



SPECIAL ARTICLE

COCHRANE REHABILITATION CORNER 5th COCHRANE REHABILITATION METHODOLOGICAL MEETING

Relevance and use of health policy, health systems and health services research for strengthening rehabilitation in real-life settings: methodological considerations

Walter R. FRONTERA ¹, Claudio CORDANI ^{2,3}, Simon DÉCARY ⁴, Wouter DE GROOTE ⁵,
Matteo J. DEL FURIA ^{2,3,6*}, Peter FEYS ⁷, Alan M. JETTE ⁸, Carlotte KIEKENS ³,
Stefano NEGRINI ^{2,3}, Aydan ORAL ⁹, Linda RESNIK ¹⁰, Cecilie RØE ¹¹, Carla SABARIEGO ¹²,
Participants in the 5th Cochrane Rehabilitation Methodological Meeting ‡

‡Members are listed at the end of the paper.

¹Department of Physical Medicine, Rehabilitation, and Sports Medicine, University of Puerto Rico School of Medicine, San Juan, Puerto Rico; ²Department of Biomedical, Surgical and Dental Sciences, University “La Statale”, Milan, Italy; ³IRCCS Istituto Ortopedico Galeazzi, Milan, Italy; ⁴Faculty of Medicine and Health Sciences, School of Rehabilitation, Research Centre of the CHUS, CIUSSS de l’Estrie-CHUS, Université de Sherbrooke, Sherbrooke, QC, Canada; ⁵Rehabilitation Programme, Department for Noncommunicable Diseases, Sensory Functions, Disability and Rehabilitation Unit, World Health Organization, Geneva, Switzerland; ⁶Department of Mental and Physical Health and Preventive Medicine, University of Campania Luigi Vanvitelli, Naples, Italy; ⁷Faculty of Rehabilitation Sciences, University of Hasselt, REVAL Rehabilitation Research Center, Diepenbeek, Belgium; ⁸Boston University’s Sargent College of Health & Rehabilitation Sciences, Boston, MA, USA; ⁹Department of Physical Medicine and Rehabilitation, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Türkiye; ¹⁰Department of Health Services, Policy and Practice, Brown University and Research Career Scientist VA Medical Center, Providence, RI, USA; ¹¹Department of Physical Medicine and Rehabilitation, Institute of Clinical Medicine, Faculty of Medicine, University of Oslo, Oslo, Norway; ¹²Swiss Paraplegic Research, Nottwil, Faculty of Health Sciences and Medicine and Center for Rehabilitation in Global Health Systems, University of Lucerne, Lucerne, Switzerland

*Corresponding author: Matteo J. Del Furia, Department of Mental and Physical Health and Preventive Medicine, University of Campania Luigi Vanvitelli, Via de Crecchio 4, 80138 Naples, Italy. E-mail: matteojohann.delfuria@gmail.com

This is an open access article distributed under the terms of the Creative Commons CC BY-NC-ND license which allows users to copy and distribute the manuscript, as long as this is not done for commercial purposes and further does not permit distribution of the manuscript if it is changed or edited in any way, and as long as the user gives appropriate credits to the original author(s) and the source (with a link to the formal publication through the relevant DOI) and provides a link to the license. Full details on the CC BY-NC-ND 4.0 are available at <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

ABSTRACT

Research on health policy, systems, and services (HPSSR) has seen significant growth in recent decades and received increasing attention in the field of rehabilitation. This growth is driven by the imperative to effectively address real-life challenges in complex healthcare settings. A recent resolution on ‘Strengthening rehabilitation in health systems’ adopted by the World Health Assembly emphasizes the need to support societal health goals related to rehabilitation, particularly to promote high-quality rehabilitation research, including HPSSR. This conceptual paper, discussed with the participants in the 5th Cochrane Rehabilitation Methodological Meeting held in Milan on September 2023, outlines study designs at diverse levels at which HPSSR studies can be conducted: the macro, meso, and micro levels. It categorizes research questions into four types: those framed from the perspective of policies, healthcare delivery organizations or systems, defined patient or provider populations, and important data sources or research methods. Illustrative examples of appropriate methodologies are provided for each type of research question, demonstrating the potential of HPSSR in shaping policies, improving healthcare delivery, and addressing patient and provider perspectives. The paper concludes by discussing the applicability, usefulness, and implementation of HPSSR findings, and the importance of knowledge transla-

tion strategies, drawing insights from implementation science. The goal is to facilitate the integration of research findings into everyday clinical practice to bridge the gap between research and practice in rehabilitation.

(Cite this article as: Frontera WR, Cordani C, Décary S, De Groot W, Del Furia MJ, Feys P, *et al.*; Participants in the 5th Cochrane Rehabilitation Methodological Meeting. Relevance and use of health policy, health systems and health services research for strengthening rehabilitation in real-life settings: methodological considerations. *Eur J Phys Rehabil Med* 2024;60:154-63. DOI: 10.23736/S1973-9087.24.08386-2)

KEY WORDS: Health policy; Health services research; Delivery of health care; Health services; Rehabilitation; Evidence-based practice.

Research in health policy, systems, and services (HPSSR) to strengthen rehabilitation has been receiving significant attention in the last decade. At present, efforts to strengthen rehabilitation in health systems and facilitate its implementation in complex settings have led to specific calls for sound HPSSR.¹ Although these research approaches have different names (Table I)²⁻⁵ and traditions, they share important common features, in particular, a strong focus on research questions that address real-life challenges that are of paramount importance for rehabilitation. Capacity-building efforts are needed to equip stakeholders who typically carry out clinical or epidemiological research with the necessary knowledge to conduct HPSSR. A first step in this direction is to illustrate how we can use this type of research to address important questions in rehabilitation. To keep a pragmatic approach to the topic, we refrain from embarking in this paper on discussions about differences and overlaps in concepts and definitions.

HPSSR studies may be conducted at the macro, meso, and micro levels. The macro level refers to the health system at large and policies either at regional, national, or even supra-national level. The meso level is the intermediate level of healthcare organizations, facilities, and the services they provide for specific populations, while the micro level includes the use of specific interventions

for rehabilitation, including medical devices and assistive technologies, in real-life settings.⁶ While this field of research is very broad, the types of questions addressed to solve challenges regarding availability, accessibility or the implementation of services in a specific context could be categorized broadly into one of four types:

1) questions framed from the perspective of specific policies or policy interventions (the macro level) that may be needed and impactful to strengthen the provision of rehabilitation through health systems;

2) questions framed from the perspective of healthcare delivery organizations or health systems (the meso level);

3) questions from a defined patient or provider population perspective (the micro level);

4) questions about established or new important data sources or research methods (the methodological level).

Finally, rehabilitation research in this field is often conducted at the intersection of patient outcomes, practice, and policy⁷ to provide the necessary relevance for clinical practice.⁸ For example, research that determines the most effective service organization for a patient population in need of rehabilitation may inform organizational changes in a health system and the development of a national policy to implement and make these interventions accessible to all in need. Similarly, research showing the benefits of

TABLE I.—Definitions.²⁻⁵

Health services research	Health services research is a multidisciplinary field of scientific investigation that studies how social factors, financing systems, organizational structures and processes, health technologies, and personal behaviors affect access to health care, the quality and cost of health care, and, ultimately, individuals' health and well-being. ^{2, 3}
Health systems research	Health systems research provides evidence that, when applied, can make healthcare affordable, safe, effective, equitable, accessible, and patient-centered. It generates evidence to help healthcare systems and healthcare professionals improve the lives of the patients they serve. Findings from health systems research enable frontline clinicians and patients to make better decisions, support healthcare delivery systems, organize care processes to improve safety, effectiveness, and efficacy, and can be used to design healthcare benefits and inform policy. ⁴
Health policy and systems research	Health policy and systems research is an emerging field that seeks to understand and improve how societies organize themselves in achieving collective health goals, and how different actors interact in the policy and implementation processes to contribute to policy outcomes. By nature, it is inter-disciplinary, a blend of economics, sociology, anthropology, political science, public health and epidemiology that together draw a comprehensive picture of how health systems respond and adapt to health policies, and how health policies can shape — and be shaped by — health systems and the broader determinants of health. ⁵

TABLE II.—*Examples of research questions in health policy, systems, and services research for rehabilitation.*

Type of question	Illustrative question	Factor studied (examples)	Unit of analysis (Y)	Example outcomes
Questions framed from specific policies or policy interventions	What is the effect of program/policy X on outcome Y?	National reimbursement demonstration project. Change in funding policy	Patient Clinician Organization	Costs, utilization/access, functional outcomes Satisfaction, workforce composition, workforce retention, burnout Quality of care, patterns of service utilization.
Questions about the delivery of care from the perspective of a defined patient or provider population	How do patients with disease or condition X fare with respect to Y? How do specific providers fare with respect to Y?	Type and dose of services, biologic, behavioral, and social determinants, and political factors	Patient Clinician	Patient Level: function, patient-centered outcomes, costs, access/disparities. Clinician level: satisfaction, burnout.
Questions framed from health care organizations or health systems	How is organizational issue X associated with an organizational outcome of interest?	Organizational issues (<i>e.g.</i> EHR, adoption, clinician shortage, for-profit/non-profit status)	Clinician or organization (<i>e.g.</i> , hospital, nursing home)	Financial, quality, human resource, care provision, or other outcome
Questions about important data sources or research methods	What are the psychometric properties of measure X? What are the most valid approaches to studying Y	Data sources <i>e.g.</i> new measures, existing measures, other data elements, core data sets, EHR data. Research methodologies: <i>e.g.</i> analytic methods	Not applicable	Validity, reliability, sensitivity to change/responsiveness, precision, utility, acceptability, burden of measures. Statistical evaluations of research methods

Example papers Authors Health service or policy topic Study design	Population	Outcomes	Strengths/weaknesses of the study design
Hebert <i>et al.</i> Impact of a national clinical guideline for the management of chronic pain Controlled interrupted time series analysis.	Any person prescribed an opioid in Scotland from 2005 to 2020	Trends in national and regional community opioid prescribing data Interrupted time series regression examined the association of SIGN 136 publication with prescribing rates for opioid- containing drugs	Strengths. This method could be used in rehabilitation research to assess the real-world impact of implementing clinical practices guidelines or policies as we currently lack evidence if our published guidelines impact quality of rehabilitation care over long period of time required to elicit behavioral changes. This study demonstrates the relevance of designing system-level metrics in administrative databases (here opioids prescribing rates) that are currently lacking to assess rehabilitation outcomes at the level of health systems. Weaknesses. This study design is limited by the data collection source, here administrative database, which can limit the number of outcomes to be assessed. In this example the authors were not able to describe if the guidelines reduced the dosage of opioids taken, or if this impacted quality of life or satisfaction. This design also has limited capacity to distinguish the real impact of the guidelines compared to other events that may have impacted clinical practices. Future studies are required to explain why and how an intervention was impactful or not.
McCallum <i>et al.</i> Access to physical therapy services. A mixed method, sequential, exploratory case-study approach. Data from 3 sources: interviews, document review, patient survey responses	A total of 110 medically underserved adults who were receiving treatment from three community healthcare clinics	Barriers that impede access to physiotherapy services for medically underserved adults in a community in a State of the USA	Strengths. The use of methodological and data triangulation (“mixed methods”) allows cross-validation of findings by comparing and contrasting data from different sources and can reduce flaws and research bias that come when using a single research technique or data source only. It enhances the validity and credibility of results. Weaknesses. This study was performed by one researcher only which may have created observer bias. The only author designed the study, collected all data, analyzed, and interpreted and wrote the paper. Even though mixed methods are used, very few quantitative data have been collected. Some hard data for example regarding actual PT contacts or sessions in the studied community HC clinics, or patients could have confirmed the information from the interviews and surveys (or not)
Chou <i>et al.</i> Automated (Electronic health record- generated) physical therapy referrals in hospitals informed by mobility assessments Regression discontinuity design	Health records of 6608 patients with a primary or secondary diagnosis of stroke	Effects of health service (automated PT referral) on outcomes of rehospitalization or mortality	Strengths: allows the measurement of treatment effect as well as multiple comparisons. Weaknesses: generalizability may be low because this study investigated the impact of the health service on patients closer to the cut-off score and not on those with very high or very low scores
Lin <i>et al.</i> Validation of a machine learning-based short- form measure to assess activities of daily living, balance, upper extremity and lower extremity motor function, and mobility in patients with stroke A machine learning algorithm, Extreme Gradient Boosting, was used to select 15 items from the BI, PASS, and STREAM, and transformed the raw scores of the selected items into the scores of the ML-5F	Patients (N.=307) with stroke.	Barthel Index (BI), Postural Assessment Scale for Stroke (PASS), and Stroke Rehabilitation Assessment of Movement (STREAM) at hospital admission and discharge	Strengths. Potential of machine learning algorithms which can be used to develop precise short-form measures that can generate scores comparable to those of the original measures. A remarkable feature of machine learning is that the algorithms continuously refine themselves for higher performance as they are exposed to more data, in contrast to traditional methods of developing short-form measures, such as Rasch analysis, where item selection is based on psychometric properties or clinical utility. The authors speculate that when the short form they developed is administered to more patients with stroke, the number of items may be further shortened and the psychometric properties can be further improved by fine-tuning the machine learning algorithms of item selection and prediction Weaknesses. Validity of tools generated from machine learning algorithm needs to be compared with traditional methods (<i>e.g.</i> , logistic regression) and demonstrate clinical impact

a specific policy has the potential to influence systems and services.^{9, 10} One could argue that HPSSR for rehabilitation shares some of the same characteristics of research focused on complex interventions commonly used in public health and other social and economic policy areas.¹¹ Complex interventions are delivered and evaluated at different levels, from individual to societal levels.

The number of investigations and investigators dedicated to rehabilitation focused on HPSSR is still limited. For example, using the PubMed database, Jesus *et al.* showed that HPSSR in rehabilitation, as a percentage of all rehabilitation research, increased from 11% to 18% between 1990 and 2017.¹² This reported growth is encouraging. It points out that there are opportunities for rehabilitation research to address questions that are highly relevant to patients, providers, health systems and policy-makers and that cannot be answered by traditional clinical research design and methodologies.¹³ However, the review by Jesus *et al.* also shows that the potential of HPSSR has not yet been fully explored by rehabilitation stakeholders. Hence, there is a gap between the need for high methodological quality research that addresses real-life problems and challenges relevant to policy-makers, researchers, multi-professional clinicians, and end-users in this field and the current rather clinical and epidemiological rehabilitation research landscape.

From the World Health Organization (WHO) perspective, HPSSR may start from any of the six health system building blocks (*e.g.*, leadership and governance, financing, information systems, workforce, medicines and technologies and service delivery)¹⁴ and include the concern for policy process as well as global influences.¹⁵ Another approach for HPSSR for rehabilitation is using the Cochrane Effective Practice and Organization of Care Taxonomy which includes four domains of interventions (*e.g.*, delivery, financial, governance arrangements and implementation strategies).¹⁶ Therefore, HPSSR is considered a transdisciplinary field directly focusing on both the responsiveness of health systems to health policies and the role of health policies in (re)shaping and strengthening the capacity and performance of health systems in delivering services.^{15, 17}

Given the current underuse of HPSSR, relevant evidence is unavailable to key stakeholders. To foster a broader use of these research approaches, this conceptual paper aims to present exemplary research questions and study designs for this type of research in rehabilitation and discuss the applicability, usefulness, and importance of these research approaches for users in everyday clinical rehabilitation services and engaging in related research.

Research questions and study designs

Given the broad focus of HPSSR for rehabilitation, we developed a framework to assist readers in understanding the different types or levels of research questions addressed in HPSSR for rehabilitation (Table II). In developing this framework, we were guided by a final report on health services research into European Policy and Practice⁶ as well as drawing on a categorization of HPSSR articles appropriate for the journal, Health Services Research and the Burgess article, "Update on the Health Services Research Doctoral Core Competencies."¹⁸ Previous discussions by the Cochrane Rehabilitation HPSSR Planning Group on the different levels of HPSSR research questions also assisted us. We propose four types of HPSSR questions relevant to the field of rehabilitation and discuss one example for each type of HPSSR question.

1. Questions framed from the perspective of or about specific policies or policy interventions

These types of HPSSR research questions focus on the healthcare system at large, either at regional, national, or even at supra-national level. A prototype research question would be examining the effect of policy X (*e.g.*, a national reimbursement demonstration project) on outcome Y (*e.g.*, costs, utilization, access to rehabilitation services, workforce satisfaction, or quality of care provided). The unit of analysis for outcome Y in this research question can be the patient, clinician, or healthcare organization.

An example of an HPSSR study focused on policy is the assessment by Hebert and collaborators of the impact of implementing a national guideline on opioid prescribing rates.¹⁹ The aim of this study was to examine the potential impact on opioid prescribing rates in Scotland following the publication of evidence-based pain management guidelines from the Scottish Intercollegiate Guideline Network (SIGN 136: management of Chronic Pain) with key recommendations on analgesic prescribing.²⁰ Using interrupted time series regression, the authors assessed trends in national and regional community opioid prescribing data from Scotland between 2005 to 2020. The results show that the publication of the national clinical guideline in 2013 was associated with a significant negative change in the trend in primary care opioid prescribing in Scotland of 21% by 2020.

Interrupted time series is a useful design for HPSSR that could be used in rehabilitation research to assess the real-world impact of implementing clinical practices guidelines or policies. Currently, there is a lack of evidence sup-

porting the impact of published guidelines on quality of rehabilitation care over a long period of time (*i.e.*, years) that are required to elicit behavioral changes. This study also demonstrates the relevance of including system-level metrics in administrative databases (here opioid prescribing rates) that are currently lacking to assess rehabilitation at the level of health systems. However, as highlighted by the authors, this study design is limited by the data collection source, here an administrative database, which can limit the possible outcomes to be assessed. In the study by Hebert *et al.*, the authors were not able to describe if the guidelines reduced the dosage of opioids taken or if this impacted quality of life or satisfaction.¹⁹ This limitation highlights the need for methodological work in HPSSR, which we will discuss later in this chapter. This design also had limited capacity to distinguish the real impact of the guidelines compared to other events that may have impacted clinical practices (*e.g.*, another related policy), reducing the study's internal validity. Future studies are required to explain why and how an intervention may have achieved an impact.

2. Questions framed from the perspective of healthcare delivery organizations or health systems

Research questions at this level of HPSSR focus on an intermediate level of healthcare delivery organizations or healthcare systems and the services they provide as the defining unit of analysis. A prototype research question at this level would focus on how a change in an organization is associated with a particular outcome. Examples could include clinician response to the introduction of a new electronic health record, level of clinician shortages or burnout in specific healthcare settings, or different levels of access to rehabilitation in for-profit *versus* not-for-profit healthcare institutions.

An example of this type of HPSSR is a study by Chou *et al.* which employed a regression discontinuity design (RDD) to assess the impact of automated physical therapy referrals on rehospitalization or mortality for patients with stroke in 23 acute care hospitals in two different geographical regions.²¹ Investigators employed a cut-off value/arbitrary threshold to make decisions on whether to provide a specific intervention/health service, in this case physical therapy. The RDD design allows investigators to measure treatment effect and the impact of an intervention/health service by comparing those individuals above and below the predetermined cut-off value. Furthermore, it allows the comparison of diverse interventions. The RDD design can provide causal inference and may answer the

significant question of whether the intervention/health service really changes outcomes for individuals.²² The causal inference provided by this design may lead to quality improvement in patient care.²³ In our view, the RDD is underutilized in rehabilitation HPSSR, and its full potential has yet to be discovered.

The RDD has been proposed as a good and valid option in HPSSR for rehabilitation in situations where randomized controlled trials cannot be conducted.^{22, 24} With its feature of using historical data, it may gain more importance in this era where analysis of “big data” and artificial intelligence research approaches are emerging.²⁵

3. Questions from a defined patient or provider population perspective

HPSSR research questions at this level focus on defined groups of patients and/or providers as the defining unit of analysis. At the patient level, the focus can be directed toward outcomes such as patient functioning, access to care, biological, social, and behavioral determinants of care, disparities in care received, or other health-related outcomes. At the provider level, the focus can be on clinician burnout, use of medical devices or technologies, or disparities in care provided.

An example of this type of HPSSR for rehabilitation is a study by McCallum *et al.* that examined access to physiotherapy (PT) services among medically underserved adults in a USA state.²⁶ Utilizing an “Exploratory Sequential Design,” investigators analyzed data from three sources collected in three community healthcare (HC) clinics. First, the author conducted semi-structured interviews with 11 healthcare providers and 110 medically underserved adults. Then, they analyzed documents from clinics, the local community, and the state and nation through data mining. Lastly, the researchers administered two questionnaires: one to the healthcare providers on their educational background and a more extensive one to the patients, including three content areas. The areas were: 1) basic demographic data; 2) medical history; 3) self-reported healthcare needs about physical mobility problems and access to PT services. The investigators used several HPSSR tools including methods triangulation, data triangulation, and a constant-comparative method. This comprehensive analysis allowed the authors to describe several results: characteristics of the community and the included patients, available resources, and knowledge of the PT practice. These results were then transformed into three main thematic gaps regarding access to PT services. Methodological and data triangulation (“mixed methods”)

allowed cross-validation of findings by comparing and contrasting data from different sources. This design feature can reduce flaws and research bias when using only a single research technique or data source and thus enhance the validity and credibility of results. It may also facilitate user involvement in the HPSSR for rehabilitation. Even though mixed methods were used, very few quantitative data were collected, for example, data regarding actual PT contacts or sessions in the studied community, healthcare clinics, or patients. Such quantitative data could have confirmed the information from the interviews and surveys (or not).

4. Questions about important data sources or research methods

The fourth and final level of research question addresses important HPSSR methodological questions that are fundamental to improving the quality of rehabilitation HPSSR. The unit of analysis of this type of research question is the method under investigation and not individuals, organizations, or health policies. Examples include studies that examine the psychometric properties of measures used in HPSSR or the statistical evaluation of new or existing methodologies used in HPSSR.

An example of this type of HPSSR question is a paper by Lin *et al.* that reported on the development and validation of a machine learning-based short-form measure to assess activities of daily living, balance, upper extremity and lower extremity motor function, and mobility in patients with stroke.²⁷ Using data from a previous study, this analysis comprised three phases: 1) generating the development and validation datasets; 2) selecting items to comprise the short measure; and 3) examining the concurrent validity and responsiveness of the short measure. The resulting short-form measure is composed of only 15 items, which is about 30% of the items of the original measures, and as such, can be administered in approximately 10 minutes for assessing five functions and thus feasible for practical use, especially in time-pressed clinical settings.

This methodological study shows the potential of machine learning algorithms, which can be used to develop precise brief measures that can generate scores comparable to those of the original measures. A remarkable feature of machine learning is that the algorithms continuously refine themselves for higher performance as they are exposed to more data, in contrast to traditional methods of developing short-form measures, such as Rasch analysis, where item selection is based on psychometric properties or clinical utility. The authors speculate that when the short-

form they developed is administered to more patients with stroke, the number of items may be further shortened, and the psychometric properties can be further improved by fine-tuning the machine learning algorithms of item selection and prediction.

Table II provides summary information to assist readers in understanding these four different levels of HPSSR research questions. For each type/level of research question, Table II lists one or more illustrative questions within each research category and summarizes the factor(s) studied, the unit of analysis, and outcome examples to help flesh out each type of research question for the reader. Table II also lists the common types of methods used to address each type of HPSSR question from a rehabilitation perspective and provides several cited articles within each type of research question drawn from the recent rehabilitation literature.

Applicability, usefulness, and implementation

Research in health policy, systems, and services for rehabilitation can generate knowledge that could be used by different stakeholders, including the government, healthcare industry, media, civil society networks, health workers, researchers, and those who receive rehabilitation services directly. Some of these stakeholders may be information stewards or other information processors. In this section, we will briefly discuss how these users can apply new knowledge in HPSSR for rehabilitation and comment on some of the implementation opportunities and challenges.

Knowledge generated in well-conducted HPSSR studies can be used to evaluate solutions to problems and decisions to implement best practices. Furthermore, the strategies to improve the accessibility, affordability, effectiveness, and quality of healthcare can be informed by these results. This knowledge can be regularly applied in several ways and settings. HPSSR for rehabilitation provides a valuable resource for clinicians that they can use to streamline their efforts and ensure that they and their health systems, are meeting regulatory requirements and the need for high-value care. Some regulating agencies may be using HPSSR for rehabilitation findings to establish reimbursement structures that encourage collaboration and efficiency, as well as to provide a mechanism to identify successful programs and to share their lessons learned. HPSSR may also be used to create measurement tools to compare different facilities and performance ratings. This makes it possible to identify areas of weakness

in facilities, assess gaps in interventions for rehabilitation and, help rehabilitation providers address these issues and make necessary improvements.

Often, however, opportunities to use research to inform health policy and service improvement and planning are not being fully exploited. Researchers are frustrated that their work isn't used more widely by decision-makers and managers and feel that the knowledge they generate is undervalued and poorly applied. Managers may see little of relevance in the research available to them and view health services research as poor value for expense if operationalization is not clearly elaborated. Decision makers are concerned about the timeliness of research: to be useful to them, it must be available when decisions are being made and consist of recently collected data. International experience suggests independent organizations or well-established evidence ecosystems can help bridge the divide between decision-makers, managers, funders, and researchers so that research is pursuing the right agenda, asking the right questions in the right way, and communicating to the people who need it. Partners need to develop a research strategy that aligns with or can be incorporated into their rehabilitation care strategy and helps them and their workforce to build on existing research initiatives and activities.

Several factors are key to making HPSSR for rehabilitation applicable and used by knowledge producers and users. First, having staff who can understand, undertake, use, and generate new research and share actionable research findings through translating and disseminating knowledge as part of a pro-research culture in health systems. Education and training are therefore critical for research to be sustainably embedded within healthcare and for people to develop careers in research.²⁸⁻³⁰ Second, because health services research is often governed by a range of laws, policies, and international, national, and professional standards, a regulatory body (*e.g.*, national health service, a department of the Ministry of Health) is needed to ensure that regulation is coordinated and standardized across the country to make it easier to do research that people can trust, and hence can be used. Third, to plan and budget for evidence-based policies for rehabilitation, mechanisms to ensure ready access to research findings and summaries of research should be in place (*e.g.*, through library services) so that decision-makers have access to knowledge and are supported for knowledge management. Fourth, evidence from research is more likely to be used in policy and program development when there is an organizational readiness to use the evidence, *e.g.*, through supportive resources

and tools and mechanisms for the generation of evidence that is highly relevant to the priorities of the knowledge user and applicable to local circumstances.^{30, 31}

When new quality evidence from HPSSR for rehabilitation is generated, implementation strategies should be considered. These are defined as approaches to enhance the adoption, use, and sustainment of evidence-based interventions, programs, or innovations.^{30, 31} Several models exist for research in knowledge translation that could be used to promote improvements in rehabilitation.³² Various theoretical frameworks have led to tailored interventions for different populations and functioning problems. Examples are the PariHs model (Promoting action on research implementation in health services), the RE-AIM model (Reach, efficacy, adoption, implementation, and maintenance), and the CFIR model (Consolidated framework for implementation research).³³⁻³⁵ The models mentioned above may allow a better understanding of the complexity of implementing rehabilitation in real-life settings.³⁶ Rehabilitation is a complex intervention where different components interact sometimes in unpredictable manners.³⁷ As mentioned in the introduction, the framework for developing and evaluating complex interventions, updated by the Medical Research Council, may help.¹¹

Over the past ten years or so, these strategies for the implementation of health services have also been compiled into taxonomies and frameworks to enhance health authorities' and practitioners' ability to conceptualize, describe, test, and apply research results in practice. The Expert Recommendations for Implementing Change (ERIC) project describes a taxonomy of 73 discrete implementation strategies that have been leveraged to optimize the use of evidence in routine care.³¹ Implementation strategies are organized in the following clusters: use of evaluative and iterative methods, provision of interactive assistance, adapted and tailored to the context, development of stakeholder interrelationships, training and education of stakeholders, support of clinicians, engagement with consumers, utilization of financial support, and changes in infrastructure.³⁸ In particular, implementation strategies such as educational meetings, audit and feedback techniques, and the use of clinical reminders hold promise for increasing the use of evidence by allied health professionals.

On the other hand, in parallel, it is also important that clinicians and program managers can replace practices and interventions that are no longer evidence-based, when new evidence supersedes old evidence or interventions are replaced with those that are more cost-effective. Deimplementation is defined as "stopping practices that are

not evidence-based, ineffective, harmful, or non-cost effective” and is not the reverse process of implementation as factors that shape the processes of implementation and de-implementation are likely to differ.³⁹ Barriers to de-implementation are numerous and complex.⁴⁰ Overcoming these may require an overarching approach to support patients, clinicians, and the system; the realist synthesis or review is a systematic, iterative, theory-driven approach that draws on a heterogeneous evidence base to establish what works, how, in what context and for whom. Unlike systematic reviews, realist syntheses use key stakeholders’ own theories alongside the literature to elicit and test program theories that can be applied. Realist syntheses draw on different theoretical and disciplinary perspectives that enable the generation of new insights, which may facilitate de-implementation.^{41, 42}

Concluding remarks

This conceptual paper highlighted the importance of HPSSR for rehabilitation, a transdisciplinary field of research which addresses real-life issues encountered by policy makers, healthcare delivery organizations, health systems, patients, and providers, and includes methodological research to strengthen the field. It also introduced research questions and study designs that exemplified HPSSR at the macro, meso, and micro levels of healthcare delivery and emphasized the applicability and usefulness of findings. Finally, the paper discussed knowledge translation strategies, including those drawn from implementation science to help drive research findings into practice.

References

1. Cieza A, Kwamie A, Magaqa Q, Paichadze N, Sabariego C, Blanchet K, *et al.* Framing rehabilitation through health policy and systems research: priorities for strengthening rehabilitation. *Health Res Policy Syst* 2022;20:101.
2. Canadian Institutes of Health Research. Health Services Research [internet]. Ottawa: Canadian Institutes of Health Research; 2023 [Internet]. Available from: <https://cihr-irsc.gc.ca/e/48809.html> [cited 2024, Jan 9].
3. Lohr KN, Steinwachs DM. Health services research: an evolving definition of the field. *Health Serv Res* 2002;37:7–9.
4. AHRQ Health systems research [internet]. Rockville: Agency for HealthCare Research and Quality; 2023 [Internet]. Available from: <https://www.ahrq.gov/healthsystemsresearch/index.html#:~:text=Health%20systems%20research%20provides%20evidence,of%20the%20patients%20they%20serve> [cited 2024, Jan 9].
5. PAHO. Health policy and systems research [internet]. Washington DC: Pan American Health Organization; 2023 [Internet]. Available from: https://www3.paho.org/hq/index.php?option=com_content&view=article&id=14481:health-policy-and-systems-research&Itemid=0&lang=en#gsc.tab=0 [cited 2024, Jan 9].
6. HSR-Europe. Health Services research into European policy and practice - Final report of the HSREPP project; 2023 [Internet]. Available from: http://www.healthservicesresearch.eu/mediaFiles/upload/publications/HSR-Europe_2011 [cited 2024, Jan 9].
7. Graham JE, Middleton A, Roberts P, Mallinson T, Prvu-Bettger J. Health services research in rehabilitation and disability – the time is now. *Arch Phys Med Rehabil* 2018;99:198–203.
8. Solvang PK, Hanisch H, Reinhardt JD. The rehabilitation research matrix: producing knowledge at micro, meso, and macro levels. *Disabil Rehabil* 2017;39:1983–9.
9. Pennestri F, Banfi G. The experience of patients in chronic care management: applications in health technology assessment (HTA) and value for public health. *Int J Environ Res Public Health* 2022;19:9868.
10. Vanni F, Foglia E, Pennestri F, Ferrario L, Banfi G. Introducing enhanced recovery after surgery in a high-volume orthopaedic hospital: a health technology assessment. *BMC Health Serv Res* 2020;20:773.
11. Skivington K, Matthews L, Simpson SA, Craig P, Baird J, Blazeby JM, *et al.* A new framework for developing and evaluation complex interventions. *BMJ* 2021;374.
12. Jesus TS, Hoenig 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. *Int J Environ Res Public Health* 2020;17:965.
13. Arienti C, Armijo-Olivo S, Minozzi S, Tjosvold L, Lazzarini SG, Patrini M, *et al.* Methodological issues in rehabilitation research: a scoping review. *Arch Phys Med Rehabil* 2021;102:1614–1622.e14.
14. World Health Organization. Rehabilitation in Health Systems: a guide for action; 2019 [Internet]. Available from: <https://apps.who.int/iris/bitstream/handle/10665/325607/9789241515986-eng.pdf> [cited 2024, Jan 9].
15. Gilson L; Alliance for Health Policy and Systems Research and World Health Organization. Health policy and systems research: a methodology reader; 2012 [Internet]. Available from: <https://apps.who.int/iris/handle/10665/44803> [cited 2024, Jan 9].
16. Effective Practice and Organization of Care (EPOC). The EPOC taxonomy of health systems interventions. EPOC Resources for review authors. Oslo: Norwegian Knowledge Centre for the Health Services; 2016 [Internet]. Available from: www.epoc.cochrane.org/epoc-taxonomy [cited 2024, Jan 9].
17. Alliance for Health Policy and Systems Research. What is health policy and systems research (HPSR)? 2023 [Internet]. Available from: <https://ahpsr.who.int/> [cited 2024, Jan 9].
18. Burgess JF, Menachemi N, Maciejewski ML. Update on the Health Services Research Doctoral Core Competencies. *Health Serv Res* 2018;53(Suppl 2):3985–4003.
19. Hébert HL, Morales DR, Torrance N, Smith BH, Colvin LA. Assessing the impact of a national clinical guideline for the management of chronic pain on opioid prescribing rates: a controlled interrupted time series analysis. *Implement Sci* 2022;17:77.
20. Scottish Intercollegiate Guidelines Network (SIGN). Management of chronic pain; 2013 [Internet]. Available from: <http://www.sign.ac.uk> [cited 2024, Jan 9].
21. Chou A, Johnson JK, Jones DB, Euloth T, Matcho BA, Bilderback A, *et al.* Effects of an electronic health record-based mobility assessment and automated referral for inpatient physical therapy on patient outcomes: A quasi-experimental study. *Health Serv Res* 2023;58(Suppl 1):51–62.
22. Hagemeyer A, Samel C, Hellmich M. The regression discontinuity design: methods and implementation with a worked example in health services research. *Z Evid Fortbild Qual Gesundheitswes* 2022;172:71–7.
23. Walkey AJ, Drainoni ML, Cordella N, Bor J. Advancing Quality Improvement with Regression Discontinuity Designs. *Ann Am Thorac Soc* 2018;15:523–9.
24. Maas IL, Nolte S, Walter OB, Berger T, Hautzinger M, Hohagen F, *et al.* The regression discontinuity design showed to be a valid alternative

to a randomized controlled trial for estimating treatment effects. *J Clin Epidemiol* 2017;82:94–102.

25. Wang M, Sushil M, Miao BY, Butte AJ. Bottom-up and top-down paradigms of artificial intelligence research approaches to healthcare data science using growing real-world big data. *J Am Med Inform Assoc* 2023;30:1323–32.

26. McCallum CA. Access to physical therapy services among medically underserved adults: a mixed-method study. *Phys Ther* 2010;90:735–47.

27. Lin GH, Li CY, Sheu CF, Huang CY, Lee SC, Huang YH, *et al.* Using machine learning to develop a short-form measure assessing 5 functions in patients with stroke. *Arch Phys Med Rehabil* 2022;103:1574–81.

28. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, *et al.* Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Adm Policy Ment Health* 2011;38:65–76.

29. Bauer MS, Damschroder L, Hagedorn H, Smith J, Kilbourne AM. An introduction to implementation science for the non-specialist. *BMC Psychol* 2015;3:32.

30. Proctor EK, Powell BJ, McMillen JC. Implementation strategies: recommendations for specifying and reporting. *Implement Sci* 2013;8:139.

31. Powell BJ, Waltz TJ, Chinman MJ, Damschroder LJ, Smith JL, Matthieu MM, *et al.* A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. *Implement Sci* 2015;10:21.

32. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, *et al.* Lost in knowledge translation: time for a map? *J Contin Educ Health Prof* 2006;26:13–24.

33. Bergström A, Ehrenberg A, Eldh AC, Graham ID, Gustafsson K, Harvey G, *et al.* The use of the PARIHS framework in implementation research and practice—a citation analysis of the literature. *Implement Sci* 2020;15:68.

34. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health* 1999;89:1322–7.

35. Damschroder LJ, Reardon CM, Widerquist MA, Lowery J. The updated Consolidated Framework for Implementation Research based on user feedback. *Implement Sci* 2022;17:75.

36. Stockley RC, Graham IS. The importance of embracing complexity in rehabilitation. *J Eval Clin Pract* 2023;29:657–61.

37. Negrini S, Selb M, Kiekens C, Todhunter-Brown A, Arienti C, Stucki G, *et al.*; 3rd Cochrane Rehabilitation Methodology Meeting participants. Rehabilitation definition for research purposes. A global stakeholders' initiative by Cochrane Rehabilitation. *Eur J Phys Rehabil Med* 2022;58:333–41.

38. Waltz TJ, Powell BJ, Matthieu MM, Damschroder LJ, Chinman MJ, Smith JL, *et al.* Use of concept mapping to characterize relationships among implementation strategies and assess their feasibility and importance: results from the Expert Recommendations for Implementing Change (ERIC) study. *Implement Sci* 2015;10:109.

39. Prasad V, Ioannidis JP. Evidence-based de-implementation for contradicted, unproven, and aspiring healthcare practices. *Implement Sci* 2014;9:1.

40. Coenen P, de Wind A, van de Ven P, de Maaker-Berkhof M, Koes B, Buchbinder R, *et al.* The slow de-implementation of non-evidence-based treatments in low back pain hospital care—Trends in treatments using Dutch hospital register data from 1991 to 2018. *Eur J Pain* 2023;27:212–22.

41. Pawson R. Evidence-based policy: a realist perspective. London: Sage; 2006.

42. Burton C, Williams L, Bucknall T, Edwards S, Fisher D, Hall B, *et al.* Understanding how and why de-implementation works in health and care: research protocol for a realist synthesis of evidence. *Syst Rev* 2019;8:194.

Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Funding

This study was supported and funded by the Italian Ministry of Health - Ricerca Corrente 2023. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Authors' contributions

Walter R. Frontera and Stefano Negrini have given substantial contributions to the conception or the design of the manuscript. Claudio Cordani, Simon Décary, Wouter De Grootte, Matteo J. Del Furia, Peter Feys, Alan M. Jette, Carlotte Kiekens, Aydan Oral, Linda Resnik, Cecilie Roe, Carla Sabariego performed data the acquisition, analysis and interpretation. All authors have participated in drafting and revisiting the manuscript critically. All authors read and approved the final version of the manuscript. All authors contributed equally to the manuscript and read and approved the final version of the manuscript.

Group author members

Chiara ARIENTI (Milan, Italy); Irene BATTEL (Milan, Italy); Maria G. CERAVOLO (Ancona, Italy); Christopher COLVIN (Charlottesville, VA, USA); Pierre CÔTÉ (Toronto, ON, Canada); Anne CUSICK (Sydney, Australia); Bernard DAN (Brussels, Belgium); Susanna EVERY-PALMER (Wellington, New Zealand); Giorgio FERRIERO (Varese, Italy); Francesca GIMIGLIANO (Naples, Italy); Christoph GUTENBRUNNER (Hannover, Germany); Carsten B. JUHL (Copenhagen, Denmark); Stefano G. LAZZARINI (Milan, Italy); William M.M. LÉVACK (Wellington, New Zealand); Sara LIGUORI (Naples, Italy); Wendy MACHALICEK (Eugene, OR, USA); Rachelle MARTIN (Wellington, New Zealand); Federico MERLO (Milan, Italy); Thorsten MEYER-FEIL (Halle, Germany); Luca MIRANDA (Milan, Italy); Bianca MOSCONI (Milan, Italy); Federico PENNESTRI (Milan, Italy); Heather SHEARER (Toronto, ON, Canada); Jessica WONG (Toronto, ON, Canada).

History

Article first published online: January 22, 2024. - Manuscript accepted: January 8, 2024. - Manuscript received: December 21, 2023.