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DIGITAL PREHABILITATION REDUCES LENGTH OF STAY IN PATIENTS PRIOR TO TKA

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INTRODUCTION

Provision of prehabilitation prior to total knee arthroplasty (TKA) through a digital mobile application is a novel concept. Traditionally, prehabilitation is provided face to face by a Physiotherapist. Kwok et al (2015) in a systematic review concluded future research should be directed at methods of prehabilitation that are cost effective method. Our research evaluates a resource effective and cost effective method of delivering prehabilitation. DoironCadrin et al 2016 have reported a randomised control trial protocol involving pre-habilitation through audio-visual software, this protocol still requires a health care practitioners time in real time, whereas our methodology enables multiple patients to be managed simultaneously, optimising health care utility.

Prehabilitation is believed to have multiple benefits for the patients' recovery and outcome. Prehabilitation may impact on length of stay (LOS) through aspects of Social Cognitive Theory (SCT). A mobile application allows a patient's exercise participation to be recorded, monitored continuously and progressed drives greater self-efficacy, outcome expectation, self-regulation and motivation which could be a mechanism by which patients receive benefit (Brown et al 2014). Another mechanism may be through lower levels of pain and function in the early period after TJR surgery, as reported in the meta-analysis completed by Wang et al (2016). The primary aim of our research is to determine whether provision of prehabilitation through a mobile digital application impacts inpatient LOS after TKA. The secondary objective is to understand the effect of digital prehabilitation on hospital costs.

MATERIALS AND METHODS

An observational, retrospective analysis was performed on a consecutive case series of 64 patients who underwent TKA by a single surgeon over a 21 month period from March, 2015 to December, 2016. The first 32 patients (control) did not undergo prehabilitation, the later 32 patients (experimental) were offered prehabilitation through a mobile application called PhysiTrack.

Of these 33 patients, 10 patients (30%) either declined or did not use the program, leaving 23 patients in the experimental group. These 10 patients were not included in the analysis. A statistical difference in the mean age of the groups was observed, producing a confounder when multi-linear regression analysis was performed. To manage this propensity score matching was performed using R-Project (R Core Team, 2013) to ensure equivalence in the mean age and sample size between the control and experimental groups. Only 22 patients could be matched with propensity score matching, leaving 22 patients in each group. T-tests were performed to assess mean group differences between age, inpatient length of stay, rehabilitation length of stay, total length of stay and hospital costs. Hospital cost are self-reported being obtained from the hospital. A chi-squared analysis was performed to analyse the decision for rehabilitation.

Exercise provision varied from 3 months to 2 weeks prior to TKA and consisted of daily quadriceps strengthening, flexion range of motion and extension stretches which were progressed at two week intervals. The program was estimated to take 20 minutes per day and the patient recorded their repetitions, sets and pain levels after completion. A Physiotherapist monitored their program and contacted the patient individually if they reported high pain levels or did not commence the program. The program was modified in response to high pain levels or other co-morbidities at the patient's request or the Physiotherapist's recommendation.

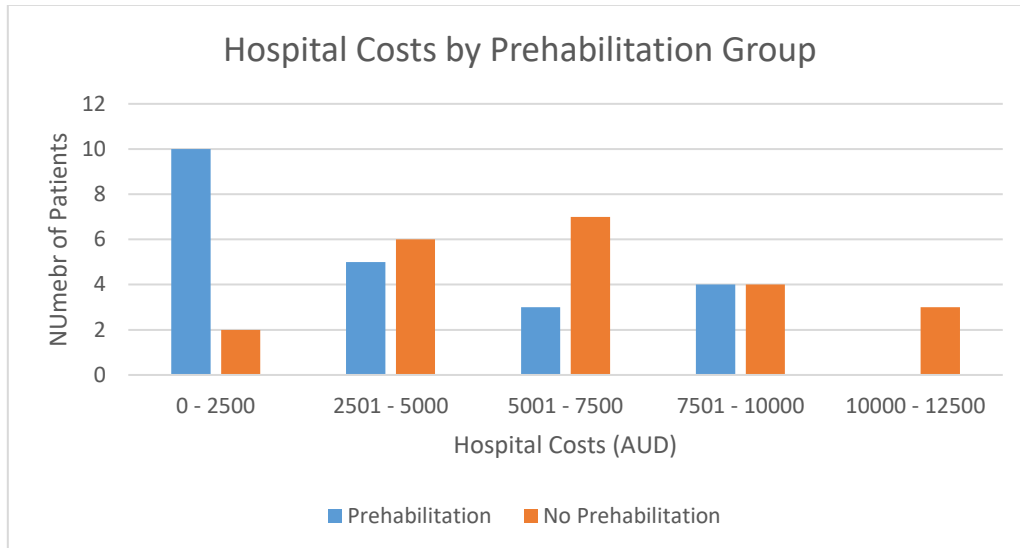
RESULTS:

44 patients were included in our analysis. The average inpatient length of stay was statistically different between the groups being 5.0 days for the control and 4.3 days for the experimental ($p=0.01$). The decision for ongoing inpatient rehabilitation (after the immediate post-operative inpatient period) was not statistically different between the groups (chi-squared $p=0.07$) with 14 from the control group and 9 from the experimental group self-electing for inpatient rehabilitation. The inpatient rehabilitation length of stay was 10.8 and 8.1 days for the control and experimental groups respectively. The remaining outcomes, being total length of stay and total hospital costs were statistically significantly at $p < 0.05$. The total length of stay was 11.9 days in the control and 7.6 days in the experimental group ($p=0.01$) and the total cost of the hospital stay was \$6362.5AUD for the control and \$4145.2AUD for the experimental group ($p=0.01$).

Table 1. Summary Statistics

	Control (n=22)	Experimental (n=22)	Mean Difference	Statistical Significance
Age	70.4	68.1	2.3	0.29
Gender (n=female)	9	10	1	-
Inpatient LOS	5.01	4.31	0.7	0.01
Inpatient Rehabilitation (n=yes)	14	9	5	0.07
Rehabilitation LOS	10.8	8.1	2.7	0.1
Total LOS	11.9	7.6	4.3	0.01
Total Cost AUD	6362.5	4145.2	2217.3	0.01

Figure 1. Graph showing hospital costs between the two groups



DISCUSSION:

Prehabilitation through a mobile digital application is a novel approach and exhibited benefits in our study. Previous research shows inconclusive results of the efficacy of traditional face to-face prehabilitation on functional outcomes and length of stay after TKA. This may be due to a dose effect, where patients participate in rehabilitation only 1 – 3 times per week. In our study patients are reminded to complete the program on a daily basis. Another advantage may be increased patient self-efficacy, as reported by Brown et al (2014). Our findings show that patients in the prehabilitation group, who underwent inpatient rehabilitation following acute care, self selected to be discharged from hospital, on average, 4.32 days earlier than the non-prehabilitation group, resulting in hospital cost saving of \$2217.37. This finding is supported by the work of Snow et al (2014) who showed that pre-operative Physiotherapy reduced post care utilisation costs by 29%, compared to the group who did not participate. Snow et al (2014) associated a \$US100 cost per patient for one to two sessions of prehabilitation prior to total hip arthroplasty (THA) and TKA surgery. Digital prehabilitation provides a cost effective method of providing healthcare, where a multiple patients can be monitored at the same time by one health care professional, which supports the conclusion by Kwok et al (2015). We believe this form of digital prehabilitation reinforces the social cognitive theory concepts of self efficacy, outcome expectation, self regulation and motivation in a way that traditional prehabilitation cannot.

The key limitation for this study is a small sample size that was analysed over a 21 month period. Exclusion of the patients who did not complete the program may create

selection bias in which patients who are not willing to complete a prehabilitation program may be more likely to have an increased length of stay.

Our research shows a cost saving with this intervention, as measured by a reduction in rehabilitation length of stay. To our knowledge, this is the first piece of research that analyses the impact of the use of a mobile application providing pre-habilitation prior to TKA. Further research is required to determine whether this effect is observed in a larger, randomised cohort of patients. Further should be also directed towards assessing the utility of pre-habilitation on a per patient basis prior to total knee arthroplasty.

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DISCLOSURES

Dr David Liu is a share holder in 360 Knee Systems

Emily Bogue, Joshua Twiggs and Brad Miles are paid employees of 360 Knee Systems