FUTURE HEALTHCARE DELIVERY VIA TELE-NURSING AND TELE-REHABILITATION

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Annotation. To combat healthcare-associated infections, especially during coronavirus disease (COVID-19) period, access to face-to-face or traditional consultations has been significantly limited, and the healthcare systems have resorted to remote service delivery techniques such as tele-health. Tele-health can be defined as any intervention in which clinical information is transferred remotely between patients and healthcare professionals. Tele-health helps to provide health education, to give effective applications of various therapies and monitor of symptoms and adverse events. One of the more frequently, widely and modernly used health care services are tele-nursing and tele-rehabilitation. Telehealth care, led by nurses, was expanded with the advent of the COVID-19 pandemic, which had as its strengths care provided without the risk of transmission of SARSCoV-2, greater access to healthcare, continuous and patient-centered care and increased satisfaction among patients and nurses. Several studies related application of tele-rehabilitation already demonstrates effectiveness, safety, and feasibility for individuals with different physical impairment. However, some factors still need better understanding in tele-nursing and tele-rehabilitation implementation stages, highlighting the different strategies used and its' beneficial aspects for patients using services remotely more often and health care professionals providing the best health care delivery by telephone, text message, email, chat or video call.

Keywords: tele-health, tele-nursing, tele-rehabilitation

INTRODUCTION

To combat healthcare-associated infections, access to face-to-face or traditional consultations has been significantly limited, and the healthcare systems have resorted to remote service delivery techniques such as tele-health (Abuyadek et al., 2024). Growing evidence supports the viability and efficacy of remote healthcare (Braga et al., 2024). Tele-medicine, tele-rehabilitation, and tele-health are part of the health informative technologies trend (Azhar et al., 2024).

According to Sharma (2024), American Tele-medicine Association states that tele-health has the potential to offer 50% of medical services. Tele-nursing refers to nursing activities that support the delivery, management, and coordination of healthcare services for patients and their families from a physical distance using information and communication technologies (Kamei et al., 2024). Tele-nursing approach transcends spatial limitations and enables nurses to promptly offer services based on the patient's needs. Tele-nursing is positioned to emerge as a pioneering healthcare delivery system in the digital age and poised for substantial growth (Mun et al., 2024).

The idea of tele-rehabilitation got popularized in times of pandemics such as COVID-19 to provide medical services and avoid the spread of infections because health care systems have undergone great transformations because of evolution in digital communication (Aman et al., 2024). Due to the lockdown, patients experienced delays, discontinuances, and cancellations to their treatments, weakening their effectiveness. As a result, the pandemic created the need for new health services by enhancing remote performances and developing national guidelines for tele-health (Lauriello et al., 2024). With remote care, the range of nursing care and rehabilitation services continues to expand (Ariyanto & Rosa, 2024). It is important to successfully implement these forms of tele-health, considering the needs for care and rehabilitation, the comfort provided by personalized medicine technologies (Vladymyrov et al., 2024).

A growing number of papers and research works on tele-medicine highlight an increasing interest in this field (Lauriello et al., 2024). In view of the need to deal with high healthcare costs, on the one hand, and increased demand for provision and accessibility of services, on the other hand, it is expected that the use of tele-medicine will intensify (Grinberg & Sela, 2023). Digital health solutions are rapidly growing, both in number and capability – despite this, confidence in these solutions among stakeholders – including clinicians and patients – remains low. In such a fast-advancing field where it is challenging to determine what is best for implementing health tele-services such as tele-nursing and tele-rehabilitation, considering benefits and difficulties of using it becomes an issue (Du Toit et al., 2024).

In our own thoughts, the scientific problem of future healthcare delivery via tele-nursing and tele-rehabilitation revolves around the challenges of implementing and optimizing these remote healthcare services to effectively meet the growing demand for accessible, high-quality, and cost-effective care. Since the tele-health topic is still being implemented in a medicine field of research, there is currently a lack of new knowledge, how the health system and patients can benefit from tele-services and what obstacles it can create during the implementation process of tele-services such as tele-nursing and tele-rehabilitation. Also, no studies have been observed that would link the provision of nursing and rehabilitation services together in tele-way.

The aim of the research: to review future healthcare delivery via tele-nursing and tele-rehabilitation theoretically.

The tasks of the research:
1. To present the concept of tele-medicine.
2. To highlight the benefits to health care by using tele-nursing and tele-rehabilitation services.
3. To discuss the difficulties of implementation of tele-nursing and tele-rehabilitation in health care.

Research method: analysis of scientific literature – by using the EBSCO Publishing, MDPI, NCBI PubMed and ResearchGate scientific publication databases, scientific articles in English from 2024 were searched and analysed using main keywords of the topic such as tele-health, tele-nursing and tele-rehabilitation. Overall, 16 scientific and the newest articles describing and investigating the most important information related concept of tele-medicine, the benefits of healthcare by using tele-nursing and rehabilitation services, the difficulties of implementation of tele-nursing and tele-rehabilitation in healthcare, were found. The analysed scientific sources not only helped to understand the research problem, relevance and significance, but also to predict the larger course of the research.

CONCEPT OF TELE-MEDICINE: LITERATURE REVIEW

Tele-medicine, now defined as tele-health or e-health, is becoming a popular alternative method to provide healthcare services supported by information and communication technologies (Lauriello et al., 2024). Remote care for users of healthcare services has been applied for various purposes, from screening to rehabilitation, reducing waiting times for appointments and travel costs (Gimenez et al., 2024). Allied healthcare professionals predominantly turned to tele-practice as an alternative means of service delivery. Tele-practice is defined as the use of tele-communication technologies to deliver services, such as health promotion, assessment or intervention, to those who are in a different physical location than the service provider (Du Toit et al., 2024). Instead of having face-to-face meetings, patients and their caregivers communicate through media made available to patients and their families (Ariyanto & Rosa, 2024).

Rehabilitation services found new opportunities through digitisation, which led to the tele-rehabilitation, a specialized branch of tele-medicine for rehabilitation, consultation, and monitoring activities (Lauriello et al., 2024). The degree to which tele-rehabilitation was accepted among different rehabilitation professionals during the COVID-19 pandemic. Results showed that 52% of the therapists who participated in one study used tele-rehabilitation for most or all their patients during the first wave of COVID-19. Of the professionals who engaged in tele-rehabilitation during the pandemic, 46% planned to continue using it regularly after the pandemic (Braga et al,, 2024).

Tele-rehabilitation provides rehabilitatory facilities to people even if the client or patient is not able to reach the rehab center due to financial, geographic or disability such as virtual diagnosis, assessment, prognosis and treatment of patients or clients (Aman et al., 2024). Tele-rehabilitation can serve as the next step for patients discharged from inpatient rehabilitation, allowing them to continue physical therapy and promote further recovery (Vladymyrov et al., 2024). For example, unlike web-based or mobile app-based exercise interventions, and exergaming, tele-exercise enables synchronous two-way video and audio transmission, allowing both the instructor and the participants to see, hear and interact with each other in real-time, like exercise intervention delivered in physical settings (Lee et al., 2024). Also, must be noted, Du Toit et al. (2024) analysed 30 province mothers' experience who used tele-assessment format for their children. Results showed majority of users reported positive experience of tele-services and user-friendly platform. Most of users felt the meeting as natural as if the assessment were conducted in person and communication with clinician was good enough (Figure 1). Furthermore, tele-rehabilitation presents higher levels of satisfaction and adhesion among patients, with scores equal to traditional rehabilitation (Braga et al., 2024).
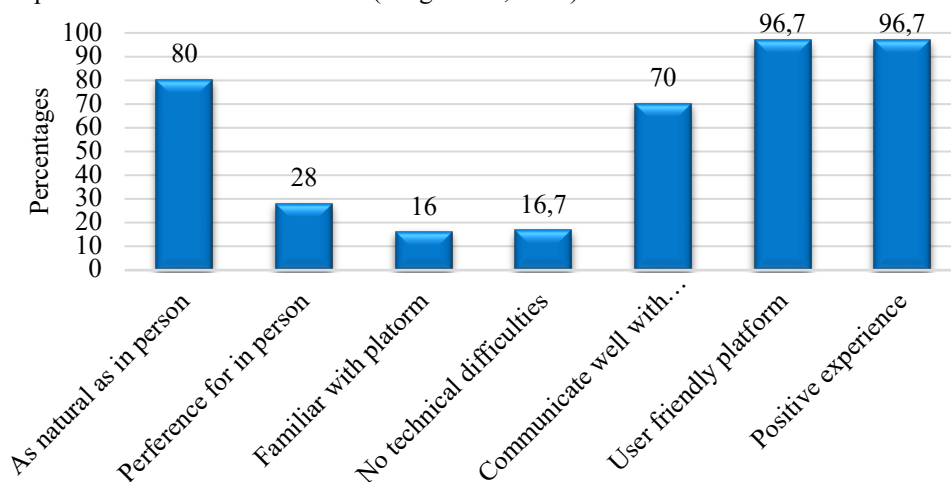

Figure 1 **Experience of tele-assessment format (**Du Toit et al., 2024)

In the context of nursing, in mid-2004, several tele-nursing services in Canada, England and Wales already had the method implemented which, like tele-medicine, is one of the methods of monitoring healthcare users with specific role of nurses. Tele-health care, led by nurses, was expanded with the advent of COVID-19 pandemic (Gimenez et al., 2024). Tele-nursing represents a facet of tele-health wherein nurses deliver healthcare services from a distance, utilizing

diverse audio or visual methods (Nejad et al., 2024). Tele-nursing encompasses a spectrum of activities, ranging from nurses counselling patients over the phone to delivering further complex nursing services at the patient's home via cameras and remote monitoring devices (Mun et al., 2024). The focus on lowering the cost of health care services, the rise in elderly and chronically ill people, and the growing desire to provide health care to remote, rural, and sparsely inhabited areas might all contribute to the tele-nursing delivery trend (Sharma, 2024). These days, tele-nursing includes health education services such as such as tele-diagnosis, tele-consultation, and tele-monitoring. It can be named more specifically like regular remote monitoring of vital signs, electrocardiogram or blood pressure, and remote doctor or nurse-patient consultations as needed (Sharma, 2024). Nejad et al. (2024) claims that continuous monitoring in tele-nursing promotes positive changes in health behaviour. Many care domains, by Ariyanto & Rosa (2024) thoughts, can benefit from the application of tele-nursing practices, such as:

- home visits;
- secure email messaging systems with hotline support;
- discharge planning;
- chronic tele-nursing in the department;
- tele-nursing for illnesses and emergencies, including outpatient care;
- call center services; triage.

Tele-communication technologies in health care are used to approach and as well as to improve the care in people in vulnerable and remote areas with different disabilities with the goal to save time and resources in system of health (Aman et al., 2024). Tele-services result in the improvement of accessibility and affordability of care services for all people who face difficulties (Kamei et al., 2024). Researches about tele-health concern the use of informative communication technologies to bridge geographic gaps between patients and providers and between providers and each other (Azhar et al., 2024). According to Vladymyrov et al. (2024), tele-services should be viewed as a process that includes two key aspects:

1. Services at the individual level, involving the diagnosis and attention to the patient's own attitudes.
2. Services at the social level, which involves creating favorable conditions for the patient's successful social adaptation and addressing society's negative attitudes towards the patient.

To conclude, Gimenez et al. (2024) highlights the important fact that tele-services should be used as a complement to healthcare, with the aim of promoting better access conditions, not replacing actions already carried out in person in healthcare services.

THE BENEFITS OF HEALTHCARE BY USING TELE-NURSING AND REHABILITTION SERVICES

The tele-health trend, with its potential to address many key challenges in healthcare, has been emerging worldwide (Abuyadek et al., 2024). Azhar et al. (2024) states that using technology to provide health services remotely has several advantages. Tele-services, a field that relies heavily on information technology, offers many benefits to patients, healthcare workers, and governments too (Ariyanto & Rosa, 2024). Healthcare workers like nurses and physiotherapists can continuously oversee, educate, follow up, and provide multidisciplinary treatments for patients such consultations, interventions, support, etc. Tele-medicine, from the point of view of governments, helps the health system face the complex challenges of aging populations, increased chronic illness, and lack of manpower (Grinberg & Sela, 2023).

The main idea of delivering tele-services is that technology is part of disease prevention measures aimed at reducing the burden on healthcare services and reducing the risk of disease transmission (Arifin et al., 2024). Rehabilitation is significant for people in order to enhance their ability to work, live an independent life and improve their daily life activities. In a constantly changing modern world transformations occur with the passage of time as new technologies are being introduced in health care industry – tele-rehabilitation is one of the most important transformations occurred in rehab system (Aman et al., 2024). Meanwhile, tele-nursing can also be equated with today's transformation, since it can bring nursing care to proximity involvement in public health and family practices (Sharma, 2024).

Tele-services help to increase patient's commitment towards improving their condition in many ways such as the care given to patients through tele-rehabilitation sessions are affordable and are more convenient (Aman et al., 2024). Azhar et al. (2024) explain that patients are empowered and given the ability to take responsibility for their medical needs and interventions when, for example – tele-rehabilitation, is used to provide care in their home or other living environment. This is because it allows for individual care, control and choice. Sharma (2024) adds that tele-health services enhance the decision-making of the patients and their families by educating them on their illnesses.

One of the most important benefits of tele-services is increasing access to customers living in remote areas (Du Toit et al., 2024). Tele-rehabilitation gives access to people from all parts of global village, underprivileged communities can get access to rehabilitation sessions easily (Aman et al., 2024). This is crucial particularly in public health crises such as epidemics and natural disasters, in remote and rural areas, especially in countries with a large population (Abuyadek et al., 2024). Despite some usability issues, using health services remotely offers much-needed benefits for individuals who live in remote areas or who want access to medical information and treatment (Azhar et al., 2024). For example, tele-rehabilitation can be used for the prescription and evaluation of aids, orthoses, and prostheses (Lauriello et al., 2024).

Lee et al. (2024) note that tele-services most important addresse patients' environmental barriers, such as transportation and accessibility.

Tele-rehabilitation is essential as it helps in reducing high demands which results in saturation of sources and generation of waiting lists so people will have more chances of access to health care services (Aman et al., 2024). While tele-nursing interventions are easier to accept and are efficient in terms of time and place (Arifin et al., 2024). Overall, virtual facilities address disparities in health services stemming from shortages of professionals, brief visit durations, and the increasing prevalence disorders (Abuyadek et al., 2024). With the use of informative communication technologies healthcare providers can contact patients who cannot access traditional medical services thereby improving continuity of care for individuals with disabilities (Azhar et al., 2024).

Lauriello et al. (2024) in their paper asked 48 patients, who were using tele-rehabilitation services, to express the main advantages of tele-rehabilitation. Most of the survey participants emphasized the time saving, more than a third of the respondents singled out the cost-efficiency and a fifth of the respondents highlighted no individual protection devices (DPI). Only a little more than 6 percent of participants saw no advantages in tele-rehabilitation (Figure 2). Meanwhile, Nejad et al. (2024) distinguish that there are essential advantages of tele-nursing from the patients' perspective also – it provides cost-effective interventions, facilitates early diagnosis of symptoms, ensures quality assurance, provides health education and identifies gaps in post-discharge care. Braga et al. (2024) say that many conducted studies show that tele-health services may result in similar or lower costs than in-person. Gimenez et al. (2024) adds that tele-nursing improves patients' outcomes such as increased user satisfaction, reduced visits to hospital services due to lack of assistance, quality of care and reduced costs associated with the long distances travelled by patients to access in-person care. Sharma (2024) summarizes that tele-health services overall enhances patient comfort to get services from home and can cause even a shorter duration of hospitalization.
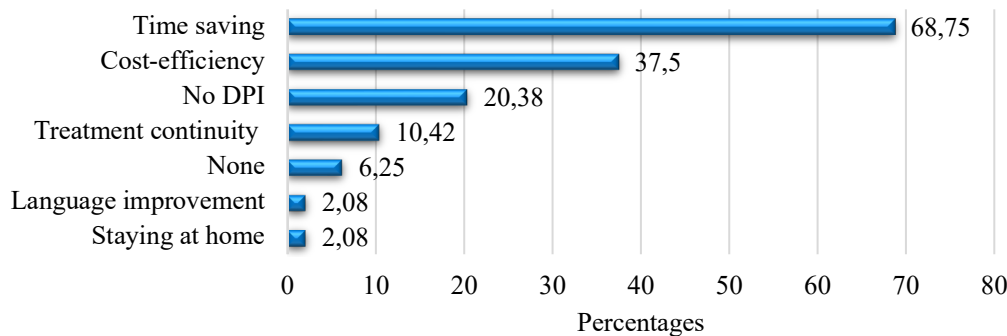

Figure 2 **Tele-rehabilitation advantages according to users' points of view** (Lauriello et al., 2024)

There are a lot of positive outcomes of the research how tele-rehabilitation is very effective for various conditions such as rheumatoid arthritis, multiple sclerosis, and stroke (Aman et al., 2024) as well as other important occupational, communication, deglutition, behavioural, cardiological, and respiratory disorders (Lauriello et al., 2024). Also, Sharma (2024) emphasizes that remote health care can also help with monitoring patients who suffer from chronic illness very well because tele-nursing:

1. aids in distance monitoring and coordinating home care.
2. teaches how to manage disease symptoms.
3. helps improve compliance with prescribed care.
4. decreases both emergency visits and outpatient department visits.

To sum up with Grinberg & Sela (2023) statements, tele-medicine services such as tele-nursing and tele-rehabilitation main benefits are about providing accessibility to treatment for patients who have so far avoided using face-to-face health services; empowering health care specialists with the use of technology and distant services by helping to develop their role; reducing the number of 'no-shows'; improving the nurse-patient ratio, and radically cutting costs.

THE DIFFICULTIES OF IMPLEMENTATION OF TELE-NURSING AND TELE-REHABILITATION IN HEALTHCARE

Technical issues are among the reasons that lacked in providing the facility of tele-rehabilitation (Aman et al., 2024). Tele-rehabilitation required technological supports (tablet, smartphone, computer), as well as a stable and high-quality Internet connection and a therapy-dedicated station (Lauriello et al., 2024). Sharma (2024) explains that implementation of tele-nursing also requires extremely plenty, modern and high-quality technologies such as the tele-health hardware (monitor, electronic board, pressure cuff, pulse oximeter, scales, video camera, laptop, computer, electrocardiogram leads, etc.) and the software that helps to create electronic health records (demographics, vital signs, weight, blood sugar results, etc.).

High cost is one of the most limitation or barrier to use tele-rehabilitation from specialists' side (Aman et al., 2024). Viewing from the other side, there is a high cost in equipment purchase and monitoring and the inability of the

patient to use the equipment for tele-health services (Sharma, 2024). In simple terms, inefficiently allocation many resources for the new tele-medicine technologies in an attempt to attract a younger, healthier, and more profitable population can have huge economic damage (Grinberg & Sela, 2023).

The main barriers to implement tele-services include data costs, trouble establishing rapport with clients, lack of access to necessary technologies and ethical issues including confidentiality, payment and clinician's competency to provide tele-practice. (Du Toit et al., 2024). Sharma (2024) adds that the legal issues, such as malpractice, negligence, and accountability, are still repeated and challenging to address. Ethical issues also include maintaining autonomy and patient integrity and being harmless to clients.

Gimenez et al. (2024) explain that to perform tele-health services all health care professionals, including nurses and physiotherapists, must have a have scientific knowledge, technical skill and creativity to give such services properly and efficiently. Kamei et al. (2024) specify the need of health care specialists to acquire new knowledge, skills, and key competencies, such as tele-communication and information risk management prior to entering tele-services to practice. Mun et al. (2024) highlight that preparation for implementation of tele-nursing or tele-rehabilitation enhancing future health care professionals' understanding of tele-services and establishing a robust human infrastructure is pivotal. Grinberg & Sela (2024) emphasize that healthcare profesionals are required to have high social and interpersonal skills, and communication skills to provide quality care similar to face-to-face sessions.

Lauriello et al. (2024) research results showed that the majority of the tele-rehabilitation users defined distraction aspect as a most common disadvantage. More than a third of the respondents admitted the logistical difficulties and almost a fifth of the respondents revealed that lack of comparison with other users is one of the key disadvantages of tele-rehabilitation. Almost one tenth of participants said that they cannot describe any disadvantages of using tele-rehabilitation services (Figure 3). However, Azhar et al. (2024) claims that to provide health services remotely may have difficulty reaching a hospital, clinic, or doctor. Lee et al. (2024) report that there are some negative perceptions of tele-services, such as mostly technical barriers and compromised supervision quality compared to direct consultations.
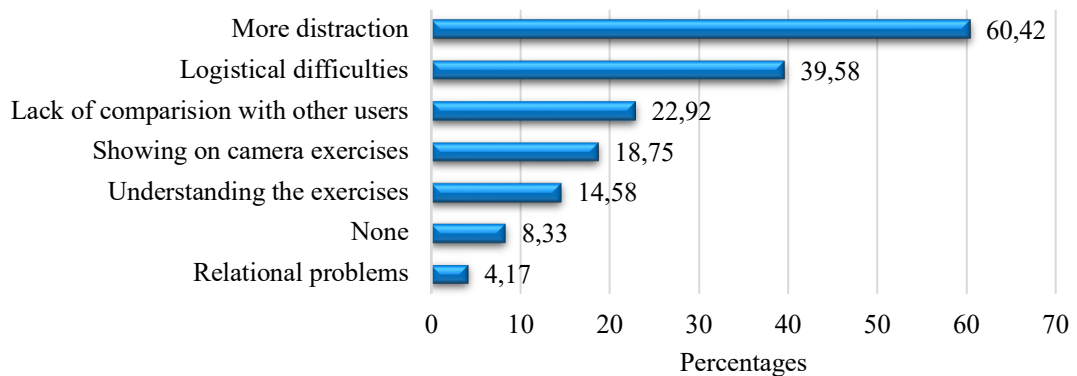

Figure 3 **Tele-rehabilitation disadvantages according to users' points of view** (Lauriello et al., 2024)

Mun et al. (2024) made research from 188 nurses about their individual, technology acceptance and perceptions factors of implementing tele-nursing. Tele-nursing experience, observation of tele-nursing during clinical practice, and exposure to tele-nursing education was found as a significant factors of attitude formation towards tele-nursing. Lack of knowledge and awareness could impede the recognition and utilization of tele-health services and potentially hinder the broader adoption of these advancements. Perceived usefulness, social influences, innovativeness, and self-efficacy were identified as key determinants in shaping nurses' attitudes toward tele-nursing. Kamei et al. (2024) add that if nurses will not have enough positive motivation, confidence, understanding, skills and attitude to implement tele-nursing in practice despite individual factors this process can get worse desperately. Grinberg & Sela (2023) discusses in their paper that using technology in practice could undermine their confidence in the question of whether nurses or physiotherapists professional qualifications and skills, which were acquired through face-to-face sessions, would suffice to cope with the unfamiliar ground in a way that allows them to provide high-quality professional care and rehabilitation, and to implement their and their colleagues' authority.
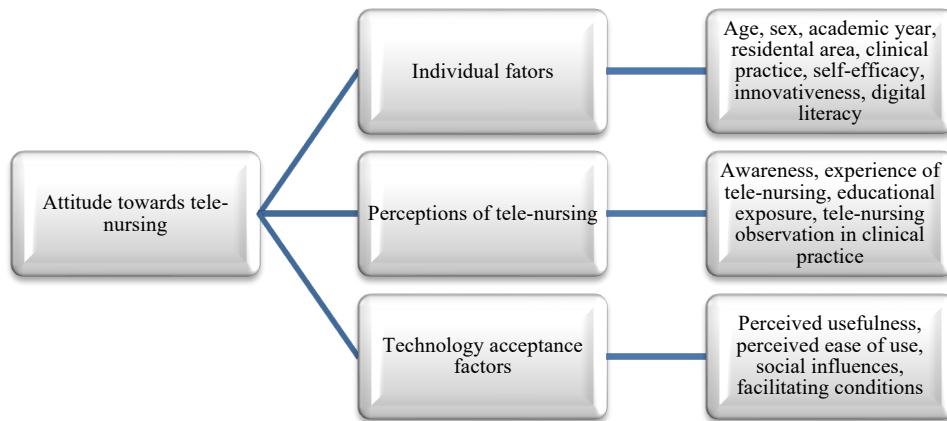
Figure 4 **Individual factors, technology acceptance factors and perceptions of nurses' attitude towards tele-nursing (**Mun et al., 2024)

Braga et al. (2024) claim that access to tele-health services and implementation of it, could be a viable means of service delivery in countries of high, mid, and low socioeconomic status, nevertheless, some barriers need to be surmounted. To summarize, Sharma (2024) explains, that real obstacles of implementation are mostly related to cost, medical competences and communication skills of professionals, patients' comfort and digital literacy.

CONCLUSIONS

1. Tele-medicine means all encounters between patients and medical staff in which the parties are not in the same location, but connected using technological means such as telephone, text message, email, chat, and video call. Tele-nursing and tele-rehabilitation are subgroups of telemedicine and are defined as providing remote nursing (such as management, guidance, and control) or rehabilitation (such as assesment, intervention and monitoring) services.

2. The main benefits of using tele-nursing and tele-rehabilitation services can be divided to physical, social, geographical, and financial.

3. The significant challenges of implementation tele-nursing and tele-rehabilitation services can be attributed to medical, technological, social and economic.

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