AN EVALUATION OF THE IMPACT OF THE IMPLEMENTATION OF THE PHARMACY MANAGEMENT INFORMATION SYSTEM AT PRIMARY HEALTH CARE FACILITIES: A CASE OF THE KAVANGO REGION, NAMIBIA

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Abstract
This study examined the influence of implemented PMIS on the health care delivery at PHC facilities within the Kavango Region, Namibia. A mixed methodological approach and design was used, with a convenient sample of 74 enrolled nurses, registered nurses, and pharmacy assistants included as participants. The findings indicated that the PMIS has contributed substantially to the performance, functioning, and operations of the pharmaceutical aspects of PHC’s and the overall health care service delivery within these organisations. In addition, organisational culture and structure aspects also appeared to influence the effective implementation of the PMIS, as the participants indicated that leaders and supervisors are critical to informing and orienting employees to the PMIS and assisting employees in the use of the information system. Finally, a number of challenges are identified with the implementation of the PMIS, such as inadequate PMIS employee training and employee retention difficulties and problems. A number of recommendations are outlined, including the implementation of PMIS training for employees required to engage and utilize the PMIS and areas of further study are denoted.

Key Words: Management Information System; Healthcare; Primary Healthcare; Pharmaceutical Industry; National Policy; Medicine; Information

Introduction
Namibia has implemented Pharmacy Management Information Systems (PMIS) with the intent to collect information on the country’s current pharmaceutical industry status. This national system is important for ascertaining, monitoring, and ensuring that the operations and management processes surrounding the pharmaceutical industry are appropriately controlled and implemented, which may assist in ensuring that required medications are available and adequately provided to the population. This study will explore the extent to which the PMIS is
being implemented at a primary health care (PHC) level, an important aspect for understanding the global status of Namibia’s pharmaceutical industry. This chapter will present the background to the research problem, the objectives of the study, the research questions, and significance of the study.

**Aim of the study**
The aim of this study is to evaluate the appropriate use and implementation of the Pharmacy Management Information System at a primary health care level within the Kavango Region of Namibia.

**Objectives of the study**
Considering the broad aim of the study, the primary of the objectives include:

1. To assess the impact of the implementation of Pharmacy Management Information System on primary health care delivery.
2. To assess the impact of organisational structure and culture on the implementation of the Pharmacy Management Information System.
3. To identify challenges associated with the implementation of the Pharmacy Management Information System at a primary healthcare level.
4. To formulate recommendations to improve the process and outcomes of the Pharmacy Management Information System.

**LITERATURE REVIEW**
In order to assess the challenges, areas of success, and the usefulness of the PMIS to various health care provider organisations, a number of studies have attempted to examine the impact of the pharmacy management information system implementation on primary health care facilitation (Haux et al., 2004; Tan, 2002; World Health Organization, 2007). The literature review outlines the fundamental concepts and available information that relate to the particular context and domain of the present study. The scope of the reviewed literature provides a broad and narrow range of discussion, enabling expansion or contraction of particular focal areas (Burns and Grove 2001:136). The literature, therefore, covers the impact of the implementation of the PMIS on the supply and delivery of medicine, the impact of the implementation of the PMIS on the use of medicines in PHC facilities, the impact of organizational structure and culture on the implementation of the PMIS, the impact of the PMIS on the health care system, challenges associated with the implementation of the PMIS at PHC levels, and strategies to improve healthcare delivery outcomes.

**Overture of fundamental concepts**
**Information systems**
In a similar manner to a number of other business management concepts, processes, and theories, there are various information systems definitions that have been posited. Laudon and Laudon (2007:14) define the term ‘information system’ as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision-making and the control of an organisation. Information systems also assist managers and workers to analyze problems, visualise complex subjects, and create new products. An information system contains information about an organisation and the environment that surrounds the organization. Essentially, an information system involves three basic activities: (1) input, (2) processing and (3) output, which coexist to produce information organisations require. A final component,
Feedback is output returned to appropriate people or activities within organisations in order to evaluate and refine the system input.

**Dimensions of information systems**
In conjunction with the primary activities associated with information systems, there are three major organizational dimensions of an information system: (1) the organisation, (2) management, and (3) technology. Using information systems effectively requires an understanding of the organization, management, and the information technology that shape or mould the systems. An information system can only be complete if all three dimensions collaborate or operate collectively to counteract or overcome the challenges posed by the environment. Awareness of organizational and managerial dimensions of information systems assists in identifying the explanation for greater success resulting from an information system among certain firms compared to others. Laudon and Laudon (2007:24) indicate that some firms invest expansively in an information system and benefit greatly from such investments, but others do not. Emphasis is also attributed towards building the right business model that suits the information system. Firms should support their information system investments with complementary assets, such as new business models, new business processes, management behavior, and organisational culture, to receive complementary returns on their information system investments.

**Management information systems**
Information is a critical resource in the operations and management of an organization. Timely availability of relevant information is vital for effective performance of managerial functions, including planning, monitoring, and performance evaluation. Management information systems (MIS) are designed and intended to provide this information in order to support decision-making at all levels of an organization. Organizations invest heavily in information systems to achieve six strategic objectives, which include (1) operational excellence, (2) new products and service models, (3) to improve customer and supplier intimacy,(4) to improve decision-making, (5) to gain competitive advantage, and (5) for survival and sustainability (Laudon and Laudon, 2007:8). Information systems have become the most important instruments available to managers that promote the achievement of higher levels of operations efficiency and productivity. It is also important that such systems are coupled with changes in operational practices and management behavior. Information systems are, therefore, essential components of management and assist in the formulation of an organization’s short and longer term strategic goals and objectives. To serve this critical function, an MIS must be properly and adequately planned and implemented in order to collect, process, store, and disseminate data (information) that is needed to support the functions of management.

**The impact of the implementation of the PMIS on primary healthcare delivery**
The aim of any health information system is to improve the ability to collect, store, and analyze accurate health care related data to improve or develop service delivery efficiency, improve data accuracy, develop effective interventions, increase accountability, and uncover patterns and trends. The system seeks to record information on health events and assess the quality of services at different levels of health care. Globally, few countries have effective and comprehensive systems in place to gather this data. These information systems used in health care, however, are ambiguous in their description of what a hospital management information system (HMIS)
means. For instance, there are multiple terms used to define and describe such systems, such as the health management information systems (HMIS), hospital management information systems (HMIS), hospital information systems (HIS), hospital system (HS), and health management system. Considering the vast terms that are used interchangeably, there appears to be confusion and clarity is required to profoundly differentiate between a hospital management information system and a health management system.

According to a variety of studies (e.g., Haux et al., 2004; Winter et al., 2001, 2003), a hospital information management system, hospital information system, or clinical information system is used within hospitals to assist the overall management of the health care facilities through the maintenance of information about diseases and patient care, including patient record retention, accounting, human resource management, asset management, stock management, and knowledge management. In addition, Haux et al. (2004) and Winter et al. (2001, 2003) suggest that the task of a hospital information system is to support patient care and associated administration by providing:

- Information, primarily pertaining to patients, in a format that it is correct, is pertinent and up to date, is accessible to the right personnel, at the desired location, and is in a user-friendly and utilizable format. Hence, the information must be correctly collected, stored, processed, and documented.
- Knowledge, primarily pertaining to diseases, but also other medical aspects, such as drug actions and adverse effects in order to support diagnosis and therapy.
- Information pertaining to the quality of patient care, hospital performance, and costs.

The goal of a health management information system is to verify quality by comparing perceptions of services delivered with the expected standards and to provide timeous and accurate information. As a result, this process or initiation seeks to enhance health care provision and planning, to improve diagnostics, and increase national patient access to acceptable health services (Haux et al., 2004; Tan, 2002). A health information system assists in describing and providing data on various medically related subsystems (World Health Organization, 2005), which include:

- Disease surveillance and outbreak notification;
- Data generated through household surveys;
- Registration of vital events and censuses (e.g., births, deaths and causes of death);
- Data collection based on patient and service records and reporting from community health workers, health workers, and health facilities;
- Program-specific monitoring and evaluation (e.g., TB, HIV/AIDS, and EPI); and
- Administration and resource management (e.g., budget, personnel, and supplies).

The function of a health information system is to collate data from all these various subsystems, to share and disseminate them to the many different audiences for health information, and to ensure that health information is used rationally, effectively, and efficiently to improve health action. A strong health information system is an essential component of sound programme development and implementation, and is a requirement for strategic decision making, providing the basis upon which improved health outcomes depend.
Haux et al. (2004) provide the differentiation between hospital information systems and health information systems, stating that complexes or systems of processing data, information, and knowledge in health care environments are called health information systems. The first difference is the implementation level of the system. A health management information system is typically implemented on a national level, indicating that hospital information systems are a single entity or subsystem of a health information system. The aim of health information systems is simple to describe and easily identifiable: to contribute to high quality, efficient patient care. This aim is primarily centered towards the patient and towards medical and nursing care; the administrative and management tasks are then needed to support such care.

According to Tan (2002), the pharmaceutical sector is highly complex, with multiple and cross-cutting factors that can influence access to and the rational use of quality medicines, which makes it, is extremely important to have a systematic method for assessing the pharmaceutical situation of clinics across district, regional, and national levels. According to the management sciences for health (2007:714), the pharmaceutical sector can use information systems in planning activities, estimating demand, allocating resources, and monitoring and evaluating pharmacy management operations. The World Health Organization (2007:5) has developed a guide for assessing, monitoring, and evaluating country pharmaceutical systems. This is an indicator-based tool for assessing whether key pharmaceutical objectives are met, including access to essential medicines, safety, effectiveness and quality of available medicines, and rational use of medication.

Management sciences for health (2012:49.2) highlights that a good PMIS integrates pharmaceutical data collection and presentation of information, which assists staff at all levels of the country’s health care system in making evidenced-based decisions for managing pharmaceutical services. The features that distinguish a PMIS from a logistics management system include:

- The incorporation of patient-specific data in addition to product centered data;
- A focus on decision making for pharmaceutical services and not just pharmaceutical resupply;
- Information pertaining to outcomes of medicine use, such as adherence to dosage and medication use, adverse drug reactions, and pharmacovigilance. These aspects directly affect pharmaceutical policy and selection decisions, including individualized treatment options;
- Overarching information about the pharmaceutical sector, such as a summary of professionals/personnel, available outlets, legislation status, and a distribution of personnel and facilities;
- Varied data sources from the whole pharmaceutical sector, not just activities related to procurement and inventory management; and
- The ability to triangulate consumption data with clinical and patient-specific data.

Based on Lates et al.’s (2009:8) perspective, the Namibian PMIS was conceived and developed to address the absence of a system that provides regular information on the country’s pharmaceutical sector and, as a result, guide decision-making in the management of this sector. The PMIS was modeled on the WHO system for monitoring the pharmaceutical sector and
makes use of some of the WHO level II indicators. However, it has a wider scope and utilizes additional locally developed indicators to address the specific needs of the local public sector pharmaceutical system. According to Lates et al. (2009:8), the system was designed to monitor a selected number of areas at health facilities, such as the medicine supply system, rational use of medicines, human resources, and medicine financing. Information garnered has been useful in reassessing strategies, prioritising and strengthening pharmaceutical system components, and to synchronise programmes and policies. Policy-makers and managers now have clear indication of national and institutional problems, and with this knowledge, are able to counteract these issues for more effective healthcare delivery.

RESEARCH METHODOLOGY
This section provides the selected methodological approach appropriately suited for the present study. The methodological elements were selected for attainment of the delineated research objectives and research questions, critical aspects to consider when developing the method for conducting a study. In particular, facets including the research philosophy, the research strategy, the target population, sampling methods, research instrument, and data analysis are outlined and discussed.

Target population
Collection of elements that the investigator seeks to make inferences about. In essence, within human science research, the target population refers to the total number of participants that have been identified based on their relevance to the criteria for inclusion in the study. In this particular study, the target population of facilitates consisted of 35 PHC facilities within the Kavango Region of Namibia. The targeted participants included enrolled nurses, registered nurses, and pharmacy assistants within these PHC facilities. Table 2 provides an account of the number of enrolled nurses, registered nurses, and pharmacy assistants within each of the targeted PHC facilities. The groups of individuals were considered appropriate for obtaining perceptions regarding the PMIS within the PHC facilities and were readily accessible.

Table 2. Target population of PHC facilities and participant’ target population

Limitations of the research
Considering the selected methodology in the present study, there are a number of identified limitations. Firstly, there are 35 PHC facilities within the Kavango Region of Namibia, which made it difficult, due to financial restrictions, to include all of them in the present study. However, the research sampled 70% of the PHC facilities in region, which was considered sufficiently representative of the total population of PHC facilities. In addition, the participants solely included enrolled nurses, registered nurses, and pharmacy assistants, which may have limited the extent to which all relevant stakeholders were included in the study. Along these lines, the results may only be generalizable to the Kavango Region and the particular groups of participants included for assessment of the PMIS at PHC facilities. Nonetheless, the identified groupings of participants were adjudicated as the most relevant individuals for examination of the phenomena included in this study, as these groups were closely associated with the PMIS use and implementation at the PHC facilities. In addition, this study focuses primarily on pharmaceutical services, which are largely managed by a few staff members. However, given that the PMIS is specific to pharmaceuticals, the obtained participants, as representatives of the staff involved with the PMIS, were deemed appropriate for the present study. This study is also restricted in that it only included state owned health care facilities, with private health care providers being excluded.
RESULTS, DISCUSSION, AND INTERPRETATION OF FINDINGS

The objectives of this study were to assess the impact of the implementation of the PMIS on primary health care delivery, to assess the impact of organizational structure and culture on the implementation of the PMIS, to identify challenges in the implementation of the PMIS at PHC level, and to formulate recommendations to improve the PMIS outcomes. In accordance with this, the data analyses were selected to achieve the primary objectives. The following segments provide the results from the analyses, based on the delineated research objective domains.

Participant response rate

The questionnaires were initially distributed to 91 participants that included enrolled nurses, registered nurses, and pharmacy assistants. Table 6 provides an indication of the response rates of the participants, across the grouped employee statuses. As indicated, 74 of the total number of sampled participants returned the questionnaires, which were considered sufficient for proceeding with the analyses. The higher rate of responses from enrolled registered nurses, compared to pharmacy assistants, resulted from rigorous follow-ups and telephone inquiries. The pharmacy assistants were less easily and readily accessible to the researcher, making it difficult to personally contact them to personally and verbally request them to complete the questionnaire.

Table 6. Participant response rates across employment category

<table>
<thead>
<tr>
<th>Level</th>
<th>Questionnaires Distributed</th>
<th>Questionnaires Returned</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled nurses</td>
<td>58</td>
<td>42</td>
<td>76%</td>
</tr>
<tr>
<td>Registered nurses</td>
<td>34</td>
<td>26</td>
<td>72%</td>
</tr>
<tr>
<td>Pharmacy Assistants</td>
<td>9</td>
<td>6</td>
<td>66%</td>
</tr>
<tr>
<td>Total</td>
<td>91 (101??)</td>
<td>74</td>
<td>81%</td>
</tr>
</tbody>
</table>
Participant demographics

Responses by gender

Figure 1. Percentage distribution of respondents by gender

In the present study, the sampled participants included a majority that was males. Specifically, 67% were male and 33% were female participants (see Figure 1). However, considering the gender demographics within the Kavango Region, the gender distribution is considered representative of the total population of enrolled nurses, registered nurses, and pharmacy assistants within the PHC facilities.

Responses by age

Table 7: Percentage distribution of respondents by age

<table>
<thead>
<tr>
<th>Age Category (Years)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19 years</td>
<td>6.5</td>
</tr>
<tr>
<td>20-24 years</td>
<td>10.1</td>
</tr>
<tr>
<td>25-29 years</td>
<td>17.4</td>
</tr>
<tr>
<td>30-34 years</td>
<td>18.1</td>
</tr>
<tr>
<td>35-39 years</td>
<td>14.5</td>
</tr>
<tr>
<td>40-44 years</td>
<td>18.1</td>
</tr>
<tr>
<td>45-49 years</td>
<td>15.2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Examining Table 7, the respondents were middle aged, concentrated between 25 and 49 years. The largest proportion, 18.1%, occurred within the 40-44 years and 30-34 years age groups (see Table 7). Perhaps, the general trend to have older employees within these PHC facilities is based on the educational requirements for employment as an enrolled nurse, a registered nurse, and a pharmacy assistant. That is, a certain level of education is required; necessitating some time before employment can ensue. On the other hand, the findings may denote that the PHC facilities need to consider employing younger staff in order to have a succession plan in place for when the older staff members retire or leave.
Responses by occupation

Figure 2. Percentage distribution of respondents by occupation

According to the responses provided by participants, the majority of the respondents, 57%, were enrolled nurses. In addition, 35% of the respondents were registered nurses, and 8% of the respondents were pharmacy assistants (see Figure 2). Although pharmacy assistants, in particular, comprised a low percentage of total participants, the distribution of the participants is considered representative of the distribution of these groups of employees across PHC facilities within the Kavango Region, as, for instance, there are typically fewer pharmacy assistants as compared to both categories of nurses.

Responses by level of education

Participants were requested to indicate the highest level of education they attained. This was to ensure that during analysis, it would be easy to recognize if respondents had a clear understanding of the questions and the study itself. All the respondents possessed a University degree of some type. In fact, the majority of the participants possessed a postgraduate degree, which may provide partial explanation for the generally older range of nurses and pharmacy assistants at the hospital. The sampled participants represent a highly skilled composition of health care workers, a requirement for providing high quality health care.
Responses by length of organizational employment

This section sought to find out the length of service of the respondents at their organization. According to the results, 40% of the respondents have worked at their particular organisation for between 9 to 11 years, 28% of the respondents have worked for between 6 to 8 years, and 15% of the respondents reported having been at their organisation for 3 to 5 years. Only 5% of the respondents reported having served their organisations for 2 years and less (see Figure 4). This is an indication that the information gathered is from experienced people who are aware of and are likely to possess knowledge regarding the PMIS’s at their health care facilities. In addition, the large number of participants that have spent an extensive duration working at the PHC facilities suggests that such facilities are effective at retaining employees, which is important for younger staff and for indicating to prospective employees that the organizations are effective at retaining staff.
Receipt of PMIS training

It was observed that most primary health workers working in the region have not been trained in PMIS. In fact, only 22.5% of the participants indicated that they had received PMIS training and orientation, which is concerning because many of the employees have been employed for an extensive period of time. Thus, the lack of training cannot be attributed to being newly employed. Ultimately, the lack of training negatively influences employees’ understanding and degree of familiarity with the PMIS, which may result in the employees being less likely to utilize the PMIS, at least effectively.
Level of PMIS understanding
The inclusion of this particular aimed at evaluating the degree to which the participants were aware of and appropriately understood the PMIS utilized within their PHC facilities. As evidenced, the majority of the participants indicated an average understanding of the PMIS (see Figure 6), which may provide impetus for the absence of indicated training received. However, considering that inadequate training has been received, the employees appear to have some level of understanding the PMIS, the purpose of it, and how to utilize it. This suggests that, perhaps, employees have provided a certain level of self-training or inter employee training in order to appropriately utilize and implement the PMIS.

Figure 6. Frequency distribution of respondents according to level of PMIS understanding

The impact of the implementation of the PMIS on primary health care delivery
This section focuses on the particular items that evaluate the impact of the implementation of PMIS on primary health care delivery.

4.4.1 Effect of PMIS on workload
As indicated by Figure 7, 18 participants (45%) believed that the introduction of the PMIS had resulted in an increase in workload that was overbearing and extensive. Perhaps, the requisite to compile more reports and maintain additional record keeping is required as a result of the PMIS. As a result, this excessive time is removed from other duties, such as patient care provisions, which may result in decreased healthcare service delivery.
Figure 7. Frequency distribution of respondents according to perceived effect of the PMIS on workload

Clinical skills improvement
With the implementation of PMIS, the majority of the participants (24; see Figure 8) agree that it has assisted in improving the skills of the clinical employees (i.e., the skills of the participants included). As a result, medication prescriptions may be more appropriate and may less frequently require additional medical doctor consultation prior to the prescription of medications. Perhaps, unnecessary prescription of medications, such as antibiotics, has been reduced.
4.4.3 Medication availability
The implantation of the PMIS aimed at improving the availability of medication and supply efficiency, which, according to the participants, has been achieved. Specifically, 33 (82.5%) of the participants either “strongly agreed” or “agreed” that the introduction of the PMIS had greatly improved stock management skills and the availability of medication (see Figure 9). Perhaps, this is reiterated by the reduction of stock-outs, a decrease in the number of emergency orders that health facilities have placed, and due to the use of average monthly consumption frequencies as a benchmark for ordering medication.
4.4.4 Improved monitoring and supervision
In response to the open-ended items, the participants consistently highlighted improved monitoring and supervision of workers as a result of the implementation of the PMIS within their particular PHC facility. In particular, the following is an example of a pharmacy assistant’s statement regarding the use of the PMIS in improving monitoring and supervision:

“It has provided a better tool for monitoring and assessing the health worker's performance in a more objective manner. The recording and listing of activities in Work-plan makes supervision easier.”

In addition, one of the registered nurses indicated the following:

“A six monthly review of program performance using indicators generated from PMIS makes the workers understand the need for the data collected and also to take timely action if needed. PMIS also allows a generation of work-plan for supervisors and medical officers. This includes a randomly generated sample of the previous months work entered in to the system for verification for example, details like immunization, births and deaths, contraceptive users. It creates a system for quality control. A health worker performance report can also be generated on monthly basis.

One of the enrolled nurses also echoed the previously delineated participant’s responses, indicating that:

"We have been using PMIS for monitoring and supervision of health workers for a long time. We have developed certain indicators like percentage of Antenatal care (ANC) registered within 12 weeks by the health worker, to objectively measure the performance of individual health workers. These
indicators are generated from PMIS and are then used to fill the Annual Confidential Report (ACR). This objective and transparent evaluation system is much appreciated by the health workers."

Information use (i.e., improved data storage and management)
Paper based records at PHC’s were prone to termite attacks and would need regular renewal. Although data were previously stored on floppy discs and then Compact Discs (CDs), better storage options are now available. Data processing is faster, and retrieval of data could be done rapidly. This is denoted by one employee’s perception of the PMIS:

"(Computerized) PMIS also helps us in maintaining our records properly. The Family Record Card (FRC-generated annually by PMIS before annual census) helps us a lot during the annual census. We are able to track every birth and death in our field by cross checking with the FRC. Eligible couple list generated by PMIS also saves lot of our time, which we otherwise would have to spend to update this list from our registers. Further, if suppose in the future, any officer comes and asks for records. To get the information from register, it would take time. But by computer, we can do it immediately ".

The impact of organisational structure and culture on the implementation of the PMIS
This section presents the results pertaining to the selected items that relate to the impact of organizational structure and culture on the implementation of the PMIS at the PHC facilities.

Analysis of submitted reports
Based on the findings from Figure 10, the majority of the respondents indicated that they are able to analyze their reports prior to final submission. As a result, the information can be examined and verified prior to final submission, which is important to avoid errors. However, a large percentage of the respondents indicated that they are not able to analyze their reports prior to submission, which may reflect inadequate time or the ineffectiveness of the PMIS. Nonetheless, it is important for these PCH facilities to improve the degree to which employees analyze their reports prior to final submission.
4.5.2 Interventions at facilities using PMIS data

According to Figure 11, most participants highlighted that the major intervention made was to air-condition the pharmacy stores to ensure that medicines are stored at appropriate temperature. Some workshops have been conducted due to the shortfalls that were identified using the data. Some of the workshops done included the Rational Use of Medicine Workshop, Stock Management Workshop, and the Standard Treatment Guidelines Workshop, which resulted from submitted data. Some health facilities have had the privilege of requesting additional staff members to their facilities. Those who “disagreed” or “strongly disagreed” highlighted that they had not heard of any interventions at their facilities. Perhaps, this suggests that certain employees are not included in the interventions, which may be important for thorough and comprehensive intervention.
4.5.3 Support and supervision

This particular item attempted to elicit responses regarding the receipt of support from supervisors with regards to the PMIS. According to Figure 12, the majority of respondents indicated that they have received support regarding the PMIS from their supervisors. The participants, who have observed support and supervision, highlighted that in most cases the support is done to verify the accuracy of the reports submitted and to observe if all standard operating procedures are being followed. Some highlighted that the data has also been used as a tool to offer guidance and assistance in areas of weakness.
Figure 12. Frequency distribution of respondents by perception of support and supervision on PMIS implementation at facilities using PMIS data

4.5.4 Feedback provided to facilities
Examining Figure 13, many participants agreed that their facilities had received performance feedback. However, this finding is inconsistent, with others indicating the feedback is not provided. Perhaps, this suggests that certain facilities and employees are not provided feedback, whereas others are not. In most cases, the participants highlighted that most of the feedback is given to them in therapeutic committee meeting. Hence, some participants, who are not part of that committee, felt that no feedback was brought to their attention.
4.5.5 Changes in the working environment
Almost half (60%) of the participants either “agreed” or “strongly agreed” that there have been changes in working environment due to the implementation of the PMIS. It is concerning though, that (17%) of the participants strongly disagreed that there have been any changes as a result of the PMIS. Such variance could be due to the selective approach to making changes or the lack of understanding of the changes being made at the facilities.
4.5.6 Is the PMIS worth implementing in PHC facilities?
This particular question sought to determine whether health care professionals at PHC facilities believe it is important to implement the PMIS at their facilities. Assessing Figure 15, the participants tended to agree that implementing the PMIS is a worthwhile investment and improves the facilities. Some participants commented that it was a necessary tool, which can be used to evaluate and monitor prescribers and dispensers competencies. Many also felt that it has helped to improve the medicine supply and delivery situation in their facilities, but others highlighted that more training and support was required to fully utilize this tool at PHC level. It is encouraging to note that 77% of the participants agreed that this is a necessary tool, which can be fully utilized at their facilities, which reverberates the previously denoted worthiness of the PMIS.
4.5.7 PMIS value in primary health care

Considering Figure 16, all respondents indicated that PMIS has been of great value in PHC facilities. The participants highlighted that it has improved pharmaceutical inventory management, reduced wastage, improved rational drug use, and case management. Some indicated that it had also been used as a tool to measure the performance of healthcare workers against the set standards. The question was further probed for any details regarding whether the data generated by the PMIS has been used, with respondents generally indicating that the data had been a major tool for planning, allocating resources according to workload, and for the motivation of additional staff members in the facilities. One health center now employs a pharmacist assistant, and other staffing posts were created as a result of this data.

Figure 16. Percentage distribution of respondents by perception of whether PMIS’s provide value in primary health care
4.5.8 Teamwork and organizational culture

Based on Figure 17, all the respondents either “strongly agreed” or “agreed” that different departments work together towards meeting organisational goals and objectives. They further indicated that their teams are dynamic and that there is mutual co-operation between the different departments and management of the MoHSS. This indicates that the management style is, perhaps, more transformational than transactional.
Challenges in the implementation of PMIS’s at PHC level

With the use of particular open-ended questions and items, participants were asked about the challenges they encountered in the implementation of the PMIS within their PHC facility. Although responses are subjective and personally opinionative, most respondents noted challenges in human capacity development. One response, from a pharmacy assistant, that typifies the response pattern to this question is as follows:

“Overall lack of computer literacy is often a problem because most of the people – especially in rural areas - have never used a computer.”

The results indicated that the computer is often seen as something for the privileged or people of higher status in a hospital, and if used it was often not to its full potential. People were oriented towards the historical and manual method for completing their work and may not have received training regarding the use of the PMIS.

Another participant, a male registered nurse, emphasized the issue of lack of training in the use of the PMIS and the current brain drain issue that is affecting PHC’s, denoting that:

“People were used to doing everything manually and were not trained in the use of PMIS based on ICT. Brain drain on local level is also a problem as it is very difficult to get people to work in rural areas. This is because working conditions in rural areas are much tougher than in the cities, though the living costs are much lower.”

Adjoining this response, another respondent added by indicating that:

“People who have had training and work with the PMIS are often promised higher salaries because of the lack of people with this knowledge in other hospitals especially in the cities. This is different compared to brain drain in Europe and the United States where it is on an international and less national level.”
Collectively, these results suggest that there are a number of basic and more complex challenges that influence the implementation of the PMIS at PHC’s. Although a lack of training may easily be amended and improved, if employees do not possess a minimum level of information technology and computer skills, training may not be effective. Hence, the effective implementation of a PMIS is often dependent on factors that may not be within the control of PHC facilities and the relevant individuals responsible for the implementation of the PMIS.

Conclusion
The chapter provided a detailed description of the data analyses and provided interpretations based on the direction of the results. In particular, the results were organized according to the three primary objectives of the study, which provided a framework for assessing the results, collectively. The results suggested that, although the employees at the PHC facilities within the Kavango Region have received insufficient training and are not thoroughly knowledgeable about the PMIS and its functions, the participants did indicate that the PMIS is useful, meaningful, and an effective tool for improving the functions and service delivery of PHC’s. Although particular challenges have been outlined and designated by the participants, preliminary identification enables the implementation of processes and procedures to improve and overcome such challenges. The following chapter provides an overall indication of the findings, outlines a number of recommendations based on the results, and details a conclusion to the study.

CONCLUSIONS AND RECOMMENDATIONS
The conclusion of the study and recommendations are based on the research findings. In particular, the findings are discussed with particular reference to the primary objectives and research questions of the study. Stemming from the findings, this study provides meaningful information for the assessment of the PMIS implemented within PHC’s within the Kavango Region, Namibia. As a result, a number of contributions to the overall health care delivery of within the Namibian MoHSS have been made, with the potential for further studies to supplement these preliminary findings.

Findings from the study
After having compiled the literature review, conducted the study, collected the data, and analyzed the data collected, the following segments denote the principal findings that have emanated from the present study.

Findings from the literature review
The literature that was reviewed focused primarily on the facets of information systems that have been implemented within the health care delivery sector. The major concepts were outlined and defined, providing a foundation for an evaluation of the literature that relates to the implementation of PMIS’s within health care delivery domains, the impact of organizational structure and culture on a PMIS, and the typical challenges that are commonly faced with the implementation of a PMIS. A detailed account of the various domains is outlined below.

The impact of the implementation of PMIS’s on primary health care delivery
The identified literature provided an indication of the influence of a PMIS on the service delivery of PHC’s. According to Haux et al. (2004), a management information system is appropriate, useful, and assists health care facilities with the provision of effective and improved health care delivery. In fact, such systems provide support for the appropriate care of patients and administrative processes by facilitating the maintenance and provision of patient information, retains knowledge pertaining to diseases and global disease figures within organizations, and
provides information about the quality of patient care and organizational health care performance (Winter et al., 2001). A health care information system is also important and contributes to the collation and maintenance of information that is obtained from various distinct information systems sub domains (e.g., surveillance of diseases and outbreaks; World Health Organization, 2005).

With specific reference to PMIS’s, the systems are integral for integrating pharmaceutical information, collecting and storing data, presenting information that assists staff in various systems and aspects of an organization, and triangulates information from all relevant parties in contact with particular patients (Management sciences for health, 2012:49.2). PMIS’s have also evidenced importance for monitoring the efficient supply and adequate facilitation of medications within health care facilities and between health care facilities; a finding that has been evidenced across a range of countries and various types of health care facilities (e.g., Bhattari, 2005; Lates et al., 2009). Collectively, the information provides an indication that PMIS’s are important contributors to the processes and practices of health care facilities, particularly pharmaceutical facets of health care. Considering that a PMIS adds substantial value and meaning to health care facilities, it appears important to assess the effectiveness of PMIS implementation within various organizations in order to evaluate the adequacy of the systems and the areas of current issues that require rectification.

The impact of organizational structure and culture on the implementation of a PMIS

The literature suggests that there may be a number of factors that may influence the effective implementation of a PMIS. One particular aspect that has been consistently identified as a problematic aspect of PMIS implementation is organizational and employee resistance to change (Coburn, 2006). In order for a PMIS to be successfully implemented and adopted by the organization as a whole, organizations and the managerial authorities must effectively manage change initiatives (Laura-Georgeta, 2008). In particular, organizations must determine methods for alleviating and deterring perceptions of risk that are associated with information technology initiative and PMIS implementation. Included in these factors of perceived risk are performance risk, psychological risk, legal and privacy risks, and perceived time risks (Archer, 2009). Effectively managing apprehension associated with initiated changes within an organization enables more efficient and appropriate use of a PMIS. Along these lines, organizational leaders and managers have a profound influence on the acceptance or engagement in change initiatives (Bank, 2000), such as a PMIS. Leaders are required to be acutely aware of employee and staff emotions, behaviors, and dispositions to the organizational environment. A cohesive organizational culture is likely to improve the extent to which a PMIS is implemented within the organization (e.g., Thompson et al., 2010), indicating that promoting a facilitative organizational culture and environment is critical to PMIS implementation. Considering the relevance of various organizational culture and structure to a PMIS, evaluating the extent to which certain factors influence the PMIS within the Kavango Region was considered important for alleviating or reducing the influence of such factors in the effective implementation of the PMIS in PHC facilities.

Challenges in the implementation of PMIS’s at primary health care facilities

The reviewed literature suggests that there are a number of challenges that are often experienced in the implementation of a PMIS within health care environments. Although the failure of a PMIS is often a result of resistance to change, there are a variety of other issues that may
influence the implementation of a PMIS. Specifically, there may be financial difficulties associated with the initial investment and the maintenance of the PMIS within each organization. In addition, there may be physical ability issues in implementing a PMIS, as the relevant individuals that utilize the system may have limited information technology and computer capabilities (Southern California Evidence-based Practice Center, 2006). Additional problems may include privacy, security, and confidentiality barriers (Coburn, 2006), the requirements of particular organizations as opposed to what the PMIS can provide, anticipated return on investment (which managerial individuals often require an assessment and indication of such facets prior to investment), and training issues or requirements that may be necessary in order to fulfill the appropriate use of a PMIS. Evidently, these challenges need to be considered and overcome in order for a PMIS to be successfully implemented within PHC facilities, and such challenges require assessment and identification within the PHC facilities within the Kavango Region, Namibia, in order to elucidate methods or strategies or avoiding or reducing the influence of such challenges on the effective use of the PIMS within these PHC facilities.

Findings from the primary research
The impact of the implementation of PMIS on primary health care delivery was quite varied. The results suggest improvements in aspects such as clinical skills, medicines availability, monitoring and supervision, record keeping practices after taking on PMIS. However, the employees indicated a heightened and more time-consuming workload associated with the implementation of the PMIS at their respective facilities. The findings support a study by Sunartono (1995), who observed an increase in medicine availability in health institutions in Java, Indonesia, after the implementation of health management information systems. The present results indicate that PMIS implementation within PHC facilities resulted in the creation of more jobs, and a shift in roles and responsibilities among health workers as a result of data outputs created by PMIS. However, the shift in roles and responsibilities often conflicts with established traditional organizational cultures. The established roles are often very hierarchical and divided; the PMIS brings change to PHC facilities, which is not appreciated by all the employees involved. It is crucial to provide employees with recognition for their important role in the organization, in order for them to realize that their importance will not change and retain their sense of appreciation.

Health workers revealed varied challenges in the implementation of the PMIS at PHC level. In depth analysis of participant open-ended responses consistently highlighted a lack of knowledge and understanding of computers on the effective implementation of PMIS and other health information systems, particularly in rural health care facilities. However, results indicated that some primary health care facilities did offer staff training in basic computer skills. Perhaps, the gap between training in basic computer skills offered by primary health care facilities and health workers knowledge and understanding of computers could be explained by inadequate training offered by primary health care facilities in the Kavango Region.

Additionally, the findings indicate that health workers with training and skills in a particular PMIS may be less likely to be retained if other organizations possess superior working conditions and employment rewards. Often, health workers migrate to urban-based health care facilities, and, in some cases, to developed countries. Nonetheless, the implementation of the
PMIS within health care facilities within the Kavango Region appeared to enhance the functions and the performance of health care delivery, with particular reference to medication supply, medication knowledge, clinical staff knowledge, and overall improvements in the pharmaceutical operations of the PHC’s in the region.

**Conclusions**
The results indicate that primary health care facilities in the Kavango Region experienced improvements in employee clinical skills, medicine availability, monitoring and supervision, and record keeping practices after implementing the PMIS. Further, results from this study suggest that health care facilities offered inadequate training in basic computer skills or the utilization of the PMIS to health workers and staff. In addition, a number of challenges were identified that threatened the adequate implementation of the PMIS, which include computer literacy and training issues with employees and the inability to retain employees, particularly following the provision of training.

**Recommendations**
The following proposed recommendations are derived from results of the study. It is imperative that appropriate intervention measures are established in order to enable a positive impact of the PMIS on service delivery at PHC level. In particular, employee training must be appropriately provided to all employees that are involved in the utilization of the PMIS at each PHC facility. In providing such training, the PHC facilities may be more equipped to effectively utilize the implemented PMIS, avoid the challenge of employees being unable to use the PMIS, and perhaps, retain more employees that are possibly leaving due to inadequate training.

Following the findings of the study, it appears important that the managerial personnel are informed and notified of the important role they possess in the implementation of the PMIS. Such individuals should be briefed to identify the emotions, behaviors, and organizational atmosphere associated with employees and the work environment, which may orient them to facets such as resistance to change and issues involved in utilizing the PMIS.

Although the present findings provide a number of novel contributions to the PMIS literature and PHC facilities within the Kavango, Region, it is important that supplementary studies are conducted to assess the effective implementation of the PMIS across the entire country and non-PHC facilities, which may improve the functioning of the PMIS and health care facilities across the country.

**Areas for further research**
In conjunction with selected limitations that were previously denoted in chapter 3, there are a number of areas for future research. Specifically, researchers are encouraged to undertake similar studies within other Namibian regions and across the country, in order to obtain a national understanding the effectiveness of the PMIS within other PHC facilities. In addition, such studies should focus on other individuals that may also be involved in the utilization of the PMIS and should not be restricted to nurses and pharmacy assistants. It is suggested that this type of study be replicated within the public sector, and, perhaps, provide some comparative information between public and private sector PMIS implementation. This may afford an indication of
whether public and private sector PMIS’s differ and offer strategies for more appropriate implementation of the PMIS within PHC organizations.

**Conclusion**

The present study sought to examine the impact implemented PMIS’s have had on the functioning of PHC’s within the Kavango Region, Namibia. In particular, the study examined the impact of the implemented PMIS at sampled PHC facilities on such organization’s health care delivery, the influence of organizational structure and culture on the implementation of the PMIS, and the challenges associated with the implementation of the PMIS. After employing a mixed philosophical methodological approach and sampling 74 enrolled nurses, registered nurses, and pharmacy assistants, the findings indicated that the PMIS has added significant value to the functioning and operations of the pharmaceutical aspect of PHC centres. In addition, organizational culture and structure aspects also appeared to influence the effective implementation of the PMIS, with leaders and supervisors playing a substantial role in informing and orienting employees to the PMIS. Finally, a number of challenges were identified with the implantation of the PMIS, which include a lack of training and employee retention problems. A number of recommendations have been outlined and areas of further study have been denoted. In conjunction with the primary aim of the study, valuable information regarding the implementation of the PMIS has been generated and provided.

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