Impact of TheraNow Telehealth Physical Therapy program on hospital readmission rate post major joint replacement surgery

Abstract:

Background:
Hip and knee replacement are two of the most commonly performed major joint replacement surgeries in orthopedic surgery. Both procedures successfully eliminate pain, correct the deformity, and improve patient mobility to regain quality of life and perform daily life activities. Rehabilitation and recovery are crucial during the 12 weeks following any major joint replacement surgery. Most people are discharged from the hospital 2–3 days after surgery to continue rehabilitation. Specific exercises aim to improve the joint's mobility, improve strength and restore patient function.

The primary cause of hospital readmissions after major joint replacement is infection and can hinder the patient's functional recovery. Therefore, a comprehensive program is essential to reduce infections and promote recovery. The virtual rehabilitation program is an evolving approach to optimize care and compliance. One such program is the TheraNow telehealth physical therapy program. TheraNow integrates artificial intelligence-powered tools and highly trained physical therapists in a care-navigation platform specially designed for rehabilitation after major joint replacement surgery. The objective of this study was to evaluate the impact of the TheraNow Telehealth Physical Therapy program on patient rehabilitation and hospital readmission rate following major joint replacement surgery.

Materials and methods:
Forty patients were assigned to a 120-day telehealth rehabilitation program on the proprietary TheraNow program. The program incorporated three phases of rehabilitation: pre-rehabilitation, post-surgical rehabilitation, and functional rehabilitation. A licensed physical therapist evaluated the patient via a synchronous video conferencing visit, at which time the Physical Therapist developed a customized program for each patient. In addition, this study tracked and identified all hospital readmissions within 30 days of discharge from the patients' medical records.

Results:
The overall mean age of the study population was 65.20±8.41. Out of the 40 enrolled patients, 3 (7.50%) are 41-50 years old, while the majority (42.5%) were more than 61-70 years old, followed by 71-80 years (27.5%) and 51-60 years (22.5). 23 (57.5%) were female, while 17 (42.5%) were males. Only one re-admission happened in the first 30 days after the surgery under the program bringing the readmission rate to 2.5%.

Conclusion:
The study reported a significantly lower hospital readmission rate after major joint replacement surgeries. The TheraNow Telehealth Physical Therapy program reported a 2.5% readmission rate in the first 30 days of the physical therapy program for major joint replacement surgeries as compared to the National average hospital readmission rate of 9.7%.

Comment [CB1]: What does this mean?

Comment [CB2]: Non sequitur from previous sentences. What data are you gathering/analyzing from the PT visits?

Comment [CB3]: Don't think this is right

Comment [CB4]: Why only have 1 statement about the outcomes of the program? What about measuring fidelity and feasibility?

Comment [CB5]: Which country? Also need to state this earlier

Introduction:
Joint replacement is performed after other conservative treatments for diseases like osteoarthritis and degenerative joint diseases have failed, such as medications, physical therapy, and injections. Total joint replacement or arthroplasty is a surgical procedure where metal, plastic, or ceramic prosthesis or implants replace parts of an arthritic or damaged joint. The prosthesis reproduces the shape and motion of the typical joint through its design. Joint replacement surgery is cost-effective and clinically relevant in appropriately selected patients. As per a recent report, total joint replacement use will increase by 71% from 2018 to 2030 [1]. Preoperative health status (e.g., greater muscle strength and capacity to complete activities of daily living) directly correlate with perioperative outcomes after total joint replacements [2]. Preoperative and postoperative care for patients with total joint replacement is generally adequate for reducing pain intensity and readmission rate; however, robust evidence is lacking [3].

Successful rehabilitation improves pain control, gait, balance, and strength, and reduces the recovery time [4, 5]. Though less commonly used, pre-habilitation (before surgery) has also been recommended [6]. In addition, preoperative health status is a strong predictor of favorable postoperative outcomes [7]. Thus, recovery and rehabilitation are crucial stages after knee and joint replacement surgeries.

In 2004, almost 20% of Medicare beneficiaries were re-hospitalized within 30 days of discharge from a prior hospitalization at an estimated cost of 17.4 billion USD [8]. Major surgical complications included dislocation, infection, and hematoma. These severe complications after total joint replacement surgeries occur in the early postoperative course and affect the quality of care. In addition, these adverse outcomes may relate to other factors such as provider procedure volume and process standardization [9]. Physical therapy (PT) after surgery is one of the essential modalities that hasten recovery. The traditional method for physical therapy is either outpatient clinic PT or home health PT. However, the current evolving technology has led to various digital solutions. One such program is the TheraNow telehealth physical therapy program which offers care on a specialized virtual rehabilitation platform with licensed and trained virtual care physical therapists.

Aim:
The objective of this study was to evaluate the impact of the TheraNow online physical therapy program on hospital readmission rate post major joint replacement surgery.

Methodology:
Forty patients participated in this particular post-joint replacement virtual rehabilitation program on TheraNow's proprietary application for an online and in-home physical therapy program. The 120-day program started with pre-rehabilitation (30 days pre-operatively), surgery, and then postoperative rehabilitation and functional rehabilitation (90 days post-operatively). Patients, Physicians, and the telehealth therapist agreed when the program met therapy goals for discharge from virtual PT. The therapist carefully monitors the customized protocol in person, created for each patient when the therapy is in session, and is tailored based on the patient's response and progression.

Every patient booked appointments according to their own choices of time slots, and the same licensed physical therapists administered the entire program from start to finish for each patient. Physical Therapists provided customized therapy to every patient with a duration of 45-60 minutes of the personalized session. In addition, the Physical Therapist received in-

Comment [CB6]: Very poorly worded sentence. Must also expand to provide more background about these types of treatments and why they fail.

Comment [CB7]: Evidence of what? This doesn't make sense. Also, don't say the care is adequate if the point of your study is to evaluate a better care program…

Comment [CB8]: Is this statistic specific to surgery? If not, these 2 sentences are completely unrelated. Further, why use such an old statistic? The current % may be very different.

Comment [CB9]: Not exactly; they'd affect the outcomes, though

Comment [CB10]: This sounds like jargon—explain what point you're making here

Comment [CB11]: Where is this offered and to whom?

Comment [CB12]: What does this mean if it's virtual?

Comment [CB13]: Must note what other data you're collecting and how/when. For example, where are you getting demographics? How do you know the 40 patients are adherent? Etc.

Comment [CB14]: Also, why not include anything about insurance status, race, etc.?

depth knowledge of every patient's condition before 1-1 online physical therapy sessions via video consultations for custom and effective care programs. Program administrators evaluated all hospital readmissions within 30 days of discharge, identified from the administrative records by reviewing patients' medical records.

Inclusion criteria:

● Patients with pre-diagnosis of DRG 470 (Major joint replacement or reattachment of lower extremity without major complication or comorbidity) procedure in the next 90 days were included in the study.

● Participants included males and females of age 40 or above in this study.

Exclusion criteria :

● Patients with pre-diagnosis of DRG 469 (Major joint replacement or reattachment of the lower extremity with major complication or comorbidity) procedure in next 90 days.

● Patients who were unable or unwilling to provide informed consent were excluded from the study.

● Patients of age < 40 years of age were excluded from the study.

Before surgery, patients virtually met with their TheraNow physical therapist, demonstrated the ability to use the application system, and received recommended exercises to begin after returning home following surgery. Program administrators also offered home visits to patients in need. The postoperative rehabilitation phase started within 48 hours of hospital discharge with a virtual Physical Therapy evaluation and 2-3 follow-up visits per week for 12 weeks. The physical therapist reviewed progress every week and revised the therapy regimen accordingly. Patients could use the system immediately after hospital discharge to view their progress. The frequency and duration of use were unrestricted. The TheraNow system tracked activity, performance, and exercise quality; the telehealth therapist monitored the patient's progress synchronously and asynchronously. In addition, all patients who were randomized to virtual PT could receive in-person PT as clinically deemed necessary. In the initial 30 days after surgery, program administrators analyzed re-admission rates by collecting data by reviewing patients' medical records.

Comment [CB15]: How many were completed? This is important information to document, and then explain implications in the conclusion

Comment [CB16]: Where are these data?

Comment [CB17]: How do we know how many of these were completed?

Comment [CB18]: How will all data be analyzed? Must mention plan for data analyses

Results:

Out of 40 enrolled patients, the overall mean age of the study population was 65.20±8.41; 23 (57.5%) are female, and 17 (42.5%) are males. Out of all the 40 patients, only one patient was readmitted to the hospital within the first 30 days after the surgery under the program bringing the readmission rate to 2.5 %.

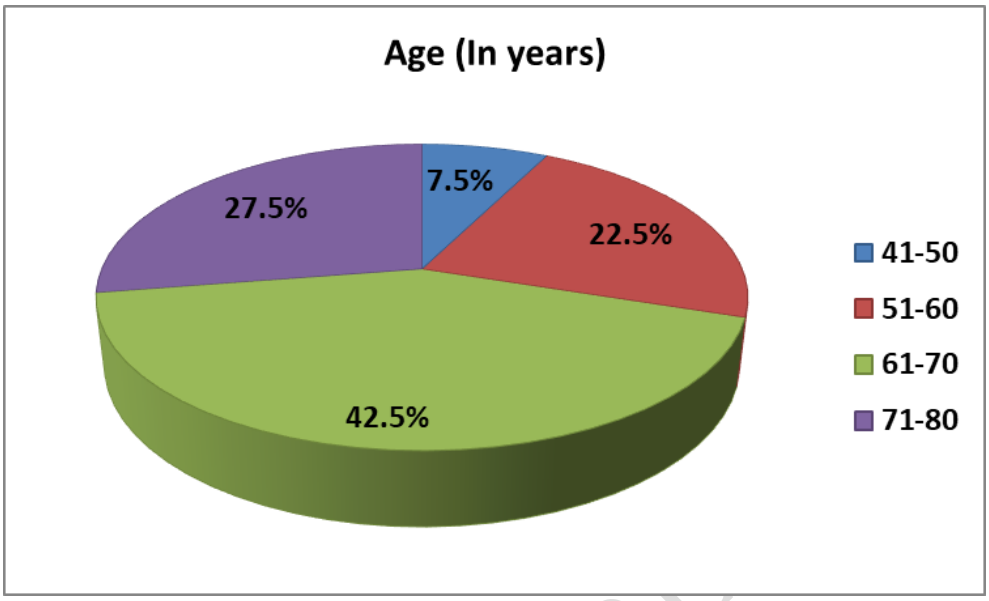
Comment [CB19]: Wholly inadequate; not including enough demographics/background about patients and comorbidities, completion of the program (and definition of "completion,"), no mention of a control group, etc.

Table 1: Demographic details of the patients

Variables		Number	%
Age	Mean±SD	65.20±8.41	
	41-50	3	7.5

	51-60	9	22.5
	61-70	17	42.5
	71-80	11	27.5
Gender	Female	23	57.5
	Male	17	42.5
Total		40	100.0

Fig 1: Age (in Years)



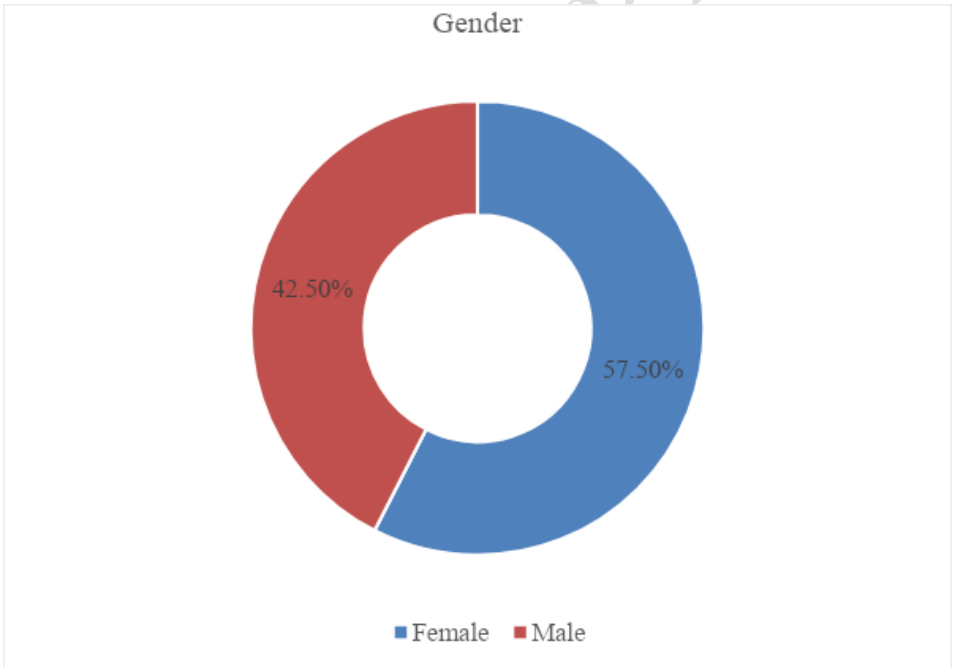


Fig 2: Gender

Comment [CB20]: No need to show these in graphs since same data are shown in Fig 1

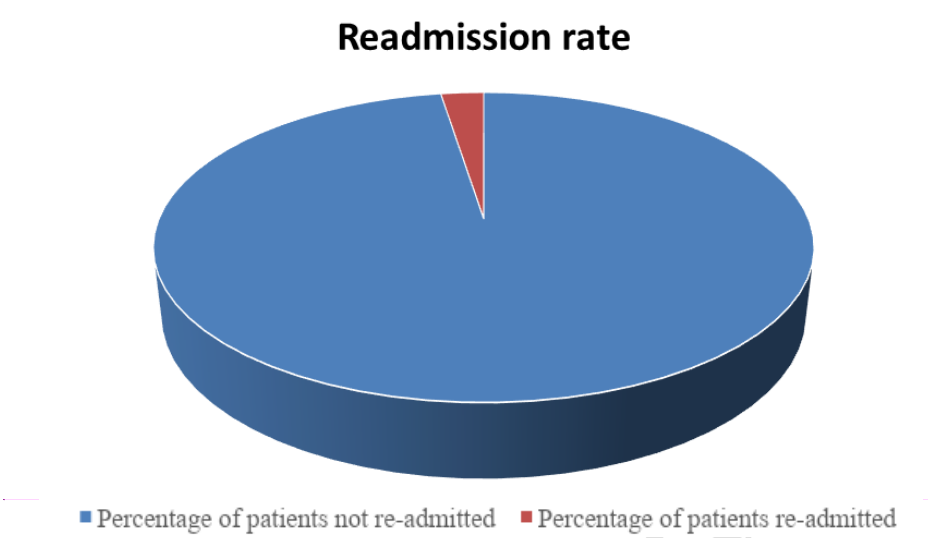


Fig 3: Readmission Rate

Discussion:

Tele-rehabilitation refers to rehabilitation care delivery via information and communication technology (ICT). Clinically, telerehabilitation includes a range of rehabilitation services like assessment, monitoring, prevention, intervention, supervision, education, consultation, and counseling delivered to adults and children by a team of physical and occupational therapists, speech-language pathologists, audiologists, rehabilitation physicians and nurses, rehabilitation engineers, assistive technologists, teachers, psychologists, and dieticians based on client's needs. TheraNow is a telerehabilitation program, a next-generation digital, physical therapy, and care application powered by human touch and artificial intelligence.

The World Health Organization defines rehabilitation as "a progressive, dynamic, goal-oriented and often time-limited process, which enables an individual with impairment to identify and reach his/her optimal mental, physical, cognitive and/or social functional level." [10] After total hip or knee replacement, physical therapy is a standard and essential treatment. It aims to maximize functionality and independence and minimize complications such as wound infection, deep vein thrombosis, pulmonary embolism, and hip dislocation (for hip replacements). The physical therapy routine has 4 components: therapeutic exercise, transfer training, gait training, and instruction in activities of daily living (ADL) [11]. Ouellet and Moffet [12] report that large locomotor deficits exist 2 months after joint replacement surgery, which partially supports the rationale for physical therapy after total joint replacement. However, physiotherapy rehabilitation for total joint replacement patients varies in where, when, and how it is delivered [13, 14].

After discharge from the hospitals, patients who have had primary total knee or hip replacement surgery may receive physical therapy as an in-patient or outpatient service. In-patient services are the physical therapy services rendered at a rehabilitation hospital or specialized hospital unit. Outpatient physical therapy is done either at an outpatient rehabilitation clinic (clinic-based) or in the patient's home (home-based). The traditional method for physical therapy is either outpatient clinic PT or in-home physical therapy. An

Comment [CB21]: Unnecessary

online physical therapy program is the current advancement in this field. “Relative to conventional home or clinic physical therapy, telerehabilitation for skilled clinical oversight and delivery of care significantly lowered three-month health-care costs after joint replacements while providing similar effectiveness,” according to the clinical trial report by Janet Prvu Bettger, ScD, of Duke University, Durham, N.C., and colleagues.

Comorbidity, demographics, and low socioeconomic status with a broad range of modifiable and non-modifiable patient-related risk factors significantly increase 30-day all-cause readmission risks following major joint replacement surgeries. The most vital risk factors are in-hospital complications before discharge, suggesting patients who suffer a complication could benefit from closer monitoring in the post-discharge period aimed at preventing avoidable readmission.

This review focuses on 30-day readmission due to any cause. Tele-rehabilitation clinical trials for patients undergoing total joint replacement have demonstrated better clinical outcomes, costs, and patient satisfaction than traditional physical therapy, without additional patient risks [19-21]. Audio-video conferencing between trained therapists and patients removes geographic and transportation barriers but does not address the limited number of therapists available to manage the number of patients in need of care. It is unclear if the findings for this virtual rehabilitation platform generalize to other virtual physical therapy programs; however, the present study demonstrates opportunities to innovate to make physical therapy accessible and integrated into the episode of care. Meeting the demands of PT is challenging. A nationwide shortage of therapists is projected [22]. Few therapists are available in traditionally underserved areas. Health insurance, including Medicare, limits the number of physical therapy visits. Paying for physical therapy out of pocket is expensive. Digital health technology for PT could be an effective, low-cost, accessible option to help patients regain physical function after joint replacement surgeries.

Conclusion

Relative to post-major joint replacement conventional home or outpatient clinic physical therapy with a national readmission rate average of 9.7% in the first 30 days, virtual physical therapy with telerehabilitation for skilled clinical oversight and care delivery provided a significantly lower hospital readmission rate of 2.5% in the first 30 days of post-major joint replacement. Preliminary results of this study indicate that hospital readmission rates were lower than the average national hospital readmission rates following a virtual skilled physical therapy rehabilitation program and may provide a cost-effective alternative method of care delivery and offer greater accessibility to care.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

Comment [CB22]: Need citation

Comment [CB23]: Need citation

Comment [CB24]: This all belongs in the intro

Comment [CB25]: This isn’t a review!

Comment [CB26]: You also need more information about your patient population so you can more thoroughly explain generalizability

Comment [CB27]: How does this medium help to lower cost to patients? How can Medicare and other insurance plans better cover it?

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