ARTICLE

Case Report: Using a Remote Presence Robot to Improve Access to Physical Therapy for People with Chronic Back Disorders in an Underserved Community

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ABSTRACT

Purpose: The purpose of this case study was to evaluate the delivery of an inter-professional (IP) spinal triage management approach to chronic back disorders using remote presence robotic technology as an innovative form of telerehabilitation in a northern Saskatchewan community. ***Methods:*** The IP team, consisting of a local nurse practitioner (NP) and a physical therapist in an urban centre, completed a comprehensive neuromusculoskeletal assessment of, and one follow-up visit with, a post-surgical spinal patient. Treatment included detailed education regarding self-management after spinal surgery, provision and progression of home exercises, and reassurance. The patient was then referred to regional, in-person physical therapy care to complete her treatment. ***Results:*** A semi-structured interview with the NP revealed a high level of satisfaction; qualitative themes included the value of IP practice and the benefit to the patient of telerehabilitation achieved through patient-centred care. In a post-treatment survey, the patient expressed a high level of satisfaction with and appreciation for the patient-centred approach and the IP team. Objective clinical improvements in spinal and straight-leg raise movements were noted at the final telerehabilitation session. ***Conclusion:*** This report demonstrates the feasibility of delivering IP spinal triage management using telerehabilitation, specifically remote presence robotics, in a remote setting. Further research should include larger scale studies that investigate health, system, and economic outcomes as well as comparative studies for other forms of telehealth technology.

Key Words: inter-professional relations; low back pain; physical therapists; robotics; telerehabilitation.

RÉSUMÉ

Objectif : l'objectif de cette étude de cas était d'évaluer le recours à une approche interprofessionnelle (IP) de gestion du triage des problèmes rachidiens pour traiter les problèmes chroniques de dos à l'aide d'une technologie robotique de présence à distance comme forme novatrice de téléréadaptation dans une communauté du nord de la Saskatchewan. ***Méthode :*** l'équipe IP, formée d'une infirmière praticienne locale et d'un physiothérapeute d'un centre urbain, a effectué une évaluation neuromusculosquelletique exhaustive d'une patiente ayant subi une chirurgie rachidienne et l'a revue pour une visite de suivi. Le traitement incluait une formation détaillée sur l'autogestion à la suite d'une chirurgie rachidienne, des exercices à faire à la maison ainsi que du réconfort. La patiente a ensuite reçu des soins en physiothérapie à la clinique régionale pour compléter le traitement. ***Résultats :*** l'entrevue semi-structurée avec l'infirmière praticienne a révélé une grande satisfaction; les thèmes qualitatifs incluaient la valeur de la pratique IP et les avantages pour la patiente de la téléréadaptation obtenue grâce à des soins axés sur le patient. Dans un sondage réalisé après le traitement, la patiente a exprimé une grande satisfaction et appréciation de l'approche axée sur le patient et de l'équipe IP. Des améliorations cliniques objectives des mouvements rachidiens et au test d'élévation de la jambe tendue (SLR) ont été observées lors de la dernière séance de téléréadaptation. ***Conclusion :*** ce rapport montre la faisabilité de la gestion IP du triage de problèmes rachidiens à l'aide de la téléréadaptation, particulièrement la présence robotique à distance, dans une région éloignée. Les recherches futures devraient inclure des études à plus grande échelle qui évaluent les résultats sur la santé, le système et l'économie ainsi que des études comparatives sur d'autres formes de technologie de télésanté.

Twenty percent of Canadians suffer from a chronic back disorder (CBD), and they are more likely to live in rural and remote areas and be of Aboriginal ethnicity.[1] When patients do not have adequate primary care, sequelae such as persisting functional and psychological concerns can be exacerbated.[2]

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Figure 1 The RP-7 robot is created by InTouch Health (InTouch Technologies Inc., Santa Barbara, CA; http://www.intouchhealth.com). This photo is reprinted with permission.

People living in rural or remote Canada have reduced access to health care services compared with those living in urban locations.[3] Physical therapists are an important component of the primary management of CBD; however, few physical therapists practise in rural areas.[4] As a result, much of the care provided to those with CBD in these regions is based on a medical model with local primary care providers—primary care nurses, nurse practitioners (NPs), and family physicians. Rural patients may travel long distances, sometimes in inclement weather, to urban centres to see physical therapists for CBD; this requires them to take time away from work and family, and they have difficulty getting recommended follow-up care near their home community. An evaluation of an urban-based Saskatchewan physical therapy spinal triage service found that 64.7% of the participants were from a rural or remote location.[5] Furthermore, patients and referring providers thought that reduced access to physical therapy in their rural community was a barrier to effective care.[6]

Evidence of the benefit of using real-time video technologies in musculoskeletal physical therapy is emerging. Intervention studies using videoconferencing (VC) have focused mainly on knee and upper-extremity issues,[7–11] and none have reported using an inter-professional (IP) approach. Although VC may be able to address some unique health care needs when delivering physical therapy services in remote communities, secure telehealth or VC units are not available in every community. Other forms of technology, such as a remote presence robot (RPR), are becoming available in some northern Saskatchewan communities. The video technology of the RPR enables the patient to receive a comprehensive neuromusculoskeletal examination and may facilitate telerehabilitation and IP care while maintaining privacy and confidentiality.

RPRs have been used successfully to deliver IP medical care with high levels of patient satisfaction,[12] and they are currently being used in remote northern Saskatchewan communities to facilitate emergency, pediatric, and post-surgical specialist care delivered by IP teams (see Figures 1 and 2). High levels of patient satisfaction have been reported when an RPR was used for medical assessment. RPRs run on a wireless Internet connection, so no wired connection is required, as it is in traditional telehealth systems. An RPR allows a physical therapist to easily move around a patient, and it has a high-quality zoom camera and sensitive audio, which captures sound in front of and behind it (see Figure 3). Screen-sharing capabilities can facilitate patient education, enabling a physical therapist in one location to show the patient in another location pictures and photographs of anatomy, pathology, recommended lumbar ergonomic postures, and exercises; they also enable the physical therapist to highlight objects on the screen to focus the patient's attention. The physical therapist uses this function to show the patient an image on the therapist's end (e.g., a photograph of anatomy). The therapist can also draw on or highlight something in the picture so that the patient can focus directly on the structure that the therapist is discussing (e.g., the therapist might draw a circle around a disc to show the patient where the problem is located in his or her spine).

No research using an RPR as a form of telerehabilitation in an IP approach to delivering physical therapy care has been documented. However, as Kairy and colleagues[13] indicated, studies with qualitative and quantitative methodologies are important for evaluating telerehabilitation. The purpose of this case report is to examine the feasibility of delivering CBD management using an IP team and an RPR to a patient with CBD in remote northern Saskatchewan.

METHODS

Case description

This research was approved by the Biomedical Research Ethics Board, University of Saskatchewan, and informed consent was received from the participant before the study began. In keeping with the respectful research pro-

Figure 2 A physical therapist in her office (lower photo, centre) views a nurse practitioner and a non-patient model in an off-site clinic (upper photo). The other panels display representations of the remote-presence robot's controls.

Figure 3 Close-up view of the remote presence robot's screen, two cameras and microphone (top).

tocols that are to be observed with an indigenous community, the community (health board and community leaders) was consulted before we initiated the study; this included giving the community an overview of the proposed research and engaging community members to provide input.

The usual care for CBD in this community is delivered by a primary care nurse, NP, or primary care physician, and it is based on a medical model rather than a rehabilitative one. Because there is no physical therapist in the community, if physical therapy is recommended a patient is placed on a wait-list for a regional generalist therapist. This therapist is located approximately 1 hour's drive away on a gravel road and is there only once per month. Individuals could also theoretically access physical therapy 2 hours' drive away in Manitoba. To receive physical therapy from a manual orthopaedic physical therapist with experience in spinal triage, patients have to travel 6.5 hours by medical taxi to an urban centre, stay overnight, and, if necessary, make arrangements for their dependents while they are away. As a result of this, as well as the lack of regular therapy available in the region and the barriers to travel (weather, availability of transport), access to rehabilitative care is extremely limited.

The managing NP in the community identified a local patient with CBD who would benefit from physical therapy. We set up an IP team, consisting of a local NP and a physical therapist in an urban centre. Before the NP assessed the patient, the consulting physical therapist provided video and written materials to her about how to

perform components of a neuromusculoskeletal assessment, and the team performed a mock assessment session with a volunteer using the RPR. This was the first time the NP had been exposed to an IP session with a physical therapist; however, she had a year of experience in IP interventions with medical specialists and family physicians using the RPR. The initial patient session lasted 1.5 hours and consisted of a lumbar neuromusculoskeletal assessment, education, and exercise prescription. One week later, we conducted another 60-minute session to evaluate the patient's status, review the exercises, and provide progressions. After the two sessions, the patient completed a satisfaction and experience survey, and we conducted a semi-structured interview with the NP.

The patient was a 45-year-old woman who worked and resided in the community. She had a 20-year history of low back pain. In the preceding 2 years, she had experienced intermittent right sciatica. After taking a 5-day car trip, her back pain became severe, and she noted increasing symptoms in her foot. This pain subsided, but 2 months later, the symptoms flared up again while she was shoveling snow. She was unable to walk because of the severity of her symptoms, was hospitalized, and underwent right L5–S1 microdiscectomy and laminotomy because her bowel and bladder were compromised. She had received no postoperative physical therapy because there was no physical therapist in the hospital and no physical therapy available in her home community. The RPR assessment took place 8.5 weeks after surgery. The patient was located with the NP, and they were joined from a distance via the RPR by an urban physical therapist.

The patient's medical history was non-contributory. She described intermittent pain of 3–5 out of 10 that was worse when she was sitting. Post-surgical pain and stiffness were reported in the right lumbar area, with numbness of the right lateral calf and foot. She did not understand what she was allowed to do, and she was afraid of moving.

The NP performed an objective assessment, guided verbally by the physical therapist, who gave her direction, explanations, and cueing to ensure that the patient demonstrated optimal movement, range of motion, and neurological testing. Active range of motion for the lumbar spine was 60% extension, 75% left-side flexion, and 75% right-side flexion (right lower lumbar discomfort); flexion from a standing position was not assessed because of the patient's recent surgery. A neurological exam demonstrated fatiguing weakness of the right extensor hallucis longus (L5). Other key muscles were normal for the lower extremities. Light-touch sensation was diminished over L4 and L5 on the right leg, and the right ankle reflex was diminished. Bilateral knee reflexes and Babinski findings were normal. Straight-leg raise on the left was 90 degrees, whereas on the right it was diminished to 50 degrees.

The IP team's impression was that the patient had residual mechanical lumbar dysfunction after surgery, with restricted neural mobility in the right sciatic system. She also had difficulty isolating contractions of her deep core musculature. The team gave the patient education on anatomy, mechanics, and pathology as well as expectations for rehabilitation, stages of healing, and safe post-surgical back care. The RPR's screen-sharing function allowed the off-site physical therapist to display pictures of anatomy, pathology, body mechanics, and exercises and to highlight specific rehabilitation components requiring attention. She reviewed standing trunk extension range-of-motion exercises, isometric deep abdominal contractions, and nerve-flossing activities, and the patient practised them.

Follow-up measures

The patient visited the clinic a second time 1 week later, and the IP clinical examination indicated improved right straight-leg raise to 80 degrees and improved lumbar extension range of motion to full range. The patient was experiencing mild lumbar ache, mild increased ache in the right ankle, and diminished lower extremity numbness. We gave the patient reassurance and education about the rehabilitation expectations and the short-term discomfort that she could anticipate with improved range of motion and neural mobility.

The patient completed a follow-up satisfaction survey 4 weeks after the RPR sessions were completed. The written survey consisted of six 5-point Likert-scale questions and one open-ended question that asked the patient to add any other details regarding her experience with the assessment and follow-up session.

We conducted a semi-structured interview with the NP by telephone 4 weeks after the second RPR session took place. Questions regarded the NP's confidence in using a team and technology to manage a patient with CBD, her view of her role on that team, whether the patient's needs were met, and the effect that having a regular model of care like this would have on her practice. We recorded the 30-minute interview so that we could transcribe it and the NP could check the transcription for accuracy before we analyzed it. An inductive thematic analysis approach was used to develop a coding structure and reveal themes.[14] Two authors (SLG and BB) developed codes independently, then discussed them with each other to further refine and confirm the themes. Two main themes of IP practice and patient-centred care arose from the interview with the NP.

The major disadvantage of lumbar assessment using remote technology or telehealth is that the physical therapist cannot touch the patient during assessment or provide the important physical contact needed for graded manual approaches. As a result, the IP team referred the patient to a regional physical therapist who attends a nearby community once a month. The regional

therapist completed the patient's treatment in one additional session, introduced flexion principles, and progressed the post-surgical rehabilitation components in person. The IP team spoke to the regional physical therapist by telephone beforehand to give him the patient's history, explain the treatment principles already applied, and recommend the progressions required during post-operative lumbar rehabilitation.

The follow-up survey indicated that the patient was "very satisfied" with this method of assessment. She said that she was "somewhat confident" in the RPR method of neuromusculoskeletal assessment, it was "probably" as good as a traditional face-to-face assessment, and she would "most definitely" recommend this method to a friend who was unable to travel. She stated further,

> The robot allowed a comprehensive verbal and physical assessment to be completed as well as a care plan tailored to my needs. I was able to have my questions answered and care plan adjusted. The robot method allowed for teaching materials to be shown and more importantly explained and discussed [pictures of exercises]. After this experience, I definitely feel less anxious and that I have more confidence re. my prognosis. I am also enjoying less pain and progress with my range of motion.

Two major themes emerged from our qualitative analysis of the interview with the NP: (1) the value of IP interaction and (2) the benefit of patient-centred care. With respect to the value of IP interaction, the NP said, "The mentorship of being able to work with the PT and sort of merging our strengths, skills, and expertise is really helpful and beneficial for the patient" and "Everybody was on the same page, so we were able to develop a care plan together that me [sic], being the primary provider for the patient, would be able to help follow through." She also reported, "I think [the patient] has more confidence in the care plan because it's coming from the two perspectives: the expert in physiotherapy and back pain as well as from me being her primary provider."

Regarding patient-centred care, the NP reported another benefit to the patient: "She [the physical therapist] was able to pull up some diagrams or some pictures and actually very clearly show us what was going on through the robot, so it turned into a really great teaching medium." In addition, the NP said, "Within this community, the fact that we're able to keep the patient local a lot more, it decreases the impact on themselves, their families having to try and find child care or whatnot, and finding transportation."

CONCLUSION

An IP team consisting of an NP and a physical therapist was able to provide post-surgical spinal assessment, initial recommendations, education, and home exercise using RPR technology to deliver IP spinal care. Without this intervention, usual care would have been based solely on a medical model; if physical therapy had been recommended, usual care would have required the patient to endure long wait times and travelling to other communities for general physical therapy, even travelling for 6.5 hours to an urban centre and staying overnight. The functionality of the RPR enabled the IP team to give the patient a comprehensive assessment, build rapport, and provide education, which empowered the patient and the team. After two sessions with the team and RPR, the IP team referred the patient to regional physical therapy for in-person completion of necessary rehabilitation progressions. Both the NP and the patient expressed high levels of satisfaction with the benefits to the patient and the IP nature of the assessment. Previous studies using telerehabilitation models for physical therapy interventions have also shown high satisfaction levels[15–17] and positive experiences.[7]

This RPR was in place for 1 year in the remote community, so the community members were familiar with its use and had seen the benefits for emergency and pediatric care. To develop this model in a new remote community, members should be exposed to the technology in a respectful manner and be fully engaged in the process of including technology in their health care.

We connected an urban physical therapist with expertise in CBD to a remote primary provider and patient using an RPR. This is one form of secure VC; possible advantages over other forms of VC include the ability of team members to move around a patient to facilitate assessment; to use adjuncts, such as a stethoscope and electrocardiogram, if required; and to use creative graphics to highlight portions of the educational materials showing on the shared screen to individualize patient instruction. The RPR has not been compared with other forms of VC to date, and this should be a focus of future research.

This is the first known case of a physical therapist and IP team using an RPR for telerehabilitation and one of the few cases of its being used in spinal care. Going forward, it is essential to engage northern indigenous communities to determine their need for and interest in managing CBD in their communities and, if so, how telerehabilitation can facilitate access to care in a culturally responsive and community-driven manner. Further research should include more robust methods, including prospective trials with larger samples, to compare usual care with care using other VC technologies. In additional, health outcomes should be evaluated, such as quality of life and the economic impact of this model of CBD management.

KEY MESSAGES

What is already known on this topic

Chronic back disorders are more common among rural dwellers and people of Aboriginal ethnicity in

Canada. Rural and remote Canadians face disparities in access to health care, including physical therapy. Telerehabilitation is emerging as a viable method of delivering health care services to rural and remote regions and may be a means of enhancing access to physical therapy.

What this study adds

Remote presence robots (RPRs) are a new form of technology being used for distance health care delivery. To our knowledge, this is the first example of physical therapy being delivered using this technology. This study examined the use of an innovative inter-professional spinal assessment and treatment team model of care delivered to a remote northern community with an RPR. Connection of the team with a regional generalist physical therapist facilitated in-person completion of treatment in a nearby community. Further research on delivery of physical therapy care involving technology in rural and remote regions must involve community engagement to ensure appropriate uptake of technology.

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