Health students' perspectives on the feasibility of telemedicine implementation in Indonesia

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Abstract.
Background: Telemedicine is widely introduced to maximize ICT utilization in improving patient health outcomes by increasing the access to health and medical information. The interaction between health professionals and ICT implementation in telemedicine leads to massive changes in the health systems.
Aims: This study aims to investigate the future health professionals' opinions about the feasibility of telemedicine implementation in Indonesia.
Methods: Expository essays on telemedicine were analyzed using qualitative content analysis. These essays were written up as part of the quality management in healthcare courses in the public health bachelor's degree of Universitas Airlangga. 34 essays were included in the analysis.
Results: Students' perspectives were portrayed through four overall feasibility themes: 1) technical feasibility was the most concerning issues in the implementation; 2) economic feasibility should be calculated by considering investment and operational costs; 3) operational feasibility remained low when the health professional competence in ICTs was lacking and unmotivated; 4) legal policy was urgently required.
Conclusion: Based on the results, it can be concluded that the future health professionals agree that telemedicine is crucial for Indonesia.

Keywords: feasibility, student, telemedicine

1. Introduction

In this digital world, information technology has become a part of human life. Various devices are invented to facilitate daily life, including in the healthcare industry. Telemedicine is one of the prominent information technology adoption that is consistently developing. Telemedicine combines information technologies and health technologies, providing accessible health intervention. The telemedicine adoption has been proven to minimize the geographic barriers in healthcare. A study claimed that telemedicine is beneficial in connecting health care providers in remote areas to consultants that results in more efficient treatment [1]. Patients also reported that their positive experience using telemedicine is due to its convenience and similarity using face-to-face treatment [2,3].

On the other hand, problematic issues also escort the rise of telemedicine implementation. Health workers often reported unfavorable telemedicine technical feasibility dimension. Physician's skills and telemedicine image quality increase their hesitation in employing telemedicine for diagnosis purposes [4]. Usability determines whether this health technology will be used regularly by health workers or not [5]. For instance, a study claimed that physicians' acceptance in using Electronic Health records is more likely higher among physicians who perceived that this technology is easy to operate [6]. Another study also revealed that health workers' acceptance toward mobile health (mHealth) is determined by its user-centered design, means that it is valued by their work and user-friendliness [7].

As a geographically populated country, Indonesia urgently demands telemedicine to solve health inequality. Indonesian community is also one of the most active internet users in the world. Thus, the purpose of this study is to identify the future health workers' perspectives in evaluating the telemedicine sustainability in Indonesia by listing the issues on the feasibility of telemedicine implementation.

2. Method

The third-year public health undergraduate students who focused on health administration and policy for their theses were invited to attend the Quality Management in Healthcare (MNS310) class. There were 34 students attended this class. After seven-week meetings discussing healthcare services,they were assigned to write an expository essay about telemedicine development in Indonesia. This essay was designed as a part of the mid-semester assessment in this class. The instruction in writing this essay was, "How is your perspective on telemedicine feasibility in Indonesia?" and "Which feasibility should be better prepared by the government?" Before expressing their thoughts, the students were asked which type of telemedicine that most possible to be achieved if implemented in Indonesia.

The data analysis was started by electronically storing the essays into Word files anonymously. We grouped the essays into the particular telemedicine types chosen by students in separate folders. A deductive coding framework was generated based on the four dimensions of the feasibility study, namely technical, economic, operation, and legal feasibilities. Each essay was coded based on the coding book independently using qualitative content analysis. An external researcher was also invited as a comparison. The coding scheme was refined several times by discussing for consensus when different perspectives in coding were encountered. All data was analyzed using Atlas.ti: The Qualitative Data Analysis & Research Software.

3. Result

34 essays from the health students were included in the analysis. 50% of the essays pointed out that teleradiology was the telemedicine type with the highest possibility to be successfully implemented in Indonesia.Meanwhile, other types of telemedicine considered would also be successful were telepsychology (20.6%), teledermatology (14.7%), and telepathology (11.8%). The data analysis resulted in the main findings of telemedicine four dimensions in the health students' perspectives. The issues are presented in Table 1.

Table 1.   Issues related to telemedicine feasibility in Indonesia

Feasibility Dimensions	Themes
Technical	ack of technology infrastructure leads to poor telemedicine quality oor telemedicine quality increases possible misinterpretation of telemedicine results
Economic	**Telemedicine development budget = investment costs + operational costs**
Operational	ealth workers' and patients' lack of ICT competence ow acceptance of health workers and patients due to the usability
Legal	**Absence of legal regulation both in the national and technical levels**

3.1 Technical feasibility

Most of the essays' introduction sections explained that telemedicine urgency was due to Indonesia's geographic condition. Indonesia is an archipelago country consisting of more than 13,000 islands. The majority of students argued that this condition required the emergence of infrastructure preparation to support the telemedicine implementation, *"Considering that Indonesia is an archipelago, there is still*

*no equitable distribution of health workers for telemedicine. Moreover, electricity and internet connections in remote areas are still intricate" (TR002).*Issues related to the technical feasibility of telemedicine is the most frequently mentioned in all of the essays. Another student also affirmed their hesitation that telemedicine would run smoothly in remote areas, *"Telemedicine seeks to protect people or individuals who find difficulty accessing health services. Meanwhile, in Indonesia, the reality is that the unreached people are those who are also technologically illiterate, and it is still impossible to carry out telepsychology independently" (TP006).*

Students pointed out their fear of using telemedicine in the future since they knew that the poor infrastructure would lead to a high possibility of misinterpretation in diagnosis and treatment. An essay stated, *"Internet connection should be strengthened so that health workers can access video calls smoothly for telemedicine and there will be no more lost internet connection among healthcare team" (TD004).* The video call feature in telemedicine aided health workers to be able to communicate with consultants immediately. However, poor internet connection obstructed this two-way communication. An unstable internet connection in remote areas also affected other telemedicine features. For instance, digital image transmission on teleradiology should wait the change in the image resolution received, *"If the internet connection is poor, the data (images) will be resized in advance to speed up data transmission" (TR002).* The good quality digital images in teleradiology could help the doctors diagnose their patients appropriately, along with the exact interpretation of these images. When it is resized into lower resolution, it is highly possible that the health workers could misinterpret the image.

3.2 Economic feasibility

The majority of students argued that the Indonesian government should invest more money to develop telemedicine. A supporting infrastructure of telemedicine should be built in remote areas. A student asserted *"...sufficient funds are required to provide and improve infrastructure, facilities, and the quality of human resources" (TD005).* This statement was echoed by another student who argued that telemedicine economic feasibility should also consider the operational cost in remote areas, *"No matter how well-developed the system is, it will be useless if the operational cost is not funded" (TP004).* The operational cost, whichis related to what the majority of students mentioned,should be prepared by the government in the operational feasibility. This cost covers some amount of money required for the human capital to run telemedicine, including its non-physical structure.

3.3 Operational feasibility

The telemedicine operationalization in Indonesia should also consider the skills of the parties involved in the system. Most of the essays elucidate that at least the operational feasibility should understand the ICT skills of health workers and patients. Regarding teledermatology, which connected patients and health workers directly,students argued thatthe wrong way of operating telemedicine by patients would lead to the wrong diagnosis, *"Patients should be educated onhow to take good pictures and videosto depict their conditions,so that the resolution of the images and videos provided do not change" (TD004).* Therefore, students suggested that extensive socialization would improve the laypeople's understanding of how telemedicine worked, *"further socialization regarding telemedicine is required for the wider community since many Indonesians are not familiar with telemedicine" (TP004).*

Health workers' possibility in utilizing telemedicine remained low when their ICT competence is lacking, *"Not only medical competencies are demanded, but HR must also master the knowledge of information technology" (TD005).* Sufficient mastery of health technology would assist the diagnosis interpretation and ensure that this technology was safe for patients, "*Health workers' high competencies will prevent the possible incidents caused by human error" (TD001).* Students raised that telemedicine should be designed by considering the usability. They explicated that it would minimize the possibility of its users ignoring telemedicine, *"Telemedicine applications must be designed as simple as possible so that they [health workers and patients] can easily understand the utilization, while still providing complete service tools following the telemedicine standard" (TR002).*

3.4 Legal feasibility

Most of the students stated that the biggest issue in telemedicine implementation was the unclear policy regulating telemedicine. A student emphasized, "*Policies and guidelines regulating all aspects of telemedicine are required as a basis for telemedicine implementation in Indonesia.*" (TD003), which was then strengthen by another student's explication, "*Government must accommodate the telemedicine programs with legal regulations*" (TD003). Students claimed that the policy should not merely regulate telemedicine at the national level. A student argued, "*Telemedicine procedures are not yet available clearly and completely, so that the frontline health workers find several obstacles in applying this technology*" (TP001). They thought that telemedicine policy should derivate into more operational guidelines in local government and health facility levels, as stated by another student, "*There must be a complete set of standard operating procedures that regulates all of the chain from the initial online patient registration to the patient receiving psychological services*" (TP007). The telemedicine technical guideline regulation would aid the managers in health facilities administer telemedicine.

4. Discussion

Telemedicine exhibits a promising monitoring mechanism of the patients with chronic disease in remote and underdeveloped areas [8]. It is also featured as a comprehensive treatment with low-cost scheme. Researchers are now on progress to prove whether telemedicine will facilitate patients in maintaining their health after hospitalization [9]. Although there are numerous benefits of telemedicine adoption, the sustainability of this technology is still unclear, particularly in developing countries such as Indonesia. As future health leaders, the health students' perspectives were substantial in predicting the telemedicine sustainability. Our findings underlined that all feasibility dimensions encountered challenges [10].

The economic and operational feasibilities were higher for telemedicine, enabling two-way interaction between health care providers and patients directly [11]. Patients who employed telemedicine in remote areas exhibited their satisfaction utilizing telemedicine to communicate with health care providers. Even though it successfully diminished their health access problems, technical issues in implementing this technology were the biggest issues. It supported our findings that technical issues were the major concern in infiltrating telemedicine in remote areas of Indonesia [11,12].

The availability of other infrastructures should also be anticipated. Our findings discovered that much money should be granted since the telemedicine development budget should cover investment and operational costs. Meanwhile, patients as the end users only had a limited budget to afford the supporting devices needed in the telemedicine mechanism [13]. Moreover, telemedicine has been studied to increase patients' expense on internet connection and phone bills [8]. For those reasons, there should be a plan to minimize the economic barrier to make telemedicine sustainable in Indonesia.

We also found that technical issues in telemedicine implementation were also related to the insufficiency of health workers, both in quantity and quality. The increasing demand for two-way patient-provider interaction led to an increasing number of consultant availability [14]. On the other hand, in telemedicine that linked health professionals, legal issues were one of the concerns to make health workers agree to adopt the technology. Health workers are special workers whose job authorities and competencies are protected by the law. Hence, they need to work under certain conditions that make them feel safe using technology without any legal punishment risks. A clear procedure will assist them to works ethically and to not harm any other parties. Unfortunately, our findings summarized that legal feasibility was still low in Indonesia [15].

5. Conclusion

In this paper, we present the perspective of the future of health workers in the telemedicine implementation in Indonesia. Our work specifically focuses on analyzing the four feasibility dimensions in telemedicine implementation. The result of this study can be understood as a preliminary feasibility study that can provide foundational guidance for future telemedicine implementation in Indonesia and other developing countries. We gathered health students'

perspectives by analyzing their thoughts in essays. The students argued that technical feasibility is the most concerning issue in the implementation. They also underlined that this technical feasibility should be supported by calculating the economic feasibility for investment and operational purposes. The students also warned that operational feasibility remains low while the health professional competence in ICTs is lacking and unmotivated. The legal policy is urgently required to make the implementation successful. Finally, this study concludes that the future health professionals agreed that telemedicine is crucial for Indonesia but should be prepared by considering a comprehensive framework.

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