The Implementation of Tele-Health Physiotherapy Services for Musculoskeletal Conditions: A Systematic Review

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Abstract—It is obvious how the COVID-19 pandemic changed the whole aspects of our lives in the recent period. The health services are one of the most affected services during this pandemic. However, these services are vital and cannot be over missed in any context or situation. One of the most recent terms or services which has been used to overcome the challenges of the current pandemic is the "Tele-Health" or "Tele- Medicine" or "Tele-Rehabilitation" which refer in all cases to the using of technology such as video calls or smart applications to provide the health care services to the patients distally. The main goal of the current systematic review is to study the implementation of the Tele-health services in physiotherapy specifically for the musculoskeletal cases in terms of its effectiveness, challenges and barriers, and the implementation guidelines. Review of 32 articles from different databases (Springer, Scopus, and PMC) in the last ten years period (2011-2021) revealed that this topic is dramatically increased in the literature last year with the rise of COVID-19 pandemic. The current review is showing the methodology, theories, results, in addition to the details of countries and journals in which the articles were published. The current study could help in providing the guidelines to implement the Tele-health services in physiotherapy for musculoskeletal conditions, with concentrating on the effectiveness and challenges.

Keywords—Implementation, Tele-health (Tele-rehabilitation/ Tele-medicine), physiotherapy (Physical therapy), musculoskeletal (Orthopedic/ sport injuries)

1 Introduction

Musculoskeletal conditions had been identified as leading reason for global morbidity and one of non- fatal diseases that demand high resources [1]. These conditions place great restrictions on daily life activities, recreational activities and occupational activities of the affected individuals, although they are not considered life threatening diseases [2]. When red flags (e.g., cancer, fracture) are absent, the most appropriate management of musculoskeletal conditions is the conservative interventions which are tailored according to the patient's clinical presentation and needs [3]. Limited provision

of medical services to patients in remote and rural areas had been associated with poor recruitment and retention of clinicians [4]. Geographic reasons and shortage of staff are not the only reasons for limited service provision. In covid-19 pandemic, there are strict social distancing policies which compromised the accessibility of patients to medical services. Tele-Health, which is the use of information telecommunication technology (ICT) for providing distance healthcare as well as education [5], is one of the solutions organizations accommodated to overcome those restrictions. The Tele-Health had been started long time back, but came to the forefront of medical care due to the increased use of smart phones. Over time, terminologies had been expanded to describe the healthcare profession involved like Tele-Psychiatry or Tele-Rehabilitation. Tele-Rehabilitation can be defined as delivering remote rehabilitation using set of tools, protocols and procedures [6]. Patients with musculoskeletal conditions and accessibility problems will need physiotherapy management using Tele- Rehabilitation.

Many studies and systematic reviews studied different aspect of implication of Tele- Health in musculoskeletal physiotherapy (e.g. effectiveness, feasibility, acceptability), therefore, the purpose of this systematic review is to investigate the implication of Tele-Health or Tele-Rehabilitation in musculoskeletal physiotherapy.

2 Review Methodology

The current study is a systematic review of the literature on the "Implementation of Tele-health services in physiotherapy for musculoskeletal conditions". The search engines PMC, Scopus, and Springer are used to collect the articles that published in the last ten years (In the period between 2011 and 2021). The used key words are: Implementation, Tele-health (Tele-rehabilitation/ Tele-medicine), physiotherapy (Physical therapy), musculoskeletal (Orthopedic/ sport injuries). The initial stage of searching retrieved a total amount of 479 articles (326 articles in PMC search engine, 47 articles in Springer search engine, and 16 articles in Scopus search engine). The second stage of review excluded the repeated articles, unpublished thesis, and any other article with irrelevant search variable. Finally, a total number of 32 articles were available to be included in the current systematic review and these are listed in the Table 1.

Table 1. List of reviewed articles:

Serial	Article	Region	Methodology	Theory
1	[7]	Australia	Masterclass paper	Implementation and deployment of musculoskeletal Tele- Health service
2	[8]	Australia	Survey	clinicians' attitudes toward Tele-Health
3	[9]	USA	Descriptive report	Implementation and deployment of musculoskeletal Tele- Health service
4	[10]	USA	Systematic Review and Meta-Analysis	Identifying barriers and outcomes of Tele- Health intervention
5	[11]	Australia	Systematic Review and Meta-Analysis	clinicians' attitudes toward Tele-Health
6	[12]	UK	narrative literature review	Implementation and deployment of musculoskeletal Tele-Health service

7	[13]	Spain	Systematic Review and Meta-Analysis	Effectiveness of Tele- Health
8	[14]	USA	narrative literature review	Implementation of musculoskeletal Tele- Health service
9	[15]	UK	semi-structured interviews	Patients' attitudes toward Tele-Health
10	[16]	Nigeria	RCT	Clinical and Cost- Effectiveness of Tele- Health
11	[17]	Australia	Questionnaire	Feasibility of Tele- Health
12	[18]	UK	narrative literature review	Guidance for transition to remote health care
13	[19]	UK	Systematic Reviews and Meta-Analysis	Patients attitude towards Tele-Health
14	[20]	UK	semi-structured interview	Clinicians and patients' attitudes toward Tele-Health
15	[21]	Germany	Systematic Reviews and Meta-Analysis	Effectiveness of Tele- Health
16	[22]	Canada	RCT	clinicians' attitudes toward Tele-Health
17	[23]	USA	Retrospective study	Effectiveness of Tele- Health
18	[24]	USA	Commentary	Benefits and potential utility of Implementing Tele- Health
19	[25]	UK	semi-structured interviews	Patients' attitudes toward Tele-Health
20	[26]	No specific country: Qatar, UK, South Africa, Norway	Narrative literature review	guiding principles of sport and exercise medicine consultations
21	[27]	Denmark	RCT	Accuracy of Tele- Health exercises
22	[28]	No specific country: Portugal, Italy, Macedonia	Systematic Review and Meta-Analysis	Accuracy and feasibility of electronic pain rating
23	[29]	Brazil	Editorial	Regulations and barriers of Tele- Health
24	[30]	No specific country: Australia	Systematic Review and Meta-Analysis	Effectiveness of Tele- Health
25	[31]	UK	Exploratory descriptive, Qualitative study using thematic analysis	Feasibility of Tele- Health
26	[32]	Australia	Systematic Review and Meta-Analysis	enablers and barriers of Tele-Health
27	[33]	USA	Pilot study	Clinicians attitude toward Tele-Health
28	[34]	Australia	retrospective study	Accessibility of Tele- Health
29	[35]	USA	narrative Literature review	Clinical and cost effectiveness of Tele-Health
30	[36]	Australia	Systematic Review and Meta-Analysis	Effectiveness of Tele- Health
31	[37]	USA	Chapter of a book	Developing technical guidelines for patients with diverse preferences and abilities
32	[38]	USA	Guidelines	Written and visual guidelines for virtual musculoskeletal assessment

3 Results

Eighteen different theories were used in the reviewed articles (Table 2). The most common theory used was measuring the effectiveness of Tele-Health musculoskeletal physiotherapy, followed by Implementation and deployment of musculoskeletal Tele-Health service and clinicians' attitudes toward Tele-Health. Other theories included patients' attitude toward Tele-Health physiotherapy, feasibility of Tele-Health and studies that investigated clinicians and patients' attitude at the same time. Other theories were barriers and outcomes of Tele-Health, guidelines for assessment, guidance for transition to remote health care and guiding principles of sport and exercise medicine consultations. Cost effectiveness of Tele-Health, Benefits and potential utility of implementing Tele-Health and Accuracy and feasibility of electronic pain rating were also investigated. The variety of the theories used indicates that this review on implication of musculoskeletal physiotherapy is inclusive and novel.

Table 2. The theory of research

Serial	Theory	Articles
1	Accessibility of Tele-Health	1
2	Accuracy of Tele-Health exercises	1
3	Accuracy and feasibility of electronic pain rating	1
4	Benefits and potential utility of implementing Tele-Health	1
5	Clinical and cost effectiveness of Tele-Health	2
6	clinicians' attitudes toward Tele-Health	4
7	Clinicians and patients' attitudes toward Tele-Health	1
8	Developing technical guidelines for patients with diverse preferences and abilities	1
9	Effectiveness of Tele-Health	5
10	enablers and barriers of Tele-Health	1
11	Feasibility of Tele-Health	2
12	Guidance for transition to remote health care	1
13	Guiding principles of sport and exercise medicine consultations	1
14	Identifying barriers and outcomes of Tele-Health intervention	1
15	Implementation and deployment of musculoskeletal Tele-Health service	5
16	Patients' attitudes toward Tele-Health	3
17	Regulations and barriers of Tele-Health	1
18	Written and visual guidelines for virtual musculoskeletal assessment	1
Grand total		***32***

The studies included in the systematic review were conducted in different countries (see Table 3), the vast majority (9 studies) were conducted in United State of America, followed by Australia (7 studies) and United Kingdom (7 studies). Six studies were done in six different countries which were Brazil, Canada, Denmark, Germany, Nigeria and Spain with one study for each country. The other three studies were conducted in multiple countries. To sum up, USA, UK and Australia were the highest counties in

conducting studies related to Tele-Health in musculoskeletal physiotherapy services during the last 10 years (75% of published studies).

Table 3. Country in which research was done

Name of country	Count of studies
Australia	7
Brazil	1
Canada	1
Denmark	1
Germany	1
Nigeria	1
No specific country: Australia	1
No specific country: Portugal, Italy, Macedonia	1
No specific country: Qatar, UK, South Africa, Norway	1
Spain	1
UK	7
USA	9
Grand Total	**32**

Table 4. years of published studies

Year	Published studies
2020	14
2019	6
2018	3
2017	3
2016	4
2015	0
2014	1
2013	0
2012	1
2011	0
Grand Total	**32**

In the last ten years, it is obvious how the research studies sharply increased in the area of Tele-Health and Tele-Medicine as general, and in the musculoskeletal physiotherapy in specific (see Table 4). The COVID-19 pandemic period was the critical point in which the needs to apply the Tele-Health services was a mandatory. Giving that, more than half of the published studies in the last ten years were published in the last two years; fourteen studies were published in 2020 and six studies were published in 2019. Before this period, three studies were published in 2018 and the same number of studies was published in 2017. In addition, four studies were published in 2016. The remaining two studies were published in 2014 and 2012, no studies reported in the literature during 2011, 2013, and 2015.

The vast majority which are thirty-one studies were conducted in the health sector industry and one study only was conducted in the mobile and web technologies sector (see Table 5).

Table 5. Industry

Row Labels	Count of Industry
Health care industry	31
Mobile and web technologies	1
Grand Total	**32**

Table 6 presents the methodologies used in the reviewed articles. Systematic Review and Meta-Analysis is the mostly used methodology in articles. Out of 32 articles there were 9 articles in which Systematic Review and Meta-Analysis method approach was used [10], [11], [13], [19], [21], [28], [30], [32], [36]. In 5 articles narrative literature review has been conducted which were [12], [14], [18], [26], [35]. One of the commonly used methods in the articles is the Randomized controlled trials (RCT) [16], [22], [27]. Retrospective research structure is one of the used methods as it was used in 2 articles [23], [34]. In addition, semi-structured interviews were used in 2 articles [20], [25]. Authors adopted survey method approach to get their results align with research, this was used in one article [8]. Commentary of real time cases had been studied which the experiments were practically proved that in one article "Benefits and potential utility of implementing Tele-Health at HSS" has an editorial commentary. Editorial used in one article [29]. Exploratory descriptive qualitative study using thematic analysis was used in one article [31]. One article used Guidelines for assessment deployment [38]. Another article used descriptive report of how to move from in-clinic to Tele-Health care during the COVID-19 pandemic [9]. A pilot study conducted in order to evaluate feasibility and acceptance of implementing Tele-Health by workers of Community-Based Rehabilitation [33]. Master class paper method was used in one article is [7]. Moreover, questionnaire method was used in one article, which is ("Feasibility of Tele-Health for patients post total joints replacement" by Nelson et al., [17].

Table 6. Methodology used in Articles

Methodology	Count of Methodology
Survey	1
Systematic Review and Meta-Analysis	9
Chapter of book	1
Commentary	1
Descriptive report of how we transitioned from in-clinic to Tele- Health care during the COVID-19 pandemic	1
Editorial	1
Exploratory descriptive qualitative study using thematic analysis	1
Guidelines for assessment deployment	1
Master class paper	1
Narrative literature review	5

Methodology	Count of Methodology
Pilot study	1
Questionnaire	1
RCT	3
Retrospective study	2
Semi-structured interview	1
Semi-structured interviews	2
Grand Total	**32**

4 Discussion

The current systematic review of the 32 studies in relevance to the implementation of Tele-health services in physiotherapy of musculoskeletal conditions revealed positive and promising results in general. However, there were very few studies that were inconclusive regarding the efficacy of this type of services, and some other studies that concentrated on the barriers point of view.

On one hand, Iacono et. al. [11] found that the potential of e-health services in addressing the health needs of rural and remote Australians appeared to be unrealized. In addition, O'Brien et. al. [30] concluded that telephone services added to the usual care were not more efficient compared to face-to-face usual care. Furthermore, a systematic review of 44 studies which were published between 2004 and 2015 found that the conclusive efficiency of the Tele-rehab services following orthopedic surgeries (total hip and knee joints replacements) was not obtained [13].

On the other hand, the vast majority of reviewed studies showed positive outcomes toward implementing the Tele-health physiotherapy services for musculoskeletal conditions. A recent narrative review done by Tack et al [12] concluded that the emerging body of evidence is supporting the use of Tele-Health for both assessment and treatment. These results were further confirmed by a plenty of other studies that addressed the feasibility and positive impact of implementing these services [7], [20], [23], [28], [31]. Dynphy et al., 2017; In addition to these studies, plenty of researchers concluded that the Tele-Health services is considered to be cost saving and cost effective [14], [27], [35]. Fatiye et al., 2020; Moreover, some studies considered this type of services to be effective in term of improving the accessibility to the physiotherapy and other health services especially for remote patients who are unable to access to those services easily [8], [15], [19]. A recent paper concluded that the Tele-Health services could facilitate the care and appointments, could address the patient's concerns, and providing the patients a safe method to contact their physicians or health care providers [9]. Another study identified 13 positive medical outcomes related to providing and implementing of Tele-Health services such as decreasing the psychological stress, improving the autonomy, and enhancing the cognitive ability [10]. In 2019, Cavanagh et. al. [35] found that using technology in treating patients is beneficial in terms of enabling the self-management, portability of treatment, and allowing the anonymous participation. Finally, in the term of acceptance and satisfaction toward the Tele-Health services,

many researchers found that it is acceptable and satisfactory for both patients and clinicians Dynphy et al., 2017, [22], [33]), it could promote better levels of engagement with health care providers [34], and it could provide a solution for remote athlete patients during COVID-19 [26].

Last but not least, it is not out of curiosity to mention that a number of studies have dealt with this topic from a somewhat different view. There is a group of studies highlighted the barriers toward implementing the Tele-Health physiotherapy services, and there is another group that undertook the task of providing medical workers and physiotherapists with the most important recommendations and guidelines that would enable them to improve the service delivery. Regarding the barriers perspective, Kruse et. al. [10] identified 14 barriers after reviewing of 57 studies; the most common barrier was the technical literacy (17%), followed by the lack of desire (13%), and cost (8%). Schäfer et. al. [21] found that e-Health services showed a low adherence level. Finally, an editorial was done recently in Brazil specified many barriers to implement the Tele-Health services in the local Brazilian community; those barriers are: the infrastructure, some legal and social issues (such as legal liability and confidentiality), the economic aspects (costs and reimbursement), outdated equipment, the speed of internet, bandwidth range, computer literacy, and finally the patient age and educational level [29]. And finally, few other studies addressed this topic from the prospective of providing the solutions and methods to develop the service delivery. Firstly, the Tele-Health physiotherapy services should be provided in conjunction with the usual face-to-face health care rather than replacing the existing medical practice [11], [15]. Secondly, these services could be improved by using both direct clinical experience and formal hands on training [8]. Thirdly, it is recommended to follow the published and proven protocols and guidelines in assessing and treating patients [40], [38, 39]. Lastly, it is found that the relations between the clients and clinic operators in addition to the inter-professional teamwork are key contributors of operationalizing the Tele- Health services [41].

5 Conclusion

The literature review on the implementation of Tele-health services in physiotherapy of musculoskeletal conditions showed that the main concepts investigated were clinical and cost effectiveness, clinicians' and patients' acceptability, barriers and enablers and guidelines for improving the provided Tele-Health care. There was evidence of clinical effectiveness of Tele-Health musculoskeletal physiotherapy for back and knees mainly, while it is lacking for upper limbs. Cost effectiveness had been shown also [42,43]. Regarding acceptability, practitioners could be more confident and more accepting with developing more experience and training. Patients' acceptance depends upon accepting the change of their new role when changing from in clinic to remote role. The most common barriers are technical literacy, lack of desire and cost, whereas the most common outcome are decreased psychological stress, increased autonomy and increased cognitive abilities. Written and visual guidelines were set for virtual assessment of different body parts and technical guidelines were set for patients depending on their preferences and abilities. Tele-Health is an effective and feasible, but cannot be used as an

alternative to in clinic services and there should be integration of both types of interventions [44,45]. Further guidelines and regulations, considering structure, legal issues, social issues, assessment and treatment are needed to improve implication of the fast expanding service.

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