Review / Derleme

The Use of Health Informatics and Information Technology: The Situation in Botswana

Sağlık Bilişimi ve Bilgi Teknolojisinin Kullanımı: Botsvana'daki Durum

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Abstract

Health Informatics (HI) and Information Technology (IT) have enormous potential to improve healthcare quality in countries around the world. A literature review was used to conduct a situational analysis of the use of HI and IT in Botswana's health sector. According to research, there is a significant gap in the available information on the status of HI and the challenges that affect Botswana's healthcare sector. As technology evolves, a frequent situation analysis is required to remedy or improve on challenges encountered during development and implementation, particularly in the health sector. The current study explores present status of HI and IT in Botswana's healthcare system as well as successes, opportunities and challenges faced in the development of e-Health and HI in Botswana. An extensive literature review was carried out to provide a conceptual background of e-Health and HI in Botswana. The paper provides incalculable data on e-Health and HI in Botswana that will be useful in informing future studies, policies and developments in the field of HI and e-Health in Botswana and other developing countries.

Key words: Health Informatics, Health Information, e-Health, Botswana

Özet

Sağlık bilişimi ve teknolojisi, küresel düzeyde ülkelerin sağlık hizmetlerinin kalitesini sağlamada büyük bir potansiyele sahiptir. Bu çalışma Botsvana'nın sağlık sektöründe sağlık bilişimi ve bilgi teknolojisi kullanımının durum analizi, literatür taraması yoluyla gerçekleştirilmiştir. Araştırmalar, sağlık bilişiminin durumu ve Botsvana sağlık sektöründe karşılaşılan zorluklar hakkında mevcut bilgilerde büyük bir boşluk olduğunu göstermektedir. Teknoloji geliştikçe, özellikle sağlık sektöründe bu tür uygulamaların geliştirilmesi ve uygulanması sırasında karşılaşılan zorlukların giderilmesi veya iyileştirilmesi için sık sık durum analizi yapılması gerekmektedir. Mevcut çalışma, Botsvana'nın sağlık sisteminde sağlık bilişimi ve e-sağlığın mevcut durumunu ve ayrıca Botsvana'da e-sağlık ve sağlık bilişiminin geliştirilmesinde karşılaşılan başarıları, fırsatları ve zorlukları araştırmaktadır. Botsvana'da e-sağlık ve sağlık bilişiminin kavramsal bir arka planını sağlamak için kapsamlı bir literatür taraması yapılmıştır. Bu makale, Botsvana'da ve diğer gelişmekte olan ülkelerde sağlık bilişimi ve e-sağlık alanındaki gelecekteki çalışmalara ve gelecekteki gelişmelere bilgi vermede faydalı olacak, Botsvana'daki e-sağlık ve sağlık bilişimi hakkında değerli veriler sunmaktadır.

Anahtar kelimeler: Sağlık Bilişimi, Bilgi Teknolojisi, e-Sağlık, Botsvana

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Introduction

Health Informatics and Information Technology have evolved over the years and this development has offered opportunities for addressing health issues worldwide that include burden of illness, poor doctor-patient relationships, lack of access to medical professionals and lack of medicines.[1] However, in most developing countries, the use of technology and HI in the healthcare sector is limited. HI is a field of information that uses computers and other technologies to manage health data and information.[2] It is the development and evaluation of methods and systems for collecting, processing and interpreting patient data using knowledge gained from scientific research. HI does not only apply to health problems, it also covers all aspects of creating, processing, communicating, storing, retrieving, managing, analyzing and synthesizing data, information and knowledge in the whole healthcare sector.[3] The fact that the use of information for medical care is more crucial than the technology itself is one of the many factors that sets HI apart from a purely IT perspective in a healthcare organisation. Simply put, healthcare technology makes it simpler to gather, transmit, store, and analyse healthcare data.[2]

The study focuses on a situation analysis of the use of HI and technology in a developing country located in the Southern African region known as Botswana. Botswana is a landlocked country with an estimated population of 2,351,625 in 2020, with 29% of that population living in rural areas.[4] The life expectancy in Botswana increased from 53.2 in 2009 to 68.0 in 2019.[5] In 2017 Botswana spent 4.8% of its GDP on public health expenditure.[6] One percent of the population is estimated to have in-cured catastrophic health expenditures in 2019. This catastrophic health expenditure is calculated as out of pocket medical expenditure in excess of 10% of household consumption or income. The total income for Botswana government accounted for 28.5% (in 2019) of the GDP.[6] 144 women in every 100,000 live births (in 2017) died from pregnancy-related causes in Botswana. Furthermore, the Universal Health Coverage Index (UHC) score is 6.6. 65% of the population in 2018 had access to electricity with a high active SIM card subscriber rate of 15%. However, in 2017 Botswana had a 41 % population usage of the internet which in global comparison is low. This rate is considerably higher (22%) than the average for the area; however it is lower than the average (60%) for its income group.[6]

Since gaining its independence, the government of Botswana has worked to guarantee that all citizens have equal access to medical care. Public, private, non-profit, and traditional medical specialties are all included in Botswana's healthcare system. Botswana has chosen a decentralised system for delivering healthcare. Primary healthcare is considered to be the main pillar of service delivery in Botswana.[7,8] The national health care system is made up of 18 general hospitals, 17 primary hospitals, 104 clinics with beds and 214 without beds, 347 health posts and 973 mobile stops, serviced by 830 doctors and 7427 nursing staff.[9] These structures aim at providing preventive, promotive and rehabilitative health services in addition to treatment and care of common health problems.

The public sector is the largest sector of Botswana's healthcare system, accounting for 98% of the medical facilities.[10] Public hospitals include primary hospitals, operating as general hospitals across the country generally equipped to handle most diseases and any immediate threat to individual's health. Secondly, they include district hospitals, consisting of more beds and highly equipped to handle severe medical issues. Finally, referral hospitals are those highly advanced and equipped facilities mainly dealing with specialized medical conditions. The government is considered to be the largest employer for health professionals. Shortage of skilled and qualified healthcare workers is one of the government's greatest concerns which threatens the provision of quality care with 4 physicians and 27 nursing and midwifery personnel per 10,000 population.[11] General health check-ups in Botswana are generally free with citizens paying 5 pula ($0.43) excluding those under 5 years and above 65 years. The Botswana citizen patients referred to other countries for medical treatment or procedures are paid for by the government.[12] Despite the worldwide spread of mobile internet, the use of IT and informatics in developing countries including Botswana is highly limited.[1] Consequently the potential of IT and HI needs to be fully explored. This study aims to conduct an analysis of the current state of the use of HI and IT in Botswana.

Health Information Technology (e- health) and Health Informatics Development in Botswana

The World Health Organization (WHO) suggested e-Health as a way to promote health and views the development of an e-Health strategy as a requirement for its implementation. The majority of nations have unconnected and uncoordinated e-Health initiatives. The use of a mobile device to access medical databases and obtain medical information is one of the components of e-Health, Health Information System (HIS),

Telemedicine (m-Health), and e-Learning in Botswana.[1] With few available interventions and few, financially dependent, and largely abandoned m-Health telemedicine initiatives, HI is not fully implemented.

Policy and Legislation for Health Information Technology (e-health) and Health Informatics in Botswana

The development of e-Health and HI in Botswana just like in any developing country can be considered as limited but with efforts made for its development. There are a few policies, strategies and legislations that support the development and implementation of Information and Communication Technology (ICT) in health care delivery in Botswana. Among these is the National ICT policy (2007).[13,14] The Botswana National Health Information System was considered to be operating under a very weak policy and regulatory framework for a considerable period of time which lacked health information and informatics legislation, national policy and strategic planning.[7,8] However, through the development and introduction of the National ICT policy in 2007 great results were achieved in policy development at the national level.[14] Through this policy, the government reaffirmed its position to promote the use of ICT as one of the driving forces of efficiency promoting the country's development in different sectors.[13] One of those sectors is the health sector, for which the policy lays out specific objectives, plans, and initiatives. The policy outlines the e-Health programme and includes provisions for project management and coordination, reviews of pertinent policies, laws, and standards, as well as effective e-Health management.[14]

The e-Health program aims to provide better quality care through better use of ICT and innovation and investment into the health systems and business practices to improve the quality, safety, timeliness and efficiency of health care throughout Botswana.[14] According to the 2007 National ICT policy, the e-Health program is implemented according to four main initiatives. The first initiative is to build a solid foundation for e-Health including the establishment of the e-Health council which aims to provide national leadership and support for e-Health projects across the entire health system. The second initiative is to enable clinicians to provide complete patient care including provision of ICT-based tools and systems to healthcare professionals for them to service patients with the highest service quality level possible. According to the policy, the significant investments is to be undertaken in professional development and change management for healthcare professionals, including accelerating the implementation of electronic or computerized patient management systems and revising health-related curricula in academic institutions.[14] The third initiative is to improve access to healthcare services and information. Several implementations for this initiative range from expanding the use of radio and television health messages to health portals integrated into e-Government sites. The final initiative is to establish a national health surveillance network to enable governments to manage and improve the health of the people as well as health care systems by systematically identifying emerging problems and monitoring the effectiveness of intervention strategies.[14]

Another progressive development regarding policies and legislation on Health IT (e-Health) and HI in Botswana was made in 2020 when the Government of Botswana officially adopted an e-Health strategy based on the WHO /International Telecommunication Union (ITU) e-Health Strategy Toolkit.[15] The Botswana's e-Health strategy is in line with the May 2018 World Health Assembly Resolution (WHA71.7) on Digital Health, Data Protection Act, Botswana National Health Monitoring and Evaluation Plan, National Health Policy and Integrated Health Service Plan (IHSP).[16-20] This strategy represents a milestone in developing e-Health and HI implementations in Botswana. However a critical review of the e-Health Strategy indicated that the term e-Health was explicitly mentioned, but there was no clear definition of these term.[1] This intern raised a limitation in which the outline intervention protocols for each component of e-Health could aid in the delivery of health services.

Healthcare Facilities, Equipments and Infrastructure

The Ministry of Transport and Communications coordinates the development of information systems infrastructure in Botswana as part of the government's mandate to integrate and advance the broader government mandate to promote the use of IT in various areas of the public sector. With some documented inequalities in the available infrastructure supporting health information systems, the government's computerization strategy has improved the delivery of infrastructure such as: telecommunications and computer networks.[21] The infrastructure is generally adequate with some communication systems such as computers, working telephones and widespread e-mail/internet services in place.[22] Healthcare in Botswana is delivered through an extensive network of medical facilities spanning from 27 Health districts.[9] Health facilities in Botswana are still heavily dependent on the traditional manual system, but in both the public and

private sector there are different electronic registration systems for providers and donors, but they are not interactive with each other, resulting in fragmented care, unnecessary repeated efforts and expenses.[23] Healthcare facilities in Botswana (both public and private) have one or more eRecord system and some hospitals support m-Health applications. Amongst the eRecord systems found in Botswana are:[23]

I. The Patient Management System (IPMS): An integrated, centralized patient records system with 12 interactive modules. It is currently found in all public hospitals and some clinics.

II. Patient Information Management System (PIMS): A standalone system for managing medical records of HIV patients used in clinics and healthcare facilities that do not have IPMS.

III. R-Care: A HIS supporting clinical, financial and procurement modules.

IV. Sukraa Hospital Information Management System: A HIS that connects to the Systems Applications Products (SAP) package to support the management of all clinical data and support billing modules.

V. Laboratory Information Management System (Senaite): An open-source system customized for a specific laboratory workflow (full laboratory sample cycle).

VI. TriMed System: Patient care/administrative services from check-in to discharge, including billing and medications.

VII. District Health Information System (DHIS2): An open-source Internet-based system used to collect aggregate data about patient diagnoses in each medical district area.

VIII. OpenMRS: An open-source system for collecting/storing day for tuberculosis patients.

IX. Mobile Telemedicine (Kgonafalo): A mobile health application for sharing patient data and images between institutions and specialists in referral hospitals. Services provided include: oral medicine, radiology services, dermatology and cervical cancer screenings.

X. Arch's Air (web-based): Used in medical wards (EMRs) for medical records and related clinical services.

XI. Optima: Used for patient registration, billing and reporting.

Between 2012 and 2015 the government cut down on the number of health IT interventions and focused mainly on the following: IPMS, DHIS2, Central Stores Drug Management and PIMS.[15]

Human Resources

According to the Ministry of Communication Science and Technology, Botswana has low awareness of e-Health/HI despite the government's full acceptance of e-Health.[14] It is evident that the national HIS in Botswana has significantly made considerable efforts to develop human resource capacity for health information management, specifically at the central level.[24] For instance, there are some staff members who have been trained in various aspects of health information management.[25] However, the high turnover has since undermined the achievements and efforts made in this area and limited the development of the whole system. The Ministry of Health has recognized the importance for people to be trained in health information management in the National Health Manpower Plan 1997-2003.[26] However, there are noted challenges which includes external training and recruitment which has continued to weaken the human resource capacity of the system. Shortage of trained personnel in health information management and other related fields of study continues to be a challenge at all levels of the health systems. One explanation for this is that there is still shortage of people with enough skills and knowledge in Sub-Saharan Africa to train other health workers.[27] Training potential users before implementing e-Health technologies can have a positive impact on their perception of e-Health.[28] However it takes a long time to train health workers in a country.[29] As a result, Botswana still faces a huge task of maintaining enough human resources to find a way to deploy HI across Botswana. Given the fundamental role of e-Health users, governments should ensure that all users (health workers and the public) are trained in e-Health before embarking on large-scale implementation of e-Health initiatives.[30]

Access and Application of Health Informatics in Healthcare

Despite the limitations on the potential for development, there is evidence of the use of medical informatics in most healthcare facilities in Botswana. The use of Skype between Botswana and Canada to exchange patient information and provide medical educational services has been reported.[31] Other reported HI interventions include the use of Short Message Service (SMS) applications (e.g. sending CD4 test results from laboratories to clinics), patient appointment notifications and billing and payment.[32,33,34] Telemedicine for dermatopathology have been reported and was later replaced by telepathology using WhatsApp.[35] Applications of HI in Botswana have also been reported through the use of m-Health for tuberculosis surveillance or monitoring.[36] It has also been reported through access and exchange of

information between health care providers.[37] Some of the researches reported a mobile pharmacy app used to track antiviral drug restocking data.[38]

Several e-Health interventions have also been applied to education or training in Botswana. For instance researchers reported the use of simulators, computers, webcams, and Skype to simulate teaching fundamentals of laparoscopic surgery in Botswana.[39] Furthermore another study described the use of SMS for clinical practice guidelines.[40] Researchers also studied the use of tablets in education and a partnership between University of Botswana School of Medicine (UBSOM) and University of Pennsylvania (UPenn) developed a mobile learning program for educating medical students.[41,42] Additionally, another study examined the information needs and behaviors of populations when seeking information and explains the responsibility of governments (and other stakeholders) and related policies in creating an information-rich environment in a country.[43]

There are also traces of telemedicine research interventions in Botswana. Majority of telemedicine research in Botswana was conducted by a research group called the Botswana-UPenn Partnership mainly focusing on mobile telemedicine (m-Health) in Gaborone and also reported on an m-Health pilot project.[36,37,38] Cervical cancer screening, teledermatology, teleradiology, oral and ophthalmology exams are all available through telemedicine. Researchers have also compared the diagnostic response of a photo-based remote cervix diagnosis by an obstetrician and gynaecologist to a personal visual examination with acetic acid by a midwife. Images for remote evaluation were taken with a mobile phone camera and sent through a multimedia messaging service (MMS). [44] HI in Botswana reflects great potential for improvement as there is evidence of access and applications in healthcare including telemedicine, electronic health records, health information systems, mobile health and e-learning tools.

Progress, Barriers and Opportunities

The Republic of Botswana through the e-Health Strategy indicates that Botswana's e-Health and informatics status has made significant progress in creating a platform for the adoption of health and informatics in general.[15] The country as a whole has generally made tremendous strides in a number of areas that has a significant impact on the expected outcome of e-Health. Firstly, there is a clear indication that the current presidency has a political will and promise to digitize the country by 2036. The department of Health Services Monitoring and Evaluation, Quality Assurance (DHSMEQA) has also been established through the Ministry of Health to lead the development of electronic health.[15] The government of Botswana has decided that Monitoring and Evaluation departments should be set up in all ministries.[15] A data warehouse has also been created to store various data sets. The Ministry of Health has a regional capacity to implement e-Health strategy and all public hospitals have electronic medical records that are maintained in real time with much higher coverage.

Recognizing, understanding and intentionally working towards removing barriers in the implementation of e-Health and HI and developing effective intervention plans is an important part moving forward. The country faces many barriers to the full implementation of e-Health and health informatics. Firstly, the Botswana government finances rely mostly on the national budget for almost all health care budgets.[19,45] Thus, HI and e-Health have the potential of stretching the government budget to the limit. Due to differing commitments, budgets and resources are often cited as hindering the achievement of many of the Ministry's goals for the use of e-Health and health informatics.[46] However, although it can be considered costly at the early states of implementation and deployment, it can be useful as a saving mechanism in the long run. IT environments require maximum security to protect all records and systems for use in HI systems, so they are intended to be seen only by those authorized to see them. As Botswana is not yet advanced in networking, databases and cybersecurity, other issues such as breach of security are likely to arise.[47] Botswana has faced some infrastructural issues including lack of basic connectivity requirements (e.g electricity) and lack of IT devices (e.g telephones) and lack of internet which hinder the use of e-Health and HI in Botswana.[48] Other barriers to the deployment of HI in Botswana include among others weak organizational skills, lack of skills training, lack of evidence-based decision-making capacity, lack of strong political leadership, lack of ICT use and technology awareness, poor data quality and lack of development of data standards.[49] Low IT literacy, lack of end-user training, bandwidth costs, lack of clinical and technical expertise, lack of user acceptance, increased physician workload and network coverage have also been documented as additional barriers to e-Health specifically mobile telemedicine.[49] Furthermore, a longitudinal analysis in Botswana reported that lack of central coordination, weak leadership, weak policy and regulatory frameworks and inadequate resources limited the growth of e-Health and HI in Botswana.[13] Furthermore, the e-Health strategy,

which is regarded as an important milestone in the deployment of HI in Botswana, fails to emphasise the importance of comprehensive interventions that address specific and identifiable health needs using health informatics. The e-Health committee's work was suboptimal, and the gap between policy and legal frameworks remains to this day.[50] Without appropriate and specific policies, the roles and responsibilities of different actors in e-Health and HI become unclear and largely undermined.

Botswana has significant potential to implement enhanced and quality health services through the use of e-Health and health informatics.[15] These interventions towards development may include the local presidency leading the digital transformation agenda, the Ministry of Health leading the action to use e-Health as a health innovation tool, recognizing the need to transform e-Health investments into tangible benefits for patients and healthcare providers, and the available technological advances that provides an opportunity for Botswana to establish itself internationally.[15] Another opportunity is that different stakeholders are aware of the potential of e-Health and HI and there is consensus on the goal to engage in e-Health activities. The government also recognizes the need for a more person-centered approach to delivering e-Health initiatives that serve the needs of patients and healthcare professionals. Furthermore, the government also recognizes the need for greater compatibility and integration of existing information systems.[15] All these opportunities provide favorable conditions for the development of electronic health and informatics in Botswana.

Conclusion

This article traces the status of Botswana's e-Health and HI and identifies current policies and legislations, implementation, successes, obstacles and opportunities. Overall, Botswana has reportedly struggled to establish a functional e-Health and HI strategy over the years. Significant challenges exist in most aspects of the Information System hence hindering progress. Barriers such as inadequate policies and regulatory frameworks, inadequate infrastructure and human resources have been observed. However, the continuous reorganization of the Ministry of Health and Wellness and the establishment of the e-Health strategy provides a great opportunity for the deployment of e-Health and HI in Botswana.[13] Training health information specialists at local facilities can enhance the country's e-Health staffing capacity. Furthermore, evidence of access to professional and other medical resources, as well as the use of HI to address some of the current shortcomings and deficiencies of the health system is required. However, specific HI strategies are required to achieve an extended and sustainable application of e-Health and HI solutions. HI is the development and evaluation of methods and systems for the acquisition, processing, and interpretation of patient data with the help of discoveries from scientific research.[3] It is definite that Botswana's system is more concerned with computer use than with overall information management in healthcare. The availability of equipment to control healthcare system processes, acquire medical knowledge, and transfer information between everyone and medical organisations is still limited. Adoption of HI may assist healthcare professionals in providing better, less expensive care, as well as making the healthcare system more efficient and better suited to the needs of patients. E-Health could be considered as a potential solution to some of these health problems in countries with limited infrastructure, a disproportionately high burden of disease, and a severe shortage of health workers.[27] The advent of COVID-19 has however unearthed a lot of potential for both developing and developed countries in terms of e-Health and HI as innovative interventions were developed as a way of dealing with and managing the pandemic using IT. When fully implemented, e-Health and HI could totally transform the way the government of Botswana provides healthcare services to meet future needs. Even though this review has significant limitations, such as the difficulty in obtaining published papers on the topic for Botswana, the problems and restrictions experienced by the Botswana government in implementing HI may be similar to several developing countries. Implementation of HI and IT in developing countries may necessitate more resources as well as initiatives to assist incipient deployments through the exchange of experiences and staff training. Although the difficulties described in this article are specific to Botswana, they may be applicable in other countries as well, and there are many other obstacles specific to other developing countries that could be considered. As a result, HI and IT implementers in developing nations must be cognizant of common constraints and challenges that might limit efforts across the board. We believe that this article will help policymakers, healthcare managers, health professionals, and project leaders from all around the world to plan and implement HI and IT in a sustainable manner, avoiding unanticipated barriers as much as possible, and making better use of their resources. Its implementation holds vast potential for the improvement of global health. As a result, governments must be aware of the need for relevant legislations and a well-trained workforce to oversee implementation.

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