

Examining The Relationship Between The Population Characteristics And Telerehabilitation Requirement- Turkey Study

Neslişah GÜN¹, Mahmut Fevzi GÜN²

<p>Corresponding Author Neslişah GÜN</p> <p>DOI https://10.48121/jihsam.991765</p> <p>Received 06.09.2021</p> <p>Accepted 22.03.2022</p> <p>Published Online 27.04.2022</p> <p>Key Words Population Characteristics Telerehabilitation COVID-19 Health System</p>	<p style="text-align: center;">ABSTRACT</p> <p><i>This study was planned to estimate the population characteristics of people who may need physiotherapy and rehabilitation and face barriers in accessing services in Turkey, and to discuss the suitability of telerehabilitation services for these people and the necessity of integrating them into health services. In October 2020, information pages of official institutions and organizations in Turkey were scanned. The general demographic indicators of the Turkish people by years, dependency and mobilization levels, major diseases in the population and the number of hospital admissions were investigated and recorded. In Turkey, the elderly population is increasing every year, and with the increase in the elderly population, the dependency ratio and the incidence of chronic diseases increase. While hospital admissions have increased each year, they have decreased during the COVID-19 period. According to the characteristics of the Turkish population, the number of people who need physiotherapy and rehabilitation is likely to be high. It is expected that the need will increase and there will be problems in accessing rehabilitation services in the coming years. In societies that are aging and have barriers to access to health services, the need for telerehabilitation applications will increase. In these societies, telerehabilitation practices should be integrated into the health system.</i></p>
--	---

¹ MSc, Faculty of Health Sciences, TC İstanbul Arel University, İstanbul. neslisahgun@arel.edu.tr / Orcid Number: <https://orcid.org/0000-0003-3506-3733>

² MSc, Faculty of Health Sciences, TC Kırklareli University, Kırklareli. mahmutfevzigun@klu.edu.tr / Orcid Number: <https://orcid.org/0000-0003-3249-0123>

INTRODUCTION

The ageing of societies, increasing longer and higher quality life expectancy, advances in technology, rapid political, economic and socio-cultural transformations, increase in costs, epidemics and changes in disease tissue bring along new dynamics in the provision, organization and financing of health services. The best way to understand and respond to these dynamics is to develop multidisciplinary, bio-psycho-social approaches. One of the mentioned approaches is telerehabilitation services.

Telerehabilitation refers to the use of information and communication technologies such as telephone, internet and video conferencing to provide remote rehabilitation services to people in their homes or other setting. Such services include therapeutic interventions, remote monitoring of progress, education, counselling, training, and a networking tool for people with disabilities (Brennan et al., 2009; Wiley & Cory, 2013).

Studies have shown that telerehabilitation gives significant results in many different disease groups. Frederix et al. reported that telerehabilitation is a feasible and practical additional and/or alternative rehabilitation approach compared to traditional in-hospital rehabilitation (Frederix et al., 2015). Telerehabilitation interventions in stroke patients have been associated with significant improvements

in recovery of motor deficits, higher cortical function, and lower depression (Sarfo et al., 2018). Hwang et al. reported that telerehabilitation is not inferior to an outpatient rehabilitation program in the hospital in patients with chronic heart failure and encourages more participation in their sessions in patients (Hwang et al., 2017). The addition of telephone information to usual physiotherapy care for people with chronic and non-specific low back pain has led to clinically significant improvements in activity and recovery expectations (Iles et al., 2011). Telerehabilitation, which is found easy, safe and convenient by patients, increases the efficiency of rehabilitation clinics by providing patients with more access to services (Covert et al., 2018; D. Leochico, 2020; Sooprarnanien et al., 2020). In addition to all these, it has been shown that telerehabilitation is a practical, time-saving and cost-saving alternative method (Cox et al., 2018; Ihrig, 2019; Nelson et al., 2019).

This study aims to identify people who may need physiotherapy and rehabilitation in Turkey and who may face obstacles in reaching the service based on data published by public institutions and organizations, especially the Ministry of Health, and to discuss the suitability and necessity of telerehabilitation services for these people.

MATERIALS AND METHODS

In this study, Turkey's general data was used. Data was taken from the publications of official institutions; Turkey Statistical Institute, Turkey Social Security Institution, the Republic of Turkey Ministry of Health. In our study, it is aimed to discuss the demographic data obtained from official

institutions and organizations, general health indicators, the number of applications, their distribution according to various sub-parameters and their changes over the years, and to reach multiple results in this direction.

RESULTS

The first findings of our study are concerned with Turkey's General demographic indicators by years

that are shown Turkey's general demographics data according to years is given in Table 1.

Table 1. General demographic indicators by years

	1990	2000	2015	2016	2017	2018
Total Population	56.473,035	67.803,927	78.741,053	79.814,871	80.810,525	82.003,882
Rural Population Rate (%)	48.70	40.80	12.40	12.10	11.80	12.10
Urban Population Rate (%)	51.30	59.20	87.60	87.90	88.20	87.90
0-14 Age Rate (%)	35.00	29.80	24.00	23.70	23.60	23.40
65 and Over Rate (%)	4.30	5.70	8.20	8.30	8.50	8.80
Young Dependency Rate (0-14 Years) (%)	57.60	46.30	35.40	34.90	34.70	34.50
Elderly Dependency Rate (65 + over) (%)	7.10	8.80	12.20	12.30	12.60	12.90
Total Dependency Rate (%)	64.70	55.10	47.60	47.20	47.20	47.40
Annual Population Growth Rate (‰)	21.70	18.30	13.40	13.50	12.40	14.70
Crude Birth Rate (‰)	24.10	21.60	17.10	16.60	16.10	15.30
Crude Death Rate (‰)	7.10	7.30	5.20	5.30	5.30	5.20
Total Fertility Rate (‰)	2.90	2.50	2.20	2.10	2.10	2.00

Resource: Health Statistics Annual 2018, (<https://dosyasb.saglik.gov.tr/Eklenti/36134.siy2018trpdf.pdf?0>, Accessed 20 October 2020)

Table 1 shows that the total population, which was 56.473,035 in 1990, increased to 82.003,882 in 2018, according to 2018 data. Between these years, a serious decrease was observed in the rural population and an increase in the urban population, while the proportion of the population aged 0-14 decreased and the rate of the population aged 65 and over increased. Also, indicators such as annual population growth rate (‰), crude birth rate (‰), crude death rate (‰) and total fertility rate (‰) decreased between these years. According to Table 1, when we come to 2018, it is seen that the elderly dependency rate has reached 12.90% and the young dependency rate has reached 34.50%. While the elderly dependency rate tended to increase every year, the young dependency rate showed a downward trend every year.

Percentage rates of those who cannot walk without any assistance or assistive device and who cannot climb stairs are given in Table 2.

Table 2. Population who cannot walk without any assistance or assistive device and who cannot climb stairs, %, 2016

Age (years)	Can not walk %	Can not climb stairs %
15-44	1.30	1.90
45-54	5.10	8.80
55-64	10.80	15.40
65-74	23.40	29.30
75 and over	48.00	55.40
Ratio in total population	6.50	8.70

Resource: Turkey Health Survey, 2016 (http://www.tuik.gov.tr/PreTablo.do?alt_id=1017, Accessed: 13.10.2020)

According to Table 2, it has been founded that the rate of those; in the 45-54 age group who cannot walk without any help or using an assistive device is 5.10% and the rate of those who cannot climb stairs is 8.80%, the proportion of those who cannot walk in the 55-64 age group is 10.80% and the proportion of those who cannot walk up and down stairs is 15.40%, the proportion of those who cannot walk in the 65-74 age group is 23.40% and the proportion of those who cannot go up and down stairs is 29.30%, the proportion of those who cannot walk in the age group

of 75 and over is 48 and the rate of those who cannot go up and down stairs is 55.40%.

Distribution of the major diseases / health problems experienced by individuals aged fifteen and over in the last 12 months by gender is given in Table 3.

Table 3. Distribution of major diseases/health problems experienced in the last 12 months by individuals aged fifteen and over by gender, %, 2016

Disease/health problem	Male	Female	Total
Lower Back Problems (Low Back Pain, Lumbar Hernia, Other Lumbar Defects)	21.40	32.80	27.10
Neck Problems (Neck Pain, Neck Hernia, Other Neck Defects)	11.50	24.60	18.10
Hypertension	11.10	20.50	15.80
Allergia (Allergic Rhinitis, Dermatitis, Allergy to Food etc.- Excluding Allergic Asthma)	7.50	13.90	10.80
Asthma (Including Allergic Asthma)	5.20	10.30	7.80
Arthrosis	4.90	10.50	7.70
Chronic Obstructive Pulmonary Disease (Chronic Bronchitis, Emphysema)	5.70	88.00	7.30
Depression	4.90	9.40	7.20
Coroner Hearth Disease (Angina, Chest Pain, Spasm)	5.90	7.10	6.50
Kidney Problems	5.20	7.50	6.40
Urinary Incontinence	3.90	7.80	5.90
Alzheimer*	5.10	6.10	5.60
Myocardial Infarction (Heart attack)	2.10	2.00	2.10
Liver Cirrhosis, Liver Failure	1.10	1.80	1.50
Stroke (Brain Hemorrhage, Cerebral Thrombosis)	1.00	0.80	0.90

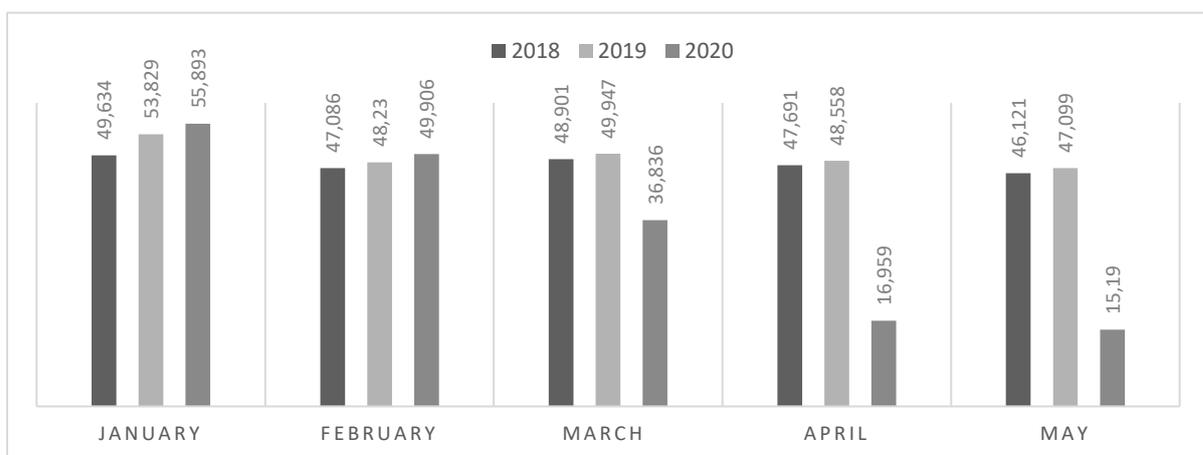
Resource: Health Statistics Annual 2018, p.50 (<https://dosyasb.saglik.gov.tr/Eklenti/36134.siy2018trpdf.pdf?0>, Accessed: 20 October 2020)

*Alzheimer's was evaluated for individuals aged 65+.

According to the data of the Health Statistics Annual of Turkey 2018, the main diseases/health problems experienced by individuals aged fifteen and over in the last 12 months in 2016, with 27.10% of the lower back problems in the first place. It is followed by neck area problems with 18.10%. Hypertension is

ranked third with 15.80%. Especially in women, these problems are seen at a higher rate than in men, and the same condition persists in diseases such as asthma, arthrosis and COPD.

Number of hospital application by years in Turkey is given in Table 4.



Resource : http://www.sgk.gov.tr/wps/portal/sgk/tr/kurumsal/istatistik/aylik_istatistik_bilgileri (Accessed: 21 October .2020)

Graph 1. Total number of hospital applications in the first five months in 2018, 2019, 2020

January and February 2020 are the months in which the highest number of patient applications are recorded, with 55,893,000 and 49,906,000, respectively in the table that gives the number of patient applications for the first five months of the last

three years. These numbers are far above the number of applications January and February of 2018 and 2019. In April and May 2020, hospital admissions were at their lowest levels and remained below the 2018 and 2019 data.

DISCUSSION

In this study, people who may need physiotherapy were identified based on the data of official institutions in Turkey, and the obstacles that these people may face in accessing physiotherapy services were examined in the light of official institution data. According to official data, the proportion of the elderly population in our country seems to have entered an upward trend since the late 90s, and it is expected that this increase will continue in the coming years. The rate of population growth has fallen in recent years along with the decrease in the rate of rough birth, and the rate of the elderly population has increased with the increase in the rate of rough death. Along with the rise in the rate of elderly population, the rate of elderly dependence has also increased. Although there is no exact data on the impact of age dependency on access to health care, it cannot be ignored that dependency is challenging in this regard. It has been observed that disability increases with age, and this is most often encountered in transfer activities (Liang et al., 2015).

In the Turkish Health Survey 2016, the proportion of "those who cannot walk without help or aid device" in the 65-74 age group was 23% and 48% in the over-75 age group was consistent with this information in the literature. In the same study, the proportion of "those who cannot climb stairs" was 29.30% in the age group of 65-74 and 55.40% in the age group of 75 and above. These data are seen as another indicator of dependency in the elderly. An excess of elderly dependency can be interpreted as an increase in the need for physiotherapy services. It is inevitable that dependent elderly people have more difficulty in accessing physiotherapy and rehabilitation services than their independent peers. It can also be seen as the reason for the increase in costs due to requirements such as the provision of assistants or assistive devices.

Data on how much a percentage of the dependent group needs physiotherapy and rehabilitation services could not be reached. But in the report "Increasing the Efficiency of Health Services and Financial Sustainability" published in 2014 by the Ministry of Development, it was stated that rehabilitation services delivered to specific groups that can be considered dependent (people with special needs due to their physical, mental, social or economic conditions) are insufficient. In this report, it is foreseen that the inadequacies and problems in these services will increase in the coming years with increasing aging (<https://www.sbb.gov.tr/wpcontent/uploads/2018/10/>

10_SaglikHizmetlerininEtkinligininArtirilmasiveMali Surdurulebilirlik .pdf accessed: 31.10.2021) With ageing, muscle mass decreases, balance, falling problems and a predisposition to chronic disease increase; exercise programs are known to give significant results in reducing these problems seen in the elderly (Aguirre & Villareal, 2015; Galloza, 2017; Marzetti et al., 2018). In the light of all these data, it should not be forgotten that this group is in the rehabilitation target group. When these people development need preventive rehabilitation or primary phase physiotherapy and rehabilitation services, telerehabilitation practices that are easier to access and financially equitable may be preferred. Thus, it is thought to produce more cost effective results

Although it has been decreasing from past to present, it is seen that the dependency ratio of 0-14 years of age in 2018 has reached a not underestimated percentage with 34%. People in the dependent group of 0-14 years of age need parents, resulting in the labour force and economic loss of parents. It also disrupts their education. It would be useful to consider telerehabilitation programs for this group in health management policies

There is a significant difference in the number of healthcare workers and beds per 100,000 people in our country, according to the regions. The elderly population and dependency rates found by region are not parallel to these numbers. Although dependency rates do not reflect the number of people in need of physiotherapy and rehabilitation services, these data can be accepted as an indicator that not every region has equal opportunities in accessing to physiotherapy services. The necessity of alternatives that do not require space, such as telerehabilitation, can eliminate the problem of access to rehabilitation services. Telerehabilitation is a viable alternative to achieve universal access to rehabilitation care and to overcome barriers to in-clinic visits among poor people with disabilities in a country with limited resources (Leochico & Valera, 2020). The inclusion of telerehabilitation among health applications will allow patients living in remote places where traditional rehabilitation services are not easily accessible to be treated using technology (Peretti et al., 2017).

According to the data of the Health Statistics Annual of Turkey 2018, the problems of the lower back and neck region are the first two when looking

at the main diseases/health problems experienced by individuals aged fifteen and over in the last 12 months in 2016. Lower back and neck pain is cited as the leading global cause of disability in most countries (Vos et al., 2016). Physiotherapy methods are widely used in low back and neck pain. Exercise reduces pain and disability in patients with lower back, neck problems, and improves the quality of life (CalvoMuñoz et al., 2013; Groeneweg et al., 2017; Rushton et al., 2015). Frogner et al. stated that people with low back pain who received physical therapist support in the first part of their treatment used fewer opioids as well as less need for high-cost medical services (Frogner et al., 2018). Telerehabilitation-based exercises for nonspecific low back pain provide more cost savings than clinical exercise (Fatoye et al., 2020). It is believed that the high costs caused by these problems will decrease with the introduction of telerehabilitation.

Since 95% of hospital applications in the country occur through Social Security Institution (SSI) it is considered reliable to use SSI's data in our study. The number of hospital applications, declined after March 2020, when COVID-19 cases were first seen in Turkey. In April and May, the number of hospital admissions increased every year from 2018 to 2020. The increase in the demand for hospital services due to chronic diseases, changes in the texture of the disease and increasing expectations with the aging population are thought to cause this. Although the number of physiotherapy and rehabilitation applications is not in the table, it is thought that there are people who cannot reach physiotherapy and rehabilitation services among the decreasing applications. When the table is viewed from the framework of continuous time series analysis, one of the demand forecasting methods; the number of hospital applications in April and May 2020 is compared with the number of applications in April and May between 2018 and 2019, it is seen that the number of applications expected to take place in April and May 2020 is far below expectations. According to the analysis, while the expected number of hospital applications in April 2020 was 49,713,45 (thousand), this number remained at 16,595, while the number of hospital applications was 50,731,53 in May, this number remained at 15,190. With COVID-19 pandemic, the first 5 months of 2020, In Turkey,

the number of applications in hospitals, has been shown to enter into a serious downward trend.

Due to COVID-19, people experience difficulties in accessing physiotherapy and rehabilitation services as well as in other health services. This situation has revealed the necessity of telerehabilitation practices in our country, which has a high elderly and dependent population and a high rate of chronic diseases such as diabetes, HT and COPD. Negrini et al. demonstrated telemedicine is feasible and acceptable to replace outpatient rehabilitation services in the case of COVID-19 emergency in Italy, thus eliminating the access problems of patients and the risk of contact with the virus that may be experienced during face-to-face treatment. Studies conducted in different countries during the pandemic period revealed the need to adapt face-to-face physical therapy consultations to the telerehabilitation model, given the spread of the COVID19 pandemic. Telerehabilitation is the driving force for a multicenter practice study that could prove to have significant results, especially during the period of combating the covid-19 epidemic (D. Leochico, 2020; Negrini et al., 2020).

Telerehabilitation is now seen as a possible solution to the issues that healthcare systems are confronting as a result of aging populations, better therapies, and limited resources. But patients must take an active role in their own treatment for telerehabilitation to be effective (de la Cal et al., 2021). Therefore, the patient must be able to collectively acquire and use the technology for which the current technical support is given. Technology must also be chosen so that it is broadly accessible and usable by a variety of individuals with different backgrounds, experiences, and functional and cognitive abilities (Pramuka & Van Roosmalen, 2009). It is essential to emphasize the need of proper training and education for those involved in this new and emerging form of intervention in order to provide more effective treatment. In order for telerehabilitation practices to be successful, facilitating access to services and educating the target group about the use of telerehabilitation systems should be included in health policies. Adoption of emerging technologies to support dynamic, individualized therapy models must be accelerated.

CONCLUSIONS

The elderly population in Turkey is increasing every year, with the increase of the elderly population, the rate of dependency and the incidence of chronic diseases are increasing.

Besides, diseases of the musculoskeletal system, especially in young and middle-aged people, are also faced with health problems that lead to labour loss.

All this shows the need for physiotherapy and rehabilitation services in our country. But reasons such as dependency, the fact that hospital rates are not evenly distributed according to the regional population, the COVID-19 pandemic, and the high cost of treatment pose various barriers to access to physiotherapy services. Telerehabilitation is an alternative method that is effective in facilitating

access to services, eliminating disadvantages in access and entitlement, and improving disease-related outcomes. Telerehabilitation services will ensure the sustainability of physiotherapy and rehabilitation programs in response to increasing health care needs and demands, especially in cases such as pandemics. For patients who cannot access a standard plan, telerehabilitation should be included in the physiotherapy services provided by health organizations.

Conflict of Interest:

The authors whose names are listed immediately below certify that they have NO affiliations with or

involvement in any organization or entity with any financial interest or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript

Ethical Approval

All procedures were carried out in conformity with the Helsinki Declaration and its subsequent revisions, or comparable ethical standards.

REFERENCES

- Aguirre, L. E., & Villareal, D. T. (2015). Physical Exercise as Therapy for Frailty. *Nestle Nutrition Institute Workshop Series*, 83, 83–92. <https://doi.org/10.1159/000382065>
- Brennan, D. M., Mawson, S., & Brownsell, S. (2009). Telerehabilitation: Enabling the remote delivery of healthcare, rehabilitation, and self management. *Studies in Health Technology and Informatics*, 145(February), 231–248. <https://doi.org/10.3233/978-1-60750-018-6-231>
- Calvo-Muñoz, I., Gómez-Conesa, A., & Sánchez-Meca, J. (2013). Physical therapy treatments for low back pain in children and adolescents: a meta-analysis. *BMC Musculoskeletal Disorders*, 14. <https://doi.org/10.1186/1471-2474-14-55>
- Covert, L. T., Slevin, J. T., & Hatterman, J. (2018). The Effect of Telerehabilitation on Missed Appointment Rates. *International Journal of Telerehabilitation*, 10(2), 65–72. <https://doi.org/10.5195/ijt.2018.6258>
- Cox, N. S., McDonald, C. F., Alison, J. A., Mahal, A., Wootton, R., Hill, C. J., Bondarenko, J., Macdonald, H., O'Halloran, P., Zanaboni, P., Clarke, K., Rennick, D., Borgelt, K., Burge, A. T., Lahham, A., Wageck, B., Crute, H., Czupryn, P., Nichols, A., & Holland, A. E. (2018). Telerehabilitation versus traditional centre-based pulmonary rehabilitation for people with chronic respiratory disease: Protocol for a randomised controlled trial. *BMC Pulmonary Medicine*, 18(1), 1–9. <https://doi.org/10.1186/s12890-018-0646-0>
- D. Leochico, C. F. (2020). Adoption of telerehabilitation in a developing country before and during the COVID-19 pandemic. *Annals of Physical and Rehabilitation Medicine*. <https://doi.org/https://doi.org/10.1016/j.rehab.2020.06.001>
- De la Cal, J. M., Fernández-Sánchez, M., Matarán-Peñarrocha, G. A., Hurley, D. A., involvement in any organization or entity with any financial interest or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript
- CastroSánchez, A. M., & Lara-Palomo, I. C. (2021). Physical therapists' opinion of e-health treatment of chronic low back pain. *International Journal of Environmental Research and Public Health*, 18(4), 1–11. <https://doi.org/10.3390/ijerph18041889>
- Fatoye, F., Gebrye, T., Fatoye, C., Mbada, C. E., Olaoye, M. I., Odole, A. C., & Dada, O. (2020). The clinical and cost-effectiveness of telerehabilitation for people with nonspecific chronic low back pain: Randomized controlled trial. *JMIR MHealth and UHealth*, 8(6). <https://doi.org/10.2196/15375>
- Frederix, I., Vanhees, L., Dendale, P., & Goetschalckx, K. (2015). A review of telerehabilitation for cardiac patients. *Journal of Telemedicine and Telecare*, 21(1), 45–53. <https://doi.org/10.1177/1357633X14562732>
- Frogner, B. K., Harwood, K., Andrilla, C. H. A., Schwartz, M., & Pines, J. M. (2018). Physical Therapy as the First Point of Care to Treat Low Back Pain: An Instrumental Variables Approach to Estimate Impact on Opioid Prescription, Health Care Utilization, and Costs. *Health Services Research*, 53(6), 4629–4646. <https://doi.org/10.1111/1475-6773.12984>
- Galloza, J. (2017). Benefits of Exercise in the Older Population. 28, 365067.
- Groeneweg, R., van Assen, L., Kropman, H., Leopold, H., Mulder, J., Smits-Engelsman, B. C. M., Ostelo, R. W. J. G., Oostendorp, R. A. B., & van Tulder, M. W. (2017). Manual therapy compared with physical therapy in patients with non-specific neck pain: A randomized controlled trial. *Chiropractic and Manual Therapies*, 25(1), 1–12. <https://doi.org/10.1186/s12998-017-0141-3>
- Hwang, R., Bruning, J., Morris, N. R., Mandrusiak, A., & Russell, T. (2017). Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a

randomised trial. *Journal of Physiotherapy*, 63(2), 101–107. <https://doi.org/10.1016/j.jphys.2017.02.017>

Ihrig, C. (2019). Travel Cost Savings and Practicality for Low-Vision Telerehabilitation. *Telemedicine and E-Health*, 25(7), 649–654. <https://doi.org/10.1089/tmj.2018.0092>

Iles, R., Taylor, N. F., Davidson, M., & O'Halloran, P. (2011). Telephone coaching can increase activity levels for people with non-chronic low back pain: A randomised trial. *Journal of Physiotherapy*, 57(4), 231–238. [https://doi.org/10.1016/S1836-9553\(11\)70053-4](https://doi.org/10.1016/S1836-9553(11)70053-4)

Leochico, C. F. D., & Valera, M. J. S. (2020). Follow-up consultations through telerehabilitation for wheelchair recipients with paraplegia in a developing country: a case report. *Spinal Cord Series and Cases*, 6(1). <https://doi.org/10.1038/s41394-020-0310-9>

Liang, Y., Song, A., Du, S., Guralnik, J. M., & Qiu, C. (2015). Trends in disability in activities of daily living among Chinese older adults, 1997–2006: the China Health and Nutrition Survey. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 70(6), 739–745. <https://doi.org/10.1093/gerona/glu204>

Marzetti, E., Cesari, M., Calvani, R., Msihid, J., Tosato, M., Rodriguez-Mañas, L., Lattanzio, F., Cherubini, A., Bejuit, R., Di Bari, M., Maggio, M., Vellas, B., Dantoine, T., Cruz-Jentoft, A. J., Sieber, C. C., Freiberger, E., Skalska, A., Grodzicki, T., Sinclair, A. J., ... Landi, F. (2018). The “Sarcopenia and Physical fRaily IN older people: multi-component Treatment strategies” (SPRINTT) randomized controlled trial: Case finding, screening and characteristics of eligible participants. *Experimental Gerontology*, 113(September), 48–57. <https://doi.org/10.1016/j.exger.2018.09.017>

Negrini, S., Donzelli, S., Negrini, A., Negrini, A., Romano, M., & Zaina, F. (2020). Feasibility and acceptability of telemedicine to substitute outpatient rehabilitation services in the COVID-19 emergency in Italy: an observational everyday clinical-life study. *Archives of Physical Medicine and Rehabilitation*, 1–6. <https://doi.org/10.1016/j.apmr.2020.08.001>

Nelson, M., Russell, T., Crossley, K., Bourke, M., & McPhail, S. (2019). Cost-effectiveness of telerehabilitation versus traditional care after total hip

replacement: A trial-based economic evaluation. *Journal of Telemedicine and Telecare*. <https://doi.org/10.1177/1357633X19869796>

Peretti, A., Amenta, F., Tayebati, S. K., Nittari, G., & Mahdi, S. S. (2017). Telerehabilitation: Review of the State-of-the-Art and Areas of Application. *JMIR Rehabilitation and Assistive Technologies*, 4(2), e7. <https://doi.org/10.2196/rehab.7511>

Pramuka, M., & Van Roosmalen, L. (2009). Telerehabilitation Technologies: Accessibility and Usability. *International Journal of Telerehabilitation*, 1(1), 85–98. <https://doi.org/10.5195/ijt.2009.6016>

Rushton, A., Heneghan, N. R., Calvert, M., Heap, A., White, L., & Goodwin, P. C. (2015). Physiotherapy post lumbar discectomy: Prospective feasibility and pilot randomised controlled trial. *PLoS ONE*, 10(11), 1–22. <https://doi.org/10.1371/journal.pone.0142013>

Sarfo, F. S., Ulasavets, U., Opare-Sem, O. K., & Ovbiagele, B. (2018). Tele-Rehabilitation after Stroke: An Updated Systematic Review of the Literature. *Journal of Stroke and Cerebrovascular Diseases*, 27(9), 2306–2318. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2018.05.013>

Soopramanien, A., Jamwal, S., & Thomas, P. W. (2020). Digital health rehabilitation can improve access to care in spinal cord injury in the UK: A proposed solution. *International Journal of Telerehabilitation*, 12(1), 3–16. <https://doi.org/10.5195/ijt.2020.6312>

Vos, T., Allen, C., Arora, M., Barber, R. M., Brown, A., Carter, A., Casey, D. C., Charlson, F. J., Chen, A. Z., Coggeshall, M., Cornaby, L., Dandona, L., Dicker, D. J., Dilegge, T., Erskine, H. E., Ferrari, A. J., Fitzmaurice, C., Fleming, T., Forouzanfar, M. H., ... Zuhlke, L. J. (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*, 388(10053), 1545–1602. [https://doi.org/10.1016/S01406736\(16\)31678-6](https://doi.org/10.1016/S01406736(16)31678-6)

Wiley, D., & Cory, A. (2013). Behavioral Health Services: Evaluation. *Encyclopedia of School Health*. <https://doi.org/10.4135/9781452276250.n28>