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Consumer perceptions of, and willingness to use, remotely-delivered service models for exercise management of knee and hip osteoarthritis: a cross-sectional survey

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Abstract

Objective. To investigate the perceptions of people with hip and/or knee OA about the remote delivery of exercise therapy by a physical therapist.

Methods. A survey of people aged ≥45 years with a clinical diagnosis of hip and/or knee OA. The survey comprised three sections including: i) demographic information; and statements about receiving exercise via the ii) telephone and; iii) video over the internet. Data were analysed by calculating response proportions and evaluating levels of agreement with each statement. Exploratory binomial regression analyses were performed to determine whether participant characteristics influenced perceptions to telerehabilitation.

Results. 330 people spanning metropolitan, regional, and rural Australia completed the survey. Respondents were in majority (≥50%) agreement with 13 of 17 statements, with most agreement about telerehabilitation saving time (telephone vs video; 78% vs 81% respectively), being easy to use (79% vs 78%), and maintaining privacy (86% vs 82%). There was no consensus agreement with liking the lack of physical contact (telephone vs video; 20% agreement vs 22% respectively), willingness to pay (32% vs 46%), belief that telephone-delivered exercise would be effective (45%), and belief that a physical therapist could adequately monitor OA over the telephone (42%).

Conclusion. People with knee and/or hip OA hold mostly positive perceptions about telerehabilitation, delivered via the telephone or by video over the internet, for provision of physical therapist-prescribed exercise services. There was concern about the lack of physical contact with the therapist when using telerehabilitation.

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Significance and innovations

- Remote models of service delivery can increase the accessibility of physical therapy services for people with hip and/or knee osteoarthritis (OA), which may improve exercise uptake and clinical outcomes in this population, reducing the burden of OA on society.
- This is the first study to investigate the perceptions people with knee and/or hip OA have about telerehabilitation (remote) models of service delivery for physical therapist-prescribed exercise.
- Most people with hip and/or knee OA have positive perceptions about care delivered over the telephone, or via video over the internet, acknowledging ease of use and time saving advantages.
- However there was uncertainty about receiving care that does not involve physical contact with the therapist, which may impact on patient perceptions about the effectiveness of care received via telerehabilitation.

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Introduction

Osteoarthritis (OA) is a common health problem that causes pain, disability, and impaired quality of life. Both knee and hip OA have a high prevalence, affecting around 24% and 11% of the population, respectively (1), and are both ranked as the 11th highest contributor to global disability (2). As the population ages and rates of obesity increase, the prevalence of OA is projected to reach 30% in 2032 (2, 3). This will lead to a large increase in demand for health services for OA in the future. As there is no cure for OA, accessible and effective models of health service delivery that can be provided on a population level are urgently needed to meet the rising burden of the condition.

All current clinical guidelines advocate exercise as a fundamental and core component of non-surgical OA management (4). Muscle strengthening and aerobic exercise has been shown to improve pain and function by increasing muscle strength and physical fitness, and decrease the burden of OA-associated comorbidities (5). The benefits of exercise on pain and physical function are similar to those of analgesics and non-steroidal anti-inflammatory drugs, but with fewer contraindications and side effects (5, 6). Unfortunately, uptake of exercise amongst people with hip and or knee OA is low internationally (7-9). For people with OA, exercise advice is typically provided by physical therapists, but for many, transport issues or geographic location may preclude visiting physical therapists, particularly in regional, rural, and remote areas where such services may be limited or non-existent (10-12).

Telerehabilitation, defined as the remote provision of rehabilitation services using telecommunication technology (13), is a model of service delivery that may improve access to specialist advice for exercise management, allowing patients to consult with a therapist from their own home or workplace. Research in people who have undergone knee

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arthroplasty has found telerehabilitation outcomes to be comparable to conventional face-to-face care (14-16). The single small study investigating the role of telerehabilitation for exercise management of people with knee OA supports these findings (17).

Little is known about the perceptions people with OA have about remotely delivered models of exercise management. Successful implementation of telerehabilitation models of service delivery is dependent upon user acceptance and perceived usefulness of the service (18-20). Previous research has found that patients with chronic pain (21) or chronic diseases (e.g. congestive heart failure, chronic obstructive pulmonary disease) (22) with no prior telerehabilitation experience express intent to use such services, viewing them as a useful and convenient mode of healthcare delivery, and valuing the potential benefits such as reduced transportation costs and flexibility. However, consumers have also expressed fears about reduced fellow sufferer contact and concerns about ease of use, issues of cost, and reduced face-to-face therapist contact (21, 22). As physical therapy services are traditionally viewed as a face-to-face encounter that is 'hands-on' (23), physical therapy-based telerehabilitation services may be less acceptable to people with OA, but this has not yet been explored. The aim of this study was to investigate consumer perceptions about, and willingness to use, remotely-delivered service models for physical therapist-prescribed exercise management of hip and/or knee OA.

Materials and methods

Study design

A descriptive, cross-sectional national survey was undertaken.

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Participants

People with clinical hip and/or knee OA living in rural, regional, and metropolitan areas of Australia were recruited between August 2015 and February 2016. People were recruited by advertisements on the Centre for Health, Exercise & Sports Medicine website, community newsletters, and using social media (Facebook). Additionally, people who had previously volunteered for research studies conducted by the researchers and who had consented to be contacted for future studies were sent an invitation to participate. To ensure a geographical spread of participants from locations across Australia, some Facebook advertisements were specifically targeted towards interstate, regional, and remote areas. We aimed for a minimum sample size of 300 to ensure reasonably accurate estimates of proportions agreeing with statements for the target population of hip and knee OA. Assuming 50% agreement with statements, a minimum sample of 300 people would ensure a maximum width of 11% in the 95% confidence intervals around the proportions.

Inclusion criteria included i) being aged 45 years or over; ii) being able to read and understand English and; iii) having knee and/or hip OA. A clinical diagnosis of OA was confirmed at the start of the survey according to the National Institute for Health and Care Excellence (NICE) criteria for clinical diagnosis of OA (24). Participants were required to respond positively to three questions: i) Are you aged 45 years or over?; ii) Do you experience activity-related hip and/or knee pain (such as pain in your hip/knee when you perform activities such as walking, getting up from a chair, dressing, or bending down)? and; iii) Do you have morning stiffness in the knee and/or hip that lasts for ≤ 30 minutes?.

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Survey instrument

Participants completed a survey (either online via SurveyGizmo or in hardcopy returned via reply-paid post) about their perceptions about receiving a physical therapist-prescribed exercise program i) over the telephone and; ii) via video over the internet (e.g. Skype, FaceTime). The survey (Appendix A) comprised three sections: Section A asked for basic demographic data (e.g. age, sex, level of education), information about the osteoarthritic joint(s) and use of and familiarity with technology; Sections B and C of the survey were adapted from some statements of the Telemedicine Perception Questionnaire (25) (item #1-10) and also included some custom-developed statements (item #11-17). Each of these sections thus included 17 statements about receiving an exercise program from a physical therapist over the telephone (Section B) and via video over the internet (Section C). For consistency, all perception statements were framed positively (i.e. "I agree that…"). Respondents were asked to rate their agreement with each statement on a 5-point Likert scale ranging from "Strongly agree" to "Strongly disagree".

Data analysis

All data were downloaded from SurveyGizmo and processed in Excel (Microsoft Corporation, Washington USA). Geographic residential locations of respondents were categorised by postcodes into: major cities, inner regional areas, outer regional areas, remote areas, and very remote areas (http://www.health.gov.au/internet/otd/publishing.nsf/Content/locator).

Data analysis was carried out with the Statistical Package for the Social Sciences (SPSS, IBM corp., Version 22, Armonk USA). Descriptive statistics were calculated. Data pertaining to statements (Sections B and C) were described as n (%), with 95% confidence intervals (CI)

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calculated around proportions. To assess levels of agreement amongst respondents within each statement, we evaluated the percentage of participants who marked "Strongly agree" and "Agree" to each statement. According to the methods of Holden et al 2009 (26), we defined 100% as unanimity, 75-99% as consensus, 51-74% as majority view, and 0-50% as no consensus. To compare perceptions of exercise delivered over the telephone and exercise delivered via video over the internet, confidence intervals around response distributions for overall agreement and disagreement were compared. If confidence intervals did not overlap, it was assumed that there was a significant difference in response distribution.

To explore whether participant characteristics influenced perceptions, we conducted binomial logistic regression analyses using responses to the statement "*If there was a service offering PT-prescribed exercise over the _____ for my OA, I would be interested in using it*" for each of the telephone and video services. For the dependent variables, participants were classified as being either in agreement (i.e. marked "strongly agree" or "agree") or not in agreement (i.e. marked "unsure", "disagree", and "strongly disagree"). Independent variables included age, gender, level of education, financial situation, joint affected by OA, previous experience with physical therapy interventions, and geographical remoteness classification. Some response categories for financial situation, level of education, and remoteness classification were grouped together to increase sample size. Analyses were performed using SPSS.

Results

Characteristics of the participants

Three hundred and thirty people provided complete datasets. The characteristics of respondents are shown in Table 1. All but one participant completed the survey online. Most participants were women, and many had knee OA, although hip OA was also represented.

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Most participants resided in major cities, with around a third from regional centres and a few from remote areas. Most respondents had seen a physical therapist before, either for their OA or another health condition. The majority had no previous experience with telerehabilitation, and for those that had, most had consulted with a health professional over the telephone rather than via video over the internet.

Familiarity with technology

Table 2 summarises the levels of familiarity with technology reported by the cohort. Almost all participants owned a mobile telephone, and at least half owned either a tablet or computer as well. Only one respondent had no access to the internet on any device. Most participants were quite a bit or extremely confident using a mobile telephone (n= 250, 78%) or computer (n=257, 79%) and most had been using the internet for more than 6 years.

[Table 1 and 2 here]

Perceptions about telerehabilitation

Responses to statements, for each of telephone and video service delivery models, are displayed in Table 3, with consensus agreement in Figure 1. There was at least majority agreement (≥50% of respondents agree or strongly agree) for most (13 out of 17) statements, however only five statements achieved consensus agreement (≥75% agree or strongly agree). These included: a) having a physical therapist prescribe exercise over the telephone, and by video over the internet, would save time (telephone vs video; 78% vs 81% respectively); b) having a physical therapist prescribe exercise via video over the internet would be convenient (78%); c) using the telephone, and video over the internet, to consult a physical therapist for exercise would be easy (79% vs 78% respectively); d) using video over the internet would be

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a useful (practical) way to receive a physical therapist-prescribed exercise program for OA (76%); and e) privacy would not be violated with an exercise program over the telephone, or video over the internet (86% vs 82% respectively).

There was no consensus agreement regarding the statements relating to: a) liking the lack of physical contact with the therapist prescribing exercise over the telephone and via video (20% vs 22% agreement, respectively); b) being willing to pay for physical therapist-prescribed exercise over the telephone and via video (32% vs 46%, respectively); c) effectiveness of telephone-delivered exercise by a physical therapist (45%), and; d) belief that a physical therapist would be able to adequately monitor OA over the telephone (42%).

For most (11 of 17) statements, response distributions were similar for both modes of service delivery, indicating no clear preference for either telephone or video. However, video was preferred over the telephone for the remaining six statements. More respondents agreed that exercise delivered via video over the internet would be effective (telephone vs video; 45% (95% CI 40-51%) vs 64% (59-68%) respectively), useful (65% (60-70%) vs 76% (71-81%)) and acceptable (56% (51-62%) vs 72% (66-77%)) compared to the telephone. Similarly, more people agreed that using video would allow the therapist to get a good understanding of their OA (telephone vs video; 57% (95% CI 51-61%) vs 71% (66-76%) respectively) and to adequately monitor their OA (42% (36-48%) vs 57% (51-62%)) compared to the telephone. More respondents were willing to pay for a service via video over the internet compared to the telephone (telephone vs video; 32% (95% CI 27-37%) vs 46% (40-52%) respectively).

[Table 3 plus Figure 1 here]

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Influence of participant characteristics on interest in using telerehabilitation is displayed in Tables 4 and 5. None of the independent variables contributed significantly to the model for interest in using telephone-delivered services. For interest in using services delivered via video, people who had hip OA had 2.5 times the odds of not agreeing, compared to those with knee OA. Similarly for video services, the odds of not agreeing were reduced by around a half in people who were able to manage financially, compared to those who were in financial strain or had to be careful with their money.

[Table 4 and 5 here]

Discussion

Our study aimed to investigate the perceptions of people with hip and/or knee OA about the remote delivery of exercise by a physical therapist. In our sample, there was consensus agreement about the convenience, ease of use, and privacy of such a service delivered over the telephone as well as via video over the internet. Our findings also showed most people with knee and/or hip OA hold positive perceptions about factors relating to the acceptability of such models of service delivery, and most believed that they would be interested in using such services if they existed. However, there was no consensus agreement regarding willingness to pay for remotely delivered services and liking the lack of physical contact with the therapist when consulting remotely.

To our knowledge, ours is the first survey investigating the perceptions of people with OA about the use of telerehabilitation for physical therapist-prescribed exercise. Previously, small qualitative studies had explored expectations about prospective telerehabilitation programs in people with congestive heart failure and/or chronic obstructive pulmonary disease (22),

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chronic pain (21), and in older adults without any specific health condition (27). A small number of studies have also explored experiences after undergoing telerehabilitation following arthroplasty (16, 28, 29). Collectively, these studies found that participants believed telerehabilitation would be a useful and convenient mode of service delivery, but had concerns about using the technology, as well as reduced contact with fellow sufferers and the treating health professional. Our data from a sample of people with hip/knee OA are broadly consistent with these findings, with our survey respondents acknowledging the advantages of remote models of service delivery. However, in contrast, our sample did not express concern about using the technology, and in fact, agreement about ease of technology use was one of the few statements that reached consensus. This may be because previous studies utilised complex and sophisticated videoconferencing systems that incorporated an extensive suite of clinical measurement tools (e.g. a single lead electrocardiogram, pulse oximeter etc.) (22) and feedback sensors about physical movements during exercise (21). In contrast, we explored the acceptability of simple and readily available technology that can be found in most homes and that many people already use on a regular basis for social purposes. Furthermore, we recruited 54% of our participants through social media, which may have biased our sample towards those who have greater confidence in using technology, and a large proportion of our cohort were highly educated (63% having university or higher university degrees), which is in contrast to previous studies where most participants had a low level of education (21).

Our findings indicate that people with OA most strongly value telerehabilitation's potential to save time, offer convenience, be easy to use, and maintain their privacy. These values are consistent with findings of previous research exploring barriers to exercise participation in this patient group (30-32). Difficulties accessing therapists and/or exercise facilities due to

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lack of transport and/or car parking have been highlighted as a major barrier. Other barriers include lacking the time to attend appointments or participate in therapy, and/or believing that exercise would conflict with everyday routines. As telerehabilitation allows patients to consult with a therapist from their own home or workplace, this may enable patients to better incorporate exercise into their daily routines and overcome barriers associated with transport or parking difficulties.

Although survey participants were generally positive about telerehabilitation for receiving physical therapist-prescribed exercise, there were some statements where no consensus agreement was reached. Less than 23% of people agreed that they would like the lack of physical contact with the therapist when consulting remotely. These findings are consistent with a qualitative study by Cranen and colleagues (21) who found that chronic pain patients thought they would feel insecure and would perform exercises incorrectly in the absence of visual and face-to-face supervision from a therapist. Physical touch is known to play an important role in physical therapy, particularly as a means to develop trust and connect with the patient (33-35). However, no previous studies have investigated whether exercise performance or outcomes are improved when a physical therapist is able to touch a patient when prescribing exercise, or whether verbal descriptions and recommendations for exercise are sufficient. Our findings suggest that service providers who are considering using telerehabilitation delivery models may wish to consider a blended model of both face-to-face care combined with remotely-delivered consultations. In addition, telerehabilitation models of care for people with OA should incorporate education for patients about the benefits of exercise, and to reassure them that "hands-on" therapies are only recommended as adjunct treatments for OA (4), and that there is no evidence that class-based or supervised exercise programs are more effective than home-based programs (5). The importance of educating

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patients about OA management is further highlighted by our finding that almost one third of respondents were unsure about whether exercise was beneficial for OA, despite the fact that exercise is one of three core management approaches and is advocated by all current clinical guidelines (4). Future studies should investigate the reasons why people with OA believe that physical contact is important when consulting a physical therapist, and whether this belief can be changed with education and/or experience using telerehabilitation.

Only 32-46% of the survey cohort agreed or strongly agreed that they would be willing to pay for a service that offered physical therapist-prescribed exercise via telerehabilitation. These findings reflect those reported elsewhere, where people with congestive heart failure and/or chronic obstructive pulmonary disease (22) and older adults (27) expressed concerns about the cost of telerehabilitation, recommending that the system be provided in a way that would be affordable to consumers. These findings suggest that future telerehabilitation services may be better suited to public healthcare sectors, where out-of-pocket costs to patients are reduced, rather than the private health care sector where patients incur out-of-pocket costs for services. However, it should also be noted that almost 50% of our cohort were unsure about their willingness to pay. This may be reflective of a limitation of our survey, as we did not provide any benchmark indicators about potential costs of such services for respondents to judge willingness to pay against. Future studies should investigate the reasons why people with OA may or may not be willing to pay for telerehabilitation services, and how such services can be made more appealing.

For some statements, respondents appeared to believe that exercise delivered over the telephone would be less acceptable, effective, and useful than delivery via video. This suggests that telerehabilitation services for people with OA should utilise video rather than

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telephone. However, videoconferencing requires access to an appropriate device (i.e. a computer/laptop/tablet with a microphone and camera) with videoconferencing software, a reliable internet connection, and the skills to confidently operate the technology. In this study, almost the entire cohort owned a mobile telephone, but only around 60% owned a desktop computer, laptop, or tablet device. Additionally, only 26% of survey respondents said they would be 'extremely' confident using videoconferencing software. Therefore, healthcare providers considering telerehabilitation services for knee OA may wish to use hybrid models of service delivery that offer both telephone and video options to give patients the flexibility of choosing the mode of delivery most suitable for their individual circumstances.

Our findings showed few participant characteristics to be influential in determining interest in using either telephone or video physical therapy telerehabilitation services, suggesting that such services are applicable to a wide range of people with OA. Although financial situation had no significant influence on interest in using telephone services, people who were able to manage without much difficulty were more likely to be interested in using video-delivered services than people who were financially strained. This may be because video services require an internet connection and more sophisticated equipment that come at a financial cost. Interestingly, people with hip OA were less interested in using video services than those with knee OA. It is not clear from this cross-sectional survey why this is the case, but these results must be interpreted cautiously given that only 13% of the entire cohort comprised people with hip OA only. We found that geographical remoteness had no significant influence on interest in using telephone or video services, which may be because our sample of people living in remote areas was too small to detect any significant differences. It is possible that, even though physical therapists in Australia are primarily metropolitan-based (36), people with OA living in metropolitan cities may value services that allow them to consult remotely

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from their own home so they can avoid heavy traffic conditions or parking difficulties when travelling to and from clinics.

Strengths of our study include the geographical range from which we recruited survey participants, with all states and territories of Australia represented, spanning metropolitan, regional, and remote areas. If we applied the older Australian government system of classifying remoteness, 28% of our sample were from rural and remote areas (data not reported). Another strength was the breadth and range of perceptions we assessed quantitatively via survey, which substantially builds on the limited qualitative data that currently exists. Our study also has a number of limitations. Around half of our survey respondents were recruited via Facebook advertisements and all but one completed the survey online. Thus, our data is likely biased towards people that are already comfortable using technology, and the perceptions of people who are less proficient with technology may differ to those of our sample. Additionally, the width of our confidence intervals must be noted. It is possible that replication of our study in different samples could yield higher proportions of people disagreeing with the statements. Finally, our recruitment methods meant that we had no way of knowing how many people chose not to respond to the survey, and therefore do not know whether responders were significantly different to non-responders.

Our study has highlighted a number of areas for future research. These include qualitative studies investigating how perceptions change after undertaking physical therapist-supervised exercise via telerehabilitation, and exploring reasons behind the perceptions of people with OA towards remote models of service delivery. Our survey did not assess all components of remote models of service delivery that may be important to patients, such as the development of therapeutic alliance or bond with therapists (37). Importantly, future research should also

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investigate the perceptions of physical therapists about telerehabilitation for people with knee OA, and whether they would be willing to deliver such a service.

In conclusion, this study found that people with knee and/or hip OA have mostly positive perceptions about telerehabilitation for providing physical therapist-prescribed exercise services. However, this study also highlights the uncertainty people have about receiving care that does not involve physical contact with a therapist. Findings from this study contribute towards future design and implementation of telerehabilitation services by better understanding why people with OA may or may not be inclined to be involved in such services.

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References

1. Pereira D, Peleteiro B, Araujo J, Branco J, Santos R, Ramos E. The effect of osteoarthritis definition on prevalence and incidence estimates: a systematic review. Osteoarthritis and Cartilage. 2011;19(11):1270-85.

2. Cross M, Smith E, Hoy D, Nolte S, Ackerman I, Fransen M, et al. The global burden of hip and knee osteoarthritis: estimates from the global burden of disease 2010 study. Ann Rheum Dis. 2014;73(7):1323-30.

3. Turkiewicz A, Petersson I, Björk J, Hawker G, Dahlberg L, Lohmander L, et al. Current and future impact of osteoarthritis on health care: a population-based study with projections to year 2032. Osteoarthritis and Cartilage. 2014;22(11):1826-32.

4. Nelson AE, Allen KD, Golightly YM, Goode AP, Jordan JM. A systematic review of recommendations and guidelines for the management of osteoarthritis: The chronic osteoarthritis management initiative of the U.S. bone and joint initiative. Semin Arthritis Rheum. 2014;43(6):701-12.

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This article is protected by copyright. All rights reserved.

5. Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL. Exercise for osteoarthritis of the knee.[Update of Cochrane Database Syst Rev. 2008;(4):CD004376; PMID: 18843657]. Cochrane Database Syst Rev. 2015;1:CD004376.

6. Zhang W, Nuki G, Moskowitz R, Abramson S, Altman R, Arden N, et al. OARSI recommendations for the management of hip and knee osteoarthritis: part III: Changes in evidence following systematic cumulative update of research published through January 2009. Osteoarthritis and Cartilage. 2010;18(4):476-99.

7. Jordan K, Sawyer S, Coakley P, Smith H, Cooper C, Arden N. The use of conventional and complementary treatments for knee osteoarthritis in the community. Rheumatology. 2004;43(3):381-4.

8. Hinman RS, Nicolson PJ, Dobson FL, Bennell KL. Use of nondrug, nonoperative interventions by community-dwelling people with hip and knee osteoarthritis. Arthritis Care Res (Hoboken). 2015;67(2):305-9.

9. Mitchell HL, Hurley MV. Management of chronic knee pain: a survey of patient preferences and treatment received. BMC Musculoskelet Disord. 2008;9:123.

10. Hagglund KJ, Clark MJ, Hilton SA, Hewett JE. Access to healthcare services among persons with osteoarthritis and rheumatoid arthritis. American journal of physical medicine & rehabilitation. 2005;84(9):702-11.

11. Ackerman IN, Busija L. Access to self-management education, conservative treatment and surgery for arthritis according to socioeconomic status. Best Practice & Research Clinical Rheumatology. 2012;26(5):561-83.

12. Dobson F, Bennell KL, French S, Nicolson PJA, Klaasman RN, Holden MA, et al. Barriers and facilitators to exercise participation in people with hip and/or knee osteoarthritis. American journal of physical medicine & rehabilitation. 2015.

13. Australian Physiotherapy Association. Telerehabilitation. Background paper.; 2009.

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Accepted Article

14. Piqueras M, Marco E, Coll M, Escalada F, Ballester A, Cinca C, et al. Effectiveness of an interactive virtual telerehabilitation system in patients after total knee arthoplasty: a randomized controlled trial. J Rehabil Med. 2013;45(4):392-6.

15. Tousignant M, Moffet H, Boissy P, Corriveau H, Cabana F, Marquis F. A randomized controlled trial of home telerehabilitation for post-knee arthroplasty. J Telemed Telecare. 2011;17(4):195-8.

16. Russell TG, Buttrum P, Wootton R, Jull GA. Internet-based outpatient telerehabilitation for patients following total knee arthroplasty: a randomized controlled trial. J Bone Joint Surg Am. 2011;93(2):113-20.

17. Odole AC, Ojo OD. Is telephysiotherapy an option for improved quality of life in patients with osteoarthritis of the knee? Int J Telemed Appl. 2014;2014:903816.

18. Broens TH, Vollenbroek-Hutten MM, Hermens HJ, van Halteren AT, Nieuwenhuis LJ. Determinants of successful telemedicine implementations: a literature study. Journal of telemedicine and telecare. 2007;13(6):303-9.

19. Chau PY, Hu PJ-H. Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories. Information & management. 2002;39(4):297-311.

20. Hu PJ, Chau PY, Sheng ORL, Tam KY. Examining the technology acceptance model using physician acceptance of telemedicine technology. Journal of management information systems. 1999:91-112.

21. Cranen K, Drossaert CH, Brinkman ES, Braakman-Jansen AL, IJzerman MJ, Vollenbroek-Hutten MM. An exploration of chronic pain patients' perceptions of home telerehabilitation services. Health Expectations. 2012;15(4):339-50.

22. Rahimpour M, Lovell NH, Celler BG, McCormick J. Patients' perceptions of a home telecare system. International journal of medical informatics. 2008;77(7):486-98.

Accepted Article

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23. Thornquist E. Face-to-face and hands-on: assumptions and assessments in the physiotherapy clinic. Medical Anthropology. 2006;25(1):65-97.

24. National Institute for Clinical Excellence. Osteoarthritis - Care and Management in Adults, Clinical Guideline CG177. In: Excellence NIfC, editor. London; 2014.

25. Demiris G, Speedie S, Finkelstein S. A questionnaire for the assessment of patients' impressions of the risks and benefits of home telecare. Journal of telemedicine and telecare. 2000;6(5):278-84.

26. Holden MA, Nicholls EE, Young J, Hay EM, Foster NE. UK-based physical therapists' attitudes and beliefs regarding exercise and knee osteoarthritis: findings from a mixed-methods study. Arthritis Rheum. 2009;61(11):1511-21.

27. Cimperman M, Brencic MM, Trkman P, Stanonik MdL. Older adults' perceptions of home telehealth services. Telemed J E Health. 2013;19(10):786-90.

28. Tousignant M, Boissy P, Moffet H, Corriveau H, Cabana F, Marquis F, et al. Patients' satisfaction of healthcare services and perception with in-home telerehabilitation and physiotherapists' satisfaction toward technology for post-knee arthroplasty: an embedded study in a randomized trial. Telemedicine and e-Health. 2011;17(5):376-82.

29. Kairy D, Tousignant M, Leclerc N, Côté A-M, Levasseur M. The patient's perspective of in-home telerehabilitation physiotherapy services following total knee arthroplasty. International journal of environmental research and public health. 2013;10(9):3998-4011.

30. Dobson F, Bennell KL, French SD, Nicolson PJ, Klaasman RN, Holden MA, et al. Barriers and Facilitators to Exercise Participation in People with Hip and/or Knee Osteoarthritis: Synthesis of the Literature Using Behavior Change Theory. American Journal of Physical Medicine & Rehabilitation. 2016;95(5):372-89.

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31. Holden MA, Nicholls EE, Young J, Hay EM, Foster NE. Role of exercise for knee pain: what do older adults in the community think? Arthritis Care Res (Hoboken). 2012;64(10):1554-64.

32. Petursdottir U, Arnadottir SA, Halldorsdottir S. Facilitators and barriers to exercising among people with osteoarthritis: a phenomenological study. Physical Therapy. 2010;90(7):1014-25.

33. Bjorbaekmo WS, Mengshoel AM. "A touch of physiotherapy" - the significance and meaning of touch in the practice of physiotherapy. Physiother. 2016;32(1):10-9.

34. Hiller A, Guillemin M, Delany C. Exploring healthcare communication models in private physiotherapy practice. Patient Educ Couns. 2015;98(10):1222-8.

35. Roger J, Darfour D, Dham A, Hickman O, Shaubach L, Shepard K. Physiotherapists' use of touch in inpatient settings. Physiotherapy research international. 2002;7(3):170-86.

36. HealthWorkforce Australia. Australia's Health Workforce Series: Physiotherapists in Focus. 2014.

37. Hall AM, Ferreira PH, Maher CG, Latimer J, Ferreira ML. The influence of the therapist-patient relationship on treatment outcome in physical rehabilitation: a systematic review. Physical Therapy. 2010.

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Table 1. Demographic and clinical characteristics of respondents (n = 330).

		n (%) or mean (±SD)
Gender	Female	253 (78)
	Male	74 (22)
Age (yrs)		61.7 (±7.7)
Geographical remoteness	Major cities	212 (66)
	Inner regional	75 (23)
	Outer regional	29 (9)
	Remote	4 (1)
	Very remote	4 (1)
Level of education	Primary school	3 (1)
	High school	68 (21)
	Trade or trade certificate	48 (14)
	University or tertiary institute degree	157 (48)
	Higher university degree	50 (15)
	Don't know/unsure	3 (1)
Financial situation	Find it a strain to get by from week to week	24 (7)
	Have to be careful with money	102 (31)
	Able to manage without much difficulty	128 (39)
	Quite comfortably off	62 (19)
	Very comfortably off	13 (4)
Joint/s affected by osteoarthritis	Knee	190 (58)
	Hip	41 (13)
	Both	95 (29)
Pain level (NRS)	Average pain over past week	5.4 (±2.0)
	Walking pain over past week	5.5 (±2.1)
Previous experience with physical therapy interventions	No	72 (22)
	Yes, for osteoarthritis	151 (46)
	Yes, for another health condition	167 (51)
Previous experience with telerehabilitation	No	292 (91)
	Yes, over the phone	22 (7)
	Yes, via video over the internet	3 (1)
	Yes, both phone and video over the internet	5 (1)

SD.: standard deviation; NRS: Numeric Rating Scale with scores ranging 0 to 10 and higher scores indicating more pain. Individual items may not add to totals due to missing data.

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Table 2. Familiarity with technology across the cohort (n = 330)

		n (%)
Owned electronic devices	Mobile phone	313 (95)
	Hand-held tablet/iPad	205 (62)
	Laptop/notebook computer	199 (60)
	Desktop computer	172 (52)
	None of the above	0 (0)
Owned devices with internet access	Mobile phone	243 (74)
	Hand-held tablet/iPad	195 (59)
	Laptop/notebook computer	199 (60)
	Desktop computer	167 (51)
	None	1 (0)
Mobile phone use	Never	1 (0)
	Once every few months	6 (2)
	Once a month	7 (2)
	Once a week	13 (4)
	Several times a week	49 (15)
	Every day	250 (77)
Confidence with a mobile phone	Not at all	0 (0)
	A little	15 (4)
	Moderately	58 (18)
	Quite a bit	112 (35)
	Extremely	138 (43)
Computer use	Never	7 (2)
	Once every few months	3 (1)
	Once a month	6 (2)
	Once a week	17 (5)
	Several times a week	47 (15)
	Every day	245 (75)
Confidence with a computer	Not at all	2 (1)
	A little	8 (3)
	Moderately	57 (17)
	Quite a bit	115 (35)
	Extremely	142 (44)

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Table 2. Familiarity with technology across the cohort (n = 330)

		n (%)
Internet use	Never	1 (0)
	Once every few months	2 (1)
	Once a month	0 (0)
	Once a week	8 (3)
	Several times a week	31 (9)
	Every day	283 (87)
Years of using the internet	Never used the internet	0 (0)
	Less than 1 year	0 (0)
	1-2 years	8 (2)
	3-4 years	22 (7)
	5-6 years	20 (7)
	More than 6 years	276 (84)
Ability to use the internet	Never used the internet	0 (0)
	Poor	5 (2)
	Fair	41 (12)
	Good	153 (47)
	Excellent	127 (39)
Confidence using video chat services	Not at all	22 (7)
	A little	30 (9)
	Moderately	93 (28)
	Quite a bit	97 (30)
	Extremely	84 (26)

Individual items may not add to totals due to missing data.

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Table 3. Perceptions towards telerehabilitation for physical therapist-prescribed exercise for knee and/or hip osteoarthritis (n = 330)

Statement		Strongly agree n (%, 95% CI)	Agree n (%, 95% CI)	Unsure n (%, 95% CI)	Disagree n (%, 95% CI)	Strongly disagree n (%, 95% CI)
Exercise is beneficial for OA.		138 (43, 37-49)	117 (36, 30-41)	63 (19, 16-24)	7 (2, 1-4)	0 (0)
An exercise program prescribed by a PT would improve my OA.		102 (31, 26-36)	124 (38, 33-44)	96 (30, 24-35)	3 (1, 0-2)	0 (0)
A PT would get a good understanding of my OA over the _____.	Telephone	36 (11, 8-15)	151 (46, 40-51)	121 (37, 32-43)	18 (5, 3-8)	4 (1, 0-2)
	Internet video	48 (15, 11-19)	183 (56, 50-61)	84 (25, 22-30)	10 (3, 1-5)	2 (1, 0-2)
My privacy would not be violated if the PT prescribed me an exercise program over the _____.	Telephone	108 (33, 28-38)	174 (53, 48-58)	23 (7, 4-10)	16 (5, 2-7)	7 (2, 1-4)
	Internet video	69 (21, 17-26)	196 (61, 54-66)	45 (14, 10-18)	11 (3, 2-5)	3 (1, 0-2)
Using the _____ to consult the PT for a prescribed exercise program would be easy for me.	Telephone	74 (23, 18-27)	184 (56, 50-61)	51 (15, 12-20)	16 (5, 2-8)	4 (1, 0-3)
	Internet video	55 (17, 13-21)	198 (61, 55-65)	54 (16, 13-21)	15 (5, 3-7)	4 (1, 0-2)
I would be as satisfied talking to the PT over the _____ as I would be talking to the PT in person in their consulting room.	Telephone	41 (12, 9-17)	163 (50, 45-55)	72 (22, 17-27)	45 (14, 10-17)	7 (2, 1-4)
	Internet video	46 (14, 11-18)	176 (54, 49-59)	69 (21, 16-26)	30 (9, 6-13)	5 (2, 0-3)
An exercise program prescribed by a PT over the _____ would improve my OA.	Telephone	40 (12, 8-16)	130 (40, 35-46)	147 (45, 39-51)	9 (3, 1-5)	1 (0, 0-1)
	Internet video	37 (12, 8-15)	147 (46, 40-51)	129 (40, 35-45)	8 (2, 1-4)	1 (0, 0-1)
An exercise program prescribed by a PT over the _____ would save me money.	Telephone	62 (19, 15-24)	162 (50, 45-56)	94 (29, 24-34)	5 (2, 0-3)	0 (0, 0-0)
	Internet video	39 (12, 8-16)	155 (48, 42-53)	121 (37, 32-43)	10 (3, 1-5)	1 (0, 0-1)
The PT would be able to adequately monitor my OA over the _____.	Telephone	19 (6, 3-8)	119 (36, 31-42)	159 (49, 43-54)	26 (8, 5-11)	3 (1, 0-2)
	Internet video	25 (8, 5-11)	159 (49, 43-54)	117 (36, 31-43)	19 (6, 4-9)	2 (1, 0-2)
I like that there would be no physical contact with the PT prescribing me exercise over the _____.	Telephone	8 (2, 1-4)	57 (18, 14-22)	135 (41, 36-46)	107 (33, 28-38)	18 (6, 3-8)
	Internet video	15 (5, 3-7)	56 (17, 13-22)	134 (41, 36-47)	105 (33, 27-38)	13 (4, 2-6)

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Table 3. Perceptions towards telerehabilitation for physical therapist-prescribed exercise for knee and/or hip osteoarthritis (n = 330)

Statement		Strongly agree n (%, 95% CI)	Agree n (%, 95% CI)	Unsure n (%, 95% CI)	Disagree n (%, 95% CI)	Strongly disagree n (%, 95% CI)
Having a PT prescribe exercise over the _____ would be a convenient form of healthcare for me.	Telephone	50 (15, 12-19)	191 (59, 53-64)	61 (19, 15-24)	18 (6, 3-8)	4 (1, 0-3)
	Internet video	49 (15, 11-19)	208 (63, 59-69)	55 (17, 13-21)	13 (4, 2-6)	2 (1, 0-2)
Having a PT prescribe exercise over the _____ would save me time.	Telephone	78 (24, 20-29)	178 (54, 49-60)	52 (16, 12-19)	16 (5, 3-7)	3 (1, 0-2)
	Internet video	59 (18, 14-22)	203 (63, 57-68)	50 (15, 12-19)	12 (4, 2-6)	1 (0, 0-1)
If there was a service offering PT-prescribed exercise over the _____ for my OA, I would be interested in using it.	Telephone	64 (20, 15-24)	174 (54, 49-60)	65 (20, 16-25)	17 (5, 3-8)	2 (1, 0-2)
	Internet video	45 (14, 11-18)	187 (58, 52-64)	71 (22, 18-26)	16 (5, 3-7)	4 (1, 0-3)
If there was a service offering PT-prescribed exercise over the _____ for my OA, I would be willing to pay for it.	Telephone	13 (4, 2-6)	92 (28, 23-33)	162 (50, 44-56)	50 (15, 12-19)	9 (3, 1-5)
	Internet video	12 (4, 2-6)	135 (42, 37-48)	137 (43, 38-49)	31 (10, 7-13)	5 (1, 0-3)
Using the _____ would be an acceptable way to receive a PT-prescribed exercise program for my OA.	Telephone	24 (7, 5-11)	157 (49, 44-54)	111 (34, 28-40)	26 (8, 5-11)	6 (2, 1-3)
	Internet video	35 (11, 7-14)	198 (61, 56-66)	69 (21, 16-26)	19 (6, 3-9)	3 (1, 0-2)
Using the _____ would be a useful (practical) way to receive a PT-prescribed exercise program for my OA.	Telephone	28 (9, 6-12)	183 (56, 50-62)	84 (26, 21-31)	25 (8, 5-11)	5 (1, 0-3)
	Internet video	41 (13, 9-16)	205 (63, 59-68)	59 (18, 14-23)	16 (5, 3-8)	3 (1, 0-2)
Using the _____ would be an effective way to receive a PT-prescribed exercise program for my OA.	Telephone	17 (5, 3-8)	131 (40, 36-46)	147 (46, 40-50)	25 (8, 5-11)	4 (1, 0-3)
	Internet video	34 (11, 7-14)	172 (53, 48-59)	101 (31, 26-37)	14 (4, 2-7)	2 (1, 0-2)
Using the _____ would be an affordable way to receive a PT-prescribed exercise program for my OA.	Telephone	17 (5, 3-8)	168 (51, 45-57)	132 (41, 35-46)	8 (2, 1-4)	2 (1, 0-2)
	Internet video	25 (8, 5-11)	155 (48, 42-53)	130 (40, 35-46)	11 (3, 2-6)	3 (1, 0-2)
Using the _____ would be a safe way to receive a PT-prescribed exercise program for my OA.	Telephone	21 (6, 4-9)	152 (46, 40-53)	131 (41, 34-46)	14 (4, 3-7)	8 (3, 1-4)
	Internet video	32 (10, 7-13)	176 (55, 49-60)	98 (30, 26-36)	13 (4, 2-6)	3 (1, 0-2)

CI: confidence interval; PT: physical therapist; OA: osteoarthritis. Individual items may not add to totals due to missing data.

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Table 4. Influence of participant characteristics on interest in using a service offering physical therapist-prescribed exercise over the telephone

	Agree n (%)	Disagree n (%)	Odds ratio (95% CI)	P-value
Age	-	-	1.0 (1.0-1.0)	0.339
Gender				
Female	184 (75)	63 (25)	0.9 (0.5-1.8)	0.823
Male	53 (74)	19 (26)	1.0 (ref)	-
Education level				
School	49 (71)	20 (29)	1.3 (0.6-2.6)	0.469
Trade or trade certificate	35 (76)	11 (24)	1.1 (0.5-2.5)	0.806
University or tertiary degree	117 (76)	38 (24)	1.0 (ref)	-
Higher university degree	34 (71)	14 (29)	1.1 (0.5-2.3)	0.871
Financial Situation				
Find it a strain to get by or have to be careful with money	89 (72)	34 (28)	1.0 (ref)	-
Able to manage without much difficulty	98 (77)	29 (23)	0.8 (0.4-1.5)	0.471
Quite or very comfortably off	50 (70)	21 (30)	1.3 (0.6-2.6)	0.532
Affected Joint				
Both	71 (77)	21 (23)	0.7 (0.4-1.3)	0.277
Hip	30 (73)	11 (27)	1.0 (0.5-2.3)	0.907
Knee	134 (73)	50 (27)	1.0 (ref)	-
Prior physical therapy interventions				
No	53 (75)	18 (25)	0.9 (0.5-1.7)	0.721
Yes	181 (73)	66 (27)	1.0 (ref)	-
Geographical remoteness				
Remote or very remote	7 (88)	1 (12)	1.0 (ref)	-
Inner or outer regional	82 (80)	21 (20)	1.8 (0.2-15.6)	0.615
Major cities	145 (71)	59 (29)	3.0 (0.3-25.8)	0.319

Odds ratios refer to likelihood of disagreement. CI: confidence interval; ref: reference level of variable

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Table 5. Influence of participant characteristics on interest in using a service offering physical therapist-prescribed exercise via video over the internet

	Agree n (%)	Disagree n (%)	Odds ratio (95% CI)	P-value
Age	-	-	1.0 (1.0-1.0)	0.452
Gender				
Female	179 (72)	69 (28)	0.9 (0.5-1.6)	0.639
Male	51 (71)	21 (29)	1.0 (ref)	-
Education level				
School	45 (63)	26 (37)	1.5 (0.8-2.9)	0.202
Trade or trade certificate	32 (68)	15 (32)	1.3 (0.6-2.8)	0.471
University or tertiary degree	116 (75)	38 (25)	1.0 (ref)	-
Higher university degree	36 (77)	11 (23)	1.0 (0.4-2.2)	0.930
Financial Situation				
Find it a strain to get by or have to be careful with money	78 (63)	46 (37)	1.0 (ref)	-
Able to manage without much difficulty	103 (81)	25 (19)	0.4 (0.2-0.8)	0.006
Quite or very comfortably off	50 (71)	20 (29)	0.8 (0.4-1.7)	0.587
Affected Joint				
Both	73 (78)	21 (22)	0.7 (0.4-1.3)	0.284
Hip	22 (54)	19 (46)	2.5 (1.2-5.1)	0.014
Knee	133 (72)	51 (28)	1.0 (ref)	-
Prior physical therapy interventions				
No	51 (72)	20 (28)	0.9 (0.5-1.7)	0.699
Yes	177 (71)	71 (29)	1.0 (ref)	-
Geographical remoteness				
Remote or very remote	6 (75)	2 (25)	1.0 (ref)	-
Inner or outer regional	73 (70)	31 (30)	1.4 (0.3-8.1)	0.713
Major cities	147 (72)	58 (28)	1.4 (0.2-8.1)	0.688

Odds ratios refer to likelihood of disagreement. CI: confidence interval; ref: reference level of variable

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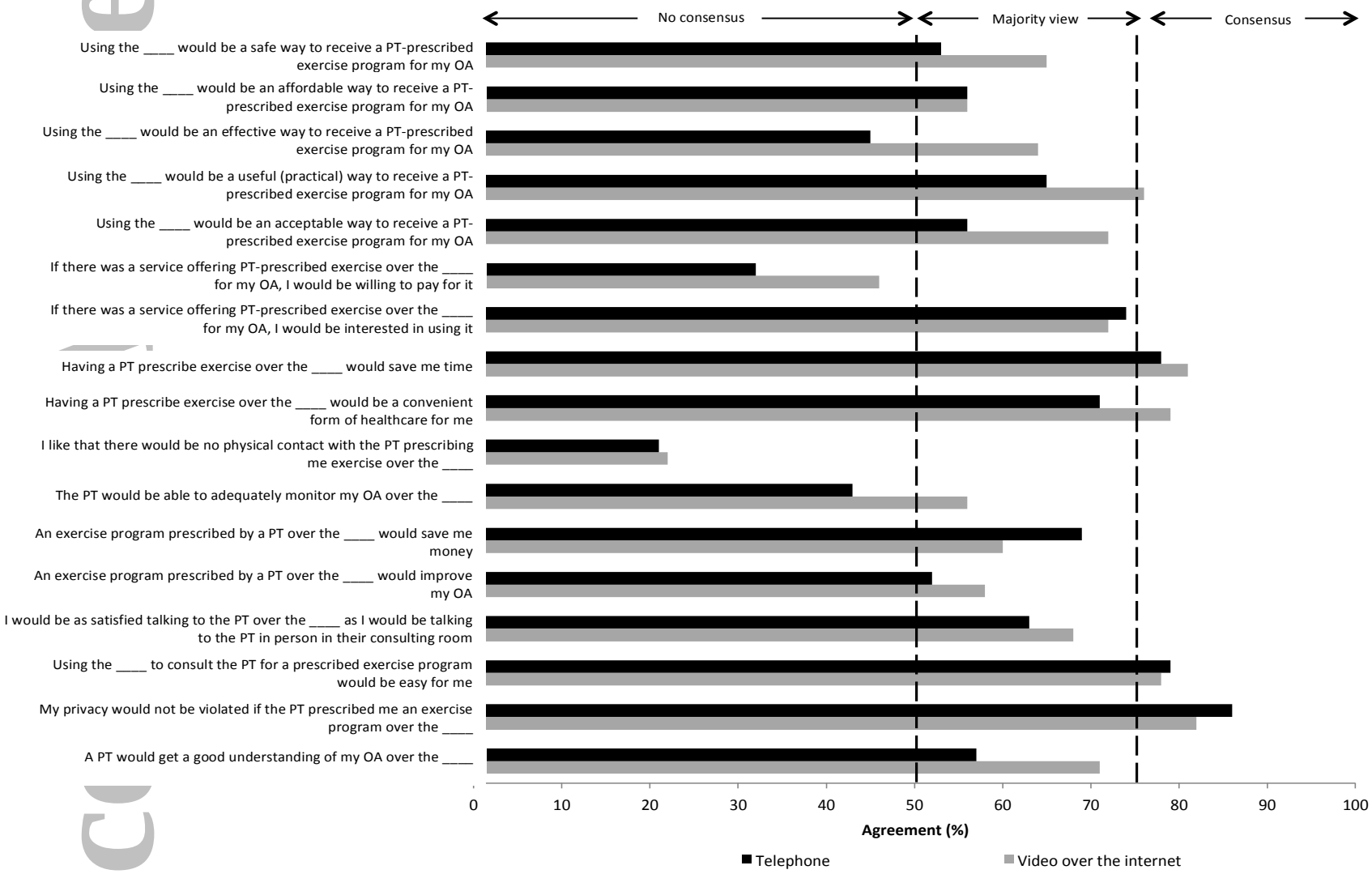


Figure 1. Percentage of survey respondents agreeing or strongly agreeing with perception statements relating to telerehabilitation.
OA: osteoarthritis; PT: physical therapist

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