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Technology acceptance model (TAM) of telescreening innovation for the prevention of mortality of high-risk pregnant women in Jayapura Regency, Papua

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ABSTRACT

The maternal mortality rate in Papua is still high. This study aimed to assess the readiness and benefits of telescreening high-risk pregnant women based on the Technology Acceptance Model (TAM) theory in Jayapura District, Papua. This cross-sectional study was based on the Technology Acceptance Model (TAM) questionnaire distributed to health workers with a validated Likert scale, and analyzed using the Structural Equation Model with the LISREL application. The results of the analysis showed that the total internet connection was 71% good or very good. 77% of respondents felt that telescreening high-risk pregnant women would be useful with 76% of respondents having the intention to commit to using the telescreening. Internet access in Jayapura Regency is good and not a barrier to telescreening. This TAM can be the basis for developing telescreening for early detection of high-risk pregnant women, so that deaths can be prevented.

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INTRODUCTION

Maternal mortality remains a worldwide health problem. According to WHO, the incidence of maternal mortality in 2017 was 462 out of 100000 live births in low-income countries. Papua, a province in Indonesia shows a high maternal mortality rate, with 573 out of 100000 live births in 2018 (Dinkes Papua, 2019). Maternal mortality is dominated by postpartum haemorrhage, followed by infection, hypertension, and other causes. However, it can be prevented through early detection of complications (screening) so that adequate therapy and intervention can be provided earlier (Hardanha, dkk, 2021; Idris, dkk, 2021).

The high maternal mortality rate is arguably a result of the lack of resources and limited access to health facilities in Papua (Dinkes Papua, 2019). Over the past decade, telescreening has been shown to promote appropriate care through improved access to health services and early

intervention to map the level of risk in pregnant women. With telescreening, early intervention in high-risk pregnancies is expected to reduce maternal mortality (Haleem, dkk, 2021).

The emergence of teleconsultation in Indonesia with various applications and video conferencing methods has helped many patients and doctors especially during the pandemic, this conferencing system has proven successful in cities and towns in Indonesia. With the advent of telemedicine, many healthcare organisations can now assess the feasibility of implementing the technology, determining whether it will be well received by various segments of the population: patients, healthcare providers and other stakeholders. All of this is also to see if there is sufficient support to make the investment worthwhile at scale (Malau & Santi, 2022; Lu, dkk, 2018).

RESEARCH METHOD

This study was a cross-sectional observational study that used a Google-form-based questionnaire for data collection. A modified Technology Acceptance Model (TAM) questionnaire with a Likert Scale model in Bahasa Indonesia was used as the tool in this study. The questionnaire consisted of 50 questions regarding respondents perceptions of telemedicine implementation and was validated through a focus group discussion consisting of various medical professionals. The questionnaire was distributed to health workers at 22 Puskesmas in Jayapura from 4 January 2023 to 8 January 2023 on the basis of self-willingness. The definition of health workers includes, but is not limited to, specialists, general practitioners, midwives, nurses, and other health workers who are legally certified under Indonesian law, and over 18 years of age.

Jayapura is a district with a high maternal mortality ratio of 184/100,000 live births. On the other hand, Jayapura has a 4G network coverage of 82%, smartphone penetration of 61%, 100% midwife coverage, and an excellent video streaming experience, making the district a suitable place for a telemedicine programme based on pregnancy healthcare.

The data collected was then managed locally by the TAM team from the Faculty of Medicine, Airlangga University, Surabaya, and the Jayapura District Health Office. The data from the 22 Puskesmas were then downloaded into Microsoft Excel for analysis. The data were then analysed with structural equation models using the LISREL application and presented in the form of descriptive statistics.

RESULTS AND DISCUSSIONS

Services Activity

Over thye course of two weeks, a brief survey and analysis was conducted using an online questionnaire based on the Technology Acceptance Model (TAM). The study was conducted in 22 Community Health Centres (Puskesmas) in Jayapura, Papua. Together with 11 health care practitioners, consisting of 140 midwives, 47 nurses, 21 doctors, 3 nutritionists, 2 pharmacists, 1 environmental health officer, 3 health promotion officers, one environmental sanitation officer, 2 analysts, 1 medical nutrition therapy officer, and 1 medical laboratory technologist. The survey was conducted remotely using internet communication.

Pre-implementation survey

There were 222 completed surveys available for analysis. Table 1 displays the demographics of the participants.

Table 1. Demographics of questionnaire participants

Age	Men	n (%) = 23 (10.36)	Range = 26 - 55 years	Avarage ± SD = 34.52 ± 6.21	
	Women	n (%) = 199 (89.64)	Range = 23 - 55 years	Avarage ± SD = 34.63 ± 7.30	
Occupation	Midwives	Nurse	Doctor	Nutritionist	Pharmacist

	n = 140	n = 47	n = 21	n = 3	n = 2
Internet Connection Quality	Very good n = 48	Good n = 110	Moderate n = 44	Bad n = 20	
Education Degree	*Diploma* n = 155	*Bachelor* n = 62	*Post-graduate* n = 4	*High School* n = 1	
Working Duration	> 5 years n = 135	2 - 4 years n = 36	1 - 2 years n = 33	< 1 year n = 18	
Local Peoples	Yes n = 68	No n = 154			
Experience in managing high-risk pregnancies	Yes n = 150	No n = 72			
General Doctor / Specialist	Yes n = 23	No n = 199			

Technology Acceptance Model (TAM)

About 61-83% of respondents said that using technology would make their work easier and increase productivity for medical practitioners. According to 80% of respondents, using technology can improve their clinical knowledge. In response to the question, 72% of respondents stated that their colleagues support and encourage them to use tele-screening and 52% agreed that it would not affect them in communicating with their colleagues or put their duties in jeopardy. A total of 75% of respondents agreed that the use of technology in tele-screening is easy and flexible to use, regarding accessibility, communication between parties, and getting the best management. More than half of the respondents have used technology before to gain access to medical care. In response to questions about previous technology use, 66% of respondents said they had used various apps to learn about maternal health; 63% had searched Google for potential diagnoses based on symptoms they may have previously experienced; 57% had used government-created self-diagnosis websites (such as COVID-19); and had experienced using video conferencing apps for personal communication (e.g. Skype with family, or Zoom with friends), and 34% of respondents had used video conferencing meetings to create consultations for their patients.

Tele-screening

About 77% of respondents agreed that adopting technology for tele-screening would improve the quality of care and patient management. In terms of usability, 76% of the respondents expressed the practicality of tele-screening for maternal health saying it makes it easier for them to oversee patient care. Most respondents - about 75% - said that adopting tele-screening could improve their efficiency in managing maternal patients. In response to the survey, nearly 76% of respondents said they plan to use tele-screening extensively to manage their patients both clinically and non-clinically. According to 73% of the medical professionals in some Papuan health centre agencies, tele-screening was highly recommended, while 73% of participants thought that tele-screening would be used as a priority approach if there were sufficient resources. About 60% of respondents disagreed that using maternal tele-screening would not be beneficial for patient care and management, 66% disagreed that using maternal tele-screening would not improve the effectiveness of patient care, and 71% disagreed that using maternal tele-screening would not improve the quality of patient management and care. Overall, our data showed that most participants agreed that tele-screening would be beneficial for maternal health management in rural areas, such as Papua.

Discussions

Technology has an influence on daily life, including increasing productivity, so that the work done can be more effective and efficient. Most respondents said that the use of technology would make their work easier and increase productivity for medical practitioners.

Correspondingly, another study mentioned that technology increases productivity, making work easier, more effective and efficient (Rasa & Laherto, 2022).

Communication technology has also developed rapidly, making it easier to use (Rasa & Laherto, 2022). Most of our respondents agreed that the use of technology in tele-screening is easy and flexible to use, regarding accessibility, communication between parties, and getting the best management. The resulting benefits can include lower cost utilisation, higher productivity and shorter time utilization (Thimbleby, 2013).

Telemedicine can also improve patient safety, as it can help identify and avoid errors in care, as well as aid in more thorough patient monitoring (Scott, et.al, 2014; Schneider, 2013). This study also found the same, that most respondents agreed that telemedicine would not affect them in communicating with their colleagues or put their duties in jeopardy. Medical care through telemedicine will enhance the ability of medical service providers to deliver more effective, safer services with more flexible access (DePuccio, et.al., 2022).

Almost all respondents stated that by using technology, their clinical knowledge could improve. In some literature, it is mentioned that doctors can also benefit from telemedicine applications, such as exchanging skills and knowledge between doctors in order to improve better health services (Haleem, et.al., 2021; Hwei & Octavius, 2021). Telemedicine also allows health care practitioners to meet patients as often as needed, making health services provided faster, more flexible, and reducing appointment failures between health practitioners and patients (Breton, et.al., 2021).

The Technology Adoption Model (TAM) developed by Fred Davis is the leading methodology for studying variables that influence user acceptance of technology. TAM assumes two important factors in the implementation of telemedicine, namely ease of use and prospective benefits, including implementation between intrinsic features and external variables. Aspects of internal variables addressed by this system include system features, user training, user engagement design, and user characteristics of the technology implementation process (Marangunić, & Granić, 2015).

Healthcare professionals have validated telemedicine as a beneficial tool for patients, as it allows healthcare practitioners to regularly contact patients and their families and discuss further treatment options (Funderskov, et.al., 2019). In this study, more than 70% of respondents agreed that adopting technology for tele-screening would improve the quality of patient care and management, especially in terms of practicality that eases their task of overseeing patient care. Other studies have found that clinical management of patients through remote decision-making can improve the quality and quantity of patient medical data (Palmer, ey.al, 2021; Deldar, et.al, 2017). Telemedicine also allows for faster response times that reduce the risk of morbidity and mortality in patients (Maarop, et.al., 2011), and even takes less time compared to face-to-face consultations (Hwei, et.al, 2021; Rhoads, et.al., 2017). Other studies have found telemedicine to be low cost, yet impactful, and allows for continuous monitoring of maternal health (Alves, et.al., 2019).

Most health workers in the study area are familiar with the use of current technology, as seen from the answers given, more than 50% of respondents can use various applications to learn about maternal health, can search on Google for potential diagnoses based on existing symptoms, can operate self-diagnosis websites created by the government (such as COVID-19); and are familiar with using video conferencing applications for personal communication. If fulfilled properly, these are sufficient for the implementation of telescreening in the study area.

In line with this, an experimental study in Malaysia (Satria, et.al., 2014), confirmed that the practice of virtual pre-natal visits could be possible with two-way communication using a Wireless Mesh Network consisting of a Medical Data Assistant (MDA), Medical Device Interface (MDI), and several monitoring devices, which would be advantageous in terms of low cost implementation,

faster data transfer, and improved quality of medical data received (Campbell-Yeo, et.al., 2021; Garne, et.al., 2016; Pflugeisen, et.al., 2016).

Human resources, infrastructure, and ethical laws are important considerations when using telemedicine. Geographically-dependent technology may limit the availability of telemedicine in remote areas compared to metropolitan areas (Tedeschi, 2021). Geographical limitations may result in poor connections, lack of internet access, as well as lack of relevant smart devices (Jakubowski, et.al., 2021). This makes it challenging for developing countries in particular to provide the basic infrastructure and resources necessary for efficient telemedicine implementation (Lu, et.al, 2021; Combi, et.al., 2016). However, this study revealed that medical professionals in several health centre agencies in Papua still recommend telescreening as a priority if sufficient resources are available. In Indonesia, telemedicine has been well-applied by all demographic groups in Jakarta, and the frequency of its use is not dependent on the level of acceptance in the community due to adequate infrastructure (Malau & Santi, 2022). A cohort study conducted in 2021 by Reisinger-Kindle et al. revealed that monitoring through telehealth increases medical personnel's satisfaction at work because it increases the capacity for patient independence (Reisinger-Kindle, et.al., 2021).

CONCLUSION

Based on survey results using TAM, more than 70% of respondents in Jayapura are capable and ready in terms of infrastructure, and human resources to accept, operate, and implement Telescreening as a tool for High Risk Pregnancy screening. Respondents felt that telescreening was a good idea (75-77%) to simplify and speed up services (72-76%), and a solution to facilitate more effective and productive screening of pregnant women (72-76%).

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