Current Practice and Barriers to Physiotherapists' Use of Resistance Exercise for Older Adults in Acute Care

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ABSTRACT

Purpose: The purpose of this cross-sectional study was to 1) describe the current use of resistance exercise (REx) and 2) identify barriers and facilitators for physiotherapists using REx among older adults in acute care.

Methods: An online questionnaire measure guided by the Theoretical Domains Framework was distributed to physiotherapists across British Columbia (BC). Responses were scored on a five-point Likert scale. Thematic analysis was used to code open text data from the questionnaire.

Results: 105 physiotherapists (male=23, age 39.9±10.3 years, 12.4±10.3 years of experience) completed the questionnaire. Respondents reported frequently performing functional testing (95%) and assessing muscle strength (70%) in older adults, but few often prescribe REx to patients (34%). Prioritization of REx among other duties (2.62±1.02) and perceived poor patient motivation (2.97±0.88) were ranked among the greatest barriers. Open text data revealed physiotherapists felt some patients were unable to perform REx, they lacked a clear definition of REx, and sufficient support personnel.

Conclusions: Addressing priorities, patient motivation, and providing resources may support physiotherapists to increase REx use, an important strategy for reducing the incidence of hospital associated deconditioning among older adults in the acute care setting.

Keywords: Resistance Training, Sarcopenia, Critical Care, Physical Therapists

Wordcount: 4990

INTRODUCTION

Among healthcare professionals, there is growing concern for the loss of functional performance following acute care hospitalization of older adults. Acute care is defined as in-patient care for short-term treatment of severe episodes of illness, with the goal of discharging patients once they are stable.[1] Due to the nature of the illnesses encountered in this setting, patients often experience prolonged immobilization, general inactivity, poor sleep, and poor nutrition.[2] Indeed, elderly patients spend an average of 83% of their hospital stay lying down and up to 12% sitting in a chair.[3] Immobilization during the hospital stay has been associated with diminished muscle strength and mass as well as reduced cognitive function in older adults. This multisystem decline has been collectively described as hospital-associated deconditioning (HAD).[2] Together, these symptoms can create prolonged challenges in a patient's daily living and lead to adverse outcomes upon discharge such as decreased independence, higher rates of recurrent hospitalizations, sarcopenia, and even death as a result of increasing frailty.[4] As HAD is thought to be at least partially avoidable in acute care settings, it is suggested that preventing muscle atrophy during the hospital stay is the most critical strategy to counter its effects.[2,5]

Resistance exercise (REx) has shown to be the most effective treatment in preventing hospital-related atrophy and thus reducing its related functional impairments.[5-7] For example, in a randomized controlled trial of older adults scheduled for a unilateral hip replacement, patients assigned to the resistance training group had greater benefits to muscle strength, mass, and function compared to those given standard home-based rehabilitation and unilateral neuromuscular electrical stimulation.[5] Additionally, the study demonstrated that the resistance training group had a reduced length of hospitalization compared to patients randomized to conventional rehabilitation regimes. Similarly, in a review of strength training interventions

amongst hospitalized older adults, high-intensity REx resulted in clinically meaningful improvements in strength and functional mobility, facilitating independence and older adults' ability to complete daily activities.[7]

It is currently unknown to what extent REx is used by physiotherapists for older patients in British Columbia (BC) acute care hospitals. While past studies have noted barriers to REx in rehabilitation settings such as perceptions of patient capacity to do REx, physiotherapist confidence in prescribing REx, and access to equipment, the barriers specific to using REx in the acute care hospital setting are unknown.[8] The purpose of this study was to 1) describe the current practice of REx and 2) identify physiotherapist barriers and facilitators for using REx among older adults in acute care.

METHODS

An integrated knowledge translation approach (i.e. involving those who the research is intended for[9]) was used, with the working group comprised of 14 physiotherapists, researchers, and a physical therapy knowledge broker (KB). Specifically, the original research question was first posed by a physiotherapist (CS), submitted to the KB in response to a call for proposals for KB facilitated projects, and selected by the KB Steering Committee as relevant, meaningful and feasible. The KB initiated the project by inviting physiotherapists throughout the province to join the research team. All members of the working group were involved at every stage of the research process. Researchers and physiotherapists co-developed the study's research questions and methods, recruited participants, distributed the survey, interpreted the data, and wrote and/or reviewed the manuscript. Where discrepancies in perspectives arose, the KB facilitated consensus.

Participants

Eligible participants were registered physiotherapists who worked with older adults in acute care in BC hospitals. Convenience sampling was used to recruit potential participants, who were contacted via email invitation and social media distribution through local and provincial distribution lists and key influencers. To increase response rate, a reminder email to all potential participants was sent one week prior to the end of data collection. In total, 1019 physiotherapists work in BC hospitals, however, the number accurately reflecting the subset of physiotherapists whose caseload includes older adults is not available.[10]

Role of the funding source

The funding source did not play a role in the design, conduct, or reporting of the study.

Study design and measures

This cross-sectional study was conducted using an online questionnaire. Collected participant demographics included the health authority and size of the town in which the physiotherapist worked, age, and years of experience working as a physiotherapist. The remainder of the questionnaire covered the following topics: current use of REx and related practices (10 items; Supplementary Table 2), perceived barriers to REx use (22 items; Table 1), and potential strategies to increase REx use (13 items; Supplementary Table 3). All items were scored on a 5-point Likert scale, ranging from 1=strongly disagree/never to 5=strongly agree/always. Participants could also provide open-text comments for each section.

A modified version of the Determinants of Implementation Behaviour Questionnaire (DIBQ) was used to assess barriers and facilitators within each of the Theoretical Domains Framework (TDF) domains.[11] The TDF outlines 14 domains that were developed in an effort to summarize 128 constructs across 33 behaviour change theories.[12] These theoretical domains can be used to identify barriers and, when linked with additional models and tools,[13,14] can inform the

development of appropriate behaviour change (e.g., self-monitoring, behavioural practice, goal setting) and implementation interventions (e.g., training, education, incentivization). The TDF has previously been used to identify barriers and facilitators to exercise amongst older adults.[15] The DIBQ is a self-report measure consisting of 93 items assessing the TDF domains. Support for the DIBQ's construct validity, internal consistency reliability, and discriminant validity has been demonstrated among physiotherapists previously.[11,16] Using the DIBQ as a template, the working group modified the statements in the questionnaire to better fit the context of the study. For example, the item "[action] in [context, time] with [target] is part of my work as a [profession]", was modified to "prescribing resistance exercise is a part of my work as a physiotherapist". Consultations with the working group and pilot testing among five physiotherapists external to the project also resulted in a reduction of the number of questionnaire items to meet clinician time constraints and exclusion of TDF domains that were deemed inapplicable (i.e., optimism and emotions).

Data Analysis

Questionnaire data was stored and encrypted on a UBC research ethics board approved database. Descriptive statistics were used to analyze quantitative results from the online questionnaire. Incomplete datasets were only included if at least one of the REx frequency or REx barriers sections were completed. All other missing data were not included. Data are presented as means and standard deviations for each statement. Two-tailed, independent t-tests were performed to compare scores between metropolitan and smaller health authorities (Vancouver Coastal Health/Providence Health Care and Fraser Health versus Island, Interior, and Northern Health), between metropolitan cities and regional, rural, and remote cities/towns, and between physiotherapists with more than 10 and less than 10 years of experience. Responses

were also dichotomized for ease of interpretation. For current use, “always” and “usually” responses were combined and “about half the time”, “seldom”, and “never” responses were combined. Questions regarding barriers and strategies were dichotomized by combining the “I strongly agree” and “I agree” responses and combining the “neutral” with the “I disagree” and “I strongly disagree” responses. The critical p-value was set at 0.05. To adjust for multiple comparisons and decrease the likelihood for type I error, Bonferroni corrections were applied where appropriate. All analyses were performed in SPSS Statistics v26.

Open-text data from the questionnaire were examined using thematic analysis.[17] Open text data were first inductively coded into subthemes, then subsequently deductively coded using the 14 TDF domains.[12] For example, the open text response, “I use REx as part of falls reduction strategies,” was coded into the inductive subtheme ‘REx definition’ and the deductive theme from the TDF domain of ‘knowledge’. Peer checking was used to support the rigour of the coding process. A critical friend (JM) was used to examine the codes and discuss themes with the coder (AC). The proposed themes and subthemes were presented to the working group who confirmed the results.

RESULTS

Of the 1019 physiotherapists working in BC hospitals, 105 responded to the questionnaire (10%). Our distribution was similar to the provincial data based on health authority, age, and years of practice (see Supplementary table 1) with the exception of Northern Health, whose physiotherapists formed a greater proportion of survey respondents (n=13, 12%) compared to the provincial level distribution of Northern Health physiotherapists (4%). Most questionnaire respondents worked in Vancouver Coastal Health/Providence Health Care and Fraser Health (n=67, 64%), were less than 40 years old (n= 59, 56%), and had less than 10 years

of practice as a physiotherapist (n= 51, 49%). The majority of the sample consisted of physiotherapists working in metropolitan cities (n= 50, 48%) and were female (n=82, 78%) (data not available at the provincial level).

Most BC physiotherapists indicated that they "always" or "usually" use functional testing to assess muscle strength in elderly patients (n=100, 95.2%) and generally assess muscle strength in elderly patients (n=74, 70.4%). However, overall, less than a third of physiotherapists use REx for older adults who are hospitalized (n=31, 29.6%). More specifically, few BC physiotherapists "always" or "usually" use manual muscle testing to assess muscle strength in elderly patients (n=40, 38.1%), provide patients/family with written instructions and/or pictures of REx (n=40, 38.1%), prescribe REx to patients (34.3%), or include patients in the selection of REx (n=26, 24.7%). There were no differences between metropolitan and smaller health authorities (p's>0.05). However, physiotherapists in regional, rural, and remote regions reported monitoring patients' use of REx more frequently than physiotherapists in metropolitan regions ($M_{regional,\ rural,\ remote}$=3.58 (1.12) 95% CI [3.29, 3.88], M_{metro}=3.08 (1.29) 95% CI [2.72, 3.45], t(103)= -2.11, p=0.038). Additionally, physiotherapists with less than 10 years of experience reported using functional testing more frequently than physiotherapists with 10 or more years experience ($M_{<10}$=4.79 (0.45) 95% CI [4.67, 4.91], $M_{\geq 10}$=4.40 (0.69) 95% CI [4.21, 4.59], t(104)=3.40, p<0.001). For a summary of responses to current use of REx by BC physiotherapists, see Supplementary Table 2.

The greatest perceived barriers to REx (representing responses with a mean score of less than 3 ["I neither agree nor disagree"]) were reported within the TDF domains of goals, reinforcement, environmental context and resources, and social influences. For a full list of barrier scores, see Table 1. While there were no differences in barriers between health authorities

or regions (p's >0.05), physiotherapists with 10 or more years of experience more strongly agreed their colleagues prescribe REx ($M_{\geq 10}$=3.77 (0.99) 95% CI [3.49, 4.05]) compared to physiotherapists with less than 10 years ($M_{<10}$=3.21 (1.11), 95% CI [2.91, 3.51], t(99)= 1.98, p=0.0094). The best supported strategies representing mean responses greater than 4 ("I agree or strongly agree") were found within the domains of environmental context and resources and knowledge. These strategies included handouts/resources for the patient/family on the benefits of REx, a resource list with a variety of websites/apps/resources to support REx prescription, a repository of potential REx for different muscle groups, and a quick fact sheet on the importance of REx. There were no differences in preferred strategies between health authorities (p's >0.05). However, physiotherapists in regional, rural, and remote regions ($M_{regional}$) more strongly agreed that virtual training would be helpful than physiotherapists in metropolitan regions ($M_{regional, rural, remote}$=3.78 (1.02) 95% CI [3.51, 4.05], M_{metro}=3.22 (1.04) 95% CI [2.92, 3.53], t(100)= -2.67, p=0.009). For a summary of REx strategies, see Supplementary Table 3.

Qualitative, open text data on barriers and facilitators demonstrated that in addition to the quantitative assessment of these factors, other barriers that affect REx prescription include: within the 'beliefs about consequences' TDF domain, patient's ability to participate in REx (due to age, function, mobility, ability to learn, condition, and need for supervision) and seeing REx as beneficial; in the 'environmental context and resources' TDF domain, time, equipment, resources (e.g., group classes, prescription programs, training) and personnel (e.g., rehab assistants, more physiotherapists); within the 'goals' TDF domain, a focus on function, mobility, and discharge; in the 'knowledge' TDF domain, a clear definition of REx; within the 'social influences domain', patient motivation; and in the 'social professional role and identity' TDF

domain, inter-disciplinary roles in REx prescription. For the complete list of coded open text data, see Supplementary Table 4.

DISCUSSION

This study highlights the behaviours and factors that affect the use of REx in treatment for older adults amongst BC physiotherapists in acute care settings. While most physiotherapists always or usually perform REx-related assessment, physiotherapists reported low rates of prescribing REx to patients. Taking together both the quantitative and qualitative data, prevalent and potentially modifiable barriers to REx use included competing priorities such as function, mobility, and discharge, a lack of time, personnel, and a clear definition of REx, and physiotherapist perceived low patient motivation and ability to perform REx.

Rates of physiotherapist REx use

Though physiotherapists in our survey typically performed REx assessments, many did not prescribe REx, which is consistent with findings from other countries. In a study of physiotherapists working in stroke rehabilitation in New Zealand, the majority of their time is spent performing assessment activities and lower-level mobility activities such as bed mobility, sitting balance, and sit to stand.[18,19] Likewise, US in-patient physiotherapists have reported spending a greater proportion of their time in higher-level mobility activities including transfers, pre-gait, gait, and advanced gait, which do not necessarily incorporate REx.[18] A study of European physiotherapists also found that ambulatory exercises, transfers, exercises, and balance occurred more often in physiotherapy sessions than did coordination, strengthening exercises, and active relaxation.[20] Indeed, the minimal time spent prescribing REx in-hospital compared to other physiotherapy activities is not unique to BC, Canada.

Barriers and facilitators to REx prescription

A clear definition that aligns with rehabilitation goals

Competing work priorities was ranked as the greatest barrier to REx use. Open text data showed that 1) a focus on rehabilitation goals such as return to function, mobility, and discharge may take precedence over prescribing REx and 2) that a clear definition of REx was lacking. Defining REx in a way that highlights the overlap between REx and these rehabilitative goals may be needed. Resistance exercise has been defined as the voluntary activation of specific skeletal muscles against external resistance with the aim of improving muscular strength, endurance and/or power.[21] Body weight, falls prevention, and functional exercises were frequently mentioned as forms of REx conducted in the acute care setting. If dosed appropriately, these types of exercise are effective options for improving strength and ultimately accomplishing similar rehabilitation goals identified as priorities in the acute care hospital setting (e.g., mobility, function, readiness for discharge). For example, a systematic review of exercise programs designed to reduce risk for falls and fractures demonstrated increases in muscle strength (by 174% on average), mass (9%) and gait speed (48%).[22] In women over 75 years old, REx programs using body weight as resistance have been shown to increase strength by 4-27%.[22] Additionally, functional exercises (i.e. movement patterns common to those performed during activities of daily living) have also been demonstrated to be safe alternatives to traditional exercise interventions while improving perceptions of function and pain.[23] These factors can be collectively amalgamated into our team's proposed definition of REx within a rehabilitation context in the acute care setting as "movement using body weight or external resistance that improves muscular strength, power, or endurance, and may ultimately positively impact mobility, function, and independence". By moving to a more goal-focused rather than process-

focused definition, REx may be viewed as an imperative intervention rather than as a competing priority.

Supporting the patient and physiotherapist: Addressing safety

Physiotherapists' perceptions of the patient's ability to participate in REx and patient motivation were two themes that were identified as important barriers to using REx in treatment. It is possible that these barriers may be addressed by communicating the safety of REx and providing support for its safe conduct. Firstly, the appropriateness of REx for most patients should be clearly communicated to physiotherapists and patients. Physiotherapists identified that some patients may be inappropriate for REx given their age, function, mobility, ability to learn, condition, and/or need for supervision. While there are cases where the acuity of the condition truly precludes a patient's ability to perform REx (e.g. unstable cardiac conditions,[24,25] severely impaired cognitive functioning[25]), it has been well-supported that strength training is safe for older adults and that immobility poses a greater risk to the individual than the exercise intervention itself.[6,7] Indeed, the American College of Sports Medicine supports that the contraindications to exercise in older adults are no different than those established for younger, healthy adults.[26] When supervised, even high intensity (70-80% of a patient's 1 repetition maximum) REx is considered appropriate for most older adults with frailty and other comorbid conditions.[2] While supervision is a barrier to REx prescription given the time constraints physiotherapists face, it may be possible to involve caregivers or other members of the healthcare team to provide supervision when exercising with older adults that require additional attention.[27] Survey results highlighted rehabilitation assistants in particular as potential facilitators to REx prescription. In BC, rehabilitation assistants have 16 months of didactic and practical training in disease and injury management, gerontology, and therapeutic exercise. In the

UK, rehabilitation assistants have previously been demonstrated to contribute to a consistent, goal-directed rehabilitation process and have also helped address workforce issues.[28],[29] Given their expertise, rehabilitation assistants may be well-suited to provide these supervisory services while also addressing the barriers of time and personnel support highlighted in this study.

Secondly, poor patient motivation may instead be a product of numerous barriers to REx participation experienced by older adults. Older adults have reported several barriers to participating in REx, or physical activity (PA) in general, such as fear of becoming too muscular, perceived risk of adverse events, or risk of injury and pain, as well as tiredness or fatigue.[30],[31] Educating patients on the potential benefits of PA (e.g., decreased fatigue,[32] decreased risk of cardiometabolic disease, improved functional independence[33]) has been previously recommended as part of the clinical role.[27,34] This conversation also presents as an opportunity to highlight the safety of REx to patients and dispel misconceptions regarding risks of adverse events, injury, and pain. Even among very elderly adults (>75 years), improvements in strength are observed with minimal adverse events when participating in REx.[35] Thus, physiotherapists may play an important role in educating and addressing the physiotherapist-identified barrier of patient motivation or perhaps more accurately, patient barriers that affect their ability to participate in REx. Taken together, education and personnel support (e.g., rehabilitation assistants) may help to address misconceptions regarding patient safety and motivation.

LIMITATIONS

A primary strength of this study is the use of an integrated knowledge translation approach in its development. Physiotherapists were involved at every stage of the research process, helping to prioritize recommendations, and enhancing the potential to increase our findings' relevance, uptake, and impact. As a limitation, some questionnaire items were removed

from the original survey to better fit the local context. In doing so, there were too few items to provide aggregate scores for domains. Another limitation was the lack of a rehabilitation-specific definition of REx used in the questionnaire. While the definition used (exercises to improve muscular strength) was broad, as noted in the survey comments, rehabilitative exercises that also meet this criterion may not have been included. As such, reported rates of REx prescription may be lower than actual use as physiotherapists might not have considered their current practices to constitute REx. It should be noted that the denominator used to calculate the response rate includes *all* physiotherapists working in the acute care setting (and not those specifically working with older adults), meaning the response rate is likely underestimated. However, the generalizability of our findings is supported by the similarity in demographics between our sample and those of the provincial data.

CONCLUSION

This study explored the current practice and factors affecting the use of REx with older adults by BC acute care physiotherapists. While many use REx-related practices such as assessing muscle strength and functional testing, diverse barriers experienced by both physiotherapists and patients limit the use of REx in the acute care hospital setting. This study proposes a definition of REx that aligns with rehabilitation priorities, highlights common misconceptions regarding patient motivation and safety, and suggests strategies to support increased use of REx in treatment programs. Future research is needed to examine whether the proposed definition of resistance exercise could be adopted by the broader physiotherapy community and whether the strategies identified in this study can influence the use of resistance exercise as a treatment strategy in the acute care setting.

Key message:

What is already known:

- Hospital-associated deconditioning can create prolonged challenges in a patient's daily living and lead to adverse outcomes upon discharge such as decreased independence, higher rates of recurrent hospitalizations, sarcopenia, and even death as a result of increasing frailty.
- It has been demonstrated that resistance exercise (REx) is crucial for preventing hospital-associated deconditioning for older adults in acute care.

What this study adds:

- While many physiotherapists reported performing resistance exercise-related assessment, few prescribe resistance exercise in the acute care hospital setting.
- To support acute care physiotherapists in using REx, we suggest a rehabilitation-specific definition of REx, emphasizing the safety and appropriateness of REx for this population, and highlight a need for providing personnel support (e.g., rehabilitation assistants) to enhance use of REx.

Declarations

Author contributions and acknowledgements

Concept/idea/research design: Chiara Singh, Maha Elashi, Kristi Gerevas, Melissa Idle, Janet Lundie, Maylinda Urbina, Alison Hoens, Jasmin Ma, Amber Chan

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Transparency declaration: The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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References

1. Canadian Institute for Health Information. Definitions and Guidelines to Support ALC Designation in Acute Inpatient Care Introduction Guidelines to support ALC designation by clinicians. 2016;
2. Falvey JR, Mangione KK, Stevens-Lapsley JE. Rethinking Hospital-Associated Deconditioning: Proposed Paradigm Shift. Phys Ther. 2015;95(9):1307–15.
3. Brown CJ, Redden DT, Flood KL, Allman RM. The underrecognized epidemic of low mobility during hospitalization of older adults. J Am Geriatr Soc. 2009;57(9):1660–5.
4. Marchiori GF, Tavares DM dos S. Changes in frailty conditions and phenotype components in elderly after hospitalization. Rev Lat Am Enfermagem. 2017;25.
5. Suetta C, Magnusson SP, Rosted A, Aagaard P, Jakobsen AK, Larsen LH, et al. Resistance training in the early postoperative phase reduces hospitalization and leads to muscle hypertrophy in elderly hip surgery patients - A controlled, randomized study. J Am Geriatr Soc. 2004;52(12):2016–22.
6. Jain H, Bhise A. Effect of Progressive Resisted Exercise on Strength, Endurance and Balance on Older Adults above 60 Years. Indian J Physiother Occup Ther - An Int J. 2014;8(4):54.
7. Connelly DM. Resisted exercise training of institutionalized older adults for improved strength and functional mobility: A review. Top Geriatr Rehabil. 2000;15(3):6–28.
8. Williams G, Denehy L. Clinical education alone is sufficient to increase resistance training exercise prescription. PLoS One. 2019;14(2):1–12.
9. Ottawa Hospital Research Institute. IKT Research Network [Internet]. 2020. Available from: https://iktrn.ohri.ca/

10. College of Physical Therapists of British Columbia Database. Internal communications.
11. Huijg JM, Gebhardt WA, Crone MR, Dusseldorp E, Presseau J. Discriminant content validity of a theoretical domains framework questionnaire for use in implementation research. Implement Sci. 2014;9(1):1–16.
12. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, et al. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. Implement Sci. 2017;12(1):1–18.
13. Michie S, van Stralen MM, West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. Implement Sci [Internet]. 2011;6(1):42. Available from: http://www.implementationscience.com/content/6/1/42
14. Michie S, Carey RN, Johnston M, Rothman AJ, Bruin M De, Kelly MP, et al. From theory-inspired to theory-based interventions: A protocol for developing and testing a methodology for linking behaviour change techniques to theoretical mechanisms of action. Ann Behav Med [Internet]. 2018; Available from: http://dx.doi.org/10.1007/s12160-016-9816-6
15. Quigley A, Baxter L, Keeler L, MacKay-Lyons M. Using the Theoretical Domains Framework to identify barriers and facilitators to exercise among older adults living with HIV. AIDS Care - Psychol Socio-Medical Asp AIDS/HIV. 2019;31(2):163–8.
16. Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJC, et al. Measuring determinants of implementation behavior: Psychometric properties of a questionnaire based on the theoretical domains framework. Implement Sci. 2014;9(1):1–15.
17. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol.

2006;3(2):77–101.

18. McNaughton H, DeJong G, Smout RJ, Melvin JL, Brandstater M. A comparison of stroke rehabilitation practice and outcomes between New Zealand and United States facilities. Arch Phys Med Rehabil. 2005;86(12 SUPPL.):115–20.

19. Signal NE. Strength training after stroke- rationale, evidence and potential implementation barriers for physiotherapists. 2014;42(2):101–7.

20. De Wit L, Putman K, Lincoln N, Baert I, Berman P, Beyens H, et al. Stroke rehabilitation in Europe: What do physiotherapists and occupational therapists actually do? Stroke. 2006;37(6):1483–9.

21. Winett RA, Carpinelli RN. Potential health-related benefits of resistance training. Prev Med (Baltim). 2001;33:503–13.

22. Seguin R, Nelson ME. The benefits of strength training for older adults. Am J Prev Med. 2003;25(3 SUPPL. 2):141–9.

23. Whitehurst MA, Johnson BL, Parker CM, Brown LE, Ford AM. The benefits of a functional exercise circuit for older adults. J Strength Cond Res. 2005;19(3):647–51.

24. Fragala MS, Cadore EL, Dorgo S, Izquierdo M, Kraemer WJ, Peterson MD, et al. Resistance Training for Older Adults: Position Statement From the National Strength and Conditioning Association. J strength Cond Res. 2019;33(8):2019–52.

25. Physiopedia. Exercise Physiology: Absolute Contraindications to Exercise.

26. American College of Sports Medicine. Exercise and physical activity for older adults: position stand. Med Sci Sport Exerc. 1998;30:992–1008.

27. Lee PG, Jackson EA, Richardson CR. Exercise prescriptions in older adults. Am Fam Physician. 2017;95(7):425–32.

28. Pullenayegum S, Fielding B, Du Plessis E, Peate I. The value of the role of the rehabilitation assistant. Br J Nurs. 2005;14(14):778–84.

29. Stanmore E, Waterman H. Crossing professional and organizational boundaries: The implementation of generic Rehabilitation Assistants within three organizations in the northwest of England. Disabil Rehabil. 2007;29(9):751–9.

30. Burton E, Farrier K, Lewin G, Pettigrew S, Hill AM, Airey P, et al. Motivators and barriers for older people participating in resistance training: A systematic review. J Aging Phys Act. 2017;25(2):311–24.

31. Brawley LR, Rejeski WJ, King AC. Promoting physical activity for older adults: The challenges for changing behavior. Am J Prev Med. 2003;25(3 SUPPL. 2):172–83.

32. Kucharski D, Lange E, Ross AB, Svedlund S, Feldthusen C, Önnheim K, et al. Moderate-to-high intensity exercise with person-centered guidance influences fatigue in older adults with rheumatoid arthritis. Rheumatol Int. 2019;39(9):1585–94.

33. Phillips SM. Resistance exercise : good for more than just Grandma and Grandpa ' s muscles. 2007;1198–205.

34. Martinello N, Bhandari A, Santos J, Dinh T. The Role of Physiotherapy in Canada: Contributing to a Stronger Health Care System. Ottawa Conf Board Canada. 2017;(March).

35. Grgic J, Garofolini A, Orazem J, Sabol F, Schoenfeld BJ, Pedisic Z. Effects of Resistance Training on Muscle Size and Strength in Very Elderly Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Sport Med [Internet]. 2020;(0123456789). Available from: https://doi.org/10.1007/s40279-020-01331-7

Table 1. Physiotherapists' perceived barriers to resistance exercise use and prescription for older adults in acute care

TDF domain	Barrier	Mean (SD) n=103	I strongly agree/ I agree responses (n)	%
Social/professional role and identity	Prescribing resistance exercise is a part of my work as a physiotherapist	4.61 (0.63)	100	95.3%
Beliefs about capabilities	I am confident that I can prescribe resistance exercises	4.55 (0.67)	97	92.4%
Skills	I have the skills to prescribe resistance exercise (e.g., assess strength, demonstrate proper technique, provide cues for proper technique)	4.53 (0.73)	99	94.3%
Knowledge	I know how to prescribe resistance exercise	4.49 (0.70)	98	93.3%
Beliefs about consequences	I believe that prescribing resistance exercises is worthwhile	4.44 (0.73)	93	88.5%
Intentions	I intend to prescribe resistance exercises in the next three months	4.18 (0.85)	78	74.3%
Behavioural regulation	I have a clear plan for under what circumstances I will prescribe resistance exercises	3.95 (0.91)	77	73.4%
Behavioural regulation	I have a clear plan of how I will prescribe resistance exercises	3.71 (0.96)	72	68.6%
Reinforcement	When I prescribe resistance exercises, I get positive feedback from patients/family	3.68 (0.88)	53	50.5%
Social/professional role and identity	Prescribing resistance exercises is compatible with my daily practice	3.53 (1.00)	56	53.3%
Social influences	Other colleagues in my work environment prescribe resistance exercises	3.47 (1.09)	54	51.4%
Social influences	Other colleagues in my work environment are helpful with prescribing resistance exercises	3.43 (1.00)	49	46.6%
Social/professional role and identity	The management of the organization I work in is supportive of prescribing resistance exercises	3.39 (0.92)	44	41.9%
Environmental context and resources	It takes little extra time to prescribe resistance exercises	3.30 (1.22)	51	48.5%
Memory, attention and decision processes	Prescribing resistance exercises is something I do without consciously having to remember	3.21 (1.13)	43	41.0%
Behavioural regulation	I have a clear plan with regard to prescribing resistance exercises when participants are not motivated	3.19 (1.11)	46	43.8%
Environmental context and resources	In the organization where I work, all necessary resources/equipment are available to prescribe resistance exercises	3.17 (1.15)	51	48.5%
Memory, attention and decision processes	Prescribing resistance exercises is something I seldom forget	3.08 (1.09)	34	32.4%
Social influences	Clients that I work with are motivated to do resistance exercises	2.97 (0.88)	29	27.6%
Environmental context and resources	Decision-makers in my healthcare authority provide sufficient support for prescribing resistance exercise	2.92 (0.95)	26	24.8%
Reinforcement	When I prescribe resistance exercises, I get positive feedback/recognition from the workplace (e.g. colleagues, managers)	2.73 (0.97)	16	15.3%
Goals	Prescribing resistance exercise is a higher priority than some of my other physiotherapy duties	2.62 (1.02)	18	17.1%

Note: TDF = Theoretical domains framework. Shaded area highlights the greatest perceived barriers to resistance exercise, including responses scoring lower than 3 ("I neither agree nor disagree")