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The Digital Technology in Supporting Nursing Services During The Covid-19 Pandemic: A Literature Review

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ABSTRACT

Digital technology plays an important role in helping health workers and improving health services. During the COVID-19 pandemic, digital technology can be an apt solution in supporting nursing/health services to patients. This study aimed to explain digital technology in terms of its forms, functions, and obstacles when harnessed to support nursing/health services during the COVID-19 pandemic. The research databases were established by sourcing articles from Pubmed, ProQuest, Springer Link, Sage Journals, and Google Scholar, focusing on articles published in 2019-2022. The research results found 5 articles discussing the forms and functions of digital technology, 2 articles discussing the functions and barriers of implementing digital technology, and 4 articles discussing the forms, functions, and barriers of implementing digital technology. Most of the forms of digital technology implementation to support nursing/health services during the COVID-19 pandemic involve virtual visits, online consultations, and monitoring patient conditions remotely. The use of digital technology in supporting nursing/health services during the COVID-19 pandemic affords various gains for health workers, patients, and patient families, which serve as the drive to improve services. In addition, these obstacles can serve as the cornerstones in evaluating the use of digital technology for future improvement. Future studies are suggested to examine one form of digital technology for nursing/health services that already exist.

Keywords: COVID-19 pandemic; digital technology; hospital; nursing care

ABSTRAK

Penggunaan teknologi digital dalam pelayanan kesehatan memberikan peran penting dalam membantu tenaga kesehatan dan meningkatkan pelayanan kesehatan. Pada masa pandemi COVID-19 diharapkan penggunaan teknologi digital dapat menjadi sebuah solusi yang lebih baik dalam mengatasi dan menunjang pelayanan keperawatan/kesehatan kepada pasien. Tujuan dari penelitian ini yaitu untuk menjelaskan teknologi digital dari segi bentuk, fungsi, serta hambatan dalam menunjang pelayanan keperawatan/kesehatan pada masa pandemi COVID-19. Sumber dari penelitian menggunakan pencarian *database* yang relevan melalui *Pubmed*, *ProQuest*, *Springer Link*, *Sage Journals*, dan *Google Scholar* dengan tahun publikasi 2019-2022. Hasil penelitian ini, ditemukan 5 artikel membahas bentuk dan fungsi teknologi digital

elayanan keperawatan/kesehatan, 2 artikel membahas fungsi dan hambatan teknologi digital pelayanan keperawatan/kesehatan, dan 4 artikel membahas bentuk, fungsi, dan hambatan dari penggunaan teknologi digital pelayanan keperawatan/kesehatan pada masa pandemi COVID-19. Sebagian besar dari bentuk penggunaan teknologi digital dalam menunjang pelayanan keperawatan/kesehatan pada masa pandemi COVID-19 berupa kunjungan virtual, konsultasi online, serta monitor kondisi pasien dari jarak jauh. Penggunaan teknologi digital dalam menunjang pelayanan keperawatan/kesehatan pada masa pandemi COVID-19 memiliki fungsi positif yang bervariasi bagi tenaga kesehatan, pasien, maupun keluarga pasien yang dapat dijadikan motivasi peningkatan pelayanan. Selain itu, juga terdapat beberapa hambatan yang dapat dijadikan evaluasi dalam penggunaan teknologi digital pelayanan agar menjadi lebih baik untuk digunakan di masa depan. Kedepannya diharapkan mampu melakukan penelitian yang berfokus pada salah satu bentuk teknologi digital pelayanan keperawatan/kesehatan yang sudah ada.

Kata kunci: pandemi COVID-19; teknologi digital; pelayanan keperawatan; rumah sakit

INTRODUCTION

Health facilities, especially hospitals, are essential in providing health services during the COVID-19 pandemic, namely providing regular health services and specific health services to COVID-19 patients. Health services during the COVID-19 pandemic played considerable roles in driving the government's health policies, such as changing hospital facilities and infrastructure, limiting the number of outpatients, limiting consultation duration, limiting the capacity of family visits, and limiting the number of hospitalized patients (Sarasnita *et al.*, 2021; Zein *et al.*, 2021). These changes put top priority on patients with severe, emergency cases, thus requiring immediate treatment (Putra *et al.*, 2021; WHO, 2020). In addition, ensuring that patients get the best health services and that health workers are protected from the possibility of contracting COVID-19 is

another consideration to why the changes become operative (Wang *et al.*, 2020; Lee *et al.*, 2020 dalam Mahayana *et al.*, 2020).

During the COVID-19 pandemic, one must pay attention to physical distancing or limiting physical contact with patients to reduce the risk of transmitting COVID-19 (Nurani *et al.*, 2021). In addition to the use of Personal Protective Equipment (PPE), hospitals deploy digital technology to deliver health services (Zein *et al.*, 2021 in Sarasnita *et al.*, 2021). The government also requires the use of digital technology for providing any health care where physical interaction is unnecessary (Pceek *et al.*, 2020), as one of the initiatives to reduce the spread of COVID-19 (Serper *et al.*, 2020)

The use of digital technology in health services is defined as the use of technology to provide and support health services

which include examination, treatment, and consultation. In this direction, remote monitoring has become an important part of medical care during the COVID-19 pandemic (Serper *et al.*, 2020; Suhadi & Ruwiah, 2021). In addition, it holds potential role for health services to protect patients and health workers (Peek *et al.*, 2020).. Many countries have adopted the use of digital technology during the COVID-19 pandemic to provide health services while nullifying physical interaction (Peek *et al.*, 2020). Serper *et al.* (2020) reported that during the COVID-19 pandemic the use of digital technology for health services such as telemedicine increased from 5% to 94%. By implication, the COVID-19 pandemic has resulted in the development of various digital technologies (Asriati *et al.*, 2020 in Sarasnita *et al.*, 2021; Nurani *et al.*, 2021).

The use of digital technology in health services during the COVID-19 pandemic aids health workers to work quickly and accurately (Alwashmi, 2020). In addition, it helps nurses in carrying out patient registration, patient monitoring, and administering drugs to patients more easily and rapidly (Sarasnita *et al.*, 2021; Alwashmi, 2020; Krick *et al.*, 2019). In the current digitalization, nurses need to utilize digital technology to improve health

services during the COVID-19 pandemic, because they are at the forefront of nursing care and deal with hospitalized patients directly (Sharma *et al.*, 2020 in Susanti *et al.*, 2021). Huter *et al.* (2020) acknowledge the positive effects of using digital technology in supporting nursing services. In the same vein, research conducted by Kalhori *et al.* (2021) demonstrate that the use of digital technology has a profound impact on controlling the COVID-19 pandemic in 10 countries with the highest prevalence of COVID-19 cases. The extant literature has reviewed digital technology in health/nursing services, but the use of digital technology in nursing services during the COVID-19 pandemic remains underexplored. To fill this void, the authors review and analyze the use of digital technology in supporting nursing services during the COVID-19 pandemic. This study aims to straddle the empirical boundaries to the development of digital technology in providing nursing services and shed light into the solutions to overcoming the possible recurrence of the pandemic.

METHOD

This review research used such online databases as Pubmed, ProQuest, Springer Link, Sage Journals, and Google Scholar. The review focused on the following

keywords: MESH (Medical Subject Heading) are (“Digital Technology”) AND (“Technology” OR “Instrumentation”) AND (“Nursing Care” OR “Nursing” OR “Nurse”) AND (“Hospital” OR “Hospital Medicine”) AND (“COVID-19” OR “SARS-CoV-2”), which resulted in 46,776 articles identified from the databases. Next, the researcher (DR) selected articles based on inclusion criteria and exclusion criteria by attending to Preferred Reporting Items for Systematic Reviews and Metal-Analyze (PRISMA) and PICOS framework consisting of Population/Problem, Intervention, Comparison, Outcome, and Study design. During the article selection, the researcher (DR) checked the journal index using SCIMAGO and assessed the quality of the article using *Joanna Briggs Institute's Critical Appraisal Tools* (JBI Critical Appraisal Tools).

The inclusion criteria included: (1) articles published in 2019-2022; (2) works categorized as journal literature/research articles; (3) articles written in English; (4) full-text articles with open access; (5) articles with qualitative and quantitative research designs; (6) articles investigating the forms, functions, and barriers to the use of digital technology in nursing services in hospitals/provided by hospitals during the COVID-19 pandemic; and (7) topics concerning the use of digital technology by nurses/health workers contributing to; (8) articles with JBI Critical Appraisal Tools assessment score of at least 50% as agreed upon by the researchers. Meanwhile, the exclusion criteria can be seen in Figure 1. Based on inclusion criteria and exclusion criteria, 11 articles were chosen for analysis (Figure 1). The analytical strategies involved summary, analysis, and synthesis (APU Writing Center, 2015).

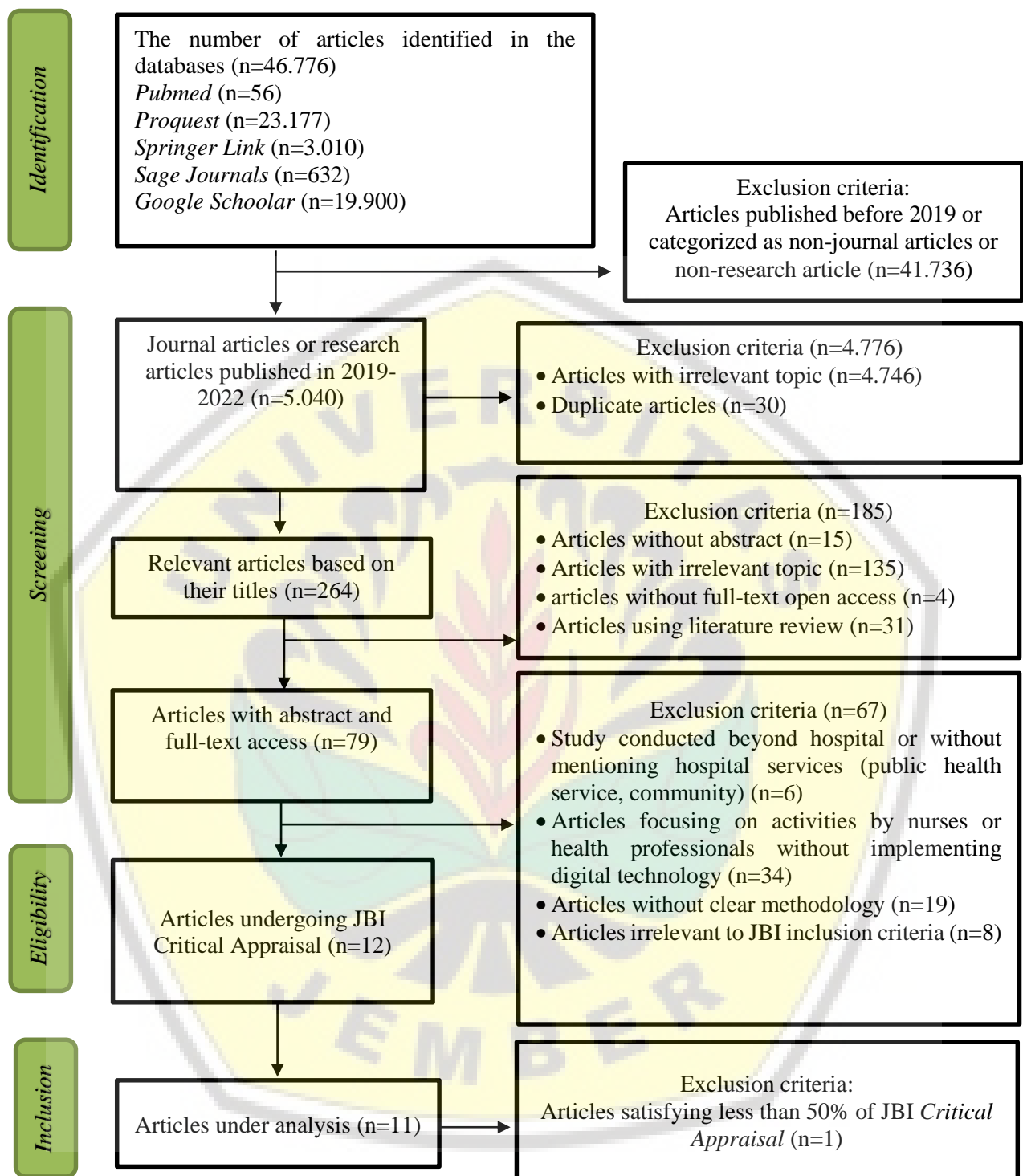


Figure 1. PRISMA Flowchart

RESULTS AND DISCUSSION

Of the 12 articles that passed the JBI Critical Appraisal, 1 article failed to meet the requirements for further analysis due to unclear research inquiries. As such, only 11 articles were put under analysis. The researchers found 11 relevant articles according to the inclusion criteria, including 5 articles discussing the form and

function of digital technology in supporting nursing/health services, 2 articles discussing the functions and barriers of digital technology in supporting nursing/health services, and 4 articles investigating the form, function, and barriers of digital technology in supporting nursing/health services during the COVID-19 pandemic.

Table 1. The Forms, Functions, and Barriers to Digital Technology in Supporting Nursing/Health Services During the COVID-19 Pandemic

Researcher	Research Site	The Use of Technology	Functions of Technology	Challenges to Technology Implementation
Gillion <i>et al.</i> , 2021	8 Acute Care Hospitals, Canada	Post-discharge after surgery Virtual Care Remote Automated Monitoring-1 (PVC-RAM-1)	Reducing the risk of hospitalization and emergency department visits	Unclear communication
Goor <i>et al.</i> , 2021	Hospitals in Utrecht, Netherlands,		Reducing the number of inpatients	Difficulty predicting the duration of oxygen therapy, making it difficult to determine which patients would benefit from remote hospital care
Frith <i>et al.</i> , 2021	Addenbrooke's Hospital, England	Active+Me	Increasing patients' ability and motivation to manage health independently by establishing good communication with patients, obtaining information about patients during the COVID-19 pandemic	Increasing the workload of patients and healthcare professionals
Rose <i>et al.</i> , 2021	Hospitals (182 ICUs) National Health Service (NHS) in England		Dealing with restrictions on family visits to patients, improving patient-centered health care, and improving the quality of ICU care during the COVID-19 pandemic	Limited time for health workers, difficulties in reaching internet connection, the lack of training for health workers in using the technology, patients and families unable to access and use technology, concerns about patient security and privacy, language barriers, and difficulties in accessing translation services, and lack of hospital management support

Researcher	Research Site	The Use of Technology	Functions of Technology	Challenges to Technology Implementation
Drewett <i>et al.</i> , 2021	Hospitals in Austin Health, Australia	COVID-Care	Reducing patient admissions in hospitals and ER	
Mohseni <i>et al.</i> , 2020	Hospitals in the United States	InTouch Provider	Limiting the exposure of health workers to patients to reduce the risk of COVID-19 transmission, reducing the use of PPE	
Ushigome <i>et al.</i> , 2021	Kyoto Prefectural Medical University Hospital, Japan	Sistem CGM Dexcom G4 Platinum	Reducing the number of hospitalized patients in the isolation room and minimizing the need for health workers to access the isolation room	
Shah <i>et al.</i> , 2021	Peter Munk Cardiac Center, Toronto General Hospital, Ontario, Canada	Medly	Reducing the number of face-to-face appointments and ensuring patient safety	Increasing workload for health workers and patients and the challenges in building relationships between health workers and patients through remote service
Zhang <i>et al.</i> , 2020	Shenzhen Mental Health Center at Shenzhen Kangning Hospital, China	Virtual Reality Exposure Therapy (VRET)	Treating the anxiety and fear of COVID-19 infection	
Bouabida <i>et al.</i> , 2022	Center Hospital University Montreal (CHUM), Canada	Techno-COVID-19 Partnership (Telecare COVID-19 and REACTS Teleconsultation)	Maintaining the quality and safety level of healthcare during the COVID-19 pandemic and reducing the use of PPE	The lack of training and/or direct patient support, increased additional workload, and fear of information leakage
Dhala <i>et al.</i> , 2020	Houston Methodist Hospital (HMH), the United States	Telekritis (Virtual Intensive Care Unit/VICU)	Reducing the use of PPE, protecting health workers in the COVID-19 unit, helping to reduce staff fatigue, reducing the length of hospital stay, and helping to connect patients with family members	

The Forms of Digital Technology to Support Nursing/Health Services during the COVID-19 Pandemic

The researchers found 9 forms of digital technology to support nursing/health services during the COVID-19 pandemic, including PVC-RAM-1, Active+Me, COVID-Care, InTouch Provider, Dexcom

CGM System. G4 Platinum, Medly, VRET, Techno-COVID-19 Partnership, VICU. Post-discharge after surgery Virtual Care Remote Automated Monitoring-1 (PVC-RAM-1) is a technology to measure a patient's biophysics, such as blood pressure, heart rate, respiratory rate, oxygen saturation, temperature, and body weight

via a tablet computer. In addition, patients can send photos of wounds for evaluation and interact with nurses virtually (Gillion et al., 2021). Active+Me is a smart application used to provide cardiac rehabilitation during the COVID-19 pandemic remotely by connecting to a telemetry-enabled scale, blood pressure monitor, pulse oximetry, and activity tracker/Patient Activation Measure (PAM). The technology application required all devices linked to a smart device with a specific application using Bluetooth. Afterward, the nurse on duty will review the patient's progress (Frith et al., 2021). COVID-Care is a digitally integrated outpatient, symptom tracking, and telemedicine service for COVID-19 patients which enables remote diagnosis and even treatment. COVID-Care pre-assesses participants reporting COVID-19 symptoms through an online survey and they will receive follow-up information about the symptom level (Drewett et al., 2021).

The InTouch Provider is a smart tablet device with a multimedia interface on a wheeled mobile workstation operated in an emergency department. InTouch Providers are equipped with cameras, interactive screens, and medical equipment to assess the patient's condition, thereby limiting the

infection risk of healthcare workers (Mohseni et al., 2020). The Dexcom G4 Platinum CGM is a technology to monitor blood glucose levels in diabetic patients with severe COVID-19 from outside the patient's isolation room. Monitoring blood sugar levels can be evaluated remotely on a regular basis through daily blood sampling and blood gas testing with the aid of internal sensors attached to patients (Ushigome et al., 2021). Medly is a self-care telemonitoring program for patients with heart disease remotely. The program uses existing devices (telephone, weight scale, blood pressure monitor, and heart rate monitor) to provide clinical support based on the patient's blood pressure, heart rate, weight, and symptoms (Shah et al., 2021).

Virtual Reality Exposure Therapy (VRET) is an effective treatment tool for anxiety disorders, using technology-driven exposure therapy to eliminate phobias related to COVID-19 infection. VRET is carried out gradually from low to high levels of stimulus, in order to decrease the patient's avoidance behavior. The mechanism can significantly reduce the symptoms associated with the phobia of COVID-19 infection (Zhang et al., 2020). The Techno-COVID-19 Partnership is a

program supporting health workers in maintaining the quality and safety of health care and reducing COVID-19 transmission. It consists of 2 digital technologies, namely Telecare COVID-19 and REACTS Teleconsultation. Telecare COVID-19 is a telemonitoring platform for outpatients after a visit or discharge from the hospital. Meanwhile, REACTS Teleconsultation is a telehealth platform where health workers and patients can conduct virtual health consultations (Bouabida et al., 2022).

The Telecritical Program (Virtual Intensive Care Unit/VICU) has 3 components, namely an operating center, patient room, and audiovisual communication (AV) infrastructure connecting the first two components. Operation Centers that provide central command capabilities are virtual MD (vMD) and virtual RN (vRN) which help to monitor patient status using AV equipment installed in the patient room. Meanwhile, AV consists of a single camera in the patient room to view the entire room and a 360-degree zoom that allows vMD and vRN to examine patients (Dhala et al., 2020). These digital technologies enable nursing/health services to monitor patients' vital signs and conduct virtual consultations. Nurses in providing health care begin with holistic health services (bio-psycho-socio-spiritual) and

subsequently provide nursing care (assessment, nursing diagnoses, nursing interventions, implementation, and evaluation of nursing) to patients (Budiono, 2016).

The Functions of Digital Technology to Support Nursing Services during the COVID-19 Pandemic

Digital technology has played major role in supporting nursing/health services during the COVID-19 pandemic. First, the technology has supported nursing/health services to reduce the use of PPE (Mohseni et al., 2020; Bouabida et al., 2022; Dhala et al., 2020). Bouabida et al. (2022) explain that digital technology helps 70% of health care professionals reduce the use of PPE. During the COVID-19 pandemic, the demand for PPE peaked significantly, leading to a shortage of PPE. As a corollary, preserving PPE supplies by utilizing digital technology is deemed an apt measure (Dhala et al., 2020). Using digital technology for nursing/health services can make efficient the use of PPE for the safety of health workers and patients during the COVID-19 pandemic (Dhala et al., 2020; Shah et al., 2021).

During the COVID-19 pandemic, digital technology for nursing/health services reduces health care risks and patient

admissions to hospitals or emergency departments (Gillion et al., 2021; Drewett et al., 2021). Any relevant measures to reduce the risk of health care and hospital admissions can prevent patient deaths. Another study documented no deaths among users of health care digital technology and two deaths among non-users (Drewett et al., 2021). In addition, using digital technology for nursing/health services during the COVID-19 pandemic helps to reduce the length of stay in hospitals and isolation rooms (Goor et al., 2021; Dhala et al., 2020; Ushigome et al. 2021). This is proven by the research by Goor et al. (2021) in which the intervention group showed a significantly shorter length of stay in the hospital ($p < 0.001$). Mohseni et al. (2020); Shah et al. (2021); Ushigome et al. (2021) also report that using digital technology limits face-to-face interaction between health workers and patients and minimizes the need for health workers to enter isolation room, therefore declining the risk of COVID-19 transmission. Although restrictions have been applied to the exposure of health workers to patients, hospitals must maintain and improve the quality of health services (Rose et al., 2021). Such a measure also helps in providing health care security during the pandemic and beyond the COVID-19

pandemic (Bouabida et al., 2022), in consideration of ensuring the sustainability of health services and the delivery of health services to patients.

In addition to being exposed to COVID-19 infection, health workers, especially nurses, also experience physical fatigue due to the increased number of patients and more working hours (Manik et al., 2020). Addressing this issue, Dhala et al. (2020) assessed the function of digital technology for nursing/health services to reduce physical fatigue in health workers. Frith et al. (2021) reported that as many as 10 patients (76.9%) affirmed that using digital technology for nursing or health services during the COVID-19 pandemic increased patients' ability and motivation to manage their health independently. This is in line with the nursing theory by Virginia Henderson, namely the Principles and Practice of Nursing (Rofii, 2021). Henderson recognizes the essential to increase patient independence, so that patient continues to recover even after hospitalization (Henderson, 1991; McKenna et al., 2014 in Rofii, 2021). In this theory, nurses shoulder the task to assist sick or healthy individuals in maintaining their health and recovery and eventually encourage their independence

once they gain the necessary strength, will, and knowledge, while accompanying and monitoring their health (Rofii, 2021). In addition, the COVID-19 pandemic not only affects physical conditions but also affects a person's mental/psychic condition, such as excessive anxiety and fear of COVID-19 infection. Zhang et al. (2020) discuss the solution to overcome these issues by using digital technology to treat anxiety and phobias. Another study also discussed the use of several digital technologies based on virtual visits for families, patients, and even existing health workers to reduce patient's psychological pressure (Rose et al., 2021).

During the COVID-19 pandemic, hospitalized patients and/or those in the ICU need emotional support from their families. This support can give encouragement and comfort to patients, while concomitantly reducing anxiety during treatment (Sukarno & Winarsih, 2021). Patients who feel comfortable during treatment are more likely to maintain their immune system and recover quickly (Nurpeni, 2013 in Sukarno & Winarsih, 2021). Due to the COVID-19 pandemic, there are restrictions and prohibitions on families from visiting patients in hospitals (Rose et al., 2021). In this case, hospitals have provided several digital technologies to help connect patients

with family members (Dhala et al., 2020). Meanwhile, health workers can use technology to communicate with patients without any direct encounter. This technology-aided communication makes it easy for health workers to obtain essential information about patients during the COVID-19 pandemic (Frith et al., 2021).

Albeit the advances in digital technology for nursing/health services during the COVID-19 pandemic, these are fundamentally bound to protect health workers and patients from the risk of COVID-19 transmission. By implication, the COVID-19 pandemic has fostered the development and implementation of digital technology for nursing/health services which might be otherwise unexplored prior to the pandemic.

The Obstacles to Digital Technology in Supporting Nursing Services during the COVID-19 Pandemic

Oemar (1992) broadly defines an obstacle as a hindrance to individuals attempting to reach their goals in everyday life. Barriers become an individual obstacle in carrying out certain activities (Suyedi et al., 2019). A number of obstacles have been identified to interfere with the use of digital technology in supporting nursing/health services. The researchers have found one article involving hospitals with at least one

ICU which analyzed various obstacles to the use of digital technology for nursing or health services during the COVID-19 pandemic. These involve the lack of training for health workers, the inability to access and use technology for patients and patient's families, poor signal connectivity, concerns about patient safety and privacy, limited time for health workers, language barriers, and difficulties in accessing translation services, and the absence of support from hospital management (Rose et al., 2021). The researcher also found another article that was analyzed discussing the same obstacles in using digital technology for nursing or health services, namely the lack of training and/or direct support for patients (Bouabida et al., 2022).

Digital technology for nursing/health services during the COVID-19 pandemic has varied to a large extent, one of which is digital technology based on virtual services designed to reduce the spread of COVID-19 infections. The use of such technology has been obstructed by unclear communication, and a lack of intensive communication between health workers and patients which can lead to declined satisfaction for both parties. This exemplifies the urgency of establishing decent communication and relationship in

the absence of direct encounters (Gillion et al., 2021; Shah et al., 2021).

Frith et al. (2021), Shah et al. (2021), and Bouabida et al. (2022) discuss one of the common obstacles to the use of digital technology for nursing/health services during the COVID-19 pandemic, namely the increased workload of health workers and patients. The increased workload for health workers is related to the high demand for health services due to high COVID-19 cases and the lack of training in the use of digital technology. This makes time management during health care delivery complicated and poses challenges to using digital technology. Concerns and fears of information leakage have also come into consideration. In addition, health professionals struggle with predicting the duration of therapy (such as oxygen therapy), making it difficult to determine which patients may benefit from remote hospital care (Goor et al., 2021). Notwithstanding, the researchers presume these obstacles as pivotal drives to improve digital technology for nursing or health services.

CONCLUSION

The use of digital technology in supporting nursing/health services during the COVID-

19 pandemic has been acknowledged to overcome the spread of the COVID-19 virus. Most hospitals have adopted digital technology to support remote health services as an essential measure to reduce virus transmission. The majority of digital technologies in supporting nursing/health services include virtual visits, online consultations, monitoring of patient conditions, evaluation of symptoms, and medical rehabilitation carried out remotely. The technologies are expected to aid health service providers in providing health care to patients both during and after the COVID-19 pandemic.

The implementations of these digital technologies have made substantial contributions to patients, health workers, and even patients' families. The advantages of using digital technology in providing nursing/health services to patients denote a major drive for the development and implementation of digital technology in the health sector. Instead of merely interfering with health service delivery during the pandemic, the obstacles to implementing digital technology can be the cornerstones to evaluating technology implementation for nursing/health services for improved services in the near future. However, health service providers need to pay heed to these obstacles and their possible consequences

for ensuring the continued delivery of quality health services.

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