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Influence of Health Information Systems on Services Delivery in Public and Private Health Facilities: A Systematic Literature Review

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Abstract: *Information and communication technologies (ICTs) are thought to have a significant influence on the delivery of health services through health information systems (HIS) use. The literature with relation to the influence of health information system on health services delivery is reviewed in this paper. The study specifically examines theoretical aspects of the concept of HIS and its benefits, the impact of HIS on service delivery, obstacles to effective use and the effect of underutilization of these systems. Using the documentary review approach, various search engines and databases were employed to search for information in peer-reviewed publications and conference papers. The search query involved keywords such as 'information systems', 'health sector', 'health information systems', 'health services', 'services delivery', 'influence of health information system on health services delivery and 'quality health services'. The review focused on material published in -English language. Information and communication technologies (ICTs) have been found to have a significant influence on the delivery of health services through health information systems (HIS) use. Health Information System (HIS) remains important in the health sector to ensure cost-effective and reliable delivery of health services. The availability and effective use of HIS provide the means at which health services can effectively and efficiently delivered in health facilities.*

Keywords: *Service delivery, health information system (HIS), public health facilities, private health facilities, systematic literature review*

1.0 Introduction

Economic development depends on a high quality population which is determined by good health among individuals in a community (Muhanga and Malungo, 2018; Muhanga, 2020a, 2020b). According to Sustainable Development Goals agenda, good health is a component of development and healthy community (UNDP, 2015; URT, 2016). Good health depends very much among others on effectiveness and efficiency of health services delivery (Muhanga and Mapoma, 2019). Information and communication technologies (ICTs) are thought to have a significant influence on the delivery of health services through health information systems (HISs) use. These systems have been introduced in health industry due to the emerged challenge in the health in terms of huge amount of data produced that need to be collected and managed. Obviously, when patient data increases in hospitals and health facilities, it becomes difficult to manage those data hence the need for a computerized information system as a tool to solve this challenge (Rahimi and Vimalrund, 2007).

The availability and effective use of HIS provide the means at which health services are delivered. According to Archangel, (2007) HIS's goal is to provide high-quality services, timely and accurate information, and clinical data sharing in order to help patients receive the best care possible. The HIS reduces cost, reduce errors in medication and improve care quality (Kimaro and Nhampossa, 2004; Bell *et al*. 2012; Ahmadian *et al*. 2017). However, HIS is considered expensive (the initial acquisition cost and continuous cost of maintenance), needs time to adapt and requires expertise, and it depends on technology (Menachemi and Collum, 2011). The extent of HIS adoption and use is fast escalating in both developed and developing countries, Tanzania inclusive, due to its significant influence on service delivery. It is reported that HIS has a significant effect on enhancing services delivery in health care as well as the quality of those services given to the public (Gatner *et al.* 2017).

This paper reviews the concept and application of health information systems. It discusses the concept of HIS, its importance, the influence and potential of HIS on service delivery. Moreover, the paper reviews the obstacles to

effective use of HIS as the cause of failure and underutilization of these systems. The goal of this study is to establish a link between health information system and services delivery, on how HIS can affect the delivery of health services.

2.0 Methodology

A documentary review (documentary research method) was employed to gather pertinent information in this study. A researcher finds written documents that contain information concerning the phenomenon that is being studied and analyzes it. The procedures used to categorize, analyze, interpret, and recognize the limitations the written documents, are known as documentary methods (Mogalakwe, 2009; Bohnsack, Pfaff and Weller, 2010; Kayunze et al., 2012; Muhanga and Malungo, 2017; Mshingo., & Muhanga, 2021). A documentary review is considered more cost effective than other methods (Mogalakwe, 2009).

This paper is based on literature review whereby the search for relevant scholarly articles was conducted using a variety of databases including Google Scholar, ProQuest, ReasearchGate, ScienceDirect, PMC and JSTOR. Also other official documents including relevant publications from the Ministry of Health in Tanzania, World Health Organization (WHO), and, United Nations Development Program (UNDP) were also used. In exploring HISs and services delivery, keywords such as 'information systems', 'health sector', 'health information systems', 'health services', 'services delivery', 'health information technology influence' on health services delivery' and 'quality health services' were used to find relevant documents and journal papers that had previously been published. Literature and documents with no time limit up to 2021 were included in literature review, excluding non-English publications.

3.0 Findings and Discussion from the Reviewed Literature

3.1 Definition of HIS

The health information system (HIS) has been defined differently by different authors. Tossy (2014:3) defines HIS as "the intersection between healthcare business process and information systems to deliver better services, is a set of components and procedures organized with the objective of generating information which will improve health care management decisions at all levels of the health system".

According to World Health Organization, (2008) and Hodge, (2012); HIS gathers data required from the health industry and similar industries, analyzes health data to ensure accuracy, time-bound, relevance, then turns the data into meaningful information to be used in decision making related to health. The effective functioning of the world's health systems depends on coordinated determinations to obtaining, reporting, using information to guide policy making, program intervention, and involve expertise on research.

Almunawar and Anshari, (2012) have defined HIS as the system used to describe the interaction between individuals, processes, and technologies in health sector in order to assist processes and administration in providing critical statistics that enhance services in the healthcare be of high quality. A health information system (HIS) is any type of standardized data that pertains to health. It involves the collection of data, information, or knowledge that can be used to aid the process of services delivery in health care or to encourage health development in a country (Panerai, 2010). The efficiency of health planning and policy, as well as the quality of health care delivery rely on the availability of reliable and timely data to help them make decisions.

3.2 Types of HIS

According to Dehnavieh *et al.*, (2019) there are numerous different types of HIS, however there is two main categories of HIS where most systems fit into one of the two categories; (i) electronic medical/health record (EMR), and, (ii) Clinical decision support system (CDSS).

3.2.1 Electronic Medical/Health Record (EMR)

EMR handles patent records or information where each patient's medical information is collected, processed and stored in electronic form (Tang and McDonald, 2006). These records include patient details, patient health history, test results, diagnosis, medications, and doctor appointments/special visits. EMR enables records to be shared by other health professionals and ensure the streamline of patient data to be accessed by various professionals and doctors in different health facility, clinic or hospital to ensure easy access of information, better treatment as well as time saving.

3.2.2 Clinical Decision Support System (CDSS)

CDSS manages information, clinical data sharing, and helps clinicians make better clinical decisions. According to Addo and Agyepong, (2020:2) "the clinical decision support in facilitating clinical work flow integration among nurses and other medical professionals". CDSS analyzes data using the system, the availability of analyzed data assist professionals and health providers in improving care to patients and decisions making.

3.3 Information Collected by HIS

The kind of information collected in health information systems includes patient information, laboratory test results, diagnosis report, treatment, and medical history (Brook, 2020). HIS collects information from health industry; in clinics, dispensaries, health facilities and hospitals (WHO, 2008). The information collected is needed and used by health providers, nurses, doctors, health planners, decision makers and policy makers; used to improve patient safety, service delivery, make plan and decisions on health matters and enact effective health policy.

3.4 Benefits of HIS

Health Information System (HIS) has been considered important in health sector to ensure cost-effective and reliable delivery of health services. According to Gatner *et al.,* (2017) as cited by Sayyid, (2021), HIS has significant role in improving health services delivered as well as the quality of services provided to community. Health facility that uses HIS benefits from availability and easy accessibility

of patient data which are collected and stored routinely in the system.

Ayabakan *et al.*, (2017:6) states that 'HIS facilitate capturing, storing, sharing, and retrieval of patient health information'. Health Information System assists in the process of collecting, compiling, and analyzing health data for better monitoring and managing of population health and lowering costs of healthcare. The analyzed health data is useful for health providers and professionals to improve the patient care. For instance, in Tanzania, District Health Information System (DHIS) captures health data in all public health facilities in the country to monitor and manage health data (Smith *et al.,* 2008; Dehnavieh *et al.,* 2019).

The importance of these systems include, simple access to health information, improved documentation quality unlike paper based documentation, reduced errors particularly medical errors, improved patient care quality, enhanced information integration, reduced hospital costs, expanded database that contain huge amount of data, and improved hospital management (Ahmadian *et al.,* 2017). The health information system comprises the management system that influences the delivery of service.

According to Malliarou and Zyga (2009), health information system helps to increase the quality of care, reduces expenses and errors, and increases the security of patients' data. Due the advantage of data security, most health facilities and hospitals use cloud-based system that ensures effectiveness of data management and security from hackers, also easy access of patient data where health providers can easily access and interact with patient in a good way to deliver better service care.

Health information systems are essential resources for managing the delivery of health care services. To determine the individuals and communities' health needs, health programmes implementing and coordinating, for this to be successful an effective health information system is essential for the development of any countries, (Azubuike and Ehiri, 1999). In most countries, health services are delivered through decentralization system where people in the community have opportunity to participate in health decision (Frumence *et al.,* 2014).

3.5 Health Information System (HIS) Impacts on Delivery of Health Services

In health sector, information systems play a vital role to deliver quality health services (Sayyadi *et al.,* 2021). Different studies have described the HIS impact on quality of the services delivered in health facilities. Manzar, (2017) asserts that most countries have rapidly adopted HIS, and the use of such systems increased due to its impact on improving patient safety as well as delivering high quality services at less cost, and efficient management of patient data.

According to Nguyen, (2015) HIS have positive impact such as to improve healthcare quality and cost saving. For quality services delivery in hospitals or health facility, HIS integration support communication between health professionals and practitioners. Through this, better flow of information and sharing of clinical data is influenced. This is simply that HIS ensures mainstreaming of patients' data that can be used by different professionals and practitioners in different contexts (Orang'i, 2019).

Health information system (HIS) is used to manage patient data; effective patient data management leads to effective health services delivery, and quality of care can be realized (Sani et al., 2017). According to Gesulga *et al.* (2017); AbouZahr and Boerma, (2005) health information systems leads to quality health services improvement through the accessibility of health information, the ease access of data allows health providers to deliver service at ease. These systems support the process of recording patient information for its availability and reliability as well as accuracy.

Moreover, HIS improves patient safety. The system can save all the patient information and can be shared in multiple databases to improve the patient's safety though the ease access of patient data with the help of the system (Alotaibi and Federico, 2017). Addo and Agyepong, (2020:2) claim that "the applications of ICT provide the access to the health services for the citizens and increase the level of patients' safety, also provide the quicker medical diagnoses, reduced workload among users, improvement in patients' waiting time and information accessibility" Furthermore, HIS helps on record keeping and management which influence the service delivery (Ondieki, 2017). However, on contrary, problems with HIS can affect the delivery of services and patient outcome (Kim, Coiera, and Magrabi, 2017). This is a caution that HIS has its own limits in terms of usefulness.

3.6 Obstacles to Effective HIS Utilization in Developing Countries

Despite the advantages of an HIS. There are innumerable obstacles to successful and effective use of health information systems, (Kimaro and Nhampossa, 2005). In both developing and developed countries such obstacles could be observed, despite developing countries having a significant share. It has been noted that in most of the developing countries the extent of use is still low, not widely used and sometimes fail after being implemented due to several factors.

Gabriel *et al.* (2014) asserts that inadequate broadband and poor internet infrastructure in health facilities is one of the challenges to effective use of HIS. Definitely, for the system to function, adequate internet broadband is required. Other factors include, insufficient capital and budget for these systems. Shortage of health knowledgeable and skilled personnel on IT, to operate health systems and problems on security of patient data are among the obstacles.

Shortage of ICT skills among medical staff; frequent power outages, if there is no power or backup power such as generator or solar then the system is off until there is power; lack of supportive ICT resources in health facilities; and problems on integration and usability of HIS due to inadequate infrastructures are obstacles to HIS use, thus affects utilization of the system and service delivery (Peltola, 2019).

Oleribe *et al.* (2019) identified key challenges that face health systems in Africa which are human resources challenges, the management of human resources is poor

hence affects the performance of staffs; low budget allocated to health; poor hospital management and infrastructure such as ICT infrastructure. Furthermore, the cost of operation such as bandwidth cost, lack of enacted policy, technical know-how, funding, awareness of users and fear for change manual systems to electronic systems.

In most countries, there is lack of enacted policies and regulations to support health systems as well as strategies to strengthen the existing system; privacy concerns due to the presence of hackers; financial resource issues due to the dependence from donors are among the obstacles (Jalghoum *et al.,* 2019). These obstacles mostly result into unsustainability of systems and services are delivered at low quality.

Moreover, other studies (WDG, 2015; Smith *et al.,* 2008) have pointed out to corruption, operational cost being high, shortage of experienced human resources for health and technology area, inadequate health systems for delivering health services, to be major challenges for health sector in developing countries Tanzania included. The aforementioned barriers to successful HIS use are the possible causes for the issue of underutilization of these systems (HISs) in both public and private health facilities in developing countries, where health information systems have potential influence on services delivery.

3.7 Health Information Systems implementation in Tanzania

The extent of implementing, integrating and adoption of HIS is rapidly growing in different countries, including Tanzania, due to the advantages of integrating information system in health industry. According to Rahimi, Vimarlund and Timpka (2009) the purpose of implementing the health information systems (HISs) is to improve the quality of health services provided to patients. The introduction of information systems to health sector has been considered to have significant influence in health services delivery, therefore leading to quality population which is determined by good health (Muhanga and Malungo, 2018).

According to WHO, (2017) HISs are implemented in approximately more than 6000 health service delivery points including public and private health facilities in Tanzania. One of the country's strategic priorities is to strengthen health systems to improve quality, equity in access and utilization of health services (WHO, 2018). The focus of national health policy of Tanzania is to encourage the health system to improve the quality of health services delivered to the community (URT, 2017); these strategies and impact on services delivery influence HIS to be implemented in health facilities to achieve the goal of delivering health services. Health Management Information System (HMIS) is implemented to manage all health data in the country (Smith et al., 2008).

In Tanzania, health information system's implemented are namely as; Care2x, INAYA, AfyaPro, GoTHoMIS and DHIS which is used in public facilities to collect health information, just to mention a few. These systems involve different functions such as, patient record keeping, billing and financial management, disease management, and human resource management (Mwaniki, 2017). However, one need to choose HIS that meet the requirements or according to the needs of the health facility or hospital taking account into the influence of HIS use on service delivery (Peltola, 2019).

4. Conclusion

Health Information System (HIS) is considered crucial in the health industry. The benefits of HIS have been recognized at different levels, much as its influences on delivery of health services in health facilities have been noted. These systems, HISs, have afforded timely delivery of health services with ease. The systems have guaranteed the availability of well managed data that may help to track patient information and ensure mainstreaming of patent data. Such data have been always used in health decision-making and policy makers. However, the benefits of HIS in health services delivery can be seen and realized if and only if the challenges such as inadequate ICT infrastructure, inadequate fund, lack of trained personnel, technical factor, poor allocation of resources and management as well as human resources that face HIS are solved.

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