

Study Protocol

Which factors affect the implementation of telerehabilitation? Study protocol for a mixed-methods systematic review with a framework synthesis

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Abstract.

BACKGROUND: Telehealth approaches are promising for the delivery of rehabilitation services but may be under-used or under-implemented.

OBJECTIVE: To report a review protocol to identify how much telerehabilitation (telehealth approaches to the delivery of rehabilitation services) have been used and implemented, and which factors have affected such implementation.

METHODS: A mixed-methods systematic review with a framework synthesis. Six databases for the scientific literature will be searched, complemented by snowballing searches and additional references coming from key informants (i.e., rehabilitation researchers from a networking group in health services research). We will include English-language empirical research examining the routine use or implementation of telehealth technologies in physical rehabilitation services or by physical rehabilitation professionals from a range of study designs, excepting case studies, case reports, and qualitative studies with $n < 5$. Two independent reviewers will perform the screenings, quality appraisals (using the Joanna Briggs Institutes' appraisal

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checklists), and the data extractions. The Consolidated Framework for Implementation Research will be used to synthesize the data on the enablers and barriers of the implementation of telerehabilitation approaches. All the authors will be involved at this synthesis, and key informants will provide feedback.

CONCLUSION: The results can inform further implementation endeavours.

Keywords: Telehealth, rehabilitation, uptake

1. Introduction

Telehealth is broadly understood as a form of health or rehabilitation service delivery using information and communication technologies (e.g., computers, tablets, mobile phones or applications) when the provider is at the distance of the served person, i.e., a remote service delivery [1, 2]. Telehealth or telerehabilitation approaches (i.e., the latter referring to telehealth approaches applied to rehabilitation contexts) have been gaining increasing attention as a form of service delivery [3–7]. During the COVID-19 pandemic, under lockdown and physical distancing measures, telerehabilitation approaches either have been recommended or sometimes have been the only form of service delivery available for many different types of rehabilitation care (e.g., exercise, coaching, support) [1, 8–11].

However, telerehabilitation approaches are far from new or merely emerging. An increasing body of literature supports its effectiveness and its comparative effectiveness (e.g., non-inferiority) for many health conditions when compared to in-person forms of rehabilitation service delivery [3, 5, 12–14]. The benefits include the potential to increase the outreach of and access to rehabilitation services, including for underserved rural or remote populations of high-income nations [4, 6, 15–17]. Similarly, telerehabilitation solutions have been identified as one means to help address the large unmet rehabilitation needs in lower income countries [7, 18–21], where human resources are scarce and often further apart in a few centralized locations [22]. Yet, despite of the potential benefits and importance, telerehabilitation approaches seem to be under-used and/or under-implemented [23, 24].

Hence, implementation of telerehabilitation approaches has been increasingly studied, notably toward understanding the implementation facilitators or barriers. For example, in the Netherlands a focus group study was conducted as a means to identify why the uptake of eRehabilitation programs (i.e., rehabilitation based on communication or information technologies) have been difficult [24]. Similarly,

a study in Denmark sought frontline practitioners' perspectives on the enablers or barriers to the implementation of telerehabilitation approaches for the Chronic Obstructive Pulmonary Disease [25]. In the United States, a mixed-methods pilot research project explored the uptake and implementation of a tele-monitored home-based exercise program for people with Parkinson's disease [26]. Also in the United States, the barriers and facilitators to the implementation of telerehabilitation in the delivery of care for rural Veterans have been studied from the perspectives of program managers and medical directors [16]. This context notwithstanding, there is no systematic synthesis on the actual use of telerehabilitation or of the factors affecting the implementation of telerehabilitation approaches.

Within the whole context above, the study questions are:

1. How large and of what type is the empirical literature on the implementation of telehealth technologies by physical rehabilitation providers and/or services?
2. How prevalent is the use of telehealth technologies by physical rehabilitation providers and/or services in routine practice?
3. What methodologies have been used to facilitate implementation or sustained use of telehealth technologies among rehabilitation providers and/or services, and how effective have they been?
4. What factors influence the integration of telehealth technologies by physical rehabilitation providers and/or services into regular practice, and which factors influence the effectiveness of any related implementation, sustainment, spread, or scale-up endeavours?

2. Methods

Design: Mixed-methods systematic review, combining quantitative and qualitative information, with a framework synthesis. The framework synthesis

applies to the analysis the factors that influence the use or implementation of telehealth technologies, or the effectiveness of related implementation endeavours.

Mixed-methods systematic reviews with a framework synthesis are increasingly common in health care research, including for studies in subject matters such as the outcomes of information science and technology [27] and for factors affecting implementation endeavours [28, 29]. Systematic review approaches with a framework synthesis also have been used in disability and rehabilitation research [30–32], and in implementation science addressing disability and rehabilitation topics [30, 31, 33]. Mixed-methods systematic reviews allow for the integration of both qualitative and quantitative research data as a means to provide comprehensive answers to complex, multidetermined research questions [34–37]. We do not use a traditional *aggregative* systematic review templates, but rather a *configurative* systematic review, both combining and synthesizing diverse types of knowledge into an overarching framework [35, 38–41]. Instead, with the objective of combining quantitative and qualitative information, we will use a ‘data-based convergent synthesis design’, with all types of data synthesized under the same method [37, 39]; herein, quantitative or mixed-methods data will be synthesized qualitatively within thematic categories [39, 40, 42], while those categories will be derived from an a priori conceptual framework.

Within such rationale, we will apply the “framework synthesis” approach to the data synthesis [40, 43], framework synthesis approaches are deductive forms of qualitative data synthesis (i.e., use a relevant a priori framework against which the reviewed information is coded and synthesized against), and has gained popularity in health services research, essentially due the theoretical soundness, feasibility, and the relative simplicity of the approach and its interpretation [40, 41, 44, 45]. More specifically in the knowledge translation and implementation science fields, there is a proliferation of frameworks, either emergent or established [46, 47], one could select to use as a guide for data synthesis. For this study, we have selected the Consolidated Framework for Implementation Research (CFIR) based on its widespread in the field of Implementation Science [48, 49] and its use for similar studies [31].

This review protocol was prepared using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA-P) guidelines and the PRISMA-P checklist. The protocol was submit-

ted for registration on the International Prospective Register of Systematic Reviews (PROSPERO) and assigned registration number CRD42021253927.

2.1. Data sources and search strategy

Six databases for the scientific, peer-reviewed literature (MEDLINE/PubMed, EMBASE, Scopus, CINAHL, PEDro, OTseeker) will be searched. No date restrictions apply, and an update of the search will be performed after the data extraction has been completed.

The Appendix details the search strategy for PubMed/MEDLINE. The strategy combines search terms related to 1) telehealth, 2) implementation, 3) publication types or study designs, and 4) rehabilitation. The latter was based on a previously published search filter for locating rehabilitation content in PubMed, with a focus on Medical Subject Headings (MeSH) [50]. Indeed, the strategy uses both indexed MeSH terms and key free-text keywords as alternative to one another for a more comprehensive search. The search strategy in PubMed/MEDLINE was reviewed using the Peer Review for Electronic Search Strategies (PRESS) template [51], and will be applied to the searches in other databases. Secondary searches using snowballing strategies (e.g., consulting references lists of included articles, citation-tracking, author-tracking, search of the review authors’ personal libraries) will also be used to identify any additional articles. Furthermore, we will also include, in our screening process, the list of papers from any other recent reviews (e.g., recently published review of telerehabilitation implementation that described themes and theories in studies related to the users’ adoption or satisfaction with telerehabilitation technologies [7]). As we will only include research-based, empirical papers, we will not search for the grey literature.

Members of Dissemination & Implementation Research Task Force of the Health Services Research Networking Group of the American Congress of Rehabilitation Medicine will serve as “key informants”. They will be provided a preliminary list of included references and asked to supply any additional references, pertaining to the eligibility criteria, that we may have missed or could not identify (e.g., with no direct link to the issues reviewed in the titles or abstracts). Any of these papers will undergo full-text review against the eligibility criteria.

2.2. Study eligibility criteria

We will include empirical research worldwide addressing the clinical use or implementation of telehealth in physical rehabilitation services or by physical rehabilitation professionals, from a range of study designs. These include the full range of quantitative, qualitative, and mixed-methods original research, exclusive of case studies, case reports, and qualitative studies with $n < 5$. We will only include papers with study results, not study protocols per se. Systematic reviews can be included, no other forms of review. We limit the review to papers reported in English as we aim to focus on the literature reported to an international audience. We have no a priori restrictions on publication dates for the inclusion of papers, although a temporal cut-off can be applied later in the synthesis stage, with a given rationale, when all the *corpus* of the review is known. These iterative decisions are common in configurative type of reviews, when the topic is complex and uncharted [52, 53].

2.2.1. Population

Our population of interest includes both the care providers and the recipients of that care. The providers are physical rehabilitation professionals and their teams, which include but are not limited to physical therapists, occupational therapists, rehabilitation-specialist physicians, rehabilitation-specialist nurses, chiropractors, speech and language pathologists, orthotic & prosthetic professionals, osteopathic medicine practitioners, and community-based rehabilitation workers. These professionals typically work in rehabilitative settings, but they may also have preventive roles (e.g., primary, secondary, or tertiary prevention). Hence, they may work at multiple levels of clinical care ranging from primary health care, to acute, post-acute and rehabilitative, palliative or long-term care, or even outside of the rehabilitation health care sector (e.g., school-based occupational therapists), as long as the care is delivered by a rehabilitation professional and is directed toward people with physical impairments or disabilities.

For the context of this study, the recipients of care are people with physical impairments or disabilities, i.e., those experiencing, at any point across the lifespan, long- or short-term impairments affecting mobility functions, among others, and subsequently the performance of daily activities or social participation. The recipients of care also may include persons at high risk of acquiring physical impairment or disability (e.g., high risk of falls) [54–56]. The working

definition does not include impairments arising from oral, intellectual, cognitive (e.g., dementia), sensorial, or mental health conditions per se; however, for example, the rehabilitation of cognitive, communicative, and neuro-behavioural impairments as a result of or associated to physical impairments (e.g., arising from stroke, traumatic brain injuries) are included in the scope of rehabilitation covered [50]. Care recipients can also include family members or informal caregivers of people undergoing telerehabilitation, provided they are also subjects of the care delivery by telerehabilitation means or are active assistants in the delivery of telerehabilitation care to the patient.

Apart from physical rehabilitation professionals, we also include physical rehabilitation services of settings as a whole structure, which include for example inpatient rehabilitation facilities or units, skilled nursing or long-term care facilities, outpatient services, and home- or community-based services - all with a focus on physical rehabilitation.

2.2.2. Intervention

With a focus on physical rehabilitation professionals or services, the intervention includes the use of any telehealth technology. Telehealth is a general term as a service delivery model that uses any information and communication technology (e.g., cell or smartphones, tablets, computers, mobile applications) to deliver health- and rehabilitation-related services when the client is at a distance from the practitioner, i.e., remotely delivered [1, 2]. This includes synchronous delivery of health services via remote telecommunications, interactive consultative and diagnostic / evaluation services offsite, as well as asynchronous forms of service delivery. Use of telematic mechanism not directly implying the delivery of care (e.g., online patient satisfaction surveys, use of mobile applications for billing purposes or scheduling appointments) will not be considered as telehealth interventions. Virtual reality, robotic or other electronic-based approaches to rehabilitation are only considered if delivered remotely and with direct involvement of a physical rehabilitation professional guiding its use.

We will also include implementation interventions for the use of telehealth technologies in the field of physical rehabilitation or by physical rehabilitation professionals. Implementation interventions refers to any systematic activities aimed to achieve the adoption and integration of evidence-based practices, policies, or innovative technologies - here telehealth technologies - into routine health care. In

this review, this will be inclusive of activities for the use, diffusion, adoption, and spread of the use of telerehabilitation approaches across geographies, settings, organizations, sectors or units of an organization. It will be also inclusive of the activities envisioning the sustainability of the use of a telehealth technology. Finally, the construct will be inclusive of the activities toward building an infrastructure or broader capacity for implementing or scaling up the use of a telehealth technology for physical rehabilitation. Related to our second study question (i.e., how prevalent is the use of telehealth technologies by physical rehabilitation providers and/or services into routine practice), we will include studies on the use of telerehabilitation approaches in routine care (i.e., non-experimental context), or pragmatic studies on the effectiveness or comparative effectiveness of telerehabilitation approaches, which by definition would reflect the conditions of routine care. Studies examining feasibility or efficacy of a new approach / technology for provision of telehealth by rehabilitation providers and/or for rehabilitation services are considered experimental conditions, i.e., not routine care; therefore, these studies are excluded.

2.2.3. Comparators

For the use of telehealth interventions, the explicit or implicit comparator is the care delivered in person in a physical rehabilitation setting or by physical rehabilitation professionals. Whenever a study compares different approaches to an implementation intervention or increasing the use of telehealth technologies for physical rehabilitation, this will be an analytical point of interest. However, there is no requirement of an explicit use of a comparator for any study to be included.

2.2.4. Outcomes

The outcomes of this review reflect the study questions, and they are not necessarily hierarchical (i.e., primary or secondary), but different in scope. With a focus on physical rehabilitation services or professionals, here the outcomes refer to the use or rate of use and implementation of telehealth technologies in routine practice or any indicators of the effectiveness of implementation endeavours in terms of providers' uptake or use of telehealth technologies.

Apart from the outcomes (i.e., endpoints), the review is focused on the factors (i.e., variables) influencing the use or implementation of telehealth technologies. These variables can be determinant, mediating, or moderating variables acting as barriers

or facilitators to the use or implementation outcomes. As possible variables, we will consider those articulated by the implementation model that will guide the data extraction and synthesis of the results.

2.3. Data management

Records arising from scientific databases and the preprint server will be exported to a commercial references manager software (EndNote, Clarivate Analytics), where duplicates will be removed. After that, records will be transferred to the COVIDENCE software for the screening and the data extraction process.

2.4. Screenings

Two independent reviewers will conduct the screenings against the eligibility criteria, after a pilot screening in at least 5% of the records at every screening level, with any subsequent readjustment or further training as needed. For the Level 1 screening (titles and abstract screening), HH, TJ, and SB will perform the independent reviewer's role, notably HH and TJ will perform the role of the reviewer number 1 and SB the reviewer number 2. The reviewers will try to reach consensus on the disagreements, while TJ or HH (the one not performing the Level 1 screening) would make the final decision about whether or not to retaining if disagreements cannot be resolved by the two Level 1 reviewers. For the Level 2 screening (final eligibility decision based on full-text review), HH will perform the first independent's reviewer role, and SK and SB will split the second reviewer role. If disagreements are not resolved by consensus, TJ will make final eligibility decisions.

2.5. Quality assessment

Each publication finally selected through the Level 2 screening will be appraised for methodological quality. We will use the tools appropriate for the study design, as assigned by HH (consulting other research authors as needed), from the entire portfolio of the Joanne Briggs Institute's critical appraisal tools [57].

Specifically, according to the study designs possible included, the following checklists:

- Checklist for Analytical Cross-Sectional Studies;
- Checklist for Case Control Studies;
- Checklist for Cohort Studies;

- Checklist for Economic Evaluations;
- Checklist for Qualitative Research;
- Checklist for Quasi-Experimental Studies (non-randomized experimental studies);
- Checklist for Randomized Controlled Trials.

Two independent reviewers, i.e., those that will have data extraction tasks under the same schema, will apply and fill in the respective checklists, appropriate for the study design. Within that process, at the end of the critical appraisal, each reviewer will preliminarily recommend the “inclusion”, “exclusion” or the option to “seek further information”, according to the methods quality. Whenever required, we (through SK) will attempt to contact study authors for unreported data or clarification of study methods using no more than two e-mails. If data remains unavailable, we will analyse the available data and report the potential impact of missing data in the discussion section. After their independent ratings, reviewers will discuss any divergent ratings toward consensus on the final eligibility based on the assessment of methods quality, involving a third reviewer (TJ) when necessary.

As typical in configurative, exploratory, or mixed-methods review, only those papers ‘fatally flawed’, i.e., with substantial methodological shortcomings will be excluded during this procedure [42, 52]. If included, evidence coming from a paper with relevant methodological shortcomings will be signalled as such in the paper’s final report, with the narrative description of the shortcomings. No formal grading will be applied within studies of the same methodological type, and no formal hierarchy will be applied across study types or coming from different epistemologies.

2.6. Data extraction

Using a data extraction form and structure constructed by the research team, formal data elements (e.g., publication and study type, service contexts addressed, professionals involved, geographies addressed) will be extracted and categorized by one of the research authors (SB), with a random sample of 10% verified by another (SK). This will follow a pre-determined coding structure elaborated by the research team. Formal citation elements (publication year, journal, keywords, language) will be directly exported from EndNote. The conjunct of these elements will be instrumental to answer to the first study question.

Two independent reviewers (SB and SK) will extract any quantitative data on the use or on the implementation of telehealth technologies, in addition to synthesizing the methodologies used to obtain that data. Additionally, the same reviewers will extract text quotations on any methodologies that were used to facilitate the implementation, adoption, and sustainment of telehealth technologies among rehabilitation providers and/or services. These data will be instrumental to answer to the second and third study questions.

Finally, for the variables that influence the use of telehealth technologies or the effectiveness of related implementation endeavours, the data extraction will be performed independently by two reviewers (SB and SK), and depicted in a table that will reflect the major constructs of an implementation framework, selected a priori (see data synthesis).

2.7. Data synthesis

Descriptive statistics will be used to respond to the first study question: i.e., synthesise how large and of which type is the empirical literature on the use or implementation of telehealth technologies. A narrative description will be used to respond to the second and third study questions, even when quantitative data is involved. It is unlikely that data can be aggregated given the probably heterogenic populations and methods. This is aligned with a convergent synthesis approach selected for this mixed-methods systematic review [34, 39].

Finally, as noted at the beginning of the methods section, a “framework synthesis” approach will be applied to address the fourth study question, on the factors influencing the use or implementation of telehealth approaches.

Among several implementation models available [46, 47, 58], many of which with limited use [47], we selected the Consolidated Framework for Implementation Research (CFIR) [48, 49, 59]. This meta-theoretical framework, which provides a repository of standardized implementation-related constructs and is focused on its determinants, has been applied extensively in the health care field, inclusively for synthesising data on rehabilitation topics [31, 60–62]. The CFIR comprises 39 constructs organized across five major domains, all of which interact to influence implementation and implementation effectiveness [63].

Other implementation frameworks could be relevant, such as the Theoretical Domains Framework

(TDF) [48, 64], the Normalization Process Model (NPM) [65], the Promoting Action on Research Implementation in Health Services (PARIHS) framework [66], the nonadoption, abandonment, scale-up, spread, and sustainability (NASS) framework [67, 68] and Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) [69], which has a greater focus on the evaluation of implementation activities. Sometimes, combinations of frameworks have been used to study implementation topics, such as the combined use of the CFIR with the TDF [48]. The CFIR and the TDF are both well-operationalized, multi-level implementation determinant frameworks derived from theory. While both address collective (e.g., organizational) and individual level determinants of implementation, the TDF has a greater focus at the individual level as well as on psychological, behavioural change theory. In turn, the CFIR addressed both individual and collective factors, but with a greater focus on the latter. The combined use of the CFIR and TDF often threaten parsimony [48], and for the context of this study we emphasize an interest in collective (e.g., organizational) factors first.

Alongside with the data extraction, two independent reviewers (SK and SB) will categorize the extracted information on the variables (e.g., determinants, moderators, mediators) reported as affecting or likely affecting the use or implementation of telehealth technologies in rehabilitation contexts. The five major domains of the CFIR will be used for that categorization. Then, another reviewer, with experience in both health services and telerehabilitation research (HH), will merge and eventually refine the categorization, using more granular classification levels of the CFIR as may be useful, consulting with any of the independent data extractors and other research authors (e.g., JPB, TJ, KJ) as needed. The whole research team will approve any temporal cut-off for the final inclusion of papers and the final synthesis, which will have a configurative rather than aggregative nature. In this way, within a summary table, we will provide a brief narrative reporting of the methods leading to the results for each component or sub-component under analysis. As such, there will be no aggregative measurement, formal assessment of heterogeneity or publication bias, or the selection unit of analysis (e.g., individual participants vs. aggregated data from each study) for the any of the data. Also, as noted before, there will be no formal grading or other formal assessment of the confidence in the evidence reported.

Depending on the which type of data arises from the reviewed studies, subgroup analyses can be performed based on health conditions, sectors, service levels, and geographies as well as technology type (e.g., smartphones, mobile applications). Similarly, depending on the type of studies included for addressing each study question, sensitivity analysis can be performed regarding for example the inclusion of only experimental or only controlled experimental designs, as a means to detect any change in the pattern of the configurative results.

A first complete draft with the study results will be developed by the primary reviewers (HH, SK, SB) but iteratively edited by the other research authors (TJ, JPB, KJ). This whole process, developed against the data extraction tables, may require reconfigurations in the framework synthesis (reallocation of content per categories), revisiting the raw material for new or additional information, and the determination of categories for which data could not be obtained. A full manuscript draft, with discussion and implications (e.g., on future research to close any identified gaps) will be shared, by the last, with our key informants (i.e., from the Dissemination & Implementation Research Task Force of the Health Services Research Networking Group of the American Congress of Rehabilitation Medicine) for any feedback or improvement suggestions.

3. Dissemination plan

The final review results will be submitted to publication into a peer-review journal in the rehabilitation, telehealth, or implementation science fields. Further dissemination will occur through the Dissemination & Implementation Research Task Force and the Broader Health Services Research Networking Group of the American Congress of Rehabilitation Medicine, including through their own communication channels. Other dissemination strategies may an oral presentation at the American Congress of Rehabilitation Medicine's major conference.

4. Conclusion

This study protocol for a mixed-methods systematic review aims to map and synthesis on the use or factors affecting the implementation of telerehabilitation approaches, in order to inform further

implementation endeavours or research. The main limitation of this review is that it focuses exclusively on English-language empirical literature.

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References

- [1] American Occupational Therapy Association. Telehealth in Occupational Therapy. The American journal of occupational therapy : official publication of the American Occupational Therapy Association. 2018;72(Supplement.2):7212410059p1-p18.
- [2] Tenforde AS, Hefner JE, Kodish-Wachs JE, Iaccarino MA, Paganoni S. Telehealth in Physical Medicine and Rehabilitation: A Narrative Review. *PM & R : the journal of injury, function, and rehabilitation*. 2017;9(5s):S51-s8.
- [3] Sarfo FS, Ulasavets U, Opare-Sem OK, Ovbiagele B. Tele-Rehabilitation after Stroke: An Updated Systematic Review of the Literature. *Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association*. 2018;27(9):2306-18.
- [4] Selzler AM, Wald J, Sedeno M, Jourdain T, Janaudis-Ferreira T, Goldstein R, et al. Telehealth pulmonary rehabilitation: A review of the literature and an example of a nationwide initiative to improve the accessibility of pulmonary rehabilitation. *Chron Respir Dis*. 2018;15(1):41-7.
- [5] Laver KE, Adey-Wakeling Z, Crotty M, Lannin NA, George S, Sherrington C. Telerehabilitation services for stroke. The Cochrane database of systematic reviews. 2020;1:Cd010255.
- [6] Abbott-Gaffney C, Jacobs K. Telehealth in school-based practice: Perceived viability to bridge global OT practitioner shortages prior to COVID-19 global health emergency. *Work (Reading, Mass)*. 2020;67(1):29-35.
- [7] Niknejad N, Ismail W, Bahari M, Nazari B. Understanding Telerehabilitation Technology to Evaluate Stakeholders' Adoption of Telerehabilitation Services: A Systematic Literature Review and Directions for Further Research. *Archives of Physical Medicine and Rehabilitation*. 2021;102(7):1390-1403.
- [8] Mukaino M, Tatemoto T, Kumazawa N, Tanabe S, Kato M, Saitoh E, et al. Staying active in isolation: Telerehabilitation for individuals with the SARS-CoV-2 infection. *American Journal of Physical Medicine & Rehabilitation*. 2020;99(6):478-479. doi: 10.1097/PHM.0000000000001441.
- [9] Armitage R, Nellums LB. COVID-19 and the consequences of isolating the elderly. *The Lancet Public Health*. 2020;5(5):e256.
- [10] American Occupational Therapy Association. A Message From AOTA on COVID-19. 2020.
- [11] Jesus TS, Landry MD, Jacobs K. A 'new normal' following COVID-19 and the economic crisis: Using systems thinking to identify challenges and opportunities in disability, telework, and rehabilitation. *Work (Reading, Mass)*. 2020;67(1):37-46.
- [12] Shukla H, Nair SR, Thakker D. Role of telerehabilitation in patients following total knee arthroplasty: Evidence from a systematic literature review and meta-analysis. *Journal of Telemedicine and Telecare*. 2017;23(2):339-46.
- [13] Rawstorn JC, Gant N, Direito A, Beckmann C, Maddison R. Telehealth exercise-based cardiac rehabilitation: a systematic review and meta-analysis. *Heart (British Cardiac Society)*. 2016;102(15):1183-92.
- [14] Speyer R, Denman D, Wilkes-Gillan S, Chen YW, Bogaardt H, Kim JH, et al. Effects of telehealth by allied health professionals and nurses in rural and remote areas: A systematic review and meta-analysis. *Journal of Rehabilitation Medicine*. 2018;50(3):225-35.
- [15] Cary MP, Jr., Spencer M, Carroll A, Hand DH, Amis K, Karan E, et al. Benefits and Challenges of Delivering Telerehabilitation Services to Rural Veterans. *Home Healthcare Now*. 2016;34(8):440-6.
- [16] Hale-Gallardo JL, Kreider CM, Jia H, Castaneda G, Freytes IM, Cowper Ripley DC, et al. Telerehabilitation for Rural Veterans: A Qualitative Assessment of Barriers and Facilitators to Implementation. *Journal of Multidisciplinary Healthcare*. 2020;13:559-70.
- [17] Rimmer JH, Thirumalai M, Young HJ, Pekmezci D, Tracy T, Riser E, et al. Rationale and design of the tele-exercise and multiple sclerosis (TEAMS) study: A comparative effectiveness trial between a clinic- and home-based telerehabilitation intervention for adults with multiple sclerosis (MS) living in the deep south. *Contemporary Clinical Trials*. 2018;71:186-93.
- [18] Sarfo FS, Adamu S, Awuah D, Sarfo-Kantanka O, Ovbiagele B. Potential role of tele-rehabilitation to address barriers to implementation of physical therapy among West African stroke survivors: A cross-sectional survey. *Journal of the Neurological Sciences*. 2017;381:203-8.
- [19] Teriö M, Eriksson G, Kamwesiga JT, Guidetti S. What's in it for me? A process evaluation of the implementation of a mobile phone-supported intervention after stroke in Uganda. *BMC Public Health*. 2019;19(1):562.
- [20] Yan LL, Li C, Chen J, Miranda JJ, Luo R, Bettger J, et al. Prevention, management, and rehabilitation of stroke in low- and middle-income countries. *eNeurologicalSci*. 2016;2:21-30.
- [21] Sureshkumar K, Murthy G, Natarajan S, Naveen C, Goenka S, Kuper H. Evaluation of the feasibility and acceptability of the 'Care for Stroke' intervention in India, a

- smartphone-enabled, carer-supported, educational intervention for management of disability following stroke. *BMJ Open*. 2016;6(2):e009243.
- [22] Jesus TS, Landry MD, Dussault G, Fronteira I. Human resources for health (and rehabilitation): Six Rehab-Workforce Challenges for the century. *Human Resources for Health*. 2017;15(1):8.
- [23] Edgar MC, Monsees S, Rhebergen J, Waring J, Van der Star T, Eng JJ, et al. Telerehabilitation in stroke recovery: a survey on access and willingness to use low-cost consumer technologies. *Telemedicine Journal and e-health : The Official Journal of the American Telemedicine Association*. 2017;23(5):421-9.
- [24] Brouns B, Meesters JLL, Wentink MM, de Kloet AJ, Arwert HJ, Vliet Vlieland TPM, et al. Why the uptake of eRehabilitation programs in stroke care is so difficult-a focus group study in the Netherlands. *Implementation Science : IS*. 2018;13(1):133.
- [25] Damhus CS, Emme C, Hansen H. Barriers and enablers of COPD telerehabilitation – a frontline staff perspective. *International Journal of Chronic Obstructive Pulmonary Disease*. 2018;13:2473-82.
- [26] Lai B, Bond K, Kim Y, Barstow B, Jovanov E, Bickel CS. Exploring the uptake and implementation of tele-monitored home-exercise programmes in adults with Parkinson's disease: A mixed-methods pilot study. *Journal of Telemedicine and Telecare*. 2020;26(1-2):53-63.
- [27] Pluye P, El Sherif R, Granikov V, Hong QN, Vedel I, Galvao MCB, et al. Health outcomes of online consumer health information: A systematic mixed studies review with framework synthesis. *Journal of the Association for Information Science and Technology*. 2019;70(7):643-59.
- [28] Muthee TB, Kimathi D, Richards GC, Etyang A, Nunan D, Williams V, et al. Factors influencing the implementation of cardiovascular risk scoring in primary care: a mixed-method systematic review. *Implementation Science : IS*. 2020;15(1):57.
- [29] Onozato T, Francisca Dos Santos Cruz C, Milhome da Costa Farre AG, Silvestre CC, de Oliveira Santos Silva R, Araujo Dos Santos Júnior G, et al. Factors influencing the implementation of clinical pharmacy services for hospitalized patients: A mixed-methods systematic review. *Research in Social & Administrative Pharmacy : RSAP*. 2020;16(4):437-49.
- [30] Tilley E, Strnadová I, Danker J, Walmsley J, Loblinkz J. The impact of self-advocacy organizations on the subjective well-being of people with intellectual disabilities: A systematic review of the literature. *Journal of Applied Research in Intellectual Disabilities : JARID*. 2020;33(6):1151-1165.
- [31] Gaskins NJ, Bray E, Hill JE, Doherty PJ, Harrison A, Connell LA. Factors influencing implementation of aerobic exercise after stroke: a systematic review. *Disabil Rehabil*. 2019;1-15.
- [32] Hurley M, Dickson K, Hallett R, Grant R, Hauari H, Walsh N, et al. Exercise interventions and patient beliefs for people with hip, knee or hip and knee osteoarthritis: a mixed methods review. *The Cochrane Database of Systematic Reviews*. 2018;4(4):Cd010842.
- [33] Brown A, O'Connor S. Mobile health applications for people with dementia: a systematic review and synthesis of qualitative studies. *Informatics for Health & Social Care*. 2020;1-17.
- [34] Gough D. Qualitative and mixed methods in systematic reviews. *Systematic Reviews*. 2015;4(1):181.
- [35] Anderson LM, Oliver SR, Michie S, Rehfuess E, Noyes J, Shemilt I. Investigating complexity in systematic reviews of interventions by using a spectrum of methods. *Journal of Clinical Epidemiology*. 2013;66(11):1223-9.
- [36] Petticrew M, Rehfuess E, Noyes J, Higgins JP, Mayhew A, Pantoja T, et al. Synthesizing evidence on complex interventions: how meta-analytical, qualitative, and mixed-method approaches can contribute. *Journal of Clinical Epidemiology*. 2013;66(11):1230-43.
- [37] Stern C, Lizarondo L, Carrier J, Godfrey C, Rieger K, Salmond S, et al. Methodological guidance for the conduct of mixed methods systematic reviews. *JBHI Evidence Synthesis*. 2020;18(10):2108-18.
- [38] Dixon-Woods M, Agarwal S, Jones D, Young B, Sutton A. Synthesising qualitative and quantitative evidence: a review of possible methods. *Journal of Health Services Research & Policy*. 2005;10(1):45-53.
- [39] Hong QN, Pluye P, Bujold M, Wassef M. Convergent and sequential synthesis designs: implications for conducting and reporting systematic reviews of qualitative and quantitative evidence. *Systematic Reviews*. 2017;6(1):61.
- [40] Gilson L. Qualitative research synthesis for health policy analysis: what does it entail and what does it offer? *Health Policy and Planning*. 2014;29(Suppl 3):iii1-5.
- [41] Carroll C, Booth A, Leaviss J, Rick J. "Best fit" framework synthesis: refining the method. *BMC Medical Research Methodology*. 2013;13:37.
- [42] Mays N, Pope C, Popay J. Systematically reviewing qualitative and quantitative evidence to inform management and policy-making in the health field. *Journal of Health Services Research & Policy*. 2005;10(Suppl 1):6-20.
- [43] Brunton G, Oliver S, Thomas J. Innovations in framework synthesis as a systematic review method. *Research Synthesis Methods*. 2020;11(3):316-30.
- [44] Walt G, Gilson L. Can frameworks inform knowledge about health policy processes? Reviewing health policy papers on agenda setting and testing them against a specific priority-setting framework. *Health Policy and Planning*. 2014;29(Suppl 3):iii6-22.
- [45] Baker P, Hawkes C, Wingrove K, Demaio AR, Parkhurst J, Thow AM, et al. What drives political commitment for nutrition? A review and framework synthesis to inform the United Nations Decade of Action on Nutrition. *BMJ Global Health*. 2018;3(1):e000485.
- [46] Esmail R, Hanson HM, Holroyd-Leduc J, Brown S, Striffler L, Straus SE, et al. A scoping review of full-spectrum knowledge translation theories, models, and frameworks. *Implementation Science : IS*. 2020;15(1):11.
- [47] Striffler L, Cardoso R, McGowan J, Cogo E, Nincic V, Khan PA, et al. Scoping review identifies significant number of knowledge translation theories, models, and frameworks with limited use. *Journal of Clinical Epidemiology*. 2018;100:92-102.
- [48] Birken SA, Powell BJ, Presseau J, Kirk MA, Lorencatto F, Gould NJ, et al. Combined use of the Consolidated Framework for Implementation Research (CFIR) and the Theoretical Domains Framework (TDF): a systematic review. *Implementation Science : IS*. 2017;12(1):2.
- [49] Kirk MA, Kelley C, Yankey N, Birken SA, Abadie B, Damschroder L. A systematic review of the use of the Consolidated Framework for Implementation Research. *Implementation Science : IS*. 2016;11:72.
- [50] Jesus TS, Hoening H, Landry MD. Development of the Rehabilitation Health Policy, Systems, and Services Research

- field: Quantitative Analyses of Publications over Time (1990-2017) and across Country Type. *International Journal of Environmental Research and Public Health*. 2020;17(3).
- [51] McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. *Journal of Clinical Epidemiology*. 2016;75:40-6.
- [52] Pawson R, Greenhalgh T, Harvey G, Walshe K. Realist review—a new method of systematic review designed for complex policy interventions. *Journal of Health Services Research & Policy*. 2005;10(Suppl 1):21-34.
- [53] Jesus TS, Bright F, Kayes N, Cott CA. Person-centred rehabilitation: what exactly does it mean? Protocol for a scoping review with thematic analysis towards framing the concept and practice of person-centred rehabilitation. *BMJ Open*. 2016;6(7):e011959.
- [54] Meyer T, Gutenbrunner C, Bickenbach J, Cieza A, Melvin J, Stucki G. Towards a conceptual description of rehabilitation as a health strategy. *Journal of Rehabilitation Medicine*. 2011;43(9):765-9.
- [55] Jesus TS, Bright FA, Pinho CS, Papadimitriou C, Kayes NM, Cott CA. Scoping review of the person-centered literature in adult physical rehabilitation. *Disability and Rehabilitation*. 2019:1-11.
- [56] NIH Medical Rehabilitation Coordinating Committee. National Institutes of Health Research Plan on Rehabilitation. *Archives of Physical Medicine and Rehabilitation*. 2017;98(4):e1-e4.
- [57] Joanna Briggs Institute. Critical Appraisal Tools [
- [58] Reed JE, Green S, Howe C. Translating evidence in complex systems: a comparative review of implementation and improvement frameworks. *International Journal for Quality in Health Care : Journal of the International Society for Quality in Health Care*. 2019;31(3):173-82.
- [59] Means AR, Kemp CG, Gwayi-Chore MC, Gimbel S, Soi C, Sherr K, et al. Evaluating and optimizing the consolidated framework for implementation research (CFIR) for use in low- and middle-income countries: a systematic review. *Implementation Science : IS*. 2020;15(1):17.
- [60] Pellerin MA, Lamontagne ME, Viau-Guay A, Poulin V. Systematic review of determinants influencing knowledge implementation in occupational therapy. *Australian Occupational Therapy Journal*. 2019;66(6):670-81.
- [61] Briggs MS, Rethman KK, Crookes J, Cheek F, Pottkotter K, McGrath S, et al. Implementing Patient-Reported Outcome Measures in Outpatient Rehabilitation Settings: A Systematic Review of Facilitators and Barriers Using the Consolidated Framework for Implementation Research. *Archives of Physical Medicine and Rehabilitation*. 2020;101(10):1796-1812.
- [62] Schwarz M, Ward EC, Cornwell P, Coccetti A. Dysphagia screening using an allied health assistant delegation model: service considerations for implementation. *Disability and Rehabilitation*. 2020:1-9.
- [63] Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science : IS*. 2009;4:50.
- [64] Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Quality & Safety in Health Care*. 2005;14(1):26-33.
- [65] May C, Finch T, Mair F, Ballini L, Dowrick C, Eccles M, et al. Understanding the implementation of complex interventions in health care: the normalization process model. *BMC Health Services Research*. 2007;7:148.
- [66] Harvey G, Kitson A. PARIHS revisited: from heuristic to integrated framework for the successful implementation of knowledge into practice. *Implementation Science : IS*. 2016;11:33.
- [67] Greenhalgh T, Wherton J, Papoutsi C, Lynch J, Hughes G, A'Court C, et al. Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies. *Journal of Medical Internet Research*. 2017;19(11):e367.
- [68] Greenhalgh T, Abimbola S. The NASSS Framework – A synthesis of multiple theories of technology implementation. *Studies in Health Technology and Informatics*. 2019;263:193-204.
- [69] Glasgow RE, Harden SM, Gaglio B, Rabin B, Smith ML, Porter GC, et al. RE-AIM planning and evaluation framework: Adapting to new science and practice with a 20-year review. *Frontiers in Public Health*. 2019;7:64.

Appendix: Search strategy for PubMed/MEDLINE

(“Telemedicine”[Mesh] OR “Telerehabilitation”[Mesh] OR “Mobile Applications”[Mesh] OR “Biomedical Technology”[Mesh] OR “Smartphone”[Mesh] OR “Cell Phone”[Mesh] OR “telerehab*”[tw] OR “tele-rehab*”[tw] OR “telehealth*”[tw] OR “tele-health*”[tw]) AND (“Diffusion of Innovation”[Mesh] OR “Technology Transfer”[Mesh] OR “Implementation Science”[Mesh] OR “Health Plan Implementation”[Mesh] OR “implement*”[tw] OR “uptake”[tw]) AND (“Clinical Trial” [Publication Type] OR “Observational Study” [Publication Type] OR “Evaluation Study” [Publication Type] OR “Comparative Study” [Publication Type] OR “Multicenter Study” [Publication Type] OR “Feasibility Studies”[Mesh] OR “Controlled Before-After Studies”[Mesh] OR “Pilot Projects”[Mesh] OR “Cohort Studies”[Mesh] OR “Case-Control Studies”[Mesh] OR “Historically Controlled Study”[Mesh] OR “Interrupted Time Series Analysis”[Mesh] OR “Cross-Sectional Studies”[Mesh] OR “Focus Groups”[Mesh] OR “Qualitative Research”[Mesh] OR “Grounded Theory”[Mesh] OR “process evaluation”[tw] OR “formative evaluation”[tw] OR “summative evaluation”[tw]) AND (“rehabilitation”[Subheading] OR “Rehabilitation”[MeSH] OR “Recovery of Function”[Major] OR “Physical Therapy Specialty”[Major] OR “Physical Therapy Modalities”[Major] OR “Phys-

ical Therapy Department, Hospital”[Major] OR “Hospitals, Rehabilitation”[Major] OR “Physical Therapist Assistants”[Major] OR “Physical Therapists”[Major] OR “Physical and Rehabilitation Medicine”[Major] OR “Rehabilitation Nursing”[Major] OR “Occupational Therapists”[Major] OR “Occupational Therapy Department, Hospital”[Major] OR “Occupational Therapy”[Major] OR “Speech-Language Pathology”[Major] OR “Activities of Daily Living”[Major] OR “Self-Help Devices”[Major] OR “Exoskeleton Device”[Major] OR “Artificial Limbs”[Major] OR “Orthotic Devices”[Major] OR “Canes”[Major] OR “Walkers”[Major] OR “Crutches”[Major] OR “Rehabilitation Centers”[Major] OR “Rehabilitation Research”[Major] NOT “Correction of Hearing Impairment”[Mesh] NOT “Substance Abuse Treatment Centers”[Mesh] NOT “Mouth Rehabilitation”[Mesh] NOT “Mental Disorders”[Mesh] NOT “United States Substance Abuse and Mental Health Services Administration”[Mesh] NOT “National Institute of Mental Health (U.S.)”[Mesh] NOT “Mental Health Services”[Mesh] NOT “Mental Health Associations”[Mesh] NOT “Community Mental Health Services”[Mesh] NOT “Community Mental Health Centers”[Mesh] NOT “Rehabilitation, Vocational”[Mesh] NOT “Sheltered Workshops”[Mesh] NOT “Psychiatric Nursing”[Mesh] NOT “Mental Health Recovery”[Mesh] NOT “Psychiatric Rehabilitation”[Mesh]) AND (“English”[language]).