

A STRUCTURAL MODEL OF HEALTHCARE PERSONNEL READINESS FOR
TELEREHABILITATION IN MALAYSIAN HEALTHCARE INSTITUTIONS

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ABSTRACT

Telerehabilitation is a modern innovation used for rehabilitation services. Evidence in favor of readiness among healthcare personnel for telerehabilitation is limited. Since “readiness” is a crucial prerequisite to the successful implementation of an innovation, studying healthcare personnel readiness for telerehabilitation is mandatory to gain a better understanding of the relationships among the factors. Meanwhile, the explored factors in telerehabilitation readiness research remain on the surface without a clear direction. There are no existing studies that explore and analyze the relationship between these factors. To fill this gap, identifying factors influencing the readiness of healthcare personnel for telerehabilitation and a model that can show the interaction of those factors are needed. This research aims to identify the relationship of factors affecting the readiness of healthcare personnel for telerehabilitation. A positivist qualitative approach is adopted using the case studies of Malaysian healthcare institutions in the rehabilitation sector. In doing so, focus group interview sessions with healthcare personnel were conducted for both pilot and primary case studies. Through the employment of the content analysis technique, the data collection analysis was divided into two phases. The first phase involved a within-case analysis and cross-case analysis while the second phase involved the verification of the factors with the healthcare personnel. Additionally, the Interpretive Structural Modeling (ISM) approach was conducted to identify the most influential factors. Finally, the model of contextual relationships of healthcare personnel readiness for telerehabilitation was formed consisting of the relationship of factors. The factors were also classified as either driver or barrier categories. The driver involves the factors of awareness, comfort, satisfaction and willingness, learnability, and e-healthcare knowledge. Furthermore, the barrier factors consist of financial/cost, planning, resistance to change, connectivity, skills, hardware and software, and training. A clear understanding of these factors will help healthcare institutions to better prioritize and manage their healthcare personnel efficiently and effectively for telerehabilitation. On the other hand, the development of a structured model will help healthcare institutions to understand the relationship between the factors closely. Important factors concerning the high driving and dependence power can be identified by understanding the relationship of factors.

ABSTRAK

Telerehabilitasi adalah inovasi moden yang digunakan untuk perkhidmatan pemulihan. Bukti yang menyokong kesediaan kakitangan penjagaan kesihatan untuk pemulihan adalah terhad. Oleh kerana “kesediaan” adalah prasyarat penting terhadap kejayaan pelaksanaan sesebuah inovasi, kajian terhadap kesediaan terhadap kakitangan penjagaan kesihatan untuk telerehabilitasi adalah penting bagi mendapatkan pemahaman yang lebih baik mengenai hubungan antara faktor yang berkaitan. Sementara itu, faktor-faktor yang telah dikaji dalam kajian kesediaan terhadap telerehabilitasi hanya kekal di peringkat awalan tanpa arah tuju yang jelas. Tiada kajian semasa yang meneroka dan menganalisis hubungan antara faktor-faktor ini. Untuk merapatkan jurang ini, mengenal pasti faktor-faktor yang mempengaruhi kesediaan kakitangan penjagaan kesihatan untuk telerehabilitasi dan model yang dapat menunjukkan interaksi faktor-faktor tersebut adalah penting. Kajian ini bertujuan untuk mengenal pasti hubungan faktor-faktor yang mempengaruhi kesediaan kakitangan penjagaan kesihatan untuk telerehabilitasi. Pendekatan kualitatif positifis digunakan melalui kajian kes di institusi penjagaan kesihatan di Malaysia dalam sektor pemulihan. Untuk melaksanakannya, sesi temuduga secara berkumpulan bersama kakitangan penjagaan kesihatan telah dijalankan di kedua-dua kajian kes awalan dan utama. Melalui penggunaan teknik analisis kandungan, analisis pengumpulan data dibahagikan kepada dua fasa. Fasa pertama melibatkan analisis kes setempat dan analisis rentas kes, manakala fasa kedua melibatkan pengesahan faktor-faktor dalam kalangan kakitangan penjagaan kesihatan. Di samping itu, pendekatan Model Interpretasi Berstruktur (MIB) telah digunakan untuk mengenal pasti faktor-faktor yang paling berpengaruh. Akhirnya, model hubungan kontekstual kesediaan kakitangan penjagaan kesihatan untuk telerehabilitasi dibentuk yang terdiri daripada hubungan antara faktor. Faktor-faktor ini juga telah diklasifikasikan samada dalam kategori pemandu atau penghalang. Faktor pemandu terdiri daripada kesedaran, keselesaan, kepuasan dan kesediaan, kemampuan belajar, dan pengetahuan e-penjagaan kesihatan. Tambahan pula, faktor penghalang terdiri daripada kewangan/ kos, perancangan, ketahanan terhadap perubahan, kesambungan, kemahiran, perkakasan dan perisian, dan latihan. Pemahaman yang jelas tentang faktor-faktor ini akan dapat membantu institusi penjagaan kesihatan untuk mengutamakan dan menguruskan kakitangan penjagaan kesihatan dengan cekap dan berkesan untuk telerehabilitasi. Di samping itu, pembangunan model berstruktur pula boleh membantu institusi penjagaan kesihatan untuk lebih memahami hubungan antara faktor dengan lebih jelas. Faktor penting mengenai daya penggerak dan kebolehpercayaan yang tinggi dapat dikenal pasti dengan memahami hubungan faktor-faktor.

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LIST OF ABBREVIATIONS

VR	-	Virtual Reality
PT	-	Physical Therapy
OT	-	Occupational Therapy
HIS	-	Health Information System
ICT	-	Information and Communication Technology
EHR	-	Electronic Health Records
EMR	-	Electronic Medical Records
CAHs	-	Critical Access Hospitals
TeleSLP	-	TeleSpeech-Language-Pathology
TAM	-	Technology Acceptance Model
AHP	-	Theory of Analytic Hierarchy Process
DOI	-	Diffusion of Innovation Theory
TOE	-	Technology-Organization-Environment Framework
DEMATEL	-	Decision Making Trial and Evaluation Laboratory
ISM	-	Interpretive Structural Modeling
OSH MS	-	Occupational safety and health management systems
GRA	-	Grey Relational Analysis
MCMD	-	Multi-Criteria Decision-Making
VIKOR	-	Vlsekriterijumska Optimizacija KOMPROMISNO Resenje
MISM	-	Modified Interpretive Structural Modelling
TISM	-	Total Interpretive Structural Modeling
FMICMAC	-	Fuzzy Matrice d'Impacts Croise's Multiplication Applique'e a' un Classement
MTEs	-	Medical Tourism Enablers
SSIM	-	Structural Self-Interaction Matrix
IRM	-	Initial Reachability Matrix
FRM	-	Final Reachability Matrix
MIB	-	Model Interpretasi Berstruktur
SOCISO	-	Social Security Organisation

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CHAPTER 1

INTRODUCTION TO THE RESEARCH

1.1 Overview

This research explored the relationship of factors influencing the readiness of healthcare personnel for telerehabilitation in healthcare institutions. The relationship of the factors was examined from the perspective of healthcare personnel. The relationship takes place when other factors influence one factor. Here, variables or factors is any entity that can take on different values, while relationship refers to the correspondence between two variables (Iriondo et al., 2003). Since there is a lacking of this relationship factor in telerehabilitation context, the recognition of relationship between those factors involved will allow the study to understand more on the factors' relationship.

This chapter provides a synopsis of the study, starting with the research background in the first section. Then, it leads to the statement of the problem, research questions, and the objectives of the research, as discussed in section two, three and four, respectively. Subsequently, sections five and six address the significance of the conducted study and its scope. Finally, the chapter concludes with a description of the overall structure of the thesis.

1.2 Background of the Study

Malaysia is categorised as an upper-middle-income country by the World Bank (Mohd Tahir et al., 2014). It inherited affordable access to the healthcare needs of all citizen from British colonial rule (Mohd Tahir et al., 2014). According to Thomas et al., (2011), the Malaysian health standard almost equal to developed countries and health indicators show that the country was better than some of the ASEAN countries.

For instance, the Infant Mortality Rate (IMR) in Malaysia is 11 per 1000 live births, which lower than in Thailand (29 per 1000 live births) and Indonesia (48 per 1000 live births) (Thomas et al., 2011).

The Ministry of Health (MOH) had also adopted an e-health strategy, such as telehealth technology to improve health literacy and service assess (Safurah et al., 2013). According to Safurah et al. (2013), in 2010, the computerised information systems also started to be installed in government hospitals in the country (14 out of 138). However, the adoption of information communication technology (ICT) in the healthcare system in Malaysia is still not exhaustive and seen slowly improve (Roshidi and Megat Zuhairy, 2012; Safurah et al., 2013). A study by Thomas et al. (2011) had identified that financing and equitable healthcare are the main challenges in many countries, including Malaysia, on these matters. The equity issues still happen, especially for the rural population, hard-core poor, and indigenous groups (Thomas et al, 2011). In rehabilitation service, Cason and Richmond (2015) claim that traditional way of direct face-to-face interaction between patients and healthcare personnel (i.e., physician, therapist, nurse) is less economical for today's environment. The patients who stay in rural areas need to allocate extra money, energy, and time to get rehabilitation treatments at the healthcare institution. Besides, Kohno et al. (2016), in their study, have identified a few challenges and issues experienced by patients to get healthcare services in Malaysia. The challenges include healthcare insurance, medical check-ups, nursing and palliative care, language barriers, word of mouth information, healthcare decision, and trust and distrust of healthcare services. These issues were considered and integrated into the social-ecological model consist of layering of global, society, community, interpersonal and social, and individual (Kohno et al., 2016).

World Health Organization, WHO (2019) has reported that about 15% of the world population has some form of disabilities. In Malaysia, it is reported by the Department of Social Welfare (2019) that only 341,011 disabled people have been registered under them with the total estimation of about 4.5 million have disabilities in Malaysia. These numbers reported under Department of Social Welfare Malaysia

caters disabilities that may occur either due to chronic illnesses, old age diseases or since birth.

Disabilities that occur during employment such as injuries or accidents which happens at the workplace should and must be reported under the Social Security Organisation (SOCSO). This is to ensure that the employee is given and receives appropriate benefits under SOCSO. The statistics reported the number of disabled employees that are eligible to claim for benefits shows an increasing trend each year. Table 1.1 and Table 1.2 prove the increasing numbers of disabled people in Malaysia for year 2015 and 2017 that was reported separately by temporary disability and permanent disability. The report also displayed that the number of people with temporary disability are higher compared to those with permanent disabilities.

Table 1.1: Number of people with disabilities according to age group on 2015

Age Group	Temporary Disability	Permanent Disability	Total
Below 20	1440	417	1857
20 – 24	8176	1809	9985
25 – 29	9475	2476	11951
30 – 34	8360	2506	10866
35 – 39	7560	2501	10061
40 – 44	7045	2349	9394
45 – 49	6349	2224	8573
50 – 54	5585	1833	7418
55 – 59	3565	957	4522
60 – 64	1625	415	2040
65 and over	905	218	1123
Total	60085	17705	77790

Source: SOCSO's Annual Report (2015)

Table 1.2: Number of people with disabilities according to age group on 2017

Age Group	Temporary Disability	Permanent Disability	Total
Below 20	2785	445	3230
20 – 24	9783	2087	11870
25 – 29	10268	2883	13151
30 – 34	9178	2847	12025
35 – 39	7986	2784	10770
40 – 44	7290	2617	9907
45 – 49	6501	2324	8825
50 – 54	5541	1994	7535
55 – 59	3690	1260	4950
60 – 64	1520	499	2019
65 and over	935	226	1161
Total	65477	19966	85443

Source: SOCSO's Annual Report (2017)

As Malaysia strives to become a developed country, the healthcare system also needs to be upgraded to overcome current and future limitations. In rehabilitation case, there is a technology that enables the patients to get this service in more cost-effectively and efficiently (Cason and Richmond, 2015), called telerehabilitation. Telerehabilitation technology is defined as an emerging method to deliver rehabilitation services to serve patients better (McCue et al., 2010; Benvenuti et al., 2014). Telerehabilitation also offers the minimising of barriers such as distance, time, and cost to patients (McCue et al., 2010; Benvenuti et al., 2014).

1.3 Research Motivation

Telerehabilitation technology is widely documented, especially in developed countries such as Canada, Italy, and the United States. Kairy, Messier, et al. (2017) study had implemented this technology to Remote Education, Augmented Communication, Training, and Supervision (Reacts) platform. In Italy, Peretti et al. (2017) had conducted a review on telerehabilitation implementation to evaluate different application fields and to highlight its benefits and drawbacks. While in the United States, Parmanto et al. (2009) in their research summarised the clinical and vocational applications of telerehabilitation. Parmanto et al. (2009) study also reviewed the literature by recognizing the external telerehabilitation influencer and issues. The external influencer, such as the professional organisation's positions which impact telerehabilitation technology by becoming the user of the system to access the course of treatment and to record data.

However, telerehabilitation research is not successful explored in Malaysia. Only a few of studies found with regards on this technology. For instance, Shamsuddin et al. (2014) and Shamsuddin et al. (2015) studied the possibility of implementing telerehabilitation services with a robot for autism. Both studies used sensor-based by applying robotic assistive therapy as a solution to help children with autism to overcome barriers of cost, access, and lack of autism therapists. The study was the first of its kind in Malaysia regarding the development of telerehabilitation involving robots in aid of the autism population (Shamsuddin et al., 2015).

The growing demand for physical rehabilitation processes poses a threat to the sustainability of healthcare services (Ruiz-fernandez et al., 2014). To reduce demand, telerehabilitation can be the perfect solution to reduce waiting lists and rising treatment costs. In Malaysia, telerehabilitation can be apply to enhance the healthcare service delivery especially for patients who live far from healthcare institutions. Telerehabilitation allow to restore a good health condition of the individual through therapy or physical action. It enables patients to exercise at their own convenience while maximizing the effectiveness of their treatment plan. Thus, telerehabilitation can be the perfect approach to integrate into Malaysian healthcare system to increase patient's capabilities.

1.4 Problem Statement

Most studies in telerehabilitation adoption were focussed on methods in delivering its services (Altilio et al., 2015; Cason and Otr, 2014), benefits (i.e., overcome barriers, cost-effectiveness) (Cason and Otr, 2014; Shamsuddin et al., 2015), and its applications (i.e., teletherapy, teleconsultation, telemonitoring) (Parmanto et al., 2009; Tse et al., 2015; Yan et al., 2013). However, the successful of telerehabilitation technology requires healthcare personnel, particularly physicians, therapists, and nurses to be mentally and physically prepared for the changes brought about through the implementation and changes of this innovation. This includes the behaviour to act, resist or support the innovation, illustrated as the readiness or preparedness towards the innovation's failure of success (Ojo et al., 2007). The readiness research can lead to better acceptance and reduce money, time, and effort losses (Rezai-Rad et al., 2012). Hence, telerehabilitation readiness research is vital for efficient its implementation and a step to prevent failure. Because of this, research on the readiness aspect is essential as the base and initial requirement for the success of telerehabilitation adoption (Jennett et al., 2005; Pramuka and Van Roosmalen, 2009).

Healthcare personnel are the main individuals that deliver telerehabilitation services to patients. The readiness and preparedness among them are essential. As it can trigger innovation's acceptance among patients (Duftschmid et al., 2019). Besides,

without proper preparation, the healthcare personnel will tend to resist to support the innovation of telerehabilitation. This situation can lead to innovation's failure (Ojo et al., 2007). Nevertheless, there is less research that recognised the importance of healthcare personnel's readiness in telerehabilitation research (Bahari et al., 2019; Légaré et al., 2010).

On the other hand, the barriers/ challenges of telerehabilitation readiness had studied by few researchers. Barrier factors such as resistance to change (Cottrell et al., 2017), lack of knowledge (Cottrell et al., 2017; Glegg and Levac, 2018), financial limitation (Cottrell et al., 2017), lack of awareness (Kairy, Poissant, et al., 2017), less use of hardware and software (Cottrell et al., 2017), lack of skill (Glegg and Levac, 2018), connectivity issues (Tyagi et al., 2018), less involvement in planning (Glegg and Levac, 2018), and low availability for training (Elnitsky et al., 2012; Glegg and Levac, 2018) had been reported in the literature. However, the identification of these factors remains on the surface without clear direction. There are no existing studies that explore and analyse the relationship between these factors. Thus, the contribution of factors identification cannot be seen. The proper approach needs to be considered to explore and analyse the relationship between factors.

The identification of this challenge shows the gap in telerehabilitation research. Therefore, this study overcomes this gap by providing an understanding through the identification of factors (i.e., driver and barrier) influencing the readiness of healthcare personnel for telerehabilitation and the model that can be used to show the interaction of those factors. These challenges also affect the growth of telerehabilitation in Malaysian healthcare institutions in general. Since there is no development of telerehabilitation study with exceptional the research conducted by (Shamsuddin et al. (2014) and (2015) in Malaysia. This study intended to contribute to this domain.

1.5 Research Questions

The main research question of this study is *“How to determine the relationship of factors influencing the readiness of healthcare personnel for telerehabilitation?”* The importance of identifying healthcare personnel’s readiness cannot be underestimated due to many factors contributing to it. There are two sub-questions have been determined to answer the main research question, as follows:

- 1) What factors (i.e., driver and barrier) that influence the readiness of healthcare personnel for telerehabilitation in healthcare institutions?
- 2) What model can be used to show the relationship of the factors?

1.6 Research Objectives

In nature, this research is both exploratory and descriptive. The main aim of this study is to identify the relationship of factors affecting the readiness of healthcare personnel for telerehabilitation in the healthcare institution in Malaysia. There are two supporting objectives to achieve this primary objective, as follows:

- 1) To recognise the factors influencing readiness from the perspective of healthcare personnel for telerehabilitation.
- 2) To develop a model that can show the relationship of factors that influence the healthcare personnel’s readiness for telerehabilitation through the use of suitable modelling approach.

1.7 Research Significance

This research contributes to the growth of readiness research for telerehabilitation. The growth of readiness research for telerehabilitation will benefit all involved stakeholders include the management of healthcare institution, healthcare

personnel, and academician/ researchers. The significance of this research consists of the aspect of theoretical. This research had contributed to the practice in determining the relationships between identified driver and barrier factors. The identification of relationships between factors allows a more profound understanding of framework or model development to solve the current issues (Mathiyazhagan et al., 2013; Pramod and Banwet, 2014).

The identification of contextual relationships between factors lead to the development of a structural model of healthcare personnel readiness for telerehabilitation. The identification of crucial factor from both driver and barrier factors resulted from this model allow the management of healthcare institutions to prioritise in overcoming limitations and improving enabler. Thus, it is useful for stakeholders to employ this model for formulating strategies which to overcome challenges and barrier for telerehabilitation. This research will become a significant impact to less exploration of the relationships between factors among healthcare personnel readiness in telerehabilitation research.

1.8 Research Scopes

The scopes of this study limited to;

- 1) This research focuses on data collection at healthcare institutions in Malaysia, which have a rehabilitation unit. The rehabilitation unit contains rehabilitation program involves Occupational Therapy, Physiotherapy, Speech Therapy, Hydro Therapy, and Orthotics and Prosthetic.
- 2) This research only focuses on general types of rehabilitation and not focus on any specific types of rehabilitation. The researcher still considers conducting the case study as long as the rehabilitation unit use rehabilitation technology. The example of the rehabilitation technology includes robotic (Locomat) and cognitive game (Capstan Lock).
- 3) This research focuses on the healthcare personnel perspective that experienced in handling patients and delivers rehabilitation services. This

research conducted at the individual phase in an internal organisational level at the healthcare institution. Therefore, the patients are not included in this research scope. The healthcare personnel recognized as the primary conduit of the healthcare provider to the patients. Thus, this research more focus on dominant stakeholder in rehabilitation services.

1.9 Thesis Organization

This section provides an overview of the overall thesis structure. Each chapter contains the chapter objective, chapter outcome, and involved phases. Chapter 1 provide a complete view of the relationship of thesis organisation include main stages and results. The introduction of whole research is generated from this chapter.

In chapter 2, the main concepts of the research from the relevant literature reviews is defined. The gaps are identified from a preliminary review to find the research significant. The overview of healthcare services, studies on telerehabilitation factors influencing the readiness of healthcare personnel for telerehabilitation, and the suitable approach to explore telerehabilitation also discussed in chapter 2. The conceptual model was developed and proposed in this chapter.

Chapter 3 describe in details the research design containing the research approach, data collection strategies, and analysis strategies used in this research. The chapter specified the research methodology and defined approach and method chosen for this study. The qualitative case study is deliberated as the selected research strategy. The detailed description of research processes, research validity and reliability also discussed in this chapter.

Chapter 4 describe the process and findings in a pilot study in details. The interview sessions were conducted among healthcare personnel at healthcare institutions. NVivo software was used to analyse the collected data. The finding of the research was presented at the end of this chapter involve the identification factors an

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