The potential value of e-health in a rural Limpopo Province municipality

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**ABSTRACT**

This qualitative study aims to assess the value of e-health in rural areas of the Limpopo Province of South Africa. The study was meant to appraise the current state of e-health readiness in rural Limpopo areas and identify any barriers to effective health service delivery. Data were collected through interviews with rural health providers from the province. The study defined e-health as an approach in which health services can be provided comprehensively by using information and communication technologies (ICTs) in a more cost-effective, efficient, and quicker way than when manual methods are used. It then established that rural health in Limpopo is deficient and is almost dysfunctional because of lacking infrastructure and scarcity of resources. Transport and road conditions, as well as a lack of patient transport, made rural health services extremely poor. The study realized that by restructuring the rural health systems in the province, there are ample opportunities to enable e-health mode to rural health service. Therefore, the study recommended restructuring rural health by introducing the use of easily available and affordable cellphone technology in the provisioning of healthcare to rural Limpopo areas.

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**Introduction**

The delivery of quality health services in South Africa is generally poor. Though health service is a human right to access healthcare, the right to healthcare is meaningless if healthcare quality is not good. A good quality and practical health system can enable reliable clinical care to comply with norms and standards set by the system, and positive feedback from patients (Chua et al., 2018). Kirby et al. (2023) explain that high proportions of people receiving effective care delivered at high quality indicate desirable health outcomes and impact. The case of poor healthcare service delivery in rural areas is a significant cause of concern, as the poorest services are experienced in these regions.

Rural health in South Africa faces weighty challenges, including high levels of unemployment, poor infrastructure, poverty risks of criminal activities, urban-rural inequalities and limited access to healthcare services (Booyens, 2003). Willie and Maqbool (2023) concur that socio-economic issues are some of the hindrances to accessing healthcare services and leading to poor health outcomes. Insufficient infrastructure and roads compound the challenges to reach health facilities. Most of the time, primary health care services are not provided in these regions. These often have a shortage of dentists, physicians, and specialists. Innovative programs and initiatives are necessary to address the shortage of healthcare professionals in rural areas and ensure that rural communities have...
access to quality and comprehensive healthcare. The experience of patients travelling long distances and not reaching the facility because of poor transport sometimes occurs. Some patients do not find doctors when visiting for appointments made long ago, while others experience cases of out-of-stock medicines. These problems in different regions differ in the levels of difficulty, whereas the poorer provinces have more challenges. The rural provinces of Eastern Cape, Limpopo, Mpumalanga, and North-West, seem to suffer most from poor health service delivery. The concern of this paper is on the poor attributes and health service problems in such settings. Thus, the Limpopo Province was selected for the study, with the focus given to one specified rural municipality for an empirical study.

The potential of e-health technologies to enhance healthcare practices in poor rural areas is implored by various advocates of good health service (Gimbel et al., 2018; Horwood et al., 2023; Keitel & D’Acremont, 2018; Tossaint-Schoenmakers et al., 2021). They cite the benefits of e-health as including the ability to support clinicians in making evidence-based, reasonable clinical decisions about patient management, which have been effectively implemented in some settings. E-health’s integrated management of childhood illness is where clinical algorithms are used to provide guidelines for managing sick children in primary healthcare clinics, and it has demonstrated immense effectiveness in low-income countries. Rush et al. (2021) explain that telemedicine proved effective during the COVID-19 pandemic and ensured confidence in telemedicine even though rural areas were not exposed abundantly to this mode in the way urban health benefited. Refahi et al. (2023) explain that telemedicine satisfaction and e-health literacy correlate.

The multifaceted barriers in rural patient-centred outcomes make rural health difficult to address. Fayet et al. (2020) concur that rural health is a complex, multi-dimensional health challenge expected to ensure healthcare access. Coombs et al. (2022) explored US rural healthcare providers’ perspectives on socio-cultural factors that affect care delivery. They also state that it is important to investigate healthcare access barriers in rural-specific areas to understand their origin and then model their implications for addressing their resolution. This article aimed to examine ways in which e-health can alleviate some of the problems experienced in a selected municipality in the Limpopo Province.

**Literature Review**

A literature review refers to an evaluative report of information from prior studies related to the current study (Paul & Criado, 2020). This section will review the studies on e-health and available solution areas.

**e-Health**

Information and communication technologies (ICTs) are crucial for reducing poverty, improving access to health and education services, and creating new sources of income and employment. Being able to access and use ICTs has become a major factor in driving competitiveness, economic growth and social development (Aksentijevi, 2021). e-Health is one of the ICT solutions implemented in the health sector. It blends technologies with the Internet to provide and improve quality of life and healthcare delivery (da Fonseca et al., 2021).

Terms used interchangeably with e-health include decision-support system (DSS), electronic health, electronic health record (EHR), electronic medical record (EMR), electronic prescribing (eRx), federal health architecture (FHA), federal health interoperability modelling and standards (FHIMS), health information exchange (HIE), health information technology (Health IT), health telematics, interoperability, m-health, precision medicine, remote monitoring, remote control teleconsultation, telehealth, telemedicine, and telemonitoring are used to imply e-health (de Mesa, 2023). This shows the widespread exploration of the e-health concept in different world regions and its transformation and context over the years. This paper considers e-health as the application of information technology and telecommunications (ITC) for diagnostic and treatment services, educational and support services and the organization and management of health services.

Developing countries are implementing ICT in e-health to improve the quality-of-service delivery (Nhamo et al., 2020). As rural areas are disadvantaged, development is delayed, and service delivery is disrupted. The case of South Africa is also included, as the South African government has been striving to improve service delivery across the country. e-Health can provide healthcare services by employing electronic technologies, practicing mobile health (m-health), and telemedicine to achieve equal access to the healthcare system. Infrastructure is the key to internet usage and e-health adoption (Putteeraj et al., 2022; Riana et al., 2021). The increase in Internet access and many smartphone users make e-health concepts relevant to many people. The development of e-health services, from web-based services to mobile health apps, online video services, and social media, among others, has shown significant growth in e-health, with new services and technology being introduced continuously. Some e-health services that are already in use globally are decision-support tools, digital radiographic systems, e-prescriptions, electronic patient records, online consultations, self-help apps, and tele monitoring (Tuula et al., 2022). With this significant rapid growth, healthcare system seems to be taking in ICT very slowly.

**e-Health service solutions**

e-Health practices involve using digital technologies, including the internet, mobile devices, computers, and information technology (IT) to provide healthcare services and health information in order to improve the quality of life and facilitate healthcare delivery. Some advantages associated with e-health (Putra, Zani, Hasyim et al., 2024) are cost saving, reduction of clinic visits, reduction of errors related to medication and prescription, minimizing or eliminating queues and waiting periods, and being able to receive medical...
advice from nurses and health professionals while at home. Some disadvantages (Sai et al., 2022; Saoudogo et al., 2024) of e-health are that e-health requires the internet (buying of data or free Wi-Fi), a smartphone in some cases, airtime to call a health professional in the event of an emergency, current poor infrastructure, high cost to implement programmes in developing countries, challenges with acceptance by patients, and usability may be difficult.

Methodology
The methodology involved qualitative research to explore the importance and readiness of implementing e-health technologies in rural South African areas. The data collection was done through interviews with healthcare professionals and possibly observations, which were used to assess the current state of e-health readiness in rural regions. Some data were sourced from a secondary source, in this case, dissertations. This approach allowed for understanding the challenges, opportunities, and specific needs related to e-health implementation in rural South Africa. Moreover, the study involved assessing tools to evaluate health institutions' preparedness to adopt e-health technologies.

In addition, the study adopted the Unified Theory of Acceptance and Use of Technology (UTAUT) framework on the use of e-health technologies in rural areas using these component variables: performance expectancy, effort expectancy, social influence, facilitating conditions, demographic factors, and attitude and behavioral intention (Gu, Khan, Khan et al., 2021).

Findings

Theme 1: Shortage of staff
The Batho Pele principle was reportedly not adhered to completely because of the shortage of staff. Batho Pele is a concept which says people first in terms of service delivery, implying poor patient-centredness (Bobbins, 2018). Some study participants described how the budgetary constraint resulted in the staff shortage at the rural centres under investigation. For example, in response to the question, “In your opinion, do you think this hospital/clinic is practicing the Batho Pele principle?”, one of the professional nurses employed at the municipality hospital said:

“There is shortage of nursing personnel at this hospital due to the fact that many nursing posts are frozen because of budgetary constraints.”

The issue of shortage of staff was corroborated by a clinic professional nurse who remarked:

“There is shortage of staff, especially during night duty. When there is an emergency and you are only two nurses without ward attendants and other health care team members, it is really very difficult to cope with the demands of the situation.”

The shortage of staff at night was also lamented by a staff nurse employed at the local hospital who said:

“I am working alone at the nursery ward during the night. If there is an emergency, I have to call the sister in charge at the postnatal ward.”

Additional detailed analysis of the above theme led to the following subthemes:

i. Freezing of posts
ii. Difficulty coping
iii. Budgetary constraints
iv. Missing patience-centredness

Theme 2: Lack of specialized equipment/instruments
In response to the question, “Are there obstacles hindering your ability to produce your best service at your health institution?”, one of the medical doctors at the hospital replied:

“No, I am unable to produce my best service at this hospital due to the lack of some specialized equipment that I require in my practice.”

The lack of specialized equipment due to the budgetary constraints imposed by the employer was also emphasized by an assistant nurse employed at the hospital who complained as follows:

“....equipment is there, but not all of them, for example, we do not have scan machines at this hospital. We always transfer patients who need to be scanned to the Polokwane hospital.”

Further detailed analysis of the theme led to the following subthemes:

i. Inability to produce the best service
ii. Budgetary constraints
iii. Inadequate machinery

**Theme 3: Lack of some basic and/or specialized drugs**

The question being answered here was, “Does your health facility always have adequate basic and specialized drugs available at all times?” Several study participants also complained about the lack of basic and specialized medications at their healthcare centres. Below is a direct quotation from one of the professional nurses at a clinic:

“There is unavailability of ARV drugs for children at this clinic. This causes conflict with the parents of these children as they have to go further to the hospital to collect the drugs.”

In agreement with the above statement, a medical officer at the hospital, when commenting about working arrangements at this hospital, said

“......there is shortage of basic and special drugs for particular patients at this hospital.”

More detailed analysis of the theme gives the subthemes:

i. Lack of ARVs

ii. No drugs/medication for children

iii. Conflict with parents

**Theme 4: Infrastructure**

In the context of this study, infrastructure relates to physical aspects of social and personal support that enable efficient working and the ability of healthcare workers to achieve organizational goals. The question was, “Is the infrastructure in your healthcare facility adequate?”. The participants remarked on the following subgroups of infrastructure: waiting and consultation rooms, theatre, wards and staff accommodation. For example, a professional nurse at a hospital said:

“The infrastructure at this hospital is so limited to an extent that the theatre is for obstetric and gynaecological problems only.”

In addition, a staff nurse employed at one of the clinics commented as follows about the infrastructure:

“......our building is too small with no shelter and not enough cubicles for consultations.”

Additional analysis of the theme gives the subthemes:

i. Lack of shelter

ii. Inadequate patient consultation space

**Theme 5: Safety and security**

The question asked here was, “Is your healthcare facility safe and secure?” Some study participants complained about poor security at their healthcare institutions, a factor which negatively affects their ability to provide good service to their clients. In this regard, a professional nurse employed at the clinic complained as follows:

“We are not able to provide 24-hour service because of insecurity at the clinic, patients threaten nurses when on night duty.”

Another professional nurse at another clinic further elaborated:

“......night duty shifts at our clinic are suspended due to threats that were made to the staff, an incident which resulted in the stabbing of one of the nurses.”

Most participants agreed that their workplace was a safe environment and their machinery and systems were advanced and always kept up to date, making it a wonderful place to be at, regardless of all the negative aspects.

Added analysis of the theme provided the subthemes:

i. No 24/7 patient service

ii. Insecurity in the clinic

iii. Nurses under threat

iv. Suspension of night clinic services

v. Stabbing of nurses
UTAUT framework adoption in e-health

The study integrated the UTAUT theoretical framework to enhance the study’s depth towards the adoption of technology in healthcare. The chosen framework has the capabilities to provide a more robust analytical perspective on e-health adoption barriers using: performance expectancy, effort expectancy, social influence, facilitating conditions, demographic factors, and attitude and behavioral intention.

Discussion

Five themes that were gathered from the empirical study are staff shortage, lack of specialized equipment/instruments, lack of specialized drugs, poor infrastructure, and deficient safety and security.

Regarding staff shortage, Tiwari et al. (2021) echo the shortage of healthcare service providers in rural settings of South Africa. Reilly (2021) states that this identifies health disparities and access to healthcare in rural and urban areas. The shortage of healthcare professionals, particularly in remote, rural areas, is a significant challenge. Additionally, the healthcare facilities freeze posts when employees resign or retire (Eriksen, Bruusgaard & Knardahl, 2003; Naughton, 2015), and the remaining healthcare workers find it difficult to cope (Van Dalen, Henkens & Schippers, 2010). There are also budgetary constraints (Cho, Jérôme, & Maurice, 2021), and indications of poor patience centredness (Ripat, 2016).

The second theme mentions that specialized equipment is generally non-existent in rural health, which is a general problem pointed out by Olugboja and Agbakwuru (2024). Limpopo Province Health decries lack of funding to acquire new and/or specialized equipment. To allow these healthcare facilities to function sustainably, they need to be transformed. Moreover, there was an inability to yield optimized services (Kotter, 2017), poor machinery (Moyimane, Matlala & Kekana, 2017) and again, budgetary constraints (Cho et al., 2021) in these rural healthcare facilities of Limpopo Province.

The third theme mentions the lack of specialized drugs. According to Ndzamela and Burton (2020), medicines in rural healthcare facilities tend to run out of stock often. However, it is easy to check by phone if there is medicine at a facility or if a doctor is available; a trip to the facility can only be embarked upon when these are available; otherwise, the costly and time-wasting activities can be paused. Also, ARV unavailability (Bakare & Bhargav, 2023), and lack of other medication (Park, Lee, Shin et al., 2018), cause conflicts due to the despair of parents (Johnston & Sullivan, 2020).

The fourth theme is poor infrastructure, which the Limpopo province government shows to be disregarding. Varadharajan and Suri (2024) explain that infrastructure is the main key to operations, which suggests that the facilities will not operate optimally. Thus, minimal infrastructure could be maintained to optimize services with what the facilities have. The theme generated subthemes “healthcare facilities provide no shelter to patients”, and “lack of proper spaces for patients’ consultations”. Leggio, Giguere, Sninger et al. (2019) compare the patients in the facilities with emergency medical services patients who often use homeless shelters to interact with emergency departments to access the healthcare system. Such patients would also not have space for receiving consultation service (Floss, Hoedebecke & Vidal-Alball, 2019).

There was also a concern of poor safety and security, the fifth theme. By limiting visits and trips to the facilities and allowing the facilities to operate only during the day, there can be less risk of cases and enabling the facilities to operate only during the day can result in less risk of safety and security issues. Additional issues that were identified include a “service that does not run around the clock” due to discontinued overnight services, which was the result of “poor safety and security” where “nurses are threatened” and even “stabbed”. These, according to Kim, Mazenga, Simon et al. (2018), are cases of below optimal performance, and lack of safety and security.

The UTAUT theoretical framework was applied as reflected below:

Performance expectancy: The study assessed the degree to which rural healthcare providers and patients believed that using e-health technologies would help them improve their healthcare performance and outcomes, and to understand how the perceived usefulness of e-health solutions would influence the intention to use and actual use of these technologies.

Effort expectancy: The study evaluated the level of effort that rural healthcare providers and patients expected to put into using e-health technologies. It also identified specific features or functionalities that are perceived as easy or difficult to use, and how this could affect the adoption of e-health solutions. The existence and availability of smartphones in communities was one of the enablers identified, as well as ambulances and mobile clinics.

Social influence: There is impact of social factors, such as peer influence, management support, and community norms, on the adoption of e-health technologies in rural healthcare facilities. Also, social influence shapes the intention to use and the actual use of e-health solutions.

Facilitating conditions: The study assessed the organizational, technical, and infrastructural factors that may enable or impede the use of e-health technologies in rural areas. It then identified the specific facilitating conditions needing to be addressed to promote the successful implementation and use of e-health solutions. Such conditions included among others the internet connectivity, the affordable cellphones, and the ICT experts in these areas to provide technical support.
Demographic factors: Age, gender, education, and prior experience with technology influence the acceptance and use of e-health in rural areas. There are targeted strategies to address the needs and concerns of specific demographic groups. Social workers in the area can play a pivotal role of educating the patients on the use of the different affordable devices based on age and level of education.

Attitude and behavioral intention: Due to security and other issues, rural healthcare providers’ and patients’ overall attitude towards e-health technologies and their intention to use these solutions are positive. These attitudes and behavioral intentions of rural patients, could translate into actual use of e-health technologies.

The discussion closes with aspects of stakeholder perspectives, feasibility assessment, and matters of policy implication. These are discussed briefly below.

Exploration of stakeholder perspectives: The study was stimulated by the problems that communities decried, which were transport scarcity, travelling expenses, lack of guarantee of finding doctors and medication availability when eventually reaching a clinic, and so on. From policymakers, the cycle has been long, and funds for projects were misappropriated in some municipalities. Hence, their input cannot be trusted. The ICT experts also decry the huge expenses required to develop infrastructure and eventually roll out to communities, and the length of time required to reach the target ultimately. While all these stakeholders find it necessary to embark on a fully-fledged e-health system project, experience has proved that the health department is inadequate in providing such a system in Limpopo.

Feasibility assessment: This study shows that e-health is essential for rural Limpopo and that such a service is feasible as there are plentiful markets across these areas. The e-health services that can be implemented without reliance on the government’s hefty infrastructure budget include existing ambulance and mobile clinic services, and smartphones that the community members already possess. To effect e-health only requires a dedicated telephone line for the contact and the reinforcement of staffing at a single dedicated centralized clinic proposed in this study.

Policy implications: The policy usually takes time to be designed and adopted, while an interim policy for e-health that this study proposes does not need approvals from a hierarchy of bureaucrats. A few senior officials in the health department can make a resolution for intervention, and success stories emerging from there can be converted into a policy for e-health.

Conclusion

This paper provides crucial insights into the potential benefits and current challenges of implementing e-health in rural areas of Limpopo Province, offering a significant contribution to the literature on rural healthcare delivery and digital health. Staff shortage should be addressed by reducing the level of responsibility of the facilities, allowing them to be satellites for medicine delivery and collection, and allowing minimal doctor consultation. This will also assist in relieving the facilities of the patient’s expectations regarding equipment used for dealing with some ailments. The infrastructure that is neither growing nor renewed should be renovated without requiring it to be used for major medical procedures. Deficient safety and security can be minimized by converting the facilities to satellites, which allows travel to them only during the day. Therefore, the e-health application should be introduced for communicating with patients through the use of technology based smartphone or email so as to avoid patients having to travel to a healthcare facility which is ill-resourced and where patient safety is not guaranteed.

Future Research Directions:

Future studies could explore the impact of implemented e-health solutions on healthcare delivery effectiveness and patient satisfaction in the Limpopo region over time. Comparative studies with other rural areas both within and outside South Africa that have successfully implemented e-health solutions could yield valuable insights and best practices.

Practical Recommendations:

The community members have mobile phones while healthcare centres have mobile and ambulance services, these can be fashioned for a short-term e-health system. Guidelines for stakeholders on prioritizing investments in infrastructure, training for healthcare providers, and community engagement strategies to increase e-health adoption would be useful.

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