



Strategies for sustainable adoption of e-health tools for digital mental health services



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Orientation: The use of electronic (e-health) tools in digital mental health services (DMHS) at South African (SA) higher education institutions (HEIs) has rapidly increased because of the coronavirus disease 2019 (COVID-19) pandemic.

Research purpose: The main purpose of this study was to evaluate how the university staff perceived the effectiveness of different strategies implemented for the sustainable adoption of e-health tools in DMHS.

Motivation for the study: Despite the increasing availability of e-health tools, there is limited understanding of how university staff perceive the effectiveness of different sustainability strategies.

Research approach/design and method: The study utilised a quantitative approach and surveyed 348 university staff at a SA HEI. Data analysis utilised descriptive statistics and one-sample *t*-tests.

Main findings: The findings highlight funding, financial incentives, digital inclusion programmes and stakeholder engagement as crucial strategies for sustainable adoption. University staff emphasised the importance of training, digital health literacy campaigns, robust data privacy and security systems, and multilingual e-health services. In addition, hybrid e-health models and continuous evaluation emerged as essential strategies.

Practical/managerial implications: University management should prioritise financial investments, stakeholder engagement and digital literacy programmes to improve the adoption of e-health tools. Strengthening data security, integrating hybrid service models and ensuring multilingual accessibility can further support sustainable DMHS.

Contribution/value-add: This study provides evidence-based strategies for the sustainable adoption of e-health tools in SA HEIs, which thus enhance DMHS and inform policy and practice.

Keywords: e-health tools; digital mental health services; sustainable adoption; South African higher education institutions; university staff perceptions.

Introduction

Mental health is an essential aspect of overall health. The intrinsic value of mental health relates to the core aspects that make individuals the way they get involved, connect, learn and work, and how individuals feel happiness and experience suffering (United Nations, 2020). South African (SA) higher education institutions (HEIs) are increasingly central to innovation ecosystems and contribute to both local and national development (Kruss et al., 2015). Thus, SA HEIs are vital academic institutions for national prosperity and progress. Accordingly, in today's knowledge-based society, the mental health of university staff needs to be regarded with utmost importance. When job demands outweigh available resources, as highlighted by Poalses and Bezuidenhout (2018), university staff can experience significant stress, which may undermine both individual well-being and institutional effectiveness. Therefore, if SA HEIs are to achieve their visions and missions and further contribute to the country's prosperity, the mental health of their staff needs to be well-promoted and supported through sustainable strategies that help deliver mental health services.

As the year 2020 was filled with digital transfer of services, mental health care was no different. To address mental health issues in the SA HEIs, on 28 July 2020, Higher Health, a national agency of the Department of Higher Education and Training (DHET), in partnership with the South African Depression and Anxiety Group (SADAG) and SA HEIs, established the digitalisation of

mental health services as an intervention to the coronavirus disease 2019 (COVID-19) pandemic (Musakuro & Gie, 2024). The digitalisation of mental health services through e-health tools included a tailor-made three-tier programme that considered why and how university staff might have been impacted and how to assist individuals who experienced problems. In addition, some SA HEIs also provided various online mental health initiatives, which included webinars, online workshops, online support groups, and also provided online resources (Musakuro & Gie, 2024). The utilisation of digital mental health activities and e-health tools altogether created platforms for sharing information and giving support to staff to curb the impact of COVID-19. The adoption and utilisation of e-health technologies are widely acknowledged as a critical digital mental health solution to the mental health problems and in enabling university staff to take charge of their health (Gooding, 2019). Therefore, the reaction to the COVID-19 pandemic presented SA HEIs with an opportunity to support staff with feasible and cost-effective tools for digital mental health service delivery. In the process, this provided SA HEIs with a fast and integrated approach that accelerated the adoption and use of e-health while strengthening mental health systems to address public health challenges.

Given the availability of various e-health tools worldwide, it seems the use of e-health tools now requires effective and efficient strategies to deliver sustainable digital mental health services (DMHS). The shift from traditional (face-to-face) mental health services to digital platforms makes alignment and integration challenging, as there are differences between the two approaches (Graham et al., 2020). This suggests that organisations such as SA HEIs must now establish strategies that allow for the utilisation of e-health tools to result in high uptake, engagement and sustainment from users. In support of these arguments, the Digital Implementation Investment Guide (DIIG) developed by the World Health Organization (WHO) (2020) recommended that sustainable adoption and use of digital health technologies should be guided by digital health strategies that detail how new digital health mechanisms should be implemented. From this, SA HEIs must develop strategies that should guide the sustainable adoption of e-health tools to provide DMHS (Govender et al., 2025). However, the main problem is that while e-health tools are increasingly becoming available for the delivery of DMHS, there is still a lack of understanding of how university staff perceive various strategies for promoting and enhancing the sustainable adoption of these tools within the context of SA HEIs (Musakuro & Gie, 2024). A lack of this knowledge could limit the design and application of effective strategies and interventions that address the specific needs and viewpoints of university staff, potentially impeding the long-term, sustainable and successful integration of e-health tools into mental health support services at universities (Ogundaini & Mlitwa, 2024).

The research problem in this study highlights the need to explore university staff perceptions regarding strategies for promoting and improving the sustainable adoption of e-health tools for DMHS. Having a clear understanding of their

perspectives can inform the development of targeted interventions and policies aimed at addressing barriers, facilitating acceptance and maximising the effectiveness of e-health initiatives within SA HEIs (Govender et al., 2025; Ogundaini & Mlitwa, 2024). Moreover, other researchers concur with this perspective and further anticipate that public healthcare will become increasingly digital in the future, suggesting that understanding the benefits of e-health tools and examining university staff's views is crucial, particularly for the implementation of DMHS and for planning future responses to pandemics (Fagherazzi et al., 2020; Rudd & Beidas, 2020). Consequently, this study has the potential to significantly contribute towards establishing and developing evidence-based knowledge on the strategies for sustainable adoption of e-health tools, which can significantly advance the achievement of United Nations' Sustainable Development Goal 3 (SDG 3), which aims to ensure healthy lives and promote well-being for all at all ages (Ogundaini & Mlitwa, 2024).

Considering the aforementioned research problem, the main purpose of this study was to evaluate how university staff perceive the effectiveness of different implementation strategies aimed at promoting and improving the sustainable adoption of e-health tools in DMHS.

Literature review and hypotheses development

The concept of e-health tools emerged in academic literature in the early 2000s and is broadly defined as health-related information and communication technologies (ICT) that use electronic information processing to support mental health care (Pagliari et al., 2005). These technologies encompass tools such as computers, smartphones, tablets and applications, together with advanced innovations such as artificial intelligence (AI), robotics, virtual reality and cloud computing, among others. Collectively, these tools deliver DMHS through platforms such as telehealth, mobile health (m-health) and social media. E-health tools fulfil a variety of roles, such as facilitating communication, promoting mental health, enhancing health literacy, storing and providing access to information, supporting clinical decision-making, monitoring patients and delivering cognitive behavioural therapy online (Asi & Williams, 2018; Gooding, 2019; Schueller et al., 2016). They also facilitate diagnosis, prevention and treatment, significantly transforming how mental health services are designed, accessed and provided. In workplace environments, e-health tools improve the provision of mental health services across both formal and informal settings (Howarth et al., 2018). Thus, e-health tools improve accessibility and allow personalised or group mental health initiatives to improve efficiency in addressing mental health challenges. The integration of e-health tools into various health care contexts reflects their growing importance in modern mental health care.

The concept of 'sustainability' varies significantly in the literature (Kuhlman & Farrington, 2010; Moore et al., 2017). However, for this study, sustainability is defined in the

context of DMHS within a university setting as the ability to provide ongoing, beneficial services to staff over the long term without compromising the ability to meet future mental health needs. This aligns with the broader concept of sustainability, which typically encompasses economic, social and environmental pillars (Mensah, 2019). Nevertheless, recognising the growing significance of technology in all aspects of modern society, the study integrates a fourth pillar: technological sustainability (Musango & Brent, 2011). This accentuates the need for e-health tools to be equitable, affordable and accessible to all staff, ensuring that technology advancement promotes, rather than hinders, the delivery of high-quality DMHS (WHO, 2018). Nonetheless, ensuring the long-term viability and effectiveness of e-health tools requires a strategic approach that is consistent with the unique socio-economic and institutional contexts of SA HEIs.

The following section explores the strategies for achieving the sustainable adoption of e-health tools for DMHS within SA HEIs, including associated hypotheses. It further accentuates the interconnected dimensions of economic, social, environmental and technological sustainability.

Economic sustainability strategies

Funding

It can be argued that funding is the most important economic sustainability strategy as it supports procuring equipment and software, scaling technology and other essential activities (Mbunge et al., 2022b). Studies show that there is a need to explore more sustainable sources of funding to achieve economic sustainability strategy of e-health tools in DMHS by diversifying and increasing partnerships with existing organisations, especially in the private and public sectors (Torous et al., 2025). This proposes that for the wider delivery of DMHS, partnering with hospitals and clinics, service providers and other institutions to incorporate e-health tools into their current systems and processes is indispensable. In addition, a recent study conducted by Mbunge et al. (2022b) strongly recommended increasing financial allocation for virtual health care services, including funding for research and development. Thus, it is hypothesised that:

H₁: University staff perceive that increased funding from diversified sources significantly improves the sustainable adoption of e-health tools.

Financial incentives

The study posits that financial incentives are economic strategies that can be utilised by SA HEIs. This is particularly important because financial incentives help promote and facilitate the usage of e-health tools by offering rewards to university staff. Financial incentives can motivate individuals to utilise e-health tools for DMHS, thereby promoting sustainable adoption and supporting economic sustainability strategies (Ricciardi et al., 2013). Consequently, financial incentives should be taken into consideration when developing strategies to promote the sustainable adoption of e-health tools for the delivery of DMHS in SA HEIs. It is therefore hypothesised that:

H₂: University staff perceive that financial incentives significantly promote the sustainable adoption of e-health tools.

Digital inclusion programmes

The adoption of e-health tools is frequently limited by concerns about cost, which are linked to how users perceive the value of the service and their willingness and capacity to pay for it (Khoja et al., 2013). In this regard, the digital inclusion programmes of e-health tools should help to improve the affordability of internet connections. The economic sustainability of e-health tools is, however, influenced by the affordability of internet connection and the e-health system procurement prices (Leon et al., 2012). Given that most e-health users have limited internet connections and some organisations find it costly to invest in ICT infrastructure, organisations such as SA HEIs are advised to integrate affordability with funding and procurement strategies to enhance their investment in e-health services (Jones et al., 2011). Researchers concur, adding that as there is a substantial growth of Wi-Fi hotspots in metropolitan centres, organisations such as SA HEIs need to partner with network providers to expand community networks in areas with limited internet access (Mbunge et al., 2022b). In doing so, the digital gap will be closed. Mbunge et al. (2022b) also advise that to deliver virtual health care, such as DMHS, financial and political commitment is necessary to make this a reality. Accordingly, this study hypothesises that:

H₃: University staff perceive that digital inclusion programmes significantly improve the sustainable adoption of e-health tools.

Social sustainability strategies

Stakeholder engagement

The study contends on the importance of making e-health tools easy to use, ensuring ease of accessibility to DMHS effectively without any problems. Thus, to ensure that the e-health tools meet the demands and are user-friendly, SA HEIs must involve university staff, mental health care practitioners and other stakeholders throughout the design and development process (Fanta & Pretorius, 2018). In support of this strategy, studies indicate that key stakeholders, particularly end-users, should be involved in the process of adopting e-health tools from the onset to overcome potential resistance, enhance acceptability and satisfy stakeholder demands (Bernaerts et al., 2024). Given this, engaging and collaborating with mental health professionals should help to ensure that e-health tools are evidence-based and meet professional standards. Thus, stakeholder engagement entails ascertaining if e-health tools fit their context. Based on this discussion, this study hypothesises that:

H₄: Involving stakeholders in the design and development of e-health tools significantly improves their sustainable adoption, as perceived by university staff.

Training

Adequate training is essential for effective usage of e-health tools (Baniyadi et al., 2018). This advocates training support for university staff in comprehending and effectively using

e-health tools, specifically for mental health. The amount of training provided to the university staff by internal or external entities can facilitate the effective usage of e-health tools for mental health in SA HEIs (Tilahun & Fritz, 2015). Other scholars recommend that training should also extend to health care providers as it will equip them with the skills needed to deliver DMHS effectively using e-health tools (Mbunge et al., 2022a). Moreover, the use of e-health tools in mental health is enhanced by technical support. To make sure that all the systems are operating at optimum levels and preventing any technical difficulties, technical support should also entail regular maintenance (Al-Mamary et al., 2014; Fanta & Pretorius, 2018). Thus, continuous technical support should be provided to users to ensure the effectiveness of e-health tools in DMHS. This study, therefore, hypothesised that:

H₅: University staff perceive that adequate training on e-health tools significantly improves their sustainable adoption in DMHS.

Digital health literacy campaigns

To increase the awareness of and improve long-term use of e-health tools, SA HEIs must develop and implement comprehensive digital health literacy campaigns. Because of the lack of understanding of how e-health tools work, the implementation of e-health tools must include digital health literacy campaigns for both healthcare providers and users (Stoll et al., 2020). The researchers explain that this can be achieved through web-based tutorials, public education and in-person support. Those who endorse this strategy suggest that organisations such as SA HEIs should raise awareness about the e-health tools that may be used to access DMHS, particularly during pandemics such as COVID-19 (Mbunge et al., 2022a). Hence, these strategies can be used to promote e-health tools and reduce the burden of accessing DMHS during pandemics. Given this, the study therefore proposes the following hypothesis:

H₆: Digital health literacy campaigns significantly increase the sustainable adoption of e-health tools in DMHS, as perceived by university staff.

Digital health communication

A key component of social sustainability strategies is digital health communication. To guarantee the effective utilisation of e-health tools, constant communication with users and providers of DMHS is imperative (Coelho et al., 2025). Moreover, digital health communication is essential for the timely and precise exchange of information with all relevant stakeholders (Al-Mamary et al., 2014). South African HEIs can regularly communicate information about available DMHS to all relevant stakeholders to improve informed decision-making. Parra et al. (2016) assert that multimedia technologies such as video podcasts, audio slideshows and animated videos can be used to enhance digital health communication in the workplace and in this study, in SA HEIs. In addition, mental health professionals need strategies to debunk misleading information and conspiracies, particularly on social media. In times of pandemics such as COVID-19,

researchers make a compelling case for health experts and media to combat infodemics and smear campaigns to reduce anxiety and promote a coordinated response (Su et al., 2021). Accordingly, digital health communication is key in advancing and increasing the acceptability of e-health tools in DMHS in SA HEIs. In the light of this, it is hypothesised that:

H₇: University staff perceive that effective digital health communication significantly enhances the sustainable adoption of e-health tools in DMHS.

Multilingual e-health services

It is proposed that SA HEIs should consider delivering DMHS in all 12 official languages to reach a broader audience. This strategic approach is especially beneficial for individuals who speak only SA languages other than English, who are excluded from utilising e-health tools effectively, as they may struggle to use e-health tools effectively because of language barriers (James & Versteeg, 2007). Consequently, a multilingual e-health services approach can mitigate the digital divide between language speakers and non-language speakers, thereby facilitating the sustainable adoption of e-health tools and accordingly, the study hypothesised that:

H₈: University staff perceive that offering e-health tools in multiple languages significantly improves the sustainable adoption of DMHS among diverse linguistic groups.

Hybrid e-health models

Looking ahead, combining e-health tools with in-person therapy and telephonic interventions can help prevent the limitations of e-health tools in DMHS. Studies show that organisations such as SA HEIs need to encourage peer support through features such as forums and community chat rooms (Noar & Harrington, 2012). The use of e-health tools will thus be supported by their integration with existing mental health resources and support networks, such as hotlines and in-person psychotherapy services. This hybrid e-health model is essential for ensuring that e-health tools can be effectively used for mental health support. It is therefore hypothesised that:

H₉: University staff perceive that hybrid e-health models significantly enhance the sustainable adoption of e-health tools in DMHS.

Continuous evaluation and improvement

Balcombe and De Leo (2021) recommend that organisations such as SA HEIs should conduct continuous evaluation and improvement strategies to ensure the effectiveness of e-health tools and their impact on delivering DMHS. This proposes that it is vital for SA HEIs to regularly assess the effectiveness of e-health tools by collecting user feedback to identify areas that require improvement and then implement the appropriate changes timely. Collecting user feedback provides key knowledge into the user experience and may aid in the identification of specific issues or challenges university staff may be experiencing. This information could also guide SA HEIs in making data-driven decisions to improve the usability and functionality of e-health tools. Moreover, it may foster a sense of involvement and satisfaction among university staff,

as they feel their opinions and input are valued and contribute to the continuous development and improvement process. Thus, it is hypothesised that:

H₁₀: University staff perceive that continuous evaluation and improvement of e-health tools significantly improve their sustainable adoption in DMHS.

Environmental strategies

Top management support

Organisational top management plays a significant role in influencing the adoption of e-health tools, given their direct impact and capacity to source and distribute financial resources (Han et al., 2020; Johnson & Diman, 2017). Thus, there is a need for top management support in universities that can help in securing and allocating financial resources as well as inspiring and motivating university staff to use e-health tools for DMHS (Al-Mamary et al., 2014). Establishing clear, recognisable and proactive leadership that is capable of driving and managing all stakeholders effectively is one of the key components in fostering the long-term adoption of e-health tools (Han et al., 2020). As such, ensuring a stable and supportive leadership structure is essential for successful e-health implementation. Given this, the study hypothesised that:

H₁₁: University staff perceive that strong top management support significantly increases the sustainable adoption of e-health tools in DMHS.

Digital infrastructure

South African HEIs need to create new strategic partnerships and further leverage their existing ICT infrastructure. This involves utilising existing infrastructure and technologies within the institutions and expanding their partnerships with external organisations to improve the scalability, security and efficiency of e-health tools in DMHS on a long-term basis (Jones et al., 2011). As part of their efforts to provide DMHS, SA HEIs must recruit experienced ICT employees with appropriate knowledge and, where necessary, outsource the services. This will help to ensure the sustainable adoption of e-health tools. Digital infrastructure is a critical factor impacting the sustainable adoption of e-health tools in DMHS. In this regard, securing additional resources, including the availability of electricity, ICT infrastructure and financial and human resources are key environmental elements that have a considerable amount of potential to facilitate the sustainable adoption of e-health tools (Fanta & Pretorius, 2018). Thus, to ensure the availability of electricity, solar energy should be considered as a renewable resource for SA HEIs as part of their commitment (Azimoh et al., 2017). Top management and public-private partnerships are central to achieving this. In the modern-day era, the popularity of renewable sources, such as solar energy, has surged, and for good reasons. For instance, researchers make a compelling case for the significant potential of solar energy as a sustainable alternative to fossil fuels (Kumar et al., 2023). The researchers further assert that using solar energy reduces carbon emissions and is a more environmentally friendly option to combat the issue of global warming. Alternatively, SA HEIs should consider installing

generators in the event of a power outage so that daily operations, including the use of e-health tools, are not disrupted. Consequently, this study hypothesises that:

H₁₂: University staff perceive that robust digital infrastructure significantly improves the sustainable adoption of e-health tools in DMHS.

Technological strategies

Data privacy and security systems

As mental health data are considered to be more sensitive than other types of health data, ethical concerns related to privacy, confidentiality and data security have the potential to harm patients (Martinez-Martin & Kreitmair, 2018). Furthermore, DMHS are less acceptable because of the risk of privacy breaches and security vulnerabilities (Wies et al., 2021). Therefore, it is important to ensure that the e-health tools being used in DMHS are secure and reliable. To protect sensitive user data, organisations such as SA HEIs must make sure the usage of e-health tools is secure and conforms with all applicable privacy regulations (Stoll et al., 2020). Moreover, to protect patient safety, organisations should stop using technology in situations when shortcomings cannot be addressed (Baniyadi et al., 2018). This recommendation is particularly important, as the consequences of failing to do so could be severe. Based on this premise, it is hypothesised that:

H₁₃: University staff perceive that robust data privacy and security systems significantly improve the sustainable adoption of e-health tools in DMHS.

Data security and security policies

Data privacy and security policies are other crucial strategies for the safe use of e-health tools. Their absence can significantly affect the effectiveness of e-health tools at SA HEIs to access DMHS (Coelho et al., 2025). This implies that SA HEIs should have well-defined data privacy and security policies for data management. Thus, SA HEIs must develop a data privacy and security policy that should guide and strengthen the governance and usage of the Internet in the institutions, specifically for the utilisation of e-health tools. This led the study to hypothesise:

H₁₄: University staff perceive that robust data privacy and security systems significantly improve the sustainable adoption of e-health tools.

Research methodology

Research approach

This study employed a cross-sectional survey design within a positivist paradigm (Saunders et al., 2019) to quantitatively evaluate university staff perceptions of implementation strategies for the sustainable adoption of e-health tools in DMHS. Data were collected from a single public HEI in Cape Town, South Africa, which is referred to as University X to maintain anonymity. The institution was selected based on its accessibility, status as the province's largest public university and demonstrated engagement with early e-health interventions for DMHS. These factors provided a strong

impetus for exploring staff perceptions of implementation strategies that could enhance staff wellbeing.

Population and sample

The study population comprised all staff members at University X. Participants were selected using voluntary response sampling. Staff received email invitations and could choose to participate by completing an online survey (Saunders et al., 2019). This approach ensured voluntary participation and complied with institutional protocols for staff research participation. The sampling frame consisted of three distinct groups: (1) top management, (2) academic and (3) non-academic (administrative) staff members. Of the 2840 university staff invited to participate, 348 completed the online survey, resulting in a response rate of 12.3%. The response rate constitutes a statistically robust sample size for quantitative data analysis (Saunders et al., 2019). Table 1 demonstrates significant demographic heterogeneity across multiple dimensions, including gender, race, age, educational qualifications, occupational roles, employment categories and years of service at University X.

Research instrument

The online survey utilised a structured questionnaire administered through Microsoft Forms, which enabled real-time data capture from June 2023 to August 2023. The questionnaire was a self-completion research tool, allowing respondents to complete independently without external

influence, thereby minimising potential bias. The questionnaire included a 5-point Likert scale where the rating was 1 – strongly agree, 2 – agree, 3 – neutral, 4 – disagree and 5 – strongly disagree. The questionnaire was uniform and consistent for all respondents, commencing with a cover letter that outlined the objective of the study and a request for honest responses, with clear options and instructions on how to respond. The final questionnaire comprised two sections – Section A (7 items) collected biographical data and Section B (14 items) explored university staff perceptions regarding strategies for the sustainable adoption of e-health tools.

The questionnaire was based on theoretical insights from the literature, as no validated scales for measuring strategies for the long-term adoption of e-health tools were found. Accordingly, to determine content validity, the study generated the items in the questionnaire from previous studies addressing issues associated with strategies for the sustainable adoption of e-health tools in DMHS.

Before collecting data, a pilot study was carried out to evaluate the validity and reliability of the research instrument. This pilot involved 18 individuals from University X who did not participate in the main study and offered valuable feedback to help refine the questionnaire. This process improved the face and construct validity of the items and addressed aspects such as structuring, design style, layout, font size and information accuracy. Furthermore, the research questionnaire was thoroughly evaluated by the study supervisor, a statistician, two academic specialist, and the Faculty Research Ethics Committee at University X. The study consistently followed strict ethical standards and received ethical clearance from the Cape Peninsula University of Technology (Faculty Ethics Committee Approval Reference Number: 2021_FBMSREC 083).

TABLE 1: Demographic information.

Item	Category	Frequency	Percentage
Gender	Male	156	44.8
	Female	192	55.2
Race	African people	161	46.3
	White people	44	12.6
	Mixed race people	89	25.6
	Indian people	51	14.7
	Asian people	3	0.8
Age group (in years)	20–29	10	2.9
	30–39	83	23.9
	40–49	149	42.8
	50–59	93	26.7
	60 or older	13	3.7
Highest level of qualification attained	National Senior Certificate	2	0.6
	Diploma	16	4.6
	Undergraduate Degree	47	13.5
	Postgraduate Degree	39	11.2
	Master's Degree	180	51.7
	Doctoral Degree	63	18.1
	Other	1	0.3
Occupation	Academic staff	205	58.9
	Non-academic staff	124	35.6
	Management staff	19	5.5
Employment category	Permanent employment	242	69.5
	Fixed-term contract employee	106	30.5
Length of service at the current institution (in years)	0–5	74	21.3
	6–10	103	29.6
	11–15	67	19.3
	16–20	76	21.8
	More than 21	28	8.0

Data analysis

The Statistical Package for Social Sciences (SPSS) version 29 was used to conduct data analysis. Descriptive statistics, comprising means and standard deviations, were calculated to summarise the data. The reliability of the scales was assessed through the computation of Cronbach's alpha coefficients, applying a minimum acceptable value of 0.7 (Saunders et al., 2019). In addition, one-sample *t*-tests were performed to determine statistical significance by comparing sample means to hypothesised values (Saunders et al., 2019). These statistical methods were selected for their respective strengths: descriptive statistics provided a clear overview of the data, while Cronbach's alpha evaluated internal consistency and confirmed measurement reliability. The one-sample *t*-tests provided a robust method for assessing whether sample means differed significantly from hypothesised values.

Ethical considerations

Ethical approval to conduct this study was obtained from the Cape Peninsula University of Technology Faculty of Business and Management Sciences Research Ethics Committee. (No. 2021_FBMSREC 083).

Results

Before data analysis, the 14-item scale measuring university staff perceptions of e-health tools adoption strategies showed strong reliability, with a Cronbach's alpha of $\alpha = 0.897$, exceeding the 0.7 threshold (Saunders et al., 2019).

Table 2 presents the means, standard deviations and standard error means for each strategy. The mean scores for each statement ranged from 1.56 to 2.33, and this indicated that university staff generally agreed with the statements. The lower mean scores (closer to 1) indicated stronger agreement. The highest agreement was on funding (mean = 1.56) and top management support (mean = 1.86). The standard deviations ranged from 0.878 to 1.541, and this revealed some variability in responses, but the means were still significantly above the test value of 0. The most variation was seen in financial incentives (standard deviation = 1.34), and this represented some mixed views by the university staff. The standard error of the mean was relatively small for all statements, and this signified that the sample means are good estimates of the population means.

The hypotheses of the study were tested using one-sample *t*-tests for all 14 strategies, evaluating university staff perceptions of their importance. The results, presented in

TABLE 2: Descriptive statistics.

Strategy	<i>N</i>	Mean	SD	SE Mean
Funding	348	1.56	0.878	0.047
Financial incentives	348	2.33	1.340	0.072
Digital inclusion programmes	348	1.83	1.126	0.060
Stakeholder engagement	348	2.07	1.406	0.075
Training	348	2.19	1.541	0.083
Digital health literacy campaigns	348	2.09	1.449	0.078
Digital health communication	348	2.21	1.510	0.081
Multilingual e-health services	348	2.27	1.378	0.074
Hybrid e-health models	348	1.87	1.192	0.064
Continuous evaluation and improvement	348	2.07	1.296	0.069
Top management support	348	1.86	1.200	0.064
Digital infrastructure	348	2.26	1.492	0.080
Data privacy and security systems	348	2.07	1.350	0.072
Data security and security policies	348	2.23	1.537	0.082

N, population; SD, Standard Deviation; SE Mean, Standard Error Mean.

TABLE 3: One-sample *t*-test results.

Strategy	<i>t</i>	<i>df</i>	One-sided <i>p</i>	Two-sided <i>p</i>	Mean difference	95% CI
Funding	33.21	347	< 0.001	< 0.001	1.563	1.47–1.66
Financial incentives	32.48	347	< 0.001	< 0.001	2.333	2.19–2.47
Digital inclusion programmes	30.36	347	< 0.001	< 0.001	1.833	1.71–1.95
Stakeholder engagement	27.53	347	< 0.001	< 0.001	2.075	1.93–2.22
Training	26.52	347	< 0.001	< 0.001	2.190	2.03–2.35
Digital health literacy campaigns	26.90	347	< 0.001	< 0.001	2.089	1.94–2.24
Digital health communication	27.27	347	< 0.001	< 0.001	2.207	2.05–2.37
Multilingual e-health services	30.77	347	< 0.001	< 0.001	2.273	2.13–2.42
Hybrid e-health models	29.27	347	< 0.001	< 0.001	1.871	1.74–2.00
Continuous evaluation and improvement	29.81	347	< 0.001	< 0.001	2.072	1.94–2.21
Top management support	28.96	347	< 0.001	< 0.001	1.862	1.74–1.99
Digital infrastructure	28.24	347	< 0.001	< 0.001	2.259	2.10–2.42
Data privacy and security systems	28.68	347	< 0.001	< 0.001	2.075	1.93–2.22
Data security and security policies	27.07	347	< 0.001	< 0.001	2.230	2.07–2.39

Note: *t*, *t*-statistic; *One-Sided p*, the *p*-value for a one-tailed test; *Two-Sided p*: The *p*-value for a two-tailed test. *df*, degrees of freedom; CI, confidence interval.

Table 3, showed that all *p*-values were less than 0.001, indicating that staff perceptions of the importance of each strategy were statistically significant. The *t*-values, which measured the difference between the sample mean and the test value in terms of standard error, were high for all strategies, further confirming the statistical significance of the results. The analysis revealed the highest *t*-values for funding ($t = 33.21$) and financial incentives ($t = 32.48$), indicating these strategies as critical enablers for the sustainable adoption of e-health tools in DMHS. In addition, all confidence intervals (CIs) excluded zero, which further supported the statistical significance of the results and reinforced their reliability. These findings highlighted the importance of the tested strategies in promoting the sustainable adoption of e-health tools among university staff.

Table 4 shows the effect sizes (Cohen's *d*), which measure the practical significance of the results. The Cohen's *d* values were all above 1.0, and this indicated large effects, meaning the strategies had strong practical importance. The largest effect sizes were for funding ($d = 1.78$), financial incentives ($d = 1.74$) and multilingual e-health services ($d = 1.65$). All CIs were above 1, and this reinforced the stability of these effects.

TABLE 4: Effect sizes (Cohen's *d*).

Strategy	Cohen's <i>d</i>	95% CI
Funding	1.780	1.611–1.949
Financial incentives	1.741	1.574–1.907
Digital inclusion programmes	1.627	1.467–1.787
Stakeholder engagement	1.476	1.323–1.627
Training	1.421	1.272–1.570
Digital health literacy campaigns	1.442	1.291–1.592
Digital health communication	1.462	1.310–1.612
Multilingual e-health services	1.649	1.487–1.810
Hybrid e-health models	1.569	1.412–1.726
Continuous evaluation and improvement	1.598	1.439–1.756
Top management support	1.552	1.396–1.708
Digital infrastructure	1.514	1.359–1.667
Data privacy and security systems	1.537	1.381–1.692
Data security and security policies	1.451	1.300–1.601

CI, confidence interval.

Discussion

The study revealed that university staff perceived increased funding from diversified sources as a significant factor in improving the long-term use of e-health tools. The literature supports the importance of funding for the procurement of equipment, software, scaling of e-health tools and other essential activities, including research and development (Mbunge et al., 2022b; Torous et al., 2025). Accordingly, the findings corroborate with the theoretical perspectives that emphasise financial resources as a key enabler of the adoption of e-health tools.

The findings indicated that financial incentives significantly promoted the long-term usage of e-health tools. This finding is consistent with existing literature, which affirms that financial incentives motivate e-health utilisation and its sustainable adoption (Ricciardi et al., 2013). The findings further support the perspective that financial incentives effectively encourage the utilisation of DMHS through e-health tools.

Digital inclusion programmes were found to significantly improve the sustainable adoption of e-health tools in DMHS. Improving the affordability of internet connections can facilitate e-health adoption, as the economic sustainability of e-health tools is influenced by both internet affordability and system procurement costs (Leon et al., 2012). Prior research also supports the importance of affordability and internet access as critical factors for e-health success (Mbunge et al., 2022b; Torous et al., 2025). These findings highlight the importance of digital inclusion initiatives in bridging the digital divide and promoting equitable access to e-health tools.

The results regarding stakeholder engagement in the design and development of e-health tools are consistent with recommendations that key stakeholders, particularly end-users, should be involved from the outset to overcome potential resistance, enhance acceptability and satisfy stakeholder demands (Bernaerts et al., 2024; Fanta & Pretorius, 2018). Involving stakeholders early in the process has been shown to improve acceptability and reduce resistance to adoption in the post-COVID-19 context.

Adequate training on e-health tools was found to significantly improve their sustainable adoption in DMHS, consistent with findings highlighting the importance of training for effective use of e-health tools (Baniyadi et al., 2018). This result is further supported by evidence confirming that training increases uptake of e-health tools (Tilahun & Fritz, 2015). The findings emphasise the critical role of training in ensuring university staff proficiency and promoting long-term adoption of e-health tools.

Digital health literacy campaigns were found to significantly increase sustainable adoption of e-health tools in DMHS, consistent with suggestions that organisations such as SA HEIs should raise awareness about available e-health tools

through such campaigns (Mbunge et al., 2022a). Digital health literacy serves as a key enabler of the adoption (Stoll et al., 2020), demonstrating these campaigns' significant role in promoting the implementation of e-health tools for DMHS.

The result that effective digital health communication significantly improves the sustainable adoption of e-health tools in DMHS is congruent with the views of Coelho et al. (2025), who assert that constant communication with users and providers of DMHS is imperative to guarantee the effective utilisation of e-health tools. Given the study results, there is a need for clear and consistent communication as a driver of technology adoption.

The study revealed that offering e-health tools in multiple languages significantly improves the sustainable adoption of DMHS among diverse linguistic groups, supporting the assertion that a multilingual approach bridges digital divides between language speakers and non-speakers to facilitate e-health adoption (James & Versteeg, 2007). In this regard, the study findings stress the importance of linguistic inclusivity in digital health initiatives.

Moreover, our study showed that hybrid e-health models notably improve the sustainable adoption of e-health tools in DMHS, coherent with the recommendations to combine digital tools with in-person support to address limitations and maximise the benefits (Noar & Harrington, 2012). In the light of this, the study findings highlight the value of hybrid models in providing comprehensive mental health support.

The study indicated that continuous evaluation and improvement of e-health tools considerably enhance sustainable adoption for DMHS, congruent with recommendations for organisations such as SA HEIs to implement such strategies to ensure the effectiveness of the use of e-health tools and the impact on service delivery (Balcombe & De Leo, 2021). Therefore, the study's findings demonstrate the importance of regular feedback and iterative improvements for refining e-health tools and ensuring their long-term success.

The study also found that strong top management support meaningfully increases the sustainable adoption of e-health tools in DMHS. This result corresponds to the findings that organisational leadership significantly influences adoption through resource allocation and decision making (Han et al., 2020; Johnson & Diman, 2017). In view of this, the findings of this study reinforce the need for proactive leadership to drive the successful implementation of digital health initiatives among the university staff in SA HEIs.

In addition, robust digital infrastructure was found to profoundly improve the sustainable adoption of e-health tools for DMHS, coinciding with the view that securing essential resources (electricity, ICT infrastructure and financial and/or human support) facilitates e-health adoption (Fanta & Pretorius, 2018). Thus, considering this, the research findings show the importance of investing in reliable digital infrastructure to support e-health initiatives.

The finding that robust data privacy and security systems substantially improve the long-term usage of e-health tools is consistent with the view that ethical concerns regarding privacy, confidentiality and data security may particularly harm mental health patients because of data sensitivity (Martinez-Martin & Kreitmair, 2018; Wies et al., 2021). Accordingly, the findings confirm the necessity of secure systems for building trust and confidence in the use of e-health tools in DMHS.

Finally, robust data privacy and security policies were found to significantly enhance the sustainable adoption of e-health tools in DMHS, aligning with the arguments that the effectiveness of such tools in SA HEIs can be substantially compromised without proper measurements to protect staff (Coelho et al., 2025). Therefore, the results of this study demonstrate that robust data privacy and security policies are essential for ensuring safe and effective use of e-health tools.

Study's limitations and suggestions for future research

The study has several limitations that should be acknowledged, which highlight the need for future research to address these gaps. Firstly, the research was limited to a single institution, which may restrict the generalisability of the results. To address this, it is recommended that future studies include multiple institutions across different regions of South Africa to provide a broader perspective of the subject matter. Secondly, the study relied on self-reported data, which may introduce bias, as staff could have overstated their agreement with certain strategies. To mitigate this limitation, the study suggests that future research employ mixed methods, combining quantitative and qualitative approaches, to triangulate the findings and provide a more comprehensive understanding of university staff perceptions. In addition, the study did not explore the impact of external factors, such as government policies or economic conditions, on the adoption of e-health tools. These factors could play a significant role in shaping the implementation strategies and sustainability of digital health initiatives. Therefore, the study recommends that future research endeavours investigate how external influences impact the adoption and integration of e-health tools in SA HEIs or similar institutions.

Theoretical implications

The study contributes to the theoretical understanding of the sustainable adoption of e-health tools in several ways. The study integrated the concept of sustainability into the adoption of e-health tools by stressing economic, social, environmental and technological dimensions. This extended existing frameworks, which often focus solely on technological or economic factors (Chambers et al., 2013; Fanta & Pretorius, 2018; Moore et al., 2017). In addition, the study highlights the importance of stakeholder engagement in the adoption of e-health tools, suggesting that involving

stakeholders, particularly university staff, in the design and development process can enhance the acceptability and effectiveness of e-health tools. Moreover, the findings regarding training and digital literacy align with the Technology Acceptance Model, which posits that perceived ease of use and usefulness are key determinants of technology adoption (Davis, 1989). The study further contributes to the theoretical discourse by highlighting the critical role of training in shaping staff perceptions of e-health tools, thereby enriching the broader understanding of technology adoption in the mental healthcare context.

Managerial implications

The research findings present several important managerial implications for university management and policymakers. With regard to financial incentives, SA HEIs are encouraged to consider providing financial rewards, such as stipends or other forms of recognition, to the university staff to encourage the sustainable adoption of e-health tools in DMHS. In terms of capacity building, SA HEIs should invest in structured training programmes including workshops, online tutorials and just-in-time technical support to improve staff proficiency in using e-health tools. Stakeholder engagement is also critical; involving university staff in the design and development of e-health tools in DMHS ensures that the tools are user-friendly and tailored to meet the specific needs of the staff. Data privacy and security must be prioritised through the implementation of robust data management systems and policies, especially considering the sensitive nature of mental health information. Finally, the adoption of hybrid models that integrate e-health tools with traditional face-to-face mental health services is recommended. This hybrid model can help to address the limitations of digital tools and ensure that university staff have access to comprehensive and accessible mental health support. Collectively, these recommendations are designed to facilitate the sustainable adoption of e-health tools while addressing the diverse needs of university staff.

Conclusion

The study provides critical insights into university staff perceptions of strategies for the sustainable adoption of e-health tools in DMHS within SA HEIs. The findings indicate that financial strategies, such as funding and financial incentives, as well as social strategies, including training and stakeholder engagement, are critical for the successful adoption of e-health tools. The importance of robust data privacy and security systems, multilingual services, and hybrid models is also emphasised as critical factors to ensure the long-term success of e-health initiatives. The research findings have significant managerial implications, particularly in terms of securing adequate funding, enhancing training programmes and engaging stakeholders, especially university staff, in the design and implementation of e-health tools. The study supports the broader objective of improving mental health services in HEIs, thus contributing to societal well-

being and enhancing pandemic preparedness. From a theoretical perspective, this study advocates for an integrated approach to the adoption of e-health tools that considers economic, social, environmental, and technological dimensions, thereby extending frameworks and highlighting the importance of a holistic perspective in promoting sustainable adoption. Even though the study has some limitations, such as the focus on a single institution and reliance on self-reported data, the study establishes a strong foundation for future research endeavours, as explained. In conclusion, the study advances the understanding of strategies to promote the sustainable adoption of e-health tools in DMHS within SA HEIs, with implications for both practice and theory.

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Competing interests

The authors reported that they received funding from Cape Peninsula University of Technology, which may be affected by the research reported in the enclosed publication. The author has disclosed those interests fully and has implemented an approved plan for managing any potential conflicts arising from their involvement. The terms of these funding arrangements have been reviewed and approved by the affiliated University in accordance with its policy on objectivity in research.

Authors' contributions

R.N.M. acted as the primary researcher for the study that formed part of his doctoral study. L.G. contributed to the supervision and funding acquisition of the study.

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Data availability

Primary data for the study are available from the corresponding author, R.N.M., upon reasonable request.

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