAST coordinators could lead to improved information use for decision making.

6.1.3 Organisational determinants

The study also showed that the decisions made by facility managers and HAST coordinators regarding the ART programme were not necessarily based on or informed by information generated from TIER.net. The culture of information use within the district was viewed to be lacking by participants as some of the decisions that were made by leadership regarding resource allocations within the district were not congruent with what the information from TIER.net suggests.

There was minimal or no enforcement of the DHIMS policy at all levels resulting in facility managers not prioritising information analysis, interpretation and use as their core function.

In light of the focus on decentralising decision-making power and authority, use of information generated from RHIS becomes a pinnacle for decision making and planning. Despite the availability of information at local levels, information use appeared to be very limited due to a number of challenges that have been identified as barriers to successful use of this information. These barriers were not unique to the RHIS that supports the ART programme. Barriers were technical, behavioural and organisational and included inadequate human resources, skills and capacity. If these barriers are effectively addressed they could improve the performance of the DOH in implementing and monitoring the A RT programme.

6.2 Recommendations

The findings from this study have identified several actions that are needed to address constraints to information use and the strengthening of information used to monitor the ART patient and ART programme management.

In order to address the lack of skills to analyse, interpret and use information generated from the TIER.net information system, training on the system should not only focus on data capturing and processing, it should also be geared toward improving the use of the information products generated.

Strategies need to be put in place for improving skills and competence in health information. This study has highlighted a specific emphasis on the need for health workers to be trained in analytical skills with respect to the interpretation of information. In addition to separate training sessions, analysis and utilization mini-training need to be a part of the monthly meetings

between facility managers and their coordinators, so that facility managers can take back the information to their staffs to promote the of information at facility level.

HAST coordinators should also be an integral part of the training, and their training should focus on analysis, interpretation and use of information so that they can provide informed support supervision to facility managers based on evidence. This skill will, in turn, enable HAST coordinators to mentor and support facility managers on the use of information to improve performance.

The DHMIS policy and SOP speaks about the responsibility of facility managers to analyse, interpret and use the information at the point of collection but this has not been monitored and enforced in all levels of the healthcare value chain. This has compromised the potential benefit that could be realised from using the TIER.net information as it is well known that what is not monitored does not get done. Therefore, rigorous monitoring and enforcement of the DHMIS policy and the related SOPs should be enforced and those that do not adhere to these should face the consequences.

To promote the use of information for informed decision making at system levels, HAST coordinators should be provided with real-time access to TIER.net for the facilities that they support. They also need access to the information in a format that allows analysis and use, and should not be made to wait for the information to reach district level. This will reduce the lead time and enable them to take appropriate action when needed. TIER.net software and the accompanying dispatches should be loaded to the HAST coordinators' computers to ensure they can access this information at their own discretion.

6.3 Further research recommended

Further research is to determine how decisions for planning and implementing ART programme are made, and if the information generated from the information system is not used, what informs such decisions.

It is also recommended to determine factors that promote or inhibit the use of information vary between various levels of the health systems which include district, sub-district and facilities. This study only focused on how organizational, technical, and behavioural factors affect the manner in which information generated from one data source at facility level is use for decision making.

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Further studies are needed to determine how complex organisations, district and sub-district levels of health care uses different information from multiple sources to inform decision making and how organizational, technical, and behavioural factors affect the manner in which information is used.

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PARTICIPANT INFORMATION SHEET

Dear participant

Thank you for giving me this opportunity to talk to you about this research. What follows is an explanation of the purpose of the research and an explanation of what will happen and what is expected of you if you agree to participate. The research is being conducted for a min-thesis which is a requirement for a Master's Degree in Health Information Management; which I'm pursuing with the University of the Western Cape.

You are invited to take part in this research project, which is called Assessing the use of information generates from the TIER.net system by healthcare managers in Ekurhuleni district. You have been invited because you are a manager and your views on the TIER.net information use are important. Your contact details were obtained the district list of the facilities that are on phase 2 of TIER.net implementation.

This Participant Information Sheet/Consent Form tells you about the research project. It explains the processes involved with taking part. Knowing what is involved will help you decide if you want to take part in the research.

Please read this information carefully. Ask questions about anything that you don't understand or want to know more about. Before deciding whether or not to take part, you might want to talk about it with a relative, friend or local health worker.

Participation in this research is voluntary. If you don't wish to take part, you don't have to.

If you decide you want to take part in the research project, you will be asked to sign the consent. By signing it you are telling us that you:

- o Understand what you have read
- o Consent to take part in the research project
- o Consent to be involved in the research described
- o Consent to the use of your personal and health information as described.

<u>QUESTIONS</u>

Should you have further questions or wish to know more, I can be contacted as follows:

Vuyi Skiti

Student No. 9500431

Cell No. +27 74 280 5570

E-mail: drvuyiskiti@gmail.com

My supervisor's contact details are as follows:

Prof. Brian Van Wyk

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Private Bag X17, Bellville 7535, South Africa

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<u>Consent form</u>

In health information systems, the ultimate purpose of collecting and analysing data is to improve programs by enabling more informed decisions based on facts. However, information is not always available to make decisions—or if it is available, it is not always used. This study is designed to find out what barriers and constraints are causing these conditions, and how to resolve them.

Your participation is requested to provide your insights about constraints and barriers to data use. Your participation is very important to this research, but it is entirely voluntary. Your responses will be treated as confidential, and we will ensure that any statements or comments you make cannot be linked either to you as an individual or to your facility or sub-district. We will be producing a report that is intended mainly to help SEAD staff and our collaborating organisations design effective monitoring and evaluation activities.

Are you willing to participate?

Yes	No

If no stop the interview
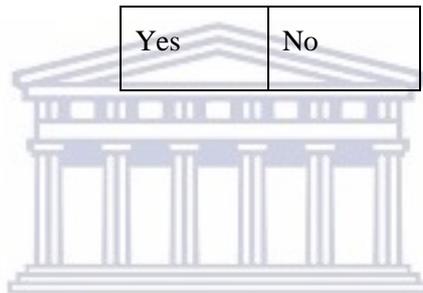
<u>Declaration by Participant</u>

I have read the Participant Information Sheet or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research described in the project.

I have had an opportunity to ask questions and I am satisfied with the answers I have received.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time during the project without affecting my future care.

Name of Participant (please print)

_____

Signature   Date

_____   _____

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APPENDIX C: Interview Guide

Participant's ID code	
Age	
Gender	
Position of the respondent	
Number of years in the position	
Highest education level	
Level – District /sub-district/facility	

Please tell me about your experience with TIER.net
Behavioural
Probe for the following **What the participant know about the system?**   **How do they find working with the system?**   **Is it user friendly?**   **Is it helpful and how?**

| |
|---|
| **What value do they place on the system?** |
| |
| **The challenges experienced?** |
| |
| **What does the participant like the most about the system and why?** |
| |
| **Use of information** |
| **What decision in relation to the ART programme do you need to make?** |
| **What information did you use to make this decision?** |
| |
| **What is your view about collecting information in general and then specific for TIER. net?** |
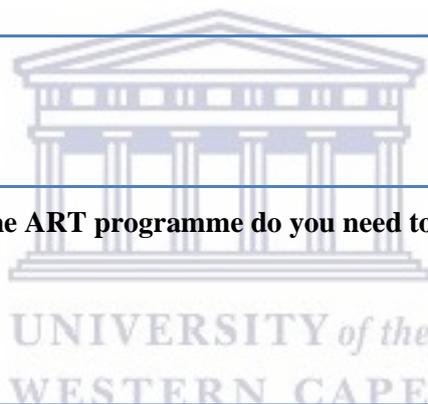
Do you ever use the information generated from TIER.net in relation to your work and how do you use it?

How does TIER.net meet your needs for information?

What specific challenges do you experience about using data probe for awareness of indicators, technical skills, motivation, time, workload, or the knowledge of the benefit of using data for programme management
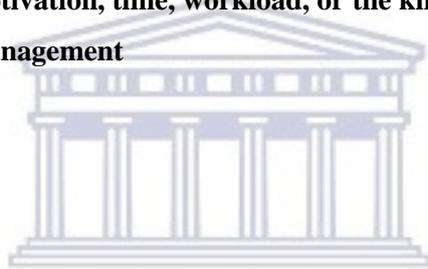
Technical

Have you ever experienced while making a programme-related decision when you were concern about data quality (timely, reliable, accuracy, validity)?

What are the participant's thoughts about the data-collection process in TIER.net?

Can the participant generate the report on TIER.net/ does the participant know how?

What is the participant's view about the quality of the data generated from TIER.net?

Does the participant trust the data?

Has there been an occasion when data quality has made it difficult for you to use information for decision making?
Technical capacity
What are your views about the capacity in your facility for collecting and using information? – This included analysis and presentation of the data for use? **What does the participant understand about data analysis and interpretation?** **Is he participant capable of doing the analysis and interpretation of the data generated from .net?**   **If the participant know is yes ask for an example of data that the participant know based on the indicators generated from TIER.net?**
Which tools do you use to analyse the data and how have you used them to aid decision making?
What is your experience with data display or visualisation and how often do you display the data in your facility?

| Organizational |
| --- |
| **In your opinion**

Do you think managers (district, provincial) are supportive of TIER.net system?

Do they value the information you provide to them?

Do you know what this information is used at higher level for?

After submitting the report to them do you get any feedback? |
| **Training**
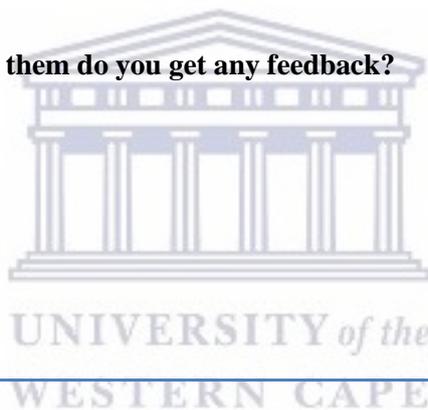
Have you attended any training on HMIS training to collect, verify and analyse information? |

APPENDIX D: Ethics Clearance Letter

EKURHULENI RESEARCH CLEARANCE CERTIFICATE

Research Project Title: Qualitative assessment of the utilization of Tier.net Health information among facility and Antiretroviral program managers in Ekurhuleni Health District.

Research Project Number: 08/06/2015-1

Name of Researcher(s): Dr Vuyi Skiti

Division/Institution/Company: MComm Information Management Degree, Department of Economic and Management Sciences, University of Western Cape

DECISION TAKEN BY THE EKURHULENI HEALTH DISTRICT RESEARCH COMMITTEE (EHDRC)

- *THIS DOCUMENT CERTIFIES THAT THE ABOVE RESEARCH PROJECT HAS BEEN FULLY APPROVED BY THE EHDRC. THE RESEARCHER(S) MAY THEREFORE COMMENCE WITH THE INTENDED RESEARCH PROJECT.*

- *NOTE THAT THE RESEARCHER WILL BE EXPECTED TO PRESENT THE RESEARCH FINDINGS OF THE PROPOSED RESEARCH PROJECT AT THE ANNUAL EKURHULENI RESEARCH CONFERENCE.*

- *THE RESEARCH COMMITTEE WISHES THE RESEARCHER(S) THE BEST OF SUCCESS.*

DR J. SEPWYA

DEPUTY CHAIRPERSON: EKURHULENI METROPOLITAN MUNICIPALITY
Dated: 22/6/2015

DR R. Kellerman

CHAIRPERSON: GAUTENG DEPARTMENT OF HEALTH (EKURHULENI REGION)
Dated: 22/06/2015 .

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