Received 19 March 2018
Accepted 7 May 2018

CONTEMPORARY ISSUES IN INFORMATION MANAGEMENT: AN AFRICAN CONTEXT

Health information systems in Namibia

Cathrine Tambudzai Nengomasha, Ruth Abankwah and Wilhelm Uutoni
Department of Information and Communication Studies, University of Namibia, Windhoek, Namibia, and

Lilian Pazvakawambwa
Department of Statistics and Population Studies, University of Namibia, Windhoek, Namibia

Abstract

Purpose – This paper aims to report some findings of a study that investigated health information systems (HISs) in Namibia with a view of establishing the nature of these systems and coming up with recommendations on how these could be enhanced.

Design/methodology/approach – This study applied a mixed methods research approach, using interviews and survey questionnaire to collect data. Survey data were analysed for descriptive statistics using SPSS and data from interviews were analysed applying content analysis for data analysis.

Findings – The findings of this study indicate fragmented HISs resulting in duplication of diagnosis, tests and treatment. The findings show that there were errors in capturing data into the systems, which could compromise the reliability of the data and compromise service delivery.

Research limitations/implications – This study was limited to two (Khomas and Oshana) of the fourteen regions in Namibia; therefore, further studies could look at other regions, as the study findings cannot be generalised to the entire country.

Practical implications – The findings and recommendations, particularly those relating to the public health sector, could inform policies and procedures, especially those relating to the patient health passport (card), and the way health information is shared within and across health sectors.

Originality/value – This study focused on health information sharing, whereas a previous study on HISs concentrated on quality of healthcare.

Keywords Health systems, Health information, Namibia, Electronic health record, Health information systems, Patient record

Paper type Research paper

Introduction

A country's health information system (HIS) integrates data from civil/vital registration, censuses, population surveys, facility surveys, individual records, service records and administrative records for policymaking and efficient management of healthcare services.

Information and Learning Science
Vol. 119 No. 7/8, 2018
pp. 358-376

2398-5348
DOI 10.1108/ILS-03-2018-0015

This paper forms part of a special section "Contemporary issues in information management: an African context", guest edited by Cathrine Nengomasha.

The ultimate goal of any HIS is to produce quality and timely information for evidence-based decisions and interventions. HISs in developing countries, including Namibia, have been said to be weak (Kamau *et al.*, 2017; Khan and Edwards, 2012; World Bank, 2009). Haoses-Gorases (2005) observed that the organisational structure of Namibia's National Health Information System (NHIS) was fragmented across different directorates and institutions. The World Bank (2009) reported about incomplete and fragmented data sources, which created a challenge of bringing diverse data sources into a seamless system. A study in Namibia identified a lack of documentation as one of the challenges facing quality healthcare in many of the health facilities and recommended "enhanced communication on quality of care, strengthening information management and data use for quality improvement" (Republic of Namibia, MOHSS, 2014, p. 2).

Namibia's healthcare system

Namibia's MoHSS Strategic Plan (2009-2013) stresses the government's strong commitment "to provide efficient and effective health services to the nation" (Republic of Namibia, Ministry of Health and Social Services, 2013, p. 34). Namibia's health system is dominated by the public sector in terms of financing, service delivery and coordination (Republic of Namibia, 2009). The Ministry of Health and Social Services (MoHSS) adopted a primary healthcare (PHC) approach to the delivery of healthcare services to the people of Namibia (Republic of Namibia, 2009, p. 19).

Namibia's healthcare infrastructure network consists of 295 clinics, 47 health centres, 30 district hospitals, three intermediate hospitals, one national referral hospital and nine Sick Bays, as well as various social welfare service points, private hospitals and clinics (Republic of Namibia, MoHSS, 2011). It also has about 1,150 outreach points (Brockmeyer, 2012). The public health sector is structured in a three-tier hierarchy with national, regional and district levels. The national level is responsible for policy formulation, regulation, planning, management development and giving support for service provision to the entire health sector; whereas the regional directorates are responsible for regional-level oversight and service delivery. Besides government, faith-based organisations and non-governmental organisations, as well as the private sector, continue to play a key role in the provision of health services. The private sector is regulated by the Hospitals and Health Facilities Act 36 of 1994, which issues private healthcare providers with licences for healthcare delivery, to compliment the services of the public sector (Republic of Namibia, MoHSS, 2014).

In Namibia, an Oracle Web-based application is operational at Windhoek Central Hospital. This application is used to manage health information in all government departments. It covers processes such as patient registration, diagnostic testing, billing and patients' discharge. The system is integrated to enable all information entered at any point to be viewed by other departments (Khan and Edwards, 2012). A 2014 study by MoHSS found that public healthcare facilities at the district level entered the data using a manual system, whereas at the national level, this was done both manually and electronically (Republic of Namibia, MoHSS, 2014).

In July 2017, the MoHSS launched its second district health information system (DHIS), "one of a half dozen different data-capturing platforms. The competing platforms meant that information was fragmented, making it extremely difficult to consolidate, triangulate and analyse data" (Nampa, 2017, para. 2).

Problem statement

HIS is an essential component of a nation's health system. However, HISs in developing countries, including Namibia, have been said to be weak, because of incomplete and

fragmented information. The new information and communication technologies (ICTs) experienced in other sectors are having an impact on HISs. An in-depth study of HISs or even an evaluation of existing HIS in Namibia had not been done, as far as these authors were aware. A study titled "An Assessment of the National Quality Management Systems Used to Monitor and Improve Quality in Health Service Provision in Hospitals and Health Centres in Namibia" had as one of its seven objectives: "To identify the current clinical information systems in the different healthcare facilities and how the information is being used to improve quality of care" (MoHSS, 2014, p. 10). This MoHSS study, concentrated on health quality management, fell short on its findings on the nature of HISs and sharing of information among health service providers. The little that was reported suggested a need for an in-depth investigation into the status of HISs in Namibia and to come up with recommendations on how they could be strengthened.

Purpose of the study

The purpose of the study was to find out the status of HISs in Namibia and how they could be strengthened. The specific objectives of the study were to investigate the existence and nature of HISs, assess how well developed these HISs are in terms of the data captured in the systems, examine the sharing of health information across different healthcare facilities, determine the extent of integration of HISs, identify the challenges in the HISs, establish the success factors and impact of HISs on the quality and efficiency of health services and to recommend measures on developing and implementing or enhancing the development and implementation of sustainable and integrated HISs that empower communities, health workers and decision makers to improve the coverage, quality and efficiency of health services in Namibia.

The study generated useful information for health services policymakers that can be used to develop and implement or improve HISs.

Methodology

This cross-sectional study used qualitative and quantitative research methods, using a triangulation of data collection methods including surveys and interviews. The study was conducted in two of the fourteen regions of Namibia, Khomas and Oshana. The population was health service providers and the public/patients. The units of analysis included MoHSS officials, public and private healthcare workers and the public/patients. Questionnaires were collected from health service providers ($n = 36$) and members of the public ($n = 563$).

Literature review

An HIS is a system that collects and processes data that are used in the management of health services (Bakker, 1997). An HIS could be electronic or paper based. However, Ngafeeson (2014, p. 258) opined that "the future of the healthcare information systems looks toward a near paperless era". A strong HIS is a key component of any health system. It leads to quality service delivery in an efficient and effective manner (Bakker, 1997).

The literature review is organised into the following sections: theoretical framework, nature and importance of HISs, data captured by HISs, challenges in HISs and success factors and impact of HISs.

Theoretical framework

The study was guided by the Health Metrics Framework (HMF) and standards for country HISs, which was devised by the Health Metrics Network (HMN) (WHO, 2006). The

framework focuses on two core requirements of strengthening HISs in low- and low-middle income countries. It puts emphasis on the need to enhance the entire health information and statistical systems, rather than only focusing on specific diseases. This means that the HIS depends on organised processes for gathering, sharing, analysing and using health-related data for decision-making. To achieve this, country health institutions and management structures should be guided by global health information standards that are aligned to broader efforts in an attempt to improve the availability and quality of health statistics (WHO, 2006). The HMN Framework outlines the global standards for health statistics and indicates how these can be integrated into country HISs.

The framework also aims at strengthening country leadership for health information production and use. Improving the quality, value and use of health information requires the development of policies and provision of incentives to enhance the dissemination and use of HI data at local, regional and global levels. This further leads to the development of relevant information that HIS stakeholders can use to make transparent and evidence-based decisions for HS interventions. The HMF provides six components of a HIS, namely:

(1) HIS resources;

(2) indicators;

(3) data sources – population-based data and institution-based data;

(4) data management – covering aspects of data handling from collection, storage, quality-assurance and flow, to processing, compilation and analysis;

(5) information products – data must be transformed into information that will become the basis for evidence and knowledge to shape health action; and

(6) dissemination and use – the value of HIS can be enhanced by making it readily accessible to decision makers and other stakeholders who need to use it.

Applying this framework guided the literature review, as well as the data collection, which focused on some aspects of the components as reflected in the presentation and discussion of findings section.

Nature of health information systems

Braa *et al.* (2007) argued that healthcare sector in a country consists of a large number of institutions, managed by a number of institutional bodies, organised into geographic areas and programmes. Therefore, national HISs are typically made up of a number of relatively independent health programmes and services, which all maintain their own vertical and uncoordinated reporting systems (Braa *et al.*, 2007).

HISs can be categorised into either "first generation" or "second generation" (Vital Wave Consulting, 2009). These first-generation HISs are mostly paper based at district health level and share common characteristics as highlighted below:

- *They function in the public sector and often only capture data from interactions with the public health system.*
- *There is significant fragmentation and duplication in data collection, because governments, donors and implementing partners have little incentive to collaborate on data collection, data sharing or leveraging common infrastructure.*
- *The HIS is not used by those providing or managing health services at the local level, as these individuals are often presumed to not need health information of this nature.*

- *Data collection is a significant burden on those collecting the data and detracts from time spent delivering services.*
- *Various independent systems are seldom integrated, which impede the ability to share data, increase the efficiency of operations or enhance the sophistication of analysis and decision-making* (Vital Wave Consulting, 2009, p. 6).

A move towards second generation (electronic based) is necessitated by countries aiming for "systems of greater scope, scale, and sophistication", which are characteristic features of NHISs (Vital Wave Consulting, 2009, p. 7).

A study by Littlejohns *et al.* (2003) which evaluated HIS in Limpopo Province in South Africa found that the following functions constituted the hospital HIS: master patient index, admissions, discharges and transfers, patient record tracking, appointments, order entry and reporting of results, systems for; laboratory, radiology, operating theatre, other clinical services dietary services and laundry. Other functions captured in the hospital HIS included financial management, hospital performance indicators and management information. The HIS was designed in such a way that each hospital had its own server to enable the hospital to manage its local data. The system generated a summary that would provide information about all other healthcare facilities the patient visited. This information was stored in a central server at the Welfare and Health Information Technology Operations Centre.

HISs are built to provide routine information for health administrators and most of the information is statistical in nature (Krickeberg, 2007). They are important support tools in the management of healthcare services delivery (Azubuike and Ehiri, 1999). Furthermore, HIS provides alert and early warning capabilities, supporting patient and health facility management (WHO, 2008).

A topical issue regarding HISs is the electronic health record (EHR). An EHR is a record in digital format that is theoretically capable of being shared across different healthcare settings through network-connected enterprise-wide information systems and other information networks or exchanges (Gunter and Terry, 2005). ICTs play a central role in patient's safe movements in terms of referrals from one hospital to another, as healthcare personnel would have access to the patient's medical history (Bakker, 1997). Moreover, e-health allows all aspects of patient information and related services to be managed in an integrated manner (WHO, 2013). This implies that the HIS integrates all types of information including vital registrations, health surveys, facility surveys, individual patient records, service records and policy documentation. EHRs may include a range of data, including demographics, medical history, medication and allergies, immunisation status, laboratory test results, radiology images, vital signs, personal statistics like age and weight and billing information (Gunter and Terry, 2005). Haoses-Gorases (2005) suggested the implementation of new technologies to facilitate access to patient or clinical information in Namibia.

Recent developments in the use of ICTs designed to enhance the EHR include cloud-based EHR. These new technologies in addition to benefiting health service providers in sharing health information also give patients the opportunity to own, manage and share their data with whoever they want (drchrono, 2017). Morrison (2017) also argued for granting patients access to their health information.

There are on-going medical records digitisation projects which ensure the availability and accessibility of reliable and secure patients' full health life histories (Morrison, 2017). One such project is the digitisation of the United Kingdom National Health System (NHS) records. Another digitisation project is the Noble's Hospital in the Isle of Man whose government aims to fully digitise its health records by 2018 (Khalil, 2017).

In Barbados, Dale Trotman launched an application in July 2017, which is believed to have the ability "to revolutionize health records management, not only in Barbados but across the Caribbean" (Barbados Today, 2017, para. 1). Besides fast tracking the appointment process, allowing doctors to deliver prescriptions electronically and do their billing processes, the MedRegis application also provides medical staff with a more efficient way of storing patients' health records, including X-ray images.

Data captured by the health information systems

A fully functional HIS does not only identify data for specific purposes but also refers users to data sources that can be used to generate the required data elements (Mbondji *et al.*, 2014). HISs should also capture data that enables policymakers, planners and health system managers to improve the performance of the health system and to track progress health-related activities. This explains why WHO (2012) pointed out that HISs are designed to collect and store patient information and to make it available for decision-making.

The Namibia Health Facility Census (HFC) (2009) regarded quality assurance as an important aspect of healthcare provision, as it monitors the quality of care, identifies problems and institutes changes to address the problems. Established standards are set to measure the quality of healthcare. In the Namibian healthcare system, some of the tools that have been devised to monitor healthcare delivery include the following:

- *A supervisory checklist for healthcare*: It determines the completeness of health management information systems (HMIS) account, equipment, supplies and other indicators.
- *A supervisory checklist for health service provision*: It is mostly used to observe the provision of healthcare.
- *A facility-wide review of mortality*: This system is structure to review the records of all patients who die.
- *Audits of medical records or registers*: This system checks medical records to determine whether protocols were followed.

However, the Namibia Health Facility Census (HFC) (2009, p. 32) report revealed that "only one third of health facilities in the country report quality assurance (QA) activities and only 14 per cent both report QA activities and had documentation of their QA activities". Such information gaps obviously compromise the quality of healthcare. Although it was reported that 95 per cent of the facilities were reported to have supporting documentation for referred patients, hospitals were "slightly less likely than health centres, clinics or sick bays to refer clients outside and to have referral forms and documentation available" (Namibia Health Facility Census (HFC), 2009, p. 33).

Krickeberg (2007) observed that the design of a HIS should be guided by six principle objectives given below:

(1) planning and managing the health system including health insurance;
(2) publishing health-related information;
(3) epidemic surveillance;
(4) supporting and improving daily clinical work; and
(5) obtaining information for local use; and
(6) conducting studies.

According to WHO (2012), patients can get health services from different healthcare facilities provided information is available at all points of care for analysis. However, standards should be in place to ensure a smooth sharing/dissemination of health information across health service providers. Such standards include metadata, medical records and vocabulary standards.

Challenges of health information systems

HISs are designed to help physicians, nurses and other healthcare workers to improve productivity; however, benefits from these systems are not fully realised due to a lack of information technology (IT) skills (Littlejohns *et al.*, 2003). Other failures associated with HISs are due to:

- functionality and reliability of the system;
- social and professional cultures of healthcare organisations not taken into consideration;
- the complexity of routine clinical and managerial processes underestimated; and
- implementation of the system taking enough time (Littlejohns *et al.*, 2003).

A study by Heeks *et al.* (1999) acknowledged some successful healthcare information systems (HCIS) while pointing out that a majority of HCISs fail due to the following gaps:

- *Rationality – reality gaps*: these arise from the formal, rational way in which many HCIS are conceived. This leads to a mismatching of the behavioural realities of some healthcare organisations.
- *Private – public sector gaps*: these arise from application in public sector contexts of HCIS, which are developed for the private sector.
- *Country gaps*: these arise from application in one country of HCIS developed in a different country.

HISs in many countries are currently weak and fragmented, and unable to supply sound data in a timely way (Mbondji *et al.*, 2014). Mate *et al.* (as cited in Mutale *et al.*, 2013) explained that evaluations of routine health facility data have identified consistent problems in HIS completeness, accuracy and timeliness in low- and middle-income country health settings which limit HIS use for routine PHC planning, monitoring and evaluation. Other factors associated with poor-quality data in resource-constrained settings include duplicate, parallel reporting channels and insufficient capacity to analyse and use data for decision-making (Chilluddo *et al.* as cited in Mutale *et al.*, 2013).

A study by Namakula and Kituyi (2014) which examined the HISs for Uganda Healthcare system reported shortages in resources which lead most small and medium health enterprises "into deploying systems from unprofessional IS designers who usually provide cheaper services but poorly designed HIS" (Namakula and Kituyi, 2014, p. 4). These authors made reference to Amanyire (2010) who studied HIS failures in three small and medium enterprise clinics in Uganda, and discovered that the major causes of failure include:

> Skills deficiency in usage of computers, resistance to change, inadequacy of necessary information system infrastructure, high cost of information system infrastructure, poorly designed HIS, concerns raised by patients and general community about privacy of their information (Namakula and Kituyi, 2014, p. 3).

Other challenges experienced with HISs include weak HISs to capture referral data; inadequate transport for delivery of basic healthcare; lack of effective information transfer; lack of standardised referral documents; inadequate skills, infrastructure, capacity of healthcare workers; and poor IT infrastructure (Hsia *et al.*, 2012; Honest and Nhampossa, 2007; Kariri *et al.*, 2017). A comparative case analysis of Tanzania and Mozambique concluded that what contributes to development of unsustainable HIS "is the misalignment of the interests, roles and responsibilities of the actors involved in the process" (Honest and Nhampossa, 2007, p. 9) i.e. the donors, developers and ministries responsible for health. Kihuba *et al.* (2014) supported this notion arguing that where local HMIS systems were not linked to DHIS, hospital managers were unable to keep in touch with wider health information needs at district level. Honest and Nhampossa (2007) recommended that HISs should incorporate social–technical aspects to take care of users' needs and organisational needs. Information system (HMIS) did not deliver quality data due to inability to ensure quality assurance, lack of supervisory support, poor data infrastructure in respect to information and communications technology application, human resources issues, limited financial resources and problems of integrating data. Another common problem is the quality of the content of health information, which is inconsistent with what is expected (Braa *et al.*, 2004).

According to Vital Wave Consulting (2009), HISs are not used by those providing or managing health services at the local level, as these individuals are often presumed to not need health information of this nature. Considering a problem typical of first-generation HISs, "the data in such systems flows upward to the central Ministry of Health (MoH) and donors, but typically not downwards (or horizontally) to the health care provider" (Vital Wave Consulting, 2009, p. 19).

Namibia's Health and Social Service Review of 2008 revealed that the Namibian MoHSS had fragmented systems which experienced the following challenges: an absence of common patient identification numbers, a lack of agreed standards across systems and databases, inadequate training which resulted in inadequate skills, poor work ethics and practices and rapid staff rotation and high staff turnover (Khan and Edwards, 2012).

Success factors and impact of health information systems

Ibrahim *et al.* (2016, p. 100) observed that a "rapid growing interest in HCIS and increased investment in its enabling technology have contributed significant improvement in development and management of health information systems". This observation was made with reference to Malaysia where HISs are popularly used in both private and government clinics and the government has invested heavily in HISs. Sabherwal, Jeyaraj and Chow (as cited in Ibrahim *et al.*, 2016) argued that HIS success should be viewed from factors such as user satisfaction, system use, perceived usefulness and user satisfaction. In addition, AMIA (2011) highlighted three factors mentioned below which determine the success of any HIS:

(1) Technical – Assessment or measurement of this factor is guided by the following questions:
   - Is the information system intuitively easy to use?
   - Is it easy to do the wrong thing within the system?
   - Interoperability is another important consideration: can the provider (physician's office or hospital) easily connect or share information from information-based systems that are purchased from multiple vendors?
   - Does the information system support regulatory, accreditation and legislative reporting requirements?

(2) Sociological – This factor borders on implementation issues using the following questions as guidelines:
   - Is the organisation ready for the implementation?
   - Do the implementers have the technical skills to install the system and have the users been trained to use it effectively?

   Sabherwal *et al.* (2006, as cited in Ibrahim *et al.*, 2016) suggested that to avoid unsuccessful HISs, healthcare organisations should engage doctors, nurses and other healthcare professionals who have sufficient training in informatics.

(3) Organisational – Assessment of this factor is guided by the questions below:
   - Does the facility or practice have access to skilled workers who understand the workflow of the organisation and the potential limitations of health information technology (HIT)?
   - Can these workers guide the organisation's selection of information systems, integrate the new system(s) with existing systems and databases, train peers on using the systems, identify system limitations and even help design next-generation systems?

A study by Namakula and Kituyi (2014) which examined the HISs for Uganda Healthcare system identified the following as the most successful factors for HISs: management support, user involvement, resource supply and education and training (Namakula and Kituyi, 2014, p. 4).

In 2009, an influenza outbreak was curbed in Mexico because the country had implemented an effective HMN framework. The signs were quickly picked up by the country's well-functioning HIS, which included individual medical record-keeping systems, skilled personnel who were able to spot atypical trends, coupled with a responsive reporting system (Córdova-Villalobos *et al.*, 2009).

A study conducted on patients diagnosed with epilepsy in Kempenhaeghe, The Netherlands, concluded that eHealth tools promote self-care, enable patients to make shared decisions and make it easier to develop strategies to support them in using eHealth tools in their self-care (Leenen *et al.*, 2016). Second-generation HISs also enable patients to "make medical appointments online, refill prescriptions, communicate directly with their physicians, and most important, see personal test results online as soon as they are available" (Hawn, 2009, p. 336).

Presentation and discussion of findings

The findings from the members of the public and the health service providers' questionnaire and interviews with key informants are integrated where applicable within subheadings reflecting the research objectives.

Nature of health information systems

The study aimed to determine the kind of health information in place at one of the hospitals. The MIS officer revealed that there were two systems in place; the Daily Health Information System (DHIS1) which captured in-patients' data, and another system DHIS2 which captured patients' data at district and regional level. This system was relatively new. The MIS Officer indicated that the system facilitated the compilation of quarterly reports and it was capable of indicating the number of admitted patients as well as statistics of patients who died in a given period. When asked whether the HIS could be accessed by all health facilities, the HIS officer disagreed. District healthcare centres, for an example, were not

electronically linked to the HIS. This created a situation described by Kihuba *et al.* (2014) that where local HMIS systems were not linked to DHIS, hospital managers were unable to keep in touch with wider health information needs at district level. Nonetheless, the above officer indicated that Namibia had a surveillance system that disseminated information about any outbreak of diseases. The information was captured in the HIS. The study identified pockets of networks, collaborations or exclusive HISs. The various health service providers who made these networks are indicated in Figure 1.

Although Figure 1 shows data in various institutions, it does not mean that the data were captured in one HIS. This is shown by the following summary of responses to the question "Who is not part of your health information network you would like to share information with?":

- all pharmacies and medical practitioners;
- specific therapist and radiologist;
- state hospitals;
- families;
- any other healthcare provider;
- private pharmacies;
- private clinic/practice and private doctors;
- private sectors/hospitals;
- Ministry of Health and Social Services;
- Namibian Associations of Medical Doctors;
- medical aids; and
- stakeholders like MVA and medical insurance companies.

Ngafeeson (2014, p. 258) argued:

> Health information technology consists of a wide range of networking technologies, clinical databases, electronic medical/health records, and other specific biomedical, administrative and financial technologies that generate, transmit and store healthcare information.

A total of 23 (71.9 per cent) health service providers responded that Namibia had a national HIS. However, several commented that it was only for the public sector. The remarks from

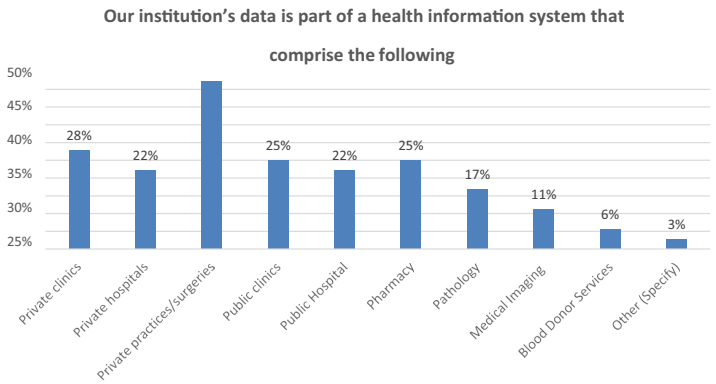

Figure 1.
Nature of the health information systems

the healthcare providers revealed that there was little integration of HISs. Suggestions point to the need for an HIS network/national health network, which includes all healthcare providers, extended to all areas. Some of the private healthcare providers suggested that a computerised healthcare network should be for specific conditions. This confirms Heeks' (2006, p. 15) sentiments that "one strategy universally prescribed as the key to the development and implementation of efficient and effective information systems is the participation by the target users in the design".

Although the above findings confirm the observation by Haoses-Gorases (2005) that Namibia's NHIS was fragmented, they, however, differ from Brockmeyer's (2012) report of health information in Namibia, which shows that half of Namibia's health facilities were reported to have a functional information system (manual or electronic) to track patients and patient care. Of note, 27 per cent (27 per cent) reported to have fully functional clinical information systems in place to track patient care and produce useful quality of care information reports from an electronic database or health record. Donor-funded programmes such as HIVQUAL and Tuberculosis had electronic tools where all patients on treatment were added on the system.

Data captured by the health information systems

The study on which this paper is based sought the views of the management information systems (MIS) officer at one of the government referral hospitals, on the quality of data on the MIS. The MIS officer indicated that he was responsible for data entries, data analysis and compilation of annual and quarterly reports, as well as training staff on how to complete forms. He explained that sometimes errors occurred in capturing patient data. The collection, collation, compilation, analysis and reporting of health data in the HIS of most developing countries are riddled with major problems. The findings confirm the observations by Lungo (as cited in Lungo and Igira, 2008) regarding the problems of HISs data in most developing countries. One of the problems cited is inaccurate data, which as the findings showed, is partly due to errors in capturing the data. The MIS officer revealed more information on gaps in the data captured in DHIS1, for instance data from 2011 to 2012 were missing, and detailed information about individual patients was also missing, such as patient's doctor and number of times a patient had been attended to or admitted in the hospital. The findings further confirm Lungo's (as cited in Lungo and Igira, 2008) observations regarding incomplete data in developing countries' HISs. Ngafeeson (2014) foresaw a need to reduce errors in medical records systems arguing that legible data devoid of errors reduce medical errors, shrink costs and invariably boost the quality of healthcare.

Kamau *et al.* (2017, p. 6) argued that "communicating patient's information at the time of specialty referral is essential to high quality consultation and coordinated safe patient care". The study on which this paper is based aimed to establish how patients' medical records were integrated and managed to ensure continuity, in cases where they were transferred from one hospital to another. However, it was indicated that the DHIS1 was not able to reflect any details about private patients. Although patients from public health facilities came with referral letters, in a few instances, some patients did not bring any records. Referral patients from public hospitals were accompanied by a health worker/nurse. The referral letters included details such as age, sex and treatment received. They also had health passports (medical record). This failure to capture complete information about referral patients is not unique to Namibian health service systems. These findings compare well with a study carried out in Kiambu district in Kenya which also found that the health facilities did not have standard referral documents (Kamau *et al.*, 2017). Lungo and Igira (2008, p. 27) highlighted the importance of "developing essential indicator and data sets and

streamlining the data collection tools in respect of data and information needs". In developing essential indicator and data sets, the Zanzibar Health Information System Project analysed existing data collection tools, listed all health data elements and indicators found in those data collection tools, tried to map the relation between the indicators and health data elements, discarded data elements that were not used to derive any indicators and came up with a data dictionary (Lungo and Igira, 2008).

Health indicators are measurements that measure different aspects of health within a community or group (National Aboriginal Health Organisation (NAHO), 2007). They are often used for purposes of programme management, allocation of resources, monitoring in-country progress, performance-based disbursement and global reporting (WHO, 2015).

Health service providers were asked to indicate the types of health indicators they were required by law to submit. Of note, 25 per cent (25 per cent) mentioned births, deaths (30.6 per cent) and communicable diseases (63.9 per cent). They were also asked to mention other types of health indicators but they did not provide any other health indicators. Other health indicators include life expectancy, infant mortality, chronic diseases rate, etc. (NAHO, 2007). Namibia recently witnessed the launch of the second Namibian HIS by MoHSS. This system will enhance the monitoring of healthcare indicators (Nampa, 2017).

This study established that indicators were submitted to HIS regional director's office; district office, regional health directorate, Oshakati hospital; Ministry of Health; and the State Hospital.

Sharing of health information across different healthcare facilities

Data in Table I are in response to the question: "How easy is it to get information from other health service providers?"

The findings show that it was much easier for other health service providers to get health information from medical imaging, pathology and pharmacies. It was not easy to get information from private clinics and blood donor services. This highlights the fragmentation of information (Khan and Edwards, 2012; World Bank, 2009; Haoses-Gorases, 2005).

In some instances, health service providers relied on patients to supply them with medical records. In response to the question, "whenever you have changed doctors or hospitals, have you been asked by the new doctor or hospital for any of your old medical records", 293 (65.8 per cent) members of the public responded "Yes" compared to 152 (34.2 per cent) who said "No". The records include health passport (health card) (43.3 per cent),

Type	Not easy (%)	Fairly easy (%)	Easy (%)	Very easy (%)
Private clinics	25.0	55.0	15.0	5.0
Private hospitals	27.3	36.4	18.2	18.2
Private practices/surgeries	19.0	38.1	23.8	19.0
Public clinics	27.8	27.8	33.3	11.1
Public hospital	23.8	33.3	28.6	14.3
Pharmacy	5.3	21.1	42.1	31.6
Pathology	15.0	10.0	55.0	20.0
Medical imaging	17.6	17.6	35.3	29.4
Blood donor service(s)	45.5	27.3	27.3	0
Other (specify)	50.0	0	25.0	25.0

Note: $N = 36$

Table I. Getting information from other service providers

patient file from previous service (7.5 per cent), X-rays (4.8 per cent) and other (0.9). The other documentation included referral letters and pathology reports. However, 28.4 per cent said they were not able to provide the records.

The respondents were asked to rate the reliability of the information they got. Reliability of the information received depended upon the type of source or how it was communicated, as indicated in Figure 2. The highest sources rated reliable was "other" (58 per cent), followed by referral letters (52 per cent) and health passport, referral letter hand delivered (i.e. manual) and electronic database with 50 per cent each. The least reliable was referral letter (via email). However, the following summary of comments from the 58 per cent who rated it reliable shows that there was some contradiction, as the information they got could not be rated reliable. The following is a summary of comments from those who indicated "others":

- When data are entered correctly.
- Patients who cannot read come with other people's passports for flu.
- We only receive health passport for medication.
- Patients use different passports.
- Patients do not reach referral point,
- Patients lose the referral letter.
- Patients do not report back to the referring facility.
- It is unreliable because some people are not using the same cards or telling you a true history.

These problems are similar to those experienced in Tanzania, where the paper-based HIS was fragmented and provided limited useful feedback and the data were said to be unreliable (Ministry of Health Plan Tanzania as cited in Honest and Nhampossa, 2007).

Challenges faced by health information systems. The study established that 115 (25.1 per cent) respondents had been treated at more than four different hospitals and clinics. When asked whether they had been asked by a new doctor or hospital for their medical record, 293 (65.8 per cent) said "yes"; however, 28.4 per cent were not able to provide their old medical records. According to a registered nurse in charge of the hospital system at one of the public hospitals, when patients were transferred or referred from private health facilities to public health facilities, they did not take a report with them.

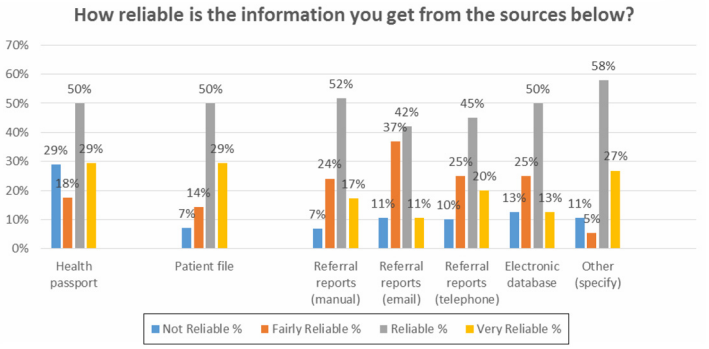

Figure 2.
Reliability of shared information

This problem can be solved by electronic personal health record (e-PHR) systems, which support the delivery and management across the care pathway in health systems (Irizarry *et al.* as cited in Hemsley *et al.*, 2017). Some studies have revealed that EHR solutions can address the challenges highlighted by the findings. They can fast track the appointment process, allowing doctors to deliver prescriptions electronically and do their billing processes. They also provide a more efficient way of storing patients' health records, including X-ray images (Barbados Today, 2017).

Nonetheless, there were functionality problems with DHIS2 due to poor internet connections, which render the system inaccessible. This problem is exacerbated by some healthcare providers' relaxed attitude of not using the HIS to share health information (as revealed in the study findings). Moreover, the tendency to rely on patients to provide medical information defeats the purpose of a HIS. This leads to fragmented health information, as noted by Haoses-Gorases (2005).

Table II shows reasons for lost health records or cases where doctors attended to patients without the benefit of their medical records.

Table II shows that 234 (54.3 per cent) members of the public who took part in the study had lost health passports in the past, 16 (16.6 per cent) lost X-rays, 30 (8.7 per cent) had files that could not be found at a hospital, 27 (7.9 per cent) had files with missing information on a doctor's consulting room and 54 (16 per cent) reported that old records were not required. A Senior Registered Nurse confirmed loss of health passports and the challenges this created for service delivery. "If the passport is lost we have to go to the registers to get the file number. If they cannot recall when they were here last, then it is difficult. We issue a new passport and a new passport always gets a new number". Similarly, Nengomasha and Beukes-Amiss' (2002) survey of health records in the MoHSS identified the problem of segmented patient history due to a patient having several patient files through loss of health passport (s) and failure to identify patient number through poor records keeping.

Lost health records or non-availability of patients' medical history result in increased medical costs, as medical tests have to be repeated or wrong prescriptions given. A total of 108 (23.2 per cent) respondents indicated that they had tests repeated, which should not have been done if the doctors had medical records. Similarly, 119 (25.5 per cent) respondents had had medicine prescribed to them for the second time because of non-availability of their medical history.

The health service providers indicated that patients did not always carry the medicine they use when moving from one doctor to another. In the absence of medical records, they ended up repeating the same procedures, which caused delay in accurate treatment and care of the patient. Whetton (as cited in Hemsley *et al.*, 2017) urged health providers to use e-PHR as it improves exchange of information across health service providers and it is central to increasing the quality and safety of healthcare.

Statement	(%)	*N*
I lost my health passport in the past	54.3	431
I lost X-rays, which were required for my next consultation	16.6	367
I have experienced an incident where my file could not be found at the hospital	8.7	346
I have experienced an incident where my file could not be found at a doctor's consulting room	7.9	341
I have experienced an incident where the old records were not required and they just opened a new file at a hospital	16.0	337

Table II. Lost patient records/history

Success factors and impact of health information systems in Namibia The findings show that 17 (70.8 per cent) rated the NHIS reliable. This shows the potential of the NHIS to quality healthcare. Table III presents data on the responses regarding the efficiency of the NHIS.

A total of 240 (71.6 per cent) responded that they were able to provide their medical records, which included health passport, patient file from previous service provider and X-rays. The pharmacists experienced a problem of some patients coming with prescriptions that were illegible or with medicine not correctly written. The study investigated the impact of HISs focussing on the benefits of having an integrated system. One of the benefits of electronic HISs is that the patient and the provider both use these systems for sharing of health information across healthcare providers (Muhammand and Wichramasinghe, as cited in Hemsley *et al.*, 2017). Trotman argued that MedRegis EHR application will solve the problem of understanding doctors' handwriting (Barbados Today, 2017).

Conclusions and recommendations

The following are the conclusions drawn from the findings.

Nature of health information systems

The study established both manual and electronic HISs. An NHIS coordinated by the MoHSS was in existence. The district health services supplied data to the Regional Health Directorate. However, the district health services did not have access to the national HIS. The private health sector also had its own systems and networks. The private health sector, as is required by law, submitted health indicators to the NHIS.

Data captured by the health information systems

The information captured in the NHIS included statistics on births, death, communicable diseases, patients' admission and discharges and other vital statistics. However, it did not capture a number of health data, such as noncommunicable diseases, injuries and immunisation. The quality of the data was further compromised by inaccurate data due to poor data capturing and omissions in the data.

Challenges faced by health information systems

The segmented nature of the current health systems allowed for duplication of tests and treatment. Not only is this costly but also negatively affects the quality of service rendered to the patients. There were instances of missing and/or incomplete health information leading to gaps in the patient's health record. Errors and inconsistencies in entering medical data by health professional in the NHIS were reported. Errors in capturing health information into the system might affect the reliability of the health indicators, as well as the patients' well-being. A shortage of trained staff to enter data into the NHIS was also noted.

Table III.
Efficiency of the national health information system

	Frequency	Valid (%)
Not efficient	2	8.3
Fairly efficient	4	16.7
Efficient	17	70.8
Very efficient	1	4.2
Total	24	100

Note: $N = 24$

Reliance on the health passport created problems as some patients were reported to be dishonest and claimed to have lost the health passport to hide information from the health service provider. Moreover, there were instances where healthcare providers relied on patients for a verbal update on their medical records. This leads to incomplete patient health history. Failure to submit a health passport or to remember a patient number was reported as a common problem, which led to duplicate patient files. This also applied to failure to transfer a patient with his/her file to another health service provider.

Success factors and impact of health information systems

HISs in Namibia were more of first generation, largely paper based and mostly relying on patients to provide the required documentation to healthcare providers as was the case with the public sector. The success factor for such a system was therefore the diligence and honesty of the patients to provide the correct and complete patient records to enable the healthcare providers to render quality and efficient healthcare services.

The fact that public healthcare clinics were able to refer patients to specific government hospitals with supporting documentation thereby avoiding the problems associated with absence of such documentation such.

Recommendations

The following are the recommendations from the study:

- The MoHSS needs to come up with an NHIS that integrates all health service providers; public and private to ensure complete health records for patients. In doing so, Namibia can learn from experiences of other countries, such as Tanzania.
- Until such a time that there is a fully integrated NHIS, there is a need to educate patients to look after their health records, which are entrusted to them, such as the health passport and X rays.
- There is a need to train health professionals on recording and keeping complete patient data, which will ensure accurate and reliable health indicators.
- The MoHSS should employ and train staff dedicated to data entry into the NHIS and production of reports.

References

AMIA (2011), "Factors influencing successful health information technology (HIT) factors-influencing-successful-health-information-technology-implementation", available at: www.amia.org/fact-sheets/ (accessed 11 February 2018).

Azubuike, M.C. and Ehiri, J.E. (1999), "Health information systems in developing countries: benefits, problems, and prospects", *The Journal of the Royal Society for the Promotion of Health*, Vol. 119 No. 3, pp. 180-184.

Bakker, S. (1997), *The Information Management: What Strategy*?, Kluwer Academic Publishers, South Holland.

Barbados Today (2017), "Entrepreneur launches medical records app. 20, July", available at: www.barbadostoday.bb/2017/07/20/entrepreneur-launches-medical-records-app-2/ (accessed 23 July 2017).

Braa, J., Hanseth, O., Heywood, A. and Shaw, V. (2007), "Developing health information systems in developing countries: the flexible standards strategy", *MIS Quarterly*, Vol. 31, pp. 1-22, available at: http://heim.ifi.uio.no/~oleha/Publications/FlexibleStandards.pdf (accessed 11 February 2018).

Braa, J., Sahay, S. and Montero, E. (2004), "Networks of action: sustainable health information systems across developing countries", *MIS Quarterly*, Vol. 28 No. 3, pp. 337-362.

Brockmeyer, B. (2012), *The Health System in Namibia*, Friedrich-Ebert-Stiftung, Windhoek, available at: http://cms.my.na/assets/documents/p19p2lof2lsi2moqo2tsjfbp5a.pdf (accessed 15 October 2016).

Córdova-Villalobos, J.A., Sarti, E., Arzoz-Pedres, J., Manuelle-Lee, G., Mendez, J.R. and Kuri-Morales, P. (2009), "The influenza A(H1N1) epidemic in Mexico", Lessons learned, available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC2765941/ (accessed 15 September 2017).

drchrono (2017), "Drchrono first cloud-based FHIR Enabled EHR", available at: www.marketwired.com/press-release/drchrono-first-cloud-based-fhir-enabled-ehr-2228654.htm (accessed 12 July 2017).

Gunter, T.D. and Terry, N.P. (2005), "The emergence of national electronic health record architectures in the United States and Australia: models, costs, and questions", *Journal of Medical Internet Research*, Vol. 7 No. 1, p. e3.

Haoses-Gorases, L. (2005), "Utilization of health information system (HIS) in Namibia: challenges and opportunities faced by the health care delivery system/health sector", available at: www.google.com.na/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=4&ved=0CD0QFjAD&url=http%3A%2F%2Fstardata.nrf.ac.za%2FCODATA2005%2FabsHaoses.doc&ei=p-eDUMbIBNHUsgb03oDIBg&usg=AFQjCNEsr–2h0i8BuPLdvsnU2WC5KfFfg (accessed 12 August 2017).

Hawn, C. (2009), "Take two aspirin and tweet me in the morning: how Twitter, Facebook, and other social media are reshaping health care", *Health Affairs (Project Hope)*, Vol. 28 No. 2, pp. 361-368.

Heeks, R. (2006), "Health information systems: failure, success and improvisation", *International Journal of Medical Informatics*, Vol. 75 No. 2, pp. 125-137, available at: www.ncbi.nlm.nih.gov/pubmed/16112893 (accessed 10 October 2016).

Heeks, R., Mundy, D. and Salazar, A. (1999), "Information systems for public management: why health care information systems succeed or fail", Working Paper Series, paper 9, available at: www.researchgate.net/publication/248440760_Why_Health_Care_Information_Systems_Succeed_or_Fail (accessed 11 February 2018).

Hemsley, B., Rollo, M., Georgiou, A., Balandin, S. and Hill, S. (2017), "Health literacy demands of electronic personal health records (e-PHRs): an integrative review to inform future inclusive research", *Patient Education and Counseling*, Vol. 101 No. 1, doi: http://dx.doi.org/doi:10.1016/j.pec.2017.07.010.

Honest, C.K. and Nhampossa, J.L. (2007), "The challenges of sustainability of health information systems in developing countries: comparative case studies of Mozambique and Tanzania", *Health Informatics in Developing Countries*, Vol. 1, pp. 1-9.

Hsia, R.Y., Mbembati, N.A., Macfarlane, S. and Kruk, M.E. (2012), "Access to emergency and surgical care in Sub–Saharan Africa: the infrastructure gap", *Health Policy and Planning*, Vol. 27 No. 3, pp. 234-244.

Ibrahim, R., Auliaputra, B., Yusoff, R.C.M., Maarop, N., Zainuddin, N.M.M. and Bahari, R. (2016), "Measuring the success of healthcare information systems in Malaysia: a case study", *IOSR Journal of Business Management (IOSR-JBM,)*, Vol. 18 No. 4, pp. 100-106.

Kamau, J.K., Onyango-Osuga, B. and Njuguna, S. (2017), "Challenges facing implementation of referral system for quality health care services in Kiambu county, Kenya", *iMedPub. Journals*, Vol. 4 No. 1, pp. 1-8.

Khalil, S. (2017), "Isle of man launches electronic document management", available at: www.digitalhealth.net/2017/06/isle-man-launches-edm/ (accessed 10 October 2016).

Khan, T. and Edwards, D. (2012), "Assessment of health information systems: Ministry of Health and Social Services (MOHSS) Republic of Namibia", available at: www.ghtechproject.com/files/GH%20Tech%20Bridge%20Project%20%20B015%20Namibia%20HIS_7_30_12%20GHTB_%20SECURED508.pdf (accessed 16 September 2017).

Kihuba, E., Gathara, D., Mwinga, S., Mulaku, M., Kosgei, R., Mogoa, W., Nyamai, R. and English, M. (2014), "Assessing the ability of health information systems in hospitals to support evidence-informed decisions in Kenya", *Global Health Action*, Vol. 7 No. 1, available at: www.ncbi.nlm.nih.gov/pubmed/25084834 (accessed 15 July 2017).

Krickeberg, K. (2007), "Principles of health information systems in developing countries", *Health Information Management Journal*, Vol. 36 No. 3, pp. 8-20.

Leenen, L.A.M., Wijnen, B.F.M., de Kinderen, R.J.A., van Heugten, C.M., Evers, M.A.A. and Mojoie, M. H.J.M. (2016), "Are people with epilepsy using eHealth-tools?", *Epilepsy & Behaviour*, Vol. 64, pp. 268-272.

Littlejohns, P., Jeremy, C., Wyatt, J.C. and Garvican, L. (2003), "Evaluating computerised health information systems: hard lessons still to be learnt", *BMJ*, Vol. 326 No. 7394, pp. 860-863.

Lungo, J.H. and Igira, F. (2008), "Development of health information system in Zanzibar: practical implications [electronic version]", *Journal of Health Informatics in Developing Countries*, Vol. 2, pp. 24-32, available at: www.jhidc.org/index.php/jhidc/issue/view/4 (accessed 11 February 2018).

Mbondji, P.E., Kebede, D., Soumbey-Alley, E.W., Zielinski, C., Kouvividila, W. and Lusamba-Dikasa, P. (2014), "Health information systems in Africa: descriptive analysis of data sources, information products and health statistics", *Journal of the Royal Society of Medicine*, Vol. 107 No. 1, pp. 34-45.

Morrison, A. (2017), "Digitising the NHS: creating a single source of truth", available at: https://thestack.com/cloud/2017/07/07/digitising-the-nhs-creating-a-single-source-of-truth/ (accessed 5 September 2017).

Mutale, W., Chintu, N., Amoroso, C., Awoonor-Williams, K., Phillips, J., Baynes, C., Michel, C., Tylor, A. and Sheri, K. (2013), "Improving health information systems for decision making across five Sub-Saharan African countries: implementation strategies from the African health initiative", *BMC Health Services Research*, Vol. 13 No. 2.

Namakula, S. and Kituyi, G.M. (2014), "Examining health information systems: success factors in Uganda's healthcare system", *The Journal of Global Healthcare Systems*, Vol. 4 No. 2, pp. 1-16.

Namibia Health Facility Census (HFC) (2009), *Ministry of Health and Social Services (MoHSS)*, Facility Census (HFC), Windhoek, available at: https://dhsprogram.com/pubs/pdf/SPA16/SPA16.pdf (accessed 8 July 2017).

Nampa (2017), "Ministry of health launches improved district health information system", available at: www.newera.com.na/2017/07/10/ministry-launches-improved-district-health-information-system/ (accessed 15 July 2017).

National Aboriginal Health Organization (2007), "Understanding health indicators", available at: www.naho.ca/documents/fnc/english/FNC-UnderstandingHealthIndicators (accessed 10 October 2016).

Nengomasha, C.T. and Beukes-Amiss, C.M. (2002), "Ministry of Health and Social Services: records management survey reports No. 1 and 2", Unpublished, University of Namibia, Windhoek.

Ngafeeson, M.N. (2014), *Health Care Information Systems: Opportunities and Challenges*, IGI Global, pp. 258-266, available at: www.igi-global.com/chapter/healthcare-information-systems-opportunities-and-challenges/112769 (accessed 12 July 2016).

Republic of Namibia, Ministry of Health and Social Services (MoHSS) (2011), "Namibia Health Facility Census (HFC) 2009", Windhoek, available at: www.mhss.gov.na/files/downloads/fa1_Quality%20Management%20Systems%20Assessment%20Report%202014.pdf (accessed 10 October 2016).

Republic of Namibia, Ministry of Health and Social Services (MoHSS) (2014), "Assessment of the national quality management systems used to monitor and improve quality in health service provision in hospitals and health centres in Namibia: final report", Windhoek, available at: www.mhss.gov.na/files/downloads/fa1_Quality%20Management%20Systems%20Assessment%20Report%202014.pdf (accessed 10 October 2017).

Republic of Namibia, Ministry of Health and Social Services (2013), "Ministry of health and social services, strategic plan (2009-2013)", available at: www.google.com.na/webhp?gws_rd=cr,ssl&ei=FWKhU_WoJobm7Aal3IDwBg#q=Republic±of±Namibia%2C±Ministry±of±Health±and±Social±Services%2C±Strategic±Plan±(2009-2013).±Ministry±of±Health±and±Social±Services±Windhoek%2C±Namibia (accessed 7 September 2016).

Republic of Namibia (2009), *Health Facility Census (HFC)*, available at: http://dhsprogram.com/pubs/pdf/SPA16/SPA16.pdf (accessed 15 October 2016).

Vital Wave Consulting (2009), "Health information systems in developing countries: a landscape analysis", available at: www.minsa.gob.pe/ogei/conferenciaops/recursos/43.pdf (accessed 2 February 2018).

WHO (2006), "Framework and standards for country health information systems: working draft", available at: www.who.int/healthmetrics/documents/hmn_framework200803.pdf (accessed 14 October 2017).

WHO (2008), "Health information systems: toolkit on monitoring health system strengthening", available at: www.who.int/healthinfo/statistics/toolkit_hss/EN_PDF_Toolkit_HSS_InformationSystems.pdf (accessed 10 October 2017).

WHO (2012), "Management of patient information trends and challenges in member states", *Global Observatory for eHealth Series*, Vol. 6 No. 2018, available at: http://apps.who.int/iris/bitstream/10665/76794/1/9789241504645_eng.pdf (accessed 15 February).

WHO (2015), "Global reference list of 100 core health indicators", available at: www.who.int/healthinfo/indicators/2015/metadata/en/ (accessed 16 September 2017).

World Bank (2009), "Health information systems", available at: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/EXTHSD/0,contentMDK:22239824~menuPK:376799~pagePK:148956~piPK:216618~theSitePK:376793,00.html (accessed 25 February 2016).

Further reading

Frøen, J.K., Myhre, S.L., Frost, M.J., Chou, D., Mehl, G., Say, L. and Jani, J.V. (2016), "eRegistries: electronic registries for maternal and child health", *BMC Pregnancy and Childbirth*, Vol. 16 No. 11.

Corresponding author

Cathrine Tambudzai Nengomasha can be contacted at: sisivictoriagutu@gmail.com