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# Effects of Telerehabilitation on Occupational Therapy Services in the Coronavirus Disease 2019 Era: An Umbrella and Mapping Review With Meta–Meta-Analysis

**AUTHOR**

***Abstract***

***Purpose***

*Telerehabilitation (TR) is a medical option that should be embraced in contemporary society to curb the spread of coronavirus. An umbrella along with mapping review based on a meta-meta-analysis (MMA) has recently been conducted using available scientific revelations to establish whether TR could be a critical option for traditional rehabilitation systems in occupational therapy practices [1].*

***Methods***

*A systematic review of reviews along with previous and current studies on the objectives and systematic evidence based on an MMA and visual maps was conducted. A systematic search was then initiated in the Google Scholar, MEDLINE (PubMed), and Cochrane Database of Systematic Reviews (CDSR). Accordingly, two independent reviewers scrutinized and examined all obtained data and simultaneously analysed the authenticity of the reviews included while evaluating the bias risks using ROBIS.*

***Results***

*Twenty-five articles that met the inclusion thresholds were selected and grouped based on the conditions of the patients on rehabilitation, which constituted musculoskeletal, cardiorespiratory, and neurological conditions. The MMA linked to occupational functioning between normal care rehabilitation and TR failed to indicate a statistical difference among patients with musculoskeletal and cardiorespiratory conditions [2]. The MMA showed statistically significant results among patients with neurological conditions but with negligible impacts in six reviews on TR. The standardized mean difference was 0.18 with a 95-confidence interval of 0.03–0.34.*

***Conclusion***

*These results suggest that TR provides admirable results that in many ways can be compared with face-to-face rehabilitation processes.*

***Impact***

*TR has the advantage of reducing costs that work along with its minimal interruptions on a patient's contemporary interactions, suggesting that it helps current medical setups when society requires minimal interactions to curb the spread of coronavirus.*

***Keywords:*** *Telerehabilitation, Occupational Therapy, Telehealth.*

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## I. Telerehabilitation (TR) and Occupational Therapy (OT)

Occupational therapists are skilled healthcare professionals who use scientific evidence to complete their interventions. They use holistic perspectives to evaluate an individual's emotional, psychological, social, and physical makeup. OT enables people to engage in activities across their lifespan by considering each individual's situation and creating individualized goals that will resume their occupations. In other words, when one has personal goals, they share them with occupational therapists and then work collectively to develop an intervention plan to steer their abilities to execute daily activities and goals [3].

TR is the use of technology to support rehabilitation services and entails all applications of diagnostic, preventative, evaluative, and therapeutic services based on a two-way interactive platform. Occupational therapists often use technology to offer assistance to patients at physically distant locations, thus enabling the services to be conducted at the patients' comfort, including residence and workplace. Subsequently, practitioners can use technology to offer intervention schemes based on alternative systems, such as virtual reality (VR).

The application of TR in evaluation processes depends on multipoint observations and engagement levels between the client and practitioners. Although previous evaluation procedures involved the use of phones to conduct assessment interviews, today, the system uses more sophisticated technologies. For instance, OT

practitioners can use technology in consultations, for example, the prescription of the best wheelchair, neurological assessment, lower-limb amputation care, early childhood intervention, ulcer management, and vocational applications [2].

Clinical reasoning informs the selection and application procedures needed for specific TR technology to evaluate patients based on their environmental and personal needs. On their part, occupational therapists apply appropriate technologies and realize effective and safe delivery of services relevant to the clients' needs and context, implying that the reliability of one technology is essential in providing OT services, particularly in evaluating a client's needs and abilities to participate in particular occupations and activities, alongside the administration of specific assessments. Additionally, practitioners should be conscious of specific evaluation demands when deciding on the evaluation processes using TR.

Today, VR has been incorporated into evaluation processes, particularly its ability to develop three-dimensional environments. VR offers some intervention options not available with conventional OT systems in contemporary contexts. For instance, VR can be initiated to support occupational interventions for individuals who have cognitive impairments [4] and enables some controllable input stimuli alongside some modifications to the environment that have since been useful in grouping knowledge. Studies have indicated that VR, especially in early intervention phases, provides safer options than real-world situations.

Besides, study findings have demonstrated that VR, as a component of TR, effectively enables clients to compare their present functional status following a stroke and their desired levels of occupational engagements. VR has been influential in evaluating and determining home accessibility attributed to its three-dimensional construction, which can assess clients' architectural environment features. The current Remote Console TR system and other VRs developed by the respective institutions have effectively conducted rehabilitation sessions in real time even when the patient is several distances away. The system accords occupational therapists to image clients' motor performance updates, VR-based exercises, and movements [5]. When VR is incorporated into TR systems, practitioners remotely acquire information and feedback as part of their interventions to distract their patients from physical pain and scale up their adherence to therapy exercises.

Occupational therapists use telemonitoring to assess their clients' adherence to some intervention processes that seek to maximize the outcomes. Furthermore, telemonitoring is used to track and respond to most follow-ups. Some occupational therapists take advantage of the Self-Monitoring, Analysis, and Reporting Technology (SMART) to examine their clients' occupational performances in the community and home. Wireless SMARTs allow practitioners in specific settings to offer services in different environments without limiting their clients' movements in such settings. For example, they exhibit particular technologies that support offsite occupational practitioners to underscore a client's real-life performances and occupation challenges and subsequently consider relevant interventions [6]. As such, they can tailor environmental accommodations to serve their clients with physical limitations or use the cueing system to steer individualized technology for clients with cognitive disabilities to enhance their independence.

**Intervention**

TR interventions entailed in this analysis are divided into the store-and-forward, interactive real time, and remote monitoring system groups. In small monitoring systems, asynchronous communication based on other monitoring devices exists, including mobile applications, blood pressure monitors, and glucometers, which can remotely transfer patients' data to the healthcare worker (HCW). Store-and-forward systems support the security of electronically transmitted data, most often in the HCWs, to support diagnoses. Alternatively, real-time interventions apply synchronous communication systems, including telephone and video consultations. Such components can be likened to conventional care and considered an alternative way of medical intervention. Studies have suggested that application-based remote monitoring is among the most used aspects of this approach. Accordingly, study findings have illustrated that store-and-forward systems are the minimally used intervention. Other most minor conventional interventions, including VR gaming, are used alongside social media [7]. Some reviews have encompassed patient education; however, the main objective of these interventions was healthcare delivery.

**Role**

Eight studies have established that the TR groups show constructive effects compared with the control groups. However, evidence asserting that TR's impacts are more reliable than the face-to-face model is limited because of the limited randomized controlled trials. Besides, data have suggested that TR in OT practices is feasible and has encouraging effects in advancing various functions in different age groups and pathologies.

In separate studies, caregivers and participants registered their satisfaction and positive attitude toward TR's application in OT services. Such findings were similar to those of studies on patients' acceptance and perception of the model's application. In other reviews, participants and their parents and caregivers were satisfied based on the program quality and perception. However, two patients and one caregiver opted for face-

to-face intervention if they had the latitude. One review has indicated a reliable increment in the number of OT interventions, such as a higher number of patients observed due to referral and inpatient interventions [8].

## II. Methods

**Design**

The researcher conducted a systematic review of reviews and simultaneously a combination of periodic evidence reports documented by Smith et al. (2011).

Search Strategy

The researchers initiated a systematic search in the following websites and databases produced between 1959 and May 10, 2020. The sites include MEDLINE (PubMed), Cochrane Database of Systematic Reviews (CDSR), and Google Scholar. In each of the searches, the reviewers considered a similar methodology and resolved disputes through consensus. Besides, the reviewers considered performing manual journal search procedures on articles that had closer connections while simultaneously including the reference list of all studies. Consequently, the researcher also provided the reference sections to capture the initial studies' information and proceeded to screen them manually. Then, the researcher used the Vancouver citation method and manually scrutinized the reference list to eliminate duplications.

**Key Terms**

The independent researchers observed fundamental terms on two fronts. Some frequent terms include telehealth, telemedicine, OT, TR, computer rehabilitation, and web rehabilitation in the intervention phase. Furthermore, in the review section, the researchers encountered fundamental terms including qualitative systematic review, review literature, and systematic qualitative review [9].

Inclusion Criteria

The reviewers used selection criteria based on clinical and methodological factors, particularly the Population, Intervention, Comparison, Outcomes, and Study criteria.

**Population**

For this study, the identified participants were aged more than 18 years and constituted patients with neurological, respiratory, cardiac, and musculoskeletal diseases. Consequently, sex was not a considered factor.

**Intervention and Control**

TR was considered the best intervention approach and was deemed any technology (VR, wearable devices, telephone, and the Internet) that facilitated the monitoring and facilitation of OT rehabilitation controlled remotely based on the telecommunication approaches. Alternatively, the intervention processes are independent and often embedded in treatment, including standard care, conventional care, and face-to-face therapy.

**Outcomes**

The researcher used all variables related to clinical results, particularly physical functioning and simultaneously health-related quality of life (HRQL).

**Study Design**

This study adopted a systematic review design with or without metanalysis.

**Selection Criteria and Data Extraction**

Initially, the independent reviewers analysed the data considering the respective reviews' application based on the study objectives and questions. The first analysis was deduced after the information collected from the previous studies' keywords, abstract, and title. In case of disagreements or in the event where abstracts never had enough information, the entire text would be reviewed. The second part of the analysis applying the entire text was conducted to examine the inclusion standards' findings. All differences among the reviewers were harmonized by discussions handled by a third party. The independent reviewers applied a structured protocol to extract data in the results to ensure that the researchers gathered comprehensive information from all studies [10].

**Assessment of Methodological Quality**

The independent reviewers examined the quality of all reports using the ROBIS model that scrutinizes the quality of work in all domains. The domains included synthesis and findings, study appraisal and data collection, study identification and selection, and study eligibility. One advantage of ROBIS is its ability to

summarize the risk bias in three categories: unclear, low, and high. The reviewers applied a similar methodology to examine the quality of all studies.

**Data Analysis and Synthesis**

The qualitative evaluation using Meta-evaluation with cooperative elucidations was executed. A similar insertion approach for the analyses was assigned. However, two approaches were included: data for the assessed inconsistencies were highlighted in a minimum of two research pieces. The outcome part disclosed the information required on contrasting quantitative data, including standard deviation on the primary variables. Nevertheless, the summary quantities in the type of forest approaches were highlighted, 17 of which comprised a significant assemblage of all standardized mean alterations or differences (SMDs) and conformed to 95% underscored by all and bestowed sign of heterogeneity among the studies. The quantitative importance of the grouped SMDs was evaluated using Hedges' g to explain potential overestimation of the actual population upshot size in minor studies.

The degree of g was construed using a 4-point Likert-type scale: 1) <0.1 was rendered substantial, and the variability (inconsistency) index (I2). An inconsistency index was generated to outline minor heterogeneity. However, a variability index greater than 50% was rendered average, and an inconsistency index greater than 75% was taken to highlight considerable heterogeneity. The I2 index corresponded to the Q test, despite its identical challenge with power as does the Q trial with several studies. A study was rendered heterogeneous when it contented one or all conditions, including the outcome of 12 being above 75%; the Q trial was substantial. An unsystematic impact model was executed to attain grouped estimation of the impact in the meta-analysis of heterogeneous studies [11].

**Evidence Map**

The researchers created scientific evidence of all systematic reviews to display the information contained in every review and further encompassed four dimensions based on the created maps.

**Number of Items (Bubble Size)**

The number of components in every included revision is denoted proportionately by the bubble size. The number of items in each included revision is represented proportionally by the size of the bubble.

**Results**

Twenty-five articles were selected based on their credibility and divided based on the kind of patient in question (neurological, postoperative, or cardiac TR). The characteristics of the studies included based on the demographic characteristics, sample size, outcomes, interventions, results, and conclusions are listed below in Figure 1:

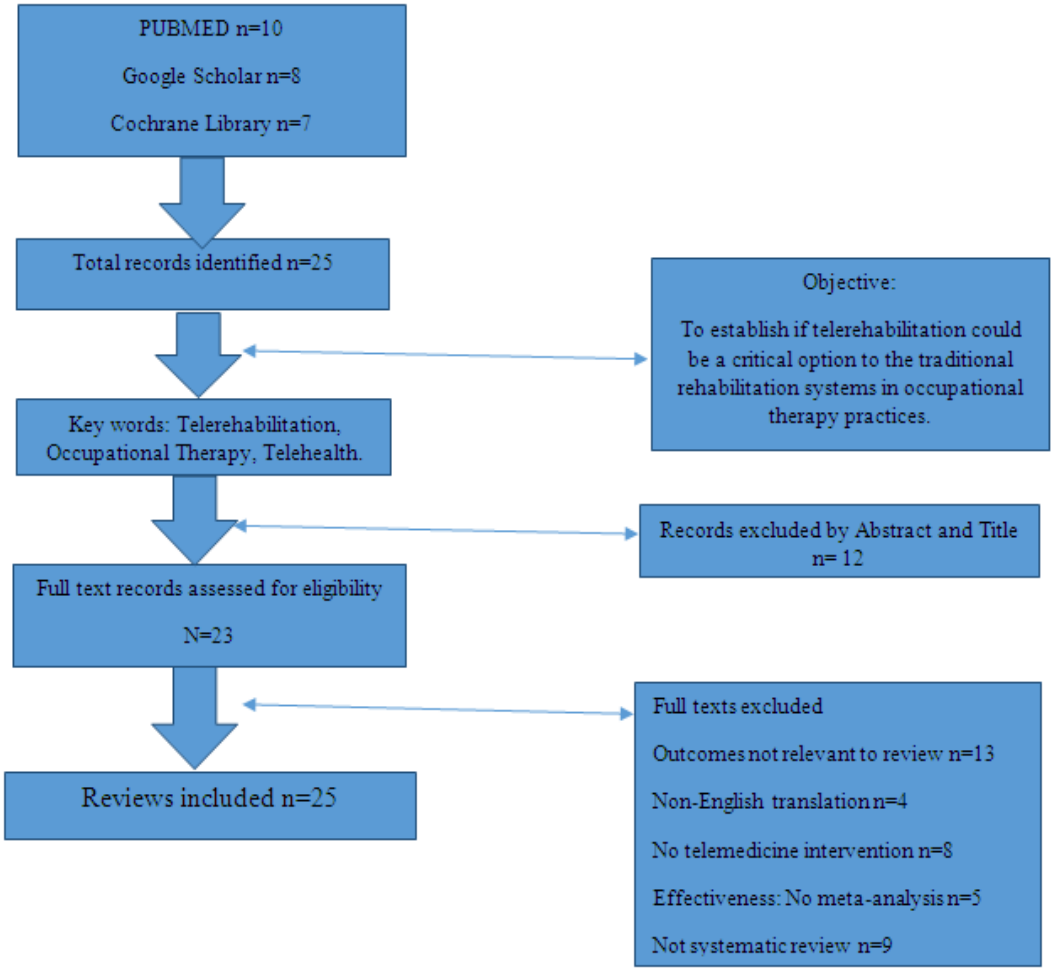


**Figure 1:** Prisma Diagram Showing the Results.

**Study Population Characteristics**

According to various reviews, TR can be used to evaluate patients with cardiorespiratory ailments, including chronic obstructive pulmonary illnesses, cardiac events, and cardiovascular conditions. In the practice of TR for patients who have lately undertaken surgery or those with musculoskeletal syndromes, seven analyses were incorporated. The primary settings for patients with musculoskeletal conditions include osteoarthritis, chronic pain, and rheumatoid arthritis. However, the regularly used procedures provided were knee and hip replacement, orthopaedic operations, and knee arthroplasties. In assessing TR's effectiveness in patients with neurological ailments, the most common conditions included stroke, acquired brain damage, multiple sclerosis, traumatic brain injury, and Alzheimer's disease [12].

**Interventions**

All interferences were centred on TR, either in collective with classical rehabilitation or individually. Additionally, TR was deliberated to any expertise, including telephone, VR, wearable devices, and the Internet, which permitted the supervision or assignment of therapy or rehabilitation. The interference's motive was to upsurge occupational aptitude or motor function using TR-grounded home exercise strategies—the interferences comprised exercises or motor tasks, aerobic exercises or motor re-education, and balance exercises. The inclusion of education-grounded interferences promoted changes in health behaviours or lifestyle.

**Outcomes**

The primary interest inconsistency among several analyses diverged from the kind of included patients. The studies that concentrated on respiratory and cardiac rehabilitation evaluated occupational capacity and purpose, HRQL, adverse occasions, and dyspnea. The analyses that evaluated patients with neurological syndromes monitored cognitive and motor purposes, individuality for daily existence, and disability. Most studies assessed facets concerning the execution of TR, including cost-effectiveness and contentment with therapy.

**Procedural Quality**

In the evaluation concerning the procedural quality, the covenant between the two analysers was great, conferring with a kappa coefficient (k) of 0.88.

## III. Findings

**Cardiorespiratory TR**

Five strategic analyses with meta-evaluation assessed TR efficiency for patients with respiratory and cardiac ailments and comprised 34 central studies. However, four investigations have outlined identical outcomes between usual care interferences 24 and 27 and TR concerning occupational purpose, and one analysis has highlighted excellent consequences for TR interference. However, the power of the outcomes is uncertain. Concerning the quantitative evaluations, the MMA of occupational purpose did not highlight a statistically significant variance between two analyses without proof of meaningful diversity [7].

**Musculoskeletal TR**

Approximately 12 analyses have assessed the purpose of TR in patients with musculoskeletal conditions and consisted of primary pieces of research. However, seven studies have highlighted no alterations between usual care interferences and TR, with a moderate to high indication for occupational purpose. One analysis could not make an inference and has outlined uncertain results in individuals with rheumatoid arthritis. Lastly, Agostini has reported excellent outcomes concerning the functionality of TR compared with standard care for individuals with knee arthroplasty. However, concerning quantitative evaluation, the MMA of occupational purpose failed to disclose statistically significant differences between three analyses with proof of significant heterogeneity.

**Neurological TR**

Thirteen strategic analyses, including central studies, have assessed TR's efficiency for individuals with neurological syndromes, even though a high equal heterogeneity was observed between the individuals and between the interferences. Considering the occupational purpose, 12 analyses have highlighted identical outcomes between standard care and TR interference, with low to adequate proof. Moreover, Laver has reported inadequate proof to define the efficiency of TR on functional inconsistencies.

Concerning qualitative evaluation, the MMA of occupational purpose highlighted a statistically meaningful but insignificant impact in six analyses favouring TR, without proof of substantial heterogeneity. The form of the funnel seemed to be proportional in the imperial model. The compassion elimination evaluation showed that no analyses have impacted the pooled SMD. Egger trial outcomes highlighted substantial proof of publication prejudice on the assessment. Additionally, the MMA concerning common life purposes did not disclose a statistically considerable variance in five analyses without evidence of substantial heterogeneity [13].

## IV. Discussion

Based on this review, TR is effective in conventional face-to-face and clinical rehabilitation systems concerning occupational functions and showed varied results among patients with musculoskeletal and neurological conditions. However, it showed ambiguous results among patients with respiratory and cardiac conditions. Moreover, the quantitative results did not register significant differences in either of the intervention processes and showed statistically applicable outcomes supporting TR among patients with neurological conditions. The MMA-produced results indicated differences among patients who needed rehabilitation procedures. For example, studies on patients with neurological disorders have considered stroke. Conversely, the reviews on musculoskeletal and cardiorespiratory TR showed significant variations that could impact the outcome.

Thus, TR could be an effective treatment procedure for patients with neurological conditions, even though more studies should be conducted to underscore its reliability in other cases. Presently, some aspects of TR are only effective in patients with neurological conditions vis-à-vis patients with musculoskeletal and cardiorespiratory conditions [14]. Primarily, patients with neurological disorders require intensive treatment to register functional improvements. However, dealing with face-to-face procedures is difficult because of a lack of adequate time [15]. Nevertheless, indicators pointed that TR could be effective in enhancing the intervention time.

In addition, TR enables the training of functional tasks among patients. It is, however, more effective in the environment than clinical settings, enabling their adaptation to daily life, which is essential among patients with neurological conditions. However, the outcome also indicated some barriers that have to be ironed out. Even though the procedure has been more effective than conventional rehabilitation systems, some study findings have suggested conflicting results in terms of patient satisfaction. Therefore, studies should be

conducted to iron the barriers, acceptance rate, and cost-effectiveness of the TR model. Several studies have often included phone-based TR.

Alternatively, several systems have adopted more multifaceted technologies, which embraced VR devices, suggesting that clients must have reliable infrastructures to execute the therapy. The challenge is that such technologies are costly and may reduce access to TR procedures. In addition, health professionals need to be trained and equipped with additional skills and knowledge to operate the systems. Moreover, studies have shown that some patients are cognitively impaired, which may hamper critical aspects of the system's clinical transfers [16].

It is proposed that data protection and privacy should be considered when using the TR model. Another fundamental challenge is that the technology requires patients to show total compliance during the intervention processes. However, creating a strong bond between therapists and patients based on online systems demands a reliable communication network defined by its practical tasks, objectives, and consultative decision-making. A significant weakness of TR is that several patients are reserved concerning the remote interactions with the medical team, thereby calling for more studies and teaching regarding this approach.

Furthermore, considering the patient's position is vital considering that some people may distrust the process because they are uncomfortable with technologies, have inadequate knowledge, and are negative in terms of expectations concerning the model. One way of boosting the patients' confidence is initiating educational strategies adopted by the healthcare team. Alternatively, the respective authorities can launch specialized training before initiating the rehabilitation processes. As previously indicated in other studies, the expected benefits vis-à-vis the practical technical support impact the patient's position and their engagement with the model. Social education is critical for standardizing and enhancing TR as an effective model in health practices. Consequently, it requires attention and participation of health authorities, health professionals, and patients at every stage of its implementation and use [17].

**Limitations**

The study introduces significant shortcomings. For instance, most referred findings had minimal methodological qualities along with higher chances of biases, indicating that researchers must be cautious in handling the results. Additionally, the study registered reasonable variability among the systematic reviews and endpoints of each evaluation. Besides, initiating a quantitative analysis on some variables is easy because of the scarcity of comparable studies. It was observed that the MMA's quantitative outcomes had indicated an increased heterogeneity that should be illustrated as a critical weakness [18].

## V. Recommendation

Further studies on the effectiveness of TR are needed, which has increased methodological robustness and simultaneously underscored its impacts on other populations, including patients with cancer and paediatric patients.

## VI. Conclusions

Recent studies have denoted that TR registers positive outcomes concerning physical functions in a manner similar to conventional face-to-face rehabilitation models, particularly among patients with neurological conditions. The relevance of TR in clinical processes, especially in the coronavirus disease 2019 era, is essential due to its minimal interference with the patient's everyday life alongside its low cost. However, it is vital to observe that prescribing exercises to patients is a multifaceted process and demands advanced therapeutic knowledge to advance its effectiveness and adherence, including communication and education. As such, the implementation of TR to occupational therapy should be conducted based on a paradigm change to realize an effective patient-based TR [19].

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**Ethics declarations**

**Conflict of interest**

The authors declare that they have no conflict of interest.

**Ethical Approval**

In this review no participants or sensitive personal information is included and thus no consent or ethical approval were relevant.

**Research Involving Human and Animal Participants**
This article does not contain any studies with human participants or animals performed by any of the authors.

**Consent for publication**
Where there was a need to adapt, copy, or refer, adequate acknowledgment and consent were sought before publication. This article was published without any external influence in the form of money or its equivalence. Consequently, the paper is objective and has been posted without conflicts of interest and has adhered to the ethical standards.

**Availability of data and material (data transparency)**
As such, the data here are transparent and conducted objectively to serve this review's purpose.

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