

Preliminary analysis of perception, knowledge and attitude of home health patients using tele rehabilitation in Riyadh, Saudi Arabia

Mazen Alqahtani

College of Applied Medical Sciences, Majmaa University, Majmaa, Kingdom of Saudi Arabia

ABSTRACT

Telerehabilitation is defined as delivery of rehabilitation services over telecommunication networks and the internet, which comprise of clinical assessment (the patients functional abilities in his or her environment) and clinical therapy. This new area of medical advancement, using state of the art technology is developing at a great speed and is definitely going to be the next milestone in health care revolution. The objective of this study was to explore the awareness, knowledge and perception of the patients for using telerehabilitation as a medium to provide physiotherapy services as a part of home healthcare services. A pretest-post test design was used where the home healthcare patients (n = 90) aged between 50 -75 years were asked to express views by given a validated modified TUQ questionnaire followed by an in depth interviewing to develop a key understanding regarding the themes. Interviews were transcribed and a qualitative thematic analysis was conducted. The awareness level regarding the telerehabilitation changed significantly from 57% to 96% post session (p<0.05). Similarly, the knowledge of the participants regarding online consultation, followup and online therapy changed significantly from 50%, 47% and 57% to 96%, 76% and 96% respectively post session of rehabilitation (p<0.05). The perception level regarding the key benefits including its usage in emergency (83%), convenience of no travel (84%), ease of getting treated at home (97%) and availability of specialist consultation (84%) were the prime ideas for excellent rating among 95% participants (p<0.05) post session. Findings are helpful to health practitioners in designing their intervention programs across the kingdom. However the actual impact could be only derived from future studies which has to be conducted based on different clinical conditions.

KEY WORDS: HOME HEALTHCARE, TELEREHABILITATION, PHYSIOTHERAPY

Article Information: *Corresponding Author: mazenalyahya@gmail.com

Received 15/03/2019 Accepted after revision 25/06/2019

Published: 30th June 2019 Pp- 309-316

This is an open access article under Creative Commons License,

Published by Society for Science & Nature, Bhopal India.

Available at: <https://bbrc.in/>

Article DOI: <http://dx.doi.org/10.21786/bbrc/12.2/13>

INTRODUCTION

Telerehabilitation is defined as the provision and delivery of rehabilitation health services at a distance using information and communication technologies and tools (Tan 2005; Russell 2007). Throughout the world, the health care practices is going through major transformation as it is driven through sea change because of the increased use of technology. The kingdom of Saudi Arabia too is witnessing a massive change with significant restructuring of healthcare systems with some major high-end technology driven development solutions. The increased demand is created on account of rapidly increasing Saudi population including the growing elderly community, changing disease patterns, global climatic changes and financial inequity (Mahmood 2018). According to a United Nations report the elderly population of Saudi Arabia those aged 60 and above is projected to increase from 3% in 2010 to 9.5% and 18.4% in 2035 and 2050, respectively (UN Report, 2018).

Similarly, comparing this phenomenon to an average life expectancy of the population in Saudi Arabia, the latest WHO data published in 2018, suggests that Saudi male and female have an average of 73.5 and female 76.5 life years with an average life expectancy of 74.8 years as against an average world life expectancy of 84 years. The increased demand in kingdom also raised because of immense economic pressure with steep fall in global oil prices in 2015–16 affecting the GDP significantly thereby been one of the key stimulus for the government to take timely corrective actions and diversify the economy from heavily oil dependent to develop other verticals for revenue generation (MoH Report, 2018).

Brianchild of Crown Prince HH Mohammad Bin Salman, Vision 2030 was adopted in April 2016 and has identified its priorities across all economic sectors and serves as a roadmap for the economic development of the KSA with development of health services been one of the most important key themes. Therefore, as a part of realization of this vision the government strongly supports the partnership of private and public sectors and been seen as a strong indication of the Government's commitment for making healthcare accessible to its citizens irrespective of the disparities available in the Saudi society (Vision 2030 Report, 2016). Access to healthcare generally relates to people's ability to use health services when and where they are needed. Determinants of healthcare access are the types and quality of services, including the costs, time, distance (ease of travel) as well as regular interface between service users and healthcare providers. Saudi Arabia is the largest and fastest growing health care market in the region and is estimated to reach \$40 billion by 2020 (NTP 2020 Report, 2016).

Moreover, the steep increase in the number of hospitals across all major cities of KSA are run by both government and private organizations which use corporate business strategies and technology driven specializations, which aim to create demand as well as attract high number patients as the facilities in majority of these hospitals are world class.

Among the various strategies listed in the NTP Report 2020, one of the key components of making healthcare accessible across the kingdom is the enhanced use of telemedicine (NTP 2020 Report, 2016). In the last one decade the health services across the kingdom have taken gigantic leap jumps with private healthcare taking lead and using innovations in delivering healthcare. One of such innovations is using Home Healthcare for delivering physiotherapy and other rehabilitation based services for the patients at home (Pulse Report 2018).

Rehabilitation is a very important component in medical care and helps in propelling patient to preinjury level. It is a well known fact that in all long term cases which requires follow-ups such as in surgical cases and other debilitating disorders including Stroke, Cancer, Multiple Sclerosis, rehabilitation is time consuming and financially constraining. To add to this, patients travelling long distances for treatment, it is not only physically challenging but emotionally draining too and especially in case of geriatric patients. Therefore home tele rehabilitation programs, are winding up progressively as an elective method of service delivery. In the western countries, quite a number of research studies has been proved that the Telerehabilitation for the delivery of health services is quite effective, however the scope of using such services in the kingdom is still novice and requires a detailed study, (Hailey et al., 2010, Johansson and Wild 2011, Chang et al 2019).

There are scant studies to prove its efficacy in the developing countries as its successful will depends on a number of factors (Clemens et al 2018). However, among all the variables, the two most important are the technological component and second been its implementation in real terms (Jackson and McClean 2012, Clemens et al 2018). Accordingly, these both are of extreme critical importance from the patient satisfaction point of view. The perceptions of the stakeholders, i.e. the patient and the members of the Rehabilitation team are of utmost importance for its use and wide spread application. The home healthcare services in Saudi Arabia is still in infancy stages with few delivery partners across the kingdom. The usage of telerehabilitation is even more nascent, as the perception of patients in using such a technology for delivering healthcare would be quite critical and important to understand the phenomenon which would be quite useful in framing the guidelines for its applications at a mass level, (Alaboudi et al 2016).

Therefore, this study is an attempt to study the awareness, knowledge and perceptions of the home healthcare patients in using physiotherapy services delivered via cloud based telerehabilitation. This study, to our knowledge is the first of its kind in the kingdom especially from the perspective of home healthcare patients. It aims to explore the key ideas which might work in favour or against the successful implementation of telerehabilitation used for the home healthcare delivery.

MATERIALS AND METHODS

The pretest-post test study design was conducted on home healthcare patients so as to obtain an in-depth understanding of the patients' perception about telerehabilitation services which they will receive as a part of home health services. While a few studies conducted earlier emphasized about telemedicine to be a key part in delivery of health services, however none of the studies emphasized on perception of patients to implement telerehabilitation as part of home healthcare (Clemens et al 2018, Khalil et al 2018).

Due necessary approval were taken from the ethical clearance committee of the respective organization, which is a reputed home healthcare organization based in Riyadh. In order to recruit participants for the study, sample population were selected from a pool of home healthcare patients who were undergoing treatment under one of the most prominent home healthcare organizations in the kingdom, which incidentally was the only first licensed stand-alone home healthcare services company in Riyadh province.

The study was conducted from Jan 15 to May 30, 2019. In this context, non-probability sampling method was used. Out of 113 home healthcare patients who underwent treatment for different ailments, 90 were randomly selected who also gave their consent to participate in the study out of which 57 were males and 33 were females. Those patients who suffered from orthopedic problems such as Knee pain, low back ache, disc prolapse etc. or underwent orthopedic surgeries such as knee replacement or meniscectomy etc. participated in the study. The study mainly included common geriatric patients for the study who were willing to participate but excluded the pediatric and the critical care, neurological and cardiac patients as they underwent major surgeries such as for stroke or CABG and also were unable to respond directly to answer the questions. The patients who were able to respond in English or Arabic were recruited for the study.

Based on literature review and discussion with key stakeholders, a questionnaire and an interview guide was prepared, modified from Telehealth Usability Questionnaire (TUQ) based on key themes of perceived use-

fulness, ease of use and learnability, Interaction quality, Reliability and Satisfaction and future use (Langbecker et al 2017). The questionnaire was converted to Arabic version adapted from the original English version and pilot tested for the home healthcare patients using both forward and backward translation methods and achieved very acceptable score of confirmatory factor analysis of 0.78 using SPSS. It was also pilot tested for the members of the rehabilitation team. The questionnaires as given in Appendix 1 were responded by the patients and the members of the rehabilitation team followed by a semi-structured individual interview from the patient as well as from the team members involved in providing home health services. The interviews were audio recorded and transcribed verbatim using Text Analysis Markup System (TAMS) Analyzer as suggested by Yin (Yin 2013).

The Tele-rehabilitation Technological solutions were a part of home health services which were delivered by the company. As a part of cloud based HIPAA compliant network, the telemedicine unit consists of a portal to track health metrics and rehabilitation treatment plan and progress by the PT specialists as well as the Case Managers. The system included case briefing, consultation by specialists as well as providing physiotherapy sessions both by Home health therapists or via health workers such as PTAs within the vicinity of home environment at patient's ease as schematically represented in Fig. no. 1.

The participants were given a pre and post session modified TUQ and asked to reflect on their entire reha-

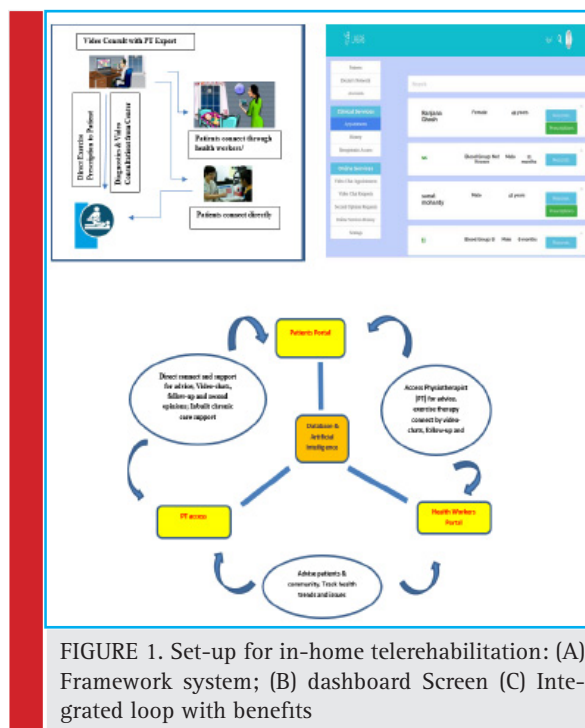


FIGURE 1. Set-up for in-home telerehabilitation: (A) Framework system; (B) dashboard Screen (C) Integrated loop with benefits

bilitation experience using the Telerehabilitation platform so as to get relevant information about telemedicine services including key events such as finding out they would receive services at home by videoconference, having the internet and videoconferencing equipment installed at home and receiving services by videoconference including dealing with technical issues. Following the same detailed interview was taken using the TAMS so as to identify key ideas which can affect usage of telerehabilitation.. Statistical tests was conducted using SPSS for Pre-post differences evaluation. using paired *t*-tests to assess factors associated with awareness, knowledge and perception. Significance was set a *priori* at $p < 0.05$.

RESULTS

The characteristics of the patients who participated in the study that could impact on the patient’s experience of telemedicine (e.g., gender, age, educational qualification, Marital status and their medical condition) were presented in Table 1.

Table 1. showing demographic characteristics of home healthcare patients	
Patient Characteristics	N =90
Gender	Male = 57 Female =33
Age	65.8 ± 9.4 (M) 58.7 ± 7.8 (F)
Educational Qualification	Illiterate = 3 Upto Primary Education = 9 Upto Secondary education = 36 Upto Higher secondary = 21 Graduate & above = 21
Marital Status	Married = 81 Unmarried = 3 Widowed = 6
Medical Condition	Orthopedics = 36 Neurology = 24 Sports = 15 Others = 15

The modified TUQ was given to the participants to measure their awareness, knowledge and perception for using Telemedicine services for Home healthcare physiotherapy services They were asked a set of questions to evaluate their understanding about the novel concept, followed by which according to their comfort were given 1 session of telemedicine to get them acquainted to the concept post which again were evaluated for their understanding and perception about the technology and its usage.

On evaluating their awareness level about the concept pretraining 70% (n = 63) of the participants con-

firmed about having heard about the concept. However out of which only 57% (n = 51) could actually knew about the concept correctly. However post session, this number was 100% percent, however 7 % still made mistake and could not answer it correctly. Similarly, been asked about the whereabouts of using telerehabilitation in Riyadh, only 57% knew or have heard about it however only 4% confirmed it of having it used earlier. The awareness level about the telerehabilitation and its nature changed significantly post session as the number swelled to 93% (n = 84) having stated the definition correctly and again 96% have known it been used by an organization called Labas, delivering home healthcare using such a technology (Table No. 2)

The second part of the questionnaire measured the knowledge. While 50% and 47% had an idea of using telerehabilitation for online consultation and online therapy respectively, 57 % had an idea of using it for post-surgery follow-ups. This perception changed significantly after training the participants with 96% been confident of using it for online physiotherapy consultation. The session also saw significant change in knowledge of participants of using the same for using it for online physiotherapy sessions as well with 76% been confident about its usage (Fig. 2). Similarly, the usage of tele-rehabilitation for followup consultations saw a significant change in patients knowledge with number reaching to a whopping 96% from 57% seen earlier ($p^{***} = .0001$) The participants were interviewed further to also seek about their knowledge and understanding about key benefits of using such a technology for imparting services. It was found that the perception of the majority of participants changed from (50%) pre session to 97% post session who felt, the ease of

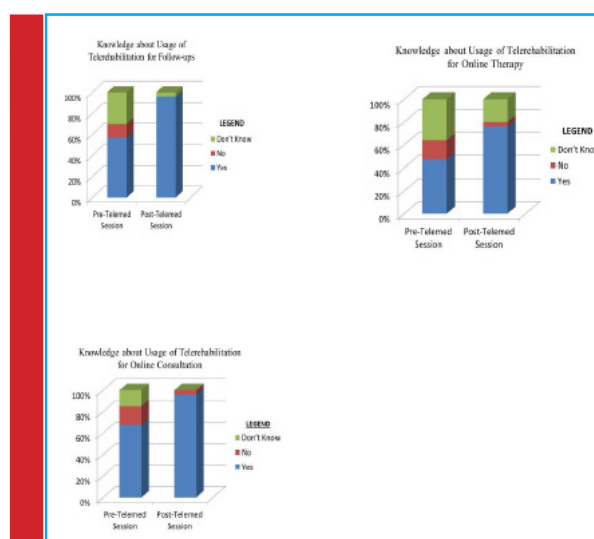


FIGURE 2. Depicting the knowledge about usage of Telerehabilitation

Table 2. Showing the assessment criteria for measuring awareness, knowledge, perception and satisfaction level of home healthcare patients with relation to the usage of pre and post telerehabilitation session			
Patients (n =90)			Significance
Assessment Criteria	Pre-Telemed session	Post Telemed session	
Awareness of Telerehabilitation	Yes = 63(70%) No = 27 (30%)	Yes = 90 (100%) No = 0	p = 0.007***
Awareness about definition of Telerehabilitation	Right = 51 (57%) Wrong = 20 (23%) Don't Know = 19 (20%)	Right = 84 (93%) Wrong = 6 (7%) Don't know = 0	
Awareness about usage of telerehabilitation in Riyadh	Yes = 51 (57%) No = 30 (33%) Don't Know = 9 (10%)	Yes = 86 (96%) No = 0 Don't Know = 4 (4%)	
Knowledge about telerehabilitation usage for online consultation	Yes = 45 (50%) No = 12 (13%) Don't Know = 33 (37%)	Yes = 86 (96%) No = 4 (4%) Don't Know = 0	P = 0.0001***
Knowledge about telerehabilitation usage for follow-ups	Yes = 42 (47%) No = 16 (17%) Don't Know = 32 (36%)	Yes = 68 (76%) No = 4 (4%) Don't Know = 18 (20%)	
Knowledge about telerehabilitation usage for online therapy	Yes = 51 (57%) No = 12 (13%) Don't Know = 27 (30%)	Yes = 86 (96%) No = 0 Don't Know = 4 (4%)	
Perception about telerehabilitation usability in imparting home health services	Yes = 45 (50%) No = 15(17%) Don't Know = 30 (33%)	Yes = 86 (96%) No = 4 (4%) Don't Know = 0	P = 0.006***
Perception about key benefits of using telerehabilitation	Need not to Travel = 39 (43%) Ease of Home = 45 (50%) Availability of Specialist advice anytime = (41%)	Need not to Travel = 76 (84%) Ease of Home = 87 (97%) Availability of Specialist advice anytime = 75 (84%)	
Perception about telerehabilitation usage in emergency	Yes = 48 (53%) No = 9 (10%) Don't know = 33 (37%)	Yes = 75 (83%) No = 3 (3%) Don't know = 12 (13%)	
Satisfaction regarding usage	NA	Yes = 81 (90%) No = 9 (10%)	P = 0.0004***
Rating about tele-rehabilitation as a modality for home health services	Excellent = 58 (64%) Good = 12 (13%) Poor = 20 (23%)	Excellent = 85 (95%) Good = 3 (3%) Poor = 2 (2%)	

getting treatment at home at your convenience is the best among all the benefits, with the comfort of not been having to travel for treatment been responded by (84%) which was earlier found to be 50% (n = 45). The additional benefit of seeking any specialist advice anytime (84%) also added to the advantages of using telerehabilitation services for delivering physiotherapy treatment.

On evaluating the satisfaction level the participants were asked whether they would use the telerehabilitation services in general and in emergency condition. It was found that the participant number changed significantly from 64% (pre-session) to 94% (post session) in case of general usage and 53% (pre-session) to 83% (post session) in case of emergency respectively. Seeking Satisfaction level, it was found that a significant 90% were satisfied with the overall experience. Similarly, 90% rated it as good to excellent as a service post session. The hallmark finding about this aspect was that the 77%

among 90% labelled the services as excellent post session as compared to 33% who termed it as excellent (pre-session) (Table 2).

DISCUSSION

Telemedicine innovations is one of the major developments of the present century. It has immense potential to change the phase of the healthcare industry and will prove to be a game changer in the coming times. Saudi Arabia is going through major reforms, as apart of Vision 2030, under National Transformation Program, Healthcare is one of the key areas of non-oil sources of revenue generation. Under the health reforms, the MoH has suggested 70 reform areas under which telemedicine is one of the focus areas (NTP 2020 Report, 2016). In the current study, we have focused on understanding the

market and its potential through evaluating the awareness, knowledge and perception of the Saudi citizens regarding the usage of telemedicine. Telemedicine is a wide area and we have restricted our focus on the use of telerehabilitation, which is one of the branches of telemedicine to substantiate our claim.

From the study, majority of the participants agreed that the telerehabilitation treatment as apart of home healthcare treatment serves as a good adjunct and have some great benefits. Upon analysis, based on the the patients awareness level, knowledge base and perceptions regarding the use of this this new technology could be clearly categorized in four main themes. The in detailed interview of the patients and using the verbatim quotes illustrate the results through which we have categorized the themes.

It was clearly evident from the results that once the participants underwent the training regarding the telerehabilitation usage almost all the participants had developed an understanding regarding its usage and benefits as well as its accessibility in Riyadh area. While discussing the benefits quotient, it was evident that improved access to the service in terms of not been having to travel long distances or far away places for treatment is the foremost benefit. On evaluating this phenomena with respect to the age group of the patients it was found that since majority of the patients (83%) were of geriatric category, proved to be statistically significant ($p < 0.05$) and definitely this advantage would be of immense value and will be one of the key USP of using this technology in the long run. This correlates to the finding of Tousignant et al., who conducted a study in Canada for the usage of telemedicine on post surgery rehabilitation among elderly patients and found that all participants gave a thumbs up to use this technology (Tousignant 2009). The total number though were only 5, where as in our study the number is 30. On interviewing deeper on further benefits regarding the elimination of transportation time for the patient, it was suggested that it is not only the transportation which matters but the family had to make lot of arrangements to facilitate the transportation. Majority of the participants (80%) echoed the sentiment and said that they liked the idea of (telerehabilitation) and found it great to use. Since every time earlier I wanted to go, they felt bad since one of their family members, be it son or daughter had to make lot of preparations in terms of taking leave from his office, meeting and visiting the doctor, following up with the progress to name a few. All this could be prevented now I feel." Since majority of them were elderly, been too much dependent was one of the most critical factors that they were concerned about. Another significant observation that evolved from the discussion was that it was not just the travel that caused problem, the pain and the hassle of getting prepared especially after knee arthroplasty

or disc surgery was of immense cause of discomfort for the patients. This phenomenon was observed not just the older population but also of concern for the middle aged as well.

In the present study, contrary to the previous quantitative study conducted the key factors which could affect the outcomes related to the satisfaction of patients concerning tele-rehabilitation (Russell 2007) were identified not only in terms of using a standard questionnaire but also taking indepth interviews which a covered a larger spectrum of the patient's experience. Majority of the respondents regarded the telerehabilitation videoconferencing technology would not be a deterrent to receiving quality rehabilitation services. However, two participants did express their reservations and gave preference for combining telerehabilitation with more traditional in-person services. These findings differed from that a study conducted by Hailey *et al.* (Hailey et al 2010), where the patients reported their perception regarding telerehabilitation based on a conversation where the participants were given an introduction regarding in-home telerehabilitation using various examples of telerehabilitation services, without actually giving them demonstration or getting them feel the experience.

In yet another studies reported (Johansson and Wild 2011, Jackson and McClean 2012) patients who were randomly allocated and made to use aweb-based exercise program so as to get the feel of telerehabilitation, the experience was expressed as positive as far as the ease-of-use and usefulness was concerned in comparison to those who were explained verbally and not experience it. Therefore the results found in the study might be one of the critical factors to explain the positive responses regarding patient's perception with respect to telerehabilitation. In some of the studies conducted in western countries the perception was expressed after going through actual hands on training. It was reported by Johansson and Wild (Johansson and Wild 2011) that tele-rehabilitation used for treating stroke patients received positive feedback and felt that adequate guidance and appropriate exercises could be conducted via this medium from a distance without actually compromising on the quality.

Even though this type of arrangement was outside the scope of the present study, however future researches could be conducted using the platform for providing rehabilitation for various clinical conditions and could be evaluated in comparison to the face to face therapy sessions. While interviewing another key component expressed was regarding the relationship of trust, comfort and ease regarding the patient and therapist. It was expressed by few participants that as far as the therapist who provided the treatment sessions in hospital or at home would take telerehabilitation sessions there would be absolutely no issues and would increase the satisfac-

tion of the patient. However, whether this criteria would effect the outcome is another debate. A study by Alaboudi et al. had discussed about some of the these types of barriers, which has to be tackled effectively so as to make telerehabilitation quite a success as far as home healthcare is concerned (Alaboudi et al 2016).

Some of participants felt that telerehabilitation should be used in adjunct with face to face therapy with on & off treatment sessions across a time period and would serve better in causing more satisfaction among the patients regarding the outcome. They expressed that differences between perceptions could actually depending on the medical condition and combination of in-person and distance services through telerehabilitation would be a better choice as compared to telerehabilitation alone. The study undertaken is a step forward to improve accessibility and availability of health services and henceforth in consistence with the emerging trends for the future medical care that is looking for immense growth as also reported by Khalil et al (Khalil et al 2018).

Therefore, in general, patients consistently reported more positive views of telerehabilitation which can have immense impact on the rehabilitation services in the manner they are executed and perceived at present. The present study therefore has helped in understanding some of the key aspects of theses perceptions and could serve as an effective platform to develop better understanding in framing the scope of services, effective utilization, delivery and execution of telerehabilitation based physiotherapy and other rehabilitation services across the kingdom especially with context to home healthcare. The study will help in understanding the usage, scope and perception of telerehabilitation based services in home health care. Though the study was based in Riyadh with limited number of patient base, future studies could be conducted using perceptions of patients from various cities across the kingdom including both urban and rural and could be used to understand whether the perceptions vary depending on geographical locations, gender, age groups etc. The future studies could be conducted by exploring the perception and satisfaction level of the patients with reference to actual home therapy been given across a wide range of medical conditions and been followed for a longer time duration. Similarly, other studies could be conducted comparing the perception of patients receiving different treatment modalities which could help explore further relationships between clinical outcome and patient perceptions.

CONCLUSION

This present study showed that participants were satisfied with most of the aspects of telerehabilitation while

given as a part of home health treatment and gave valuable insights so as to develop the therapy further and help in leveraging its scope of practice with clear instructions, guidelines and delivery codes. As a part of vision 2030, this method of delivering therapy could be used as a very important component for not only facilitating the services but also have immense potential which can be leveraged at various degrees in different forms to reap economic benefits.

ACKNOWLEDGEMENTS

We thank all the participants who agreed to be part in this study as well the entire home health care team of Labas Home Healthcare which helped in conducting this study.

CONFLICT OF INTEREST

The authors report no conflicts of interest.

REFERENCES

- Alaboudi A., Atkins A., et al. (2016) Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. *Journal of Infect. and Pub. Health*, 9(6): 725-733.
- Chang AY; Skibekk VF; Tyrovolas S; Kassebaum NJ; Dieleman LJ. (2019) Measuring population ageing: an analysis of the global burden of disease study 2017. *The Lancet Public Health* 4(3) PE159 – E167.
- Clemens Scott Kruse, Priyanka Karem et al. (2018) Evaluating barriers to adopting telemedicine worldwide: A systematic review. *J Telemed Telecare*. 24(1): 4–12. Published online 2016 Oct 16. doi: 10.1177/1357633X16674087
- Farid Midhet Mahmood Prevalence and prevention of lifestyle-related diseases in Saudi Arabia. *Int J Health Sci (Qassim)*. 2018 Sep-Oct; 12(5): 1–2.
- Hailey, D.; Roine, R.; Ohinmaa, A.; Dennett, L. (2010) Evidence on the Effectiveness of Telerehabilitation Applications; Institute of Health Economics and Finnish Office for Health Technology Assessment, Edmonton and Helsinki, Canada.
- Jackson, D.E.; McClean, S.I. (2012). Trends in telemedicine assessment indicate neglect of key criteria for predicting success. *Jour. of Health Organ.and Mgmt.*, 26, 508–523
- Johansson, T.; Wild C. (2011) Telerehabilitation in stroke care—A systematic review. *J. Telemed. Telecare*; 17: 1–6.
- Khalil MKM., Al-Eidi S, Al-Qaed M and AlSanad S., (2018) The future of integrative health and medicine in Saudi Arabia. *Integrative Medicine Research*, 7(4) : 316-321.
- Langbecker D., Caffery LJ; et al. (2017)Using survey methods in telehealth research: A practical guide. *Journal of Telmed. and Telecare*. 23(9) :770-779

Mazen Alqahtani

McKinsey Global Institute Report. (2015) Saudi Arabia beyond oil: the investment and productivity transformation: McKinsey global institute.

Ministry of Health. Annual statistical book. Riyadh: Ministry of Health; (2018) Available from [https://www.moh.gov.sa/en/Ministry/Statistics/book/Documents/Annual Statistical book-1438H.pdf](https://www.moh.gov.sa/en/Ministry/Statistics/book/Documents/Annual%20Statistical%20book-1438H.pdf)

Russell, T.G. (2007) Physical rehabilitation using telemedicine. *J. Telemed. Telecare*, 13, 217–220.

Saudi Arabia's Vision. National Transformation Program 2020 (2016). Available from (<https://vision2030.gov.sa/en/programs/NTP%202.0>)

Tan J (2005) E-health care information systems: an introduction for students and professionals. (2005) John Wiley and Sons, p. 219, ISBN 978-0-7879-6618-8

The Pulse: 8th edition (2018) Kingdom of Saudi Arabia overview Healthcare, Colliers International, Riyadh, KSA

Tousignant M., Boissy P., Corriveau H., Moffet H. 3, Cabana F; (2009) In-Home Telerehabilitation for Post-Knee Arthroplasty: A Pilot Study. *Int. Jour. Of Telerehab*; 1(1): 1-11

United Nations. World Population Prospects: The 2012 Revision (2012). Available from: <https://data.un.org/Default.aspx>.

Vision 2030. Health Sector Transformation Strategy Kingdom of Saudi Arabia: National Transformation Program 2020. Available from http://www.vision2030.gov.sa/sites/default/files/NTP_En.pdf.

Yin R. (2003) Case Study Research: Design and Methods. 3rd ed. Sage Publications; Thousand Oaks, CA, USA.