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Do mHealth Apps amplify the Digital Divide? Assessing the use of Mobile Health Digital Technologies among Rural Communities in South Africa

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Abstract

The recent COVID-19 pandemic was pivotal to the global adoption of mHealth and other digital technologies. The critical need for behavioural containment measures, created numerous digital health technological advantages to sustaining healthcare especially in developing, resource-constrained countries. However, it is debatable whether using digital technologies exacerbated the digital divide existent health disparities among rural communities in developing countries. The study attempted to determine the use of the South African government's COVID-19 HealthAlert App by a rural South African township community. Theoretically, the Digital Health Equity Framework underpinned the study. A quantitative research approach using a cross-sectional survey design among 197 residents, was adopted. Major findings indicate that 55% of the participants used the health App and 89% used smartphones to access online information and use mobile Apps frequently. and used the information provided by the Covid19 HealthAlert App to manage their health during the pandemic. Most participants stated that ease of using the App was enhanced by the fact that it was zero-rated, meaning they could access it without data or an Internet connection. However, lack of digital security through perceived lack of privacy and the protection of personal information were cited as concerns deterring the use of mHealth Apps. The study was important by contributing to scholarship regarding the use of mHealth Apps for health-seeking behaviour by rural communities during a health crisis, specifically the debate about the digital health divide. It informs health promotion organisations about digital health technologies user experiences by rural communities for effectiveness.

Keywords: mHealth App; Digital Health Divide, South African Rural Township Community, Digital Access, Digital Security, COVID-19 health seeking behaviour, health communication, Covid19 HealthAlert App

Introduction

The recent COVID-19 pandemic underscored the importance of interactive, two-way symmetric strategic communication that enables stakeholder engagement between governments and their citizens, using digital platforms. Digitization has revolutionalised how individuals access healthcare information and engage with healthcare professionals (Sendra et al., 2021) through a plethora of digital communications such as digital signage, advertising screens, telehealth, telemedicine, short text messaging Apps, mobile health Appications (mHealth Apps), and email messaging. Other types of digital health communications tools include phone calls, interactive voice responses, or multimedia messages providing healthcare information, advice, monitoring, and support (Ames et al., 2019). And during the recent COVID-19 pandemic, the South African National Department of Health (NDoH) used various digital and social media platforms to communicate health to its citizens.

Nonetheless, the COVID-19 pandemic increased debates about the potential of reliance on digital technologies to compound already existing health disparities especially among disadvantaged communities. Shaw and Glover (2024) argue that characteristics of neoliberal capitalism such as inequitable internet access and digital devices produce and sustain digital health disparities. The COVID-19 health crisis disrupted the usual channels of community engagement at a time when trusting relationships between the community and scientists were critical to mitigating the pandemic (Byiringiro et al., 2022). Governments were challenged to find ways of reaching their key stakeholders promptly to allow them to partake in containment behaviour (Sitto et al., 2022). Yet during a health crisis, reliable health communication is crucial for ensuring public health needs.

In 2020, the NDoH developed the COVID-19 HealthAlert App in form of a short text messaging mobile App offered through WhatsApp with the intention of informing citizens about COVID-19 developments and assisting

them to make informed, effective health decisions. The App registered more than 3 million users within two weeks of the inception of the WhatsApp platform, indicating a strong public appetite for accurate health information about the COVID-19 virus (Farao, 2020). Albertus & Makoza (2023) note that users experienced some challenges with using the App. However, although stakeholder engagement efforts were made through the COVID-19 HealthAlert App, Nguyen et al. (2021) imply that continuing digital inequality gaps suggest that not everyone is equally exposed to or could access the growing interactions through digital technologies throughout a health crisis. Some studies have found that the use of digital technologies augmented the digital health divide among some disadvantaged communities during COVID-19 (Litchfield et al., 2021; Lubinga et al., 2021). The use of digital technologies is yet to have a significant impact in rural and underprivileged communities such as those in Limpopo province, yet the structure of the South African health system makes it an imperative.

The South African health system is structured into two tiers, resulting into vulnerable mostly rural, poor individuals being largely dependent on the under-resourced public sector (Gordon et al., 2020). Vulnerable South Africans, often travel considerable distances by foot or rely on one or two modes of public transit to access a public healthcare facility. This imposes constraints on the quality of healthcare services received since they may occasionally be denied access upon late arrival or unable to obtain the necessary aid due to inadequate healthcare facilities. Statistically in many South African households (61.8%) at least one person has internet access or use. Yet, the mostly rural Limpopo Province has the least internet access and use of (43.6%) compared to all other eight provinces (Stats SA, 2018). With such existent digital inequalities, the COVID-19 pandemic presented challenges for the NdoH in delivering health communication messages especially to rural communities. The COVID-19 HealthAlert App may have amplified the health disparities that have long existed in South Africa before the COVID-19 pandemic. Lack of user feedback may have compounded perceptions about limited use, lack of usefulness and no value accruing from use (Albertus & Makoza, 2023). There are gaps within literature regarding use of technologies, such as mHealth Apps for health-seeking behavior by rural township populations in South Africa.

The aim of the study was to assess the use of the COVID-19 HealthAlert App for health seeking behaviour by a rural South African Township Community.

Research Objectives:

- To assess Seshego township residents' use of the COVID-19 HealthAlert App for health-seeking behaviour during the COVID-19 pandemic.

- To evaluate perceptions about the COVID-19 HealthAlert App by Seshego township residents.

Hypotheses

H_0: The NDoH COVID-19 HealthAlert App did not influence Seshego Township residents' engagement in COVID-19 contagion containment behaviour.

H_1: The use of the NDoH COVID-19 HealthAlert App influenced Seshego Township residents' engagement in COVID-19 contagion containment behaviour.

Literature Review

mHealth and the Digital Divide

MHealth initiatives have demonstrated the ability to enhance healthcare quality and coverage and facilitate greater accessibility to health information, services, and skills. Modern individuals have constant access to smartphones, enabling them to interact with mHealth applications in their everyday environment (Flaherty et al., 2021). Using mHealth apps may alleviate limited access to healthcare facilities. These apps provide pertinent health information tailored to individual's needs, receivable from the convenience of their phones. mHealth technologies play a crucial role in eHealth by providing cost-effective and secure means of utilizing information and communication technologies to assist public health activities (WHO, 2018).

Furthermore, the widespread adoption of mobile applications among various social demographics renders them valuable instruments to facilitating health-related actions among individuals from poorer socioeconomic backgrounds (Flaherty et al., 2021). Utilizing short messaging services (SMSs) enables prompt distribution of health communication, including raising awareness about diseases, promoting adherence to health guidance and information, sending reminders, and sharing preventive actions (Mbunge et al., 2021). mHealth technology as patient empowerment tools modify unhealthy behaviours and are linked to higher rates of engaging in behaviours that promote health (Mahmood et al., 2019).

The use of mHealth during health crises

mHealth has been effectively used during previous health crises. For instance, health Apps were used to monitor the spread of Influenza through a self-administered questionnaire (Asadzadeh & Kalankesh, 2021), improving disease outbreak notifications in Kenya (Toda et al. in 2016). A mobile-centric surveillance App was employed for instant monitoring and identification of the Zika virus (Fujibayashi et al., 2018). The COVID-19

pandemic underscored the potential of using mobile Apps to effect various containment measures (Smith et al., 2020; Kouroubali et al., 2020; Katehakis et al., 2020; Kondylakis et al., 2020; Giebel et al., 2024). Specifically, mHealth was used for early identification, rapid screening, patient monitoring, information dissemination, education, and therapy in response to the COVID-19 pandemic (Asadzadeh & Kalankesh, 2021).

The Digital Health Equity Framework

Crawford and Serhal (2020) proposed a Digital Health Equity Framework (DHEF) that suggests a number of digital determinants of health. Digital health equity provides individuals with an equal opportunity to benefit from the practices and knowledge associated with developing and applying digital technologies that aim to enhance health (WHO, 2020; Crawford & Serhal, 2020).

The Digital Determinants of Health (DDoH)

These are digital environment conditions that impact many hazards and outcomes associated with health, functioning, and quality of life (Crawford & Serhal, 2020). The variables of the Framework include access to digital health resources and health literacy, use of digital resources for health-seeking or avoidance, beliefs about the potential for digital health to be helpful or harmful and values and cultural norms/preferences for use of digital resources. This article discusses two relevant variables out of the several mentioned above.

The use of digital resources for health-seeking or avoidance.

This variable intersects with factors such as race, gender, and geography, among the determinants of one's power in society. They define one's social location, which is closely linked to and interacts with one's material circumstances and how they are used (Crawford & Serhal, 2020). Using digital resources for health services is not universally applicable because most users encounter difficulties due to the digital environment's inadequate interaction and communication characteristics (Kaihlanen et al., 2022). Consequently, individuals may perceive in-person health services as more efficacious in addressing intricate and challenging issues (Kaihlanen et al., 2022).

Preferences for use of digital resources.

Values and cultural norms or preferences interact with coping styles and appraisal of risk, along with health-related beliefs that influence the use of digital resources (Crawford & Serhal, 2020). An elderly people population expressed concerns over the efficacy and adequacy of digital tools in addressing health issues, suggesting that they may not be managed as effectively as in-person interventions (Kaihlanen et al., 2022). Consequently, numerous individuals seeking health-related assistance expressed a lack of appreciation for digital health services, perceiving them as lacking additional benefits. Instead, they strongly favoured in-person meetings because they preferred direct interpersonal communication, nonverbal cues, and physical contact (Kaihlanen et al., 2022).

Method

A quantitative research approach with a cross-sectional survey design was adopted. Convenience sampling yielded 197 participants from Seshego township, Limpopo Province, South Africa. Participants were mostly recruited from public places. Permission to conduct the study was sought and provided by the Polokwane Local Municipality and Seshego township ward councillors among others. Relevant ethical considerations as well as COVID-19 protocols were observed.

Self-administered questionnaires were employed to collect data in 2022. The questionnaire had four sections comprising of demographic data using binary and Likert type questions. The questionnaire included questions about health-seeking behaviour using the COVID-19 HealthAlert App, how participants tracked their health-related goals and perceptions about digital security.

To ensure rigour, the internal reliability of the study was measured using Cronbach's Alpha coefficient. A high Cronbach's Alpha coefficient of 0.920 was attained. Content validity was ascertained through pre-testing of the questionnaire prior to the survey through a pilot study. Construct validity was ensured by performing a factor analysis. A factor correlation showed a positive correlation of $p<0.01$. Data was analysed using descriptive and inferential statistics.

Findings

Participant characteristics

Descriptive statistics were conducted to analyse and generate results for the demographics (Table 1).

Table 1: **Demographic characteristics study participants n=197**

Characteristics	(n)	%
Gender		
Male	84	45,4%
Female	99	53,5%
Other (Prefer not to say)	2	1,1%
Age (M=32,37)		

18-26	67	37%
27-35	53	30%
36-44	35	19%
45-53	11	6%
54-62	10	5%
63 and older	3	1,5%
Education		
No education	6	3,2%
Secondary School Education (Matric)	82	44,1%
Tertiary Education	87	52,5%
Other	11	5,9%
Frequency of Mobile App use in general		
Hourly	49	28,2%
Daily	105	60,3%
Weekly	6	3,4%
Monthly	11	6,3%
Other	3	1,7%
Have used the COVID-19 HealthAlertApp		
Yes	107	54,5%
No	90	45,5%
Year of using the COVID-19HealthAlertApp		
2020	70	35,4%
2021	23	12,4%
2022	8	3,9%
2023	6	2,8%
Never	90	45,5%

The Use of the COVID-19 Healthalert App for Health-Seeking Behaviour

The study's first objective was to assess Seshego township residents' use of the COVID-19 HealthAlert App for health-seeking behavior. Three constructs were used to measure the first objective of the study. (1) Use of the COVID-19 HealthAlert App during the COVID-19 pandemic, (2) use of the COVID-19 HealthAlert App to track health-related goals, and (3) perceptions regarding the use of the COVID-19 HealthAlert App for disease information.

How the COVID-19 HealthAlert App was used

A five-point Likert Scale (Table 2) was used to measure how participants used the COVID-19 HealthAlert App during the pandemic. Many participants (42.5%) used the App as a reputable source for National COVID-19 statistics updates. Others used App to seek advice about avoidance of contracting COVID-19 (36,4%), monitor symptoms (34,8%), search for health-related remedies to boost immune systems (33,6%). The App was also used for vaccination registration (33,1%), to establish vaccination safety during pregnancy (22,7%) and vaccination safety during breastfeeding (30,3%).

Table 2: Use of the COVID-19 HealthAlert App during the COVID-19 pandemic.

Statements	SD	D	N	A	SA	M	Std Dev
Look for COVID-19 health related remedies to boost the immune system	14,3%	12,9%	23,6%	33,6%	15,7%	3,24	1,273
Get updates about national Covid19 statistics	11,2%	6,7%	14,9%	42,5%	24,6%	3,63	1,243
Monitor symptoms of COVID-19	9,8%	10,6%	23,5%	34,8%	21,2%	3,47	1,220
Seek advice about how to avoid contracting COVID-19	10,6%	9,1%	15,2%	36,4%	28,8%	3,64	1,280
Register for vaccination	19,9%	11,0%	10,3%	33,1%	25,7%	3,34	1,472
Find out if it is safe to vaccinate when pregnant	12,9%	17,4%	27,3%	22,7%	19,7%	3,19	1,927
Find out if it is safe to vaccinate and breastfeed	10,6%	15,9%	22,0%	30,3%	21,2%	3,36	1,273

Use of the COVID-19 HealthAlert app to track health-related goals.

Participants were asked if they were able to track their health-related goals on the COVID-19 HealthAlert App (see Table 3). Most participants were able to follow preventative measures such as avoiding contact (42,2%), made decisions about how to treat their health in the case of infection (34,9%), ate health food based on the nutritional guide provided in the (33,6%). In addition, 31,5% were able to find the exact information they were looking for. A few participants did not increase their physical activity during hard lockdown as advised (9,4%).

Table 3: Using the COVID-19 HealthAlert App for health-related goals.

Statements	SD	D	N	A	SA	M	Std Dev
Eat healthy based on the nutritional guide provided in the App	13,1%	15,3%	24,1%	33,6%	13,9%	3,50	1,242
Follow the social distancing measures in place	8,9%	5,9%	17,8%	42,2%	25,2%	3,20	1,175
Reduce smoking based on the health recommendations	19,7%	13,4%	25,2%	22,8%	18,9%	3,69	1,384
Increase my physical activity	9,4%	9,4%	27,6%	33,9%	19,7%	3,08	1,187
Prevent getting infected by following guidelines on washing/sanitizing of hands frequently	10,1%	6,2%	14,7%	34,9%	34,1%	3,45	1,266
Decide about how to treat my health in the case of infection	10,1%	10,1%	16,3%	34,9%	28,7%	3,77	1,283
Find the exact information I am looking for	11,8%	10,2%	22,8%	31,5%	23,6%	3,62	3,45

Perceptions About the COVID-19 Healthalert App

The second objective of the study was to assess the perceptions by Seshego township residents towards the COVID-19 HealthAlert App.

A five-point Likert scale was used to measure perceptions on digital security using the COVID-19 HealthAlert App (Table 4). Only 7,6% of participants were satisfied with the protection of their personal information, while 12,8% indicated that they were content with their privacy. About 31,6% of participants were unsure that their privacy is protected and 31,8% who were unsure about whether their personal information is protected. Regarding the relevance of App information, 37,8% were unsure whether information shared on the APP applied to them, and 32% questioned the reliability of the information. With digital literacy, 36,4% participants were unsure about the key words to use to search for the health information they were looking for and only (15%) were sure about the health choice they had to make from the APP.

Table 4: Perceptions about digital security through the use of the COVID-19 HealthAlert App.

Statements	SD	D	N	A	SA	M	Std Dev
My privacy on the App	12,8%	18,8%	24,1%	31,6%	12,8%	3,13	1,233
If my personal information is protected	7,6%	20,5%	25,0%	31,8%	15,2%	3,27	1,171
The information on App applies to me	7,9%	14,2%	26,8%	37,8%	13,4%	3,35	1,22
About the reliability of the information on the App	8,6%	14,1%	28,9%	32,0%	16,4%	3,34	1,166
Know the health choice I have to make from the App	6,3%	15,0%	26,0%	33,1%	19,7%	3,45	1,153
The proper words to use to find the health information I am looking for	7,8%	17,1%	24,0%	36,4%	14,7%	3,33	1,155

Participants stated that the App was easy to use (35,5%) and that information was well organised, making it possible for them to easily find the information they needed (40,3%). Ease of access to information made them feel empowered to take care of their health (37,5%). They further felt empowered because information was accessible when they needed it and the COVID-19 HealthAlert App allowed them to know enough about their health (74,2%).

Hypotheses-related results

Independent T-test results on the use of the Covid-19 HealthAlert by gender indicated that in general there was no influence of the COVID-19 Health Alert App on the health-seeking behaviour of the participants, according to the null hypothesis. For instance, gender ($p<0,021$ for males & $p<0.000$ for females). A regression analysis showed that age (Sig. value = 0,801>0,050) did not influence the use of the COVID-19 Health Alert App to track progress of health-related goals. Even though the assumption was that younger people would find it easier to use the App. Employment status did not influence the use of the App to track health-related goals and neither did digital privacy affect the use of the App to track health related goals.

Discussion and Conclusions

Using the COVID-19 HealthAlert App for Health Seeking Behaviour

Many Seshego Township residents who participated in the study were already using Apps for different types of health-seeking behaviour. They use lifestyle Apps to improve their health through fitness, diet, exercise, period trackers, habit trackers, meditation, and breathing, tracking steps, managing stress, and getting enough sleep. This may explain why the majority of the participants stated that they access Apps on an hourly or daily basis. In line with the DHEF theory, digital resources are linked to digital literacy and are important for health-related behaviour. It is concerning that almost half of the participants did not use this App (Albertus & Makoza, 2023) even though data indicates that almost all the participants own electronic devices. Digital literacy as well as digital security may have affected the use of the HealthAlert App among others.

Digital Literacy and Security

Digital illiteracy could have been prevalent among some of the participants whose comprehension of the information was poor and may have in turn negatively influenced their health seeking behaviour as Garavand et al., (2024) found. In addition, digital illiteracy may have influenced participant preferences, favouring in-person rather than App (digital) communication. Some participants stated that more effort should have been made to engage with them in-person on the threat of the COVID-19 outbreak rather than using online technologies such as the COVID-19 HealthAlert App. Health communication conducted through digital and online technologies is often perceived to be impersonal as (Thapa et al., 2021) observe. Some of the participants mentioned that they did not find the App information that they were looking for which implies that the information presentation in form of layout may not have been conducive to online reading. Users expressed concern that excessive amounts of information on mHeath Apps overwhelmed them, they were unable to locate relevant information (Iyengar et al., 2020; Albertus & Makoza, 2023).

Digital security is important to rural township residents. Almost half of the participants expressed concerns about the privacy of their information questioning whether their personal information was protected on the App. Kaihlanen et al. (2022) also found digital privacy concerns, specifically that security issues contributed to apprehension of using mHealth especially among elderly groups.

Peak of using the App

It is logical that most of the participants used the App in 2020 and that its use waned significantly from 2022. There was a decline in the adoption and use of the COVID-19 HealthAlert App in 2022, which was when the South African National State of Disaster in response to the pandemic ended. The high use of the COVID-19 HealthAlert App in 2020 could have been two-fold; it was the debut of the pandemic therefore people needed information about the novel virus. The App was used mostly for informational purposes specifically to access daily COVID-19 statistics from the NdoH and nutrition to manage health, remedies to boost immunity, how to engage in preventative behaviour.

Positive Perceptions about the COVID-19 Healthalert App

The participants expressed positive perceptions about the COVID-19 HealthAlert App for health-seeking behaviour, more than half of the participants agreed that the interface of the COVID-19 HealthAlert App was easy to use, information was well organized, and thus, they were able to find the information they needed as Schinköthe et al. (2020) found. Use of mHealth technologies is associated with higher rates of engaging in health-related behaviour (Mahmood et al.,2019). Ease of using the App may have been enhanced due to its being zero-rated, which means users can use it without connecting to the Internet. Almost half of the participants expressed appreciation that they were able to use the COVID-19 HealthAlert App even though they did not have mobile data or Internet Access. This was a major advantage considering the costs of data and issues of connectivity, and how they could affect rural users. However, Barrett et al. (2020) caution that mHealth Apps should only be used as a complementary tool.

An unexpected finding as that some participants were not aware that they could use the zero-rated App even when the Internet connection was poor, not available, or they did not have data. This is concerning given that the Department of Health was deliberate in providing a zero-rated App to enable wide access even among poor populations, furthermore that the app could be used even when the connection was poor of when users did not have data. Lack of awareness could have denied access and wide use of the App among rural populations.

In rejection of the null hypothesis, the level of education positively influenced the use of the App to track progress of health-related goals. This is supported by Mbunge et al. (2022), it is highlighted that traditional numeracy and literacy have an impact on the use of digital technologies and the lack of literacy skills may constitute a divide. This may mean that the NDoH was largely successful in using the COVID-19 Health Alert App for digital stakeholder engagement with the public.

This study should be interpreted with some limitations. The study was conducted in Seshego township and if replicated, results may differ. Future studies may consider monitoring patterns of actual mHealth App usage among rural populations.

Conclusion

This study conducted suggests that the using mHealth Apps for health crisis communication should consider user preferences and address privacy concerns, even though it can be argued that preferences are not homogenous. mHealth does not necessarily amplify the digital health divide among rural populations. This is because mobile technologies are pervasive among various socio-economic groups in the country. Future integration of mHealth Apps into public health care should be greatly publicised by various health promoters especially among rural communities. This will ensure that the public is aware of various App advantages, such as zero-rating, no requirement for data or Internet connections for use. Easy access ensures inclusion of largely rural South African populations many of whom cannot afford to buy data or access internet connections thus diminishing the digital health divide.

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