


BMJ Open ACT Transition from Hospital to Home Orthopaedic Survey: a cross-sectional survey of unplanned 30-day readmissions for patients having total hip arthroplasty

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ABSTRACT

Objectives The aim of this study was to identify patient, hospital and transitional factors associated with unplanned 30-day readmissions in patients who had a total hip arthroplasty (THA).

Design A cross-sectional survey was performed. All patients attending a 6-week follow-up after a THA in the Australian Capital Territory (ACT) at four public and private clinics in the ACT from 1 February 2018 to 31 January 2019, were invited to complete an *ACT Transition from Hospital to Home Orthopaedic Survey*.

Participants Within the ACT, 431 patients over the age of 16 attending their 6-week post-surgery consultation following a THA entered and completed the survey (response rate 77%).

Primary outcome measure The primary outcome measure was self-reported readmissions for any reason within 30 days of discharge after a THA. Multiple logistic regression was used to estimate ORs of factors associated with unplanned 30-day readmissions.

Results Of the 431 participants (representing 40% of all THAs conducted in the ACT during the study period), 27 (6%) were readmitted within 30 days of discharge. After controlling for age and sex, patients who did not feel rested on discharge were more likely to be readmitted within 30 days than those who felt rested on discharge (OR=5.75, 95% CI: (2.13 to 15.55), p=0.001). There was no association between post-hospital syndrome (ie, in-hospital experiences of pain, sleep and diet) overall and readmission. Patients who suffered peripheral vascular disease (PVD) were significantly more likely to have an unplanned 30-day readmission (OR=16.9, 95% CI: (3.06 to 93.53), p=0.001). There was no significant difference between private and public patient readmissions.

Conclusions Hospitals should develop strategies that maximise rest and sleep during patients' hospital stay. Diagnosis and optimum treatment of pre-existing PVD prior to THA should also be a priority to minimise the odds of subsequent unplanned readmissions.

INTRODUCTION

Under the National Healthcare Agreement in Australia, unplanned hospital readmission

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A survey codesigned with patients and clinicians, encompassing multiple aspects in the biopsychosocial model of health was distributed to public and private hospital patients to examine factors associated with unplanned 30-day readmission following a total hip arthroplasty.
- ⇒ Study design did not enable confirmation of self-reported readmission rates, or examination of reasons for readmission in relation to unplanned 30-day readmission.
- ⇒ Classification of the dependent variables may have enabled more detailed analyses of factors such as pain and sleep, for example, the presence of noise and light in and around patients' beds.

rates are indicators of the quality of care that patients receive in hospital.¹ Preoperative discussion and planning to address significant risk factors can lead to a reduction in readmission.²

The rate of lower limb joint replacement in the Australian Capital Territory (ACT) is 256.3 per 100 000 population³ which is more than 55% higher when compared with the Australian and Organisation for Economic Co-operation and Development (OECD) averages of 163.5 and 162.3, respectively.¹ The national Australian rate represents a 100% increase since 2005 when it was just 81 per 100 000.⁴ Unplanned 30-day readmission rates following a total hip arthroplasty (THA) have also been increasing in Australia.³ With the high rates of hip replacements performed in the ACT, it is critical to identify risk factors that are associated with unplanned 30-day readmissions to better predict high-risk individuals and improve patient outcomes.

Patient factors associated with unplanned 30-day readmissions following a THA include coexisting illness,^{5–7} age,^{5 8–10} body mass index (BMI)^{5 10–12} and discharge location.^{12 13} A high BMI is associated with deep surgical site infections, which is one of the predominant causes of readmission. Discharge to an inpatient or residential aged care facility has resulted in an increased likelihood of readmission within 30 days that is believed to be due to the increased complex medical conditions and frailty of these patients, who often require more care.¹³ Hospital-related factors associated with unplanned 30-day readmissions include length of stay^{10 12 13} and procedure duration.⁷ Many of these associations are not modifiable and reflect a patient's underlying condition. However, patients' experiences in hospital and the quality of their transition to primary care are potentially modifiable, but their relationship with 30-day readmissions has not been studied.

Patient enablement—patients' understanding of and confidence to manage their illness—has been positively associated with better health outcomes.¹⁴ Research using the Patient Enablement Instrument indicates that older patients and men are more enabled after consulting with a general practitioner (GP) compared with younger patients and women.¹⁵ Longer consultations, continuity of care with the same GP or general practice nurse are also positively associated with improved patient enablement.^{15 16} The relationship between readmissions after THA and patient enablement has not been examined.

Post-hospital syndrome is a phenomenon that is theorised to exacerbate underlying comorbidities outside of the patients' presenting complaint to hospital.¹⁷ Krumholz describes the 30 days following discharge as a vulnerable period during which patients are more susceptible to adverse health events.¹⁷ He suggests that factors within the hospital environment such as a reduction in the quality of patients' diet, sleep and physical activity contribute to post-hospital syndrome.¹⁷ If this theory is correct, strategies that aim to reduce the likelihood of post-hospital syndrome after a THA may reduce unplanned 30-day readmissions.

Transitional care, including patient education, discharge planning programmes and home visits, is associated with a reduction in unplanned readmissions.^{18 19} The risk of emergency hospital readmission for cardiovascular disease has been shown to be associated with routine and timely contact with a family doctor.²⁰ However, there have been no studies examining the relationship between post-surgical contact with family doctors or rehabilitation after THA and 30-day readmissions.

The aim of this study was to identify patient, hospital and transitional factors associated with unplanned 30-day readmissions in patients following THA.

METHOD

Participants

The population of ACT is 423 800 and is serviced by three public and three private hospitals, with The Canberra Hospital being the tertiary referral centre for Canberra and surrounding areas.²¹

Patients over the age of 16 attending their 6-week post-surgery consultation following hip joint arthroplasty were included in the survey. Patients under the age of 16 and those who had their 6-week post-surgery consultations in other states or territories were excluded.

Patient and public involvement

Five people who had previously had an arthroplasty with a surgeon from one of the participating clinics completed the survey and provided feedback regarding its meaningfulness in relation to their experiences, and the length and readability of the survey.

Study design

A cross-sectional survey was conducted at four different public and private clinics in Canberra between 1 February 2018 and 31 January 2019. The survey was distributed to patients who had either a THA or total knee arthroplasty. In this article, we report the results for respondents who had a THA.

Instrument

The *ACT Transition from Hospital to Home Orthopaedic Survey* is a 50-item survey addressing: (1) Post-hospital syndrome (patients' experiences of sleep, pain and diet in hospital); (2) Patient enablement; (3) Medication enablement; (4) Transition to general practice; (5) Prehospital and post-hospital information and pre-surgical/post-surgical rehabilitation; (6) Patient demographics and comorbidities; and (7) Readmission to hospital within 30 days of discharge. The tool was developed and piloted by a team of researchers, clinicians, patients and consumer advocates (online supplemental file 1).²² Further validation of the survey was completed using exploratory factor analysis. Other specific modifications are described below.

Post-hospital syndrome: Fifteen items addressing pain, sleep and diet during a patient's hospital stay were included.¹⁷ The post-hospital syndrome scale was created by combining the total pain, sleep and diet scores. This section was tailored so as to quantify post-hospital syndrome as an outcome of interest.

Patient enablement was measured using the Patient Enablement Instrument.¹⁵

Medication enablement: A three-item tool that was derived from a previous qualitative study of patient enablement in general practice nurse consultations was used.²³ It examined patient enablement in terms of their understanding of the medicines prescribed to them after discussions with a healthcare provider, their confidence to take the medicines and adherence to medications.

Transition to general practice: Seven items were included to examine patients' relationships with their

Table 1 Exploratory factor analysis and emerging variables

Factor	Variance	Difference	Proportion	Cumulative
Factor 1	2.11	0.24	0.15	0.15
Factor 2	1.87	0.40	0.13	0.28
Factor 3	1.46	0.01	0.10	0.39
Bartlett test of sphericity p=0.000				
Kaiser-Meyer-Olkin=0.616				

family doctor, including continuity of care with the same doctor, waiting times and knowledge of when to see their doctor following surgery.

Interaction with the recommended rehabilitation programme: One item examined patients' referral and attendance to physiotherapy rehabilitation following discharge from hospital. This item was specifically developed for this survey as interaction with physiotherapists or a rehabilitation programme has a positive impact on patient recovery.²⁴

Comorbidity: The functional comorbidity index was used.²⁵ It is a scale scoring 0–18 indicating the number of comorbid diseases a patient has. Specific comorbid diseases such as arthritis, osteoporosis, asthma, diabetes mellitus type 1 and 2, anxiety/panic disorder, visual impairment, hearing impairment and degenerative disc disease (back disease, spinal stenosis or severe chronic back pain) were included in this scale that is designed to measure physical function as a primary outcome.

Data collection

Surveys were distributed in paper form by reception staff at the four survey sites to patients attending their 6-week post-surgery consultation. Patients were invited to complete the survey while they waited for their appointment. As far as we were aware, no participants requested assistance from clinical staff to complete the survey. Participants deposited completed surveys into a sealed box in the waiting room. The researcher collected the completed surveys at regular intervals.

Data analysis

All data analysis was conducted using Stata IC V.15.²⁶

A 'Total Pain Score' variable was created to encompass 'Worst Pain', 'Pain Experienced During the Hospital Stay' and 'Pain On Discharge'. This allowed for the examination of the total effect of pain on readmissions as well as the total pain score in combination with total sleep and total diet scores to examine post-hospital syndrome as a combined phenomenon. As experiencing pain and therapies that aim to minimise pain can affect patients' ability to sleep and perform physical activity, the total pain score is an important component that enables the analysis of its contribution to the postulated post-hospital syndrome.

The primary outcome of interest (dependent variable) was a self-reported binary variable of 30-day readmissions to hospital regardless of diagnosis, under any setting to any hospital within the ACT. Independent variables also include age, sex, living situation, country of origin, education, self-rated health, comorbidities, post-hospital syndrome, general practice experience, medication enablement and patient enablement.

To determine the validity of the post-hospital syndrome scale, the relationship between the variables of the scale was analysed by an exploratory factor analysis (EFA) using orthogonal varimax rotation. An eigenvalue of >1 was the criterion for retaining modes/themes. The internal consistency of the modes was examined using Cronbach's alpha. Kaiser-Meyer-Olkin criteria and Bartlett test were performed to confirm suitability of the data for an EFA

Table 2 Three themes emerging from the exploratory factor analysis

Variable	Factor 1	Factor 2	Factor 3
How would you describe the general level of pain you experienced?	0.79	0.14	0.07
Did you experience pain during your stay in hospital?	0.76	−0.08	0.08
How would you describe the worst level of pain you experienced?	0.69	0.15	−0.00
When you left hospital, how would you rate your pain out of 10?	0.58	−0.13	0.20
Overall, how would you rate the quality of the food in hospital?	0.01	0.89	0.08
Did you feel your dietary requirements were met in hospital?	0.05	0.87	0.13
Overall, how would you rate the quality of sleep in hospital?	0.04	0.06	0.87
Did you feel well rested when you left hospital?	0.16	0.25	0.73

Bolded numbers refer to items with communalities higher than 0.4, indicating that they load onto the same factors.

(table 1) as well as the themes that emerged from the EFA (table 2).

As the outcome of interest was binary, ORs with a 95% CI were determined using logistic regression. Independent variables were examined for potential collinearity using Spearman's correlation coefficient (r) for nominal variables, and χ^2 for categorical variables.²⁷ If two eligible variables demonstrated a strong correlation (>0.6) or significant correlation ($p \leq 0.2$), only one variable was included in the final analysis.

Initially, univariate logistic regression was conducted for each independent variable, with unplanned 30-day readmission as the dependent (outcome) variable (online supplemental table 1). Variables which were significant ($p \leq 0.25$) in the univariate analysis were included in the multiple logistic regression analysis. Variables that were not significant ($p > 0.25$) were excluded. The internal reliability of each scale was determined using Cronbach's alpha. If a value greater than 0.5 was achieved, this indicated a good internal consistency. The mean and SD were calculated for continuous variables and frequencies and proportions for categorical variables.

Additionally, two multiple logistic regression models were run to reduce confounding of variable dependence, one with individual variables within the Functional Comorbidity Index, medication enablement and patient enablement instrument and the other using the combined total scores. Age and sex were included as 'a priori' in the multivariate model. Participants were divided into two groups based on their response to a question on the survey asking whether they had a THA or a total knee arthroplasty. Otherwise, only variables for which multicollinearity tests were satisfied ($r < 0.73$ and $p > 0.05$) were included in the final model. All eligible variables were included in the multiple logistic regression model and removed stepwise until only significant variables ($p < 0.05$) remained.

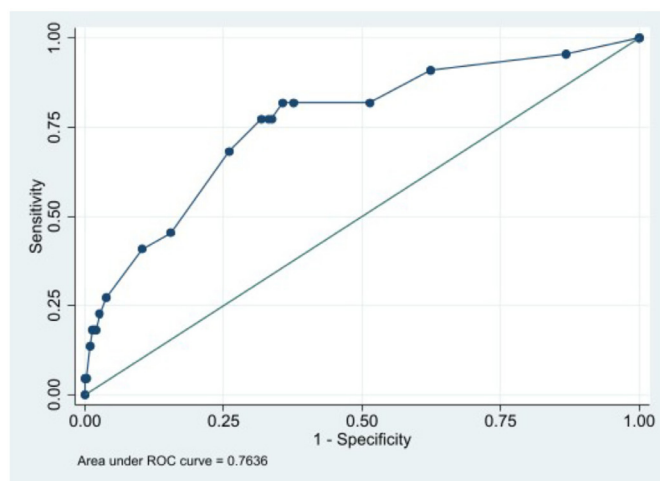


Figure 1 Receiver operator curve (ROC) showing sensitivity and specificity of significant variables obtained from univariate analysis and multiple logistical regressions (table 4). The calculated area under the curve is 0.76, indicating a high overall accuracy of the predicted model.

To assess the fit of the final model, likelihood ratio tests and Hosmer-Lemeshow goodness of fit test were used and the receiver operator curve (figure 1) was plotted for specificity and sensitivity of the predicted model. The area under the curve of 0.76 indicated a high overall accuracy of the logistic model (76%).

Post-hospital syndrome EFA

Three modes/themes with acceptable internal consistency emerged from the EFA. First, the theme diet was described by responses to two questions: 'Did you feel your dietary requirements were met in hospital?' and 'Overall, how would you rate the quality of the food in hospital?'. The second theme was pain, explained by four questions: 'How would you describe the general level of pain you experienced?', 'Did you experience pain during your stay in hospital?', 'Describe the worst level of pain you experienced' and 'When you left hospital, how would you rate your pain out of 10?'. The third theme was sleep, explained by two questions: 'Did you feel well rested when you left the hospital?' and 'Did you mostly sleep in a single or shared room?'.

Missing data

Variables with $>10\%$ missing values were not included in the regression model.²⁸ When there was $<10\%$ missing values for the variable 'patient enablement', these were imputed to equal the average value of non-missing data.

RESULTS

A total of 1069 surveys were distributed and 827 surveys were completed, yielding a 77% response rate overall. Of the completed surveys, 431 respondents received a THA representing 40% (431 of 1086) of all THA performed in ACT in 2018.³ In this group, there was a 6% rate ($n=27$) of unplanned readmissions within 30 days following discharge. Public patients comprised 27% ($n=116$) while 73% ($n=315$) were private patients. Table 3 presents participants' demographic details. Online supplemental table 2 compares the number of non-readmitted and readmitted patients in relation to the independent variables.

After controlling for age and sex, patients with peripheral vascular disease (PVD) were significantly more likely to have an unplanned 30-day readmission to hospital than those without PVD (OR: 16.91; $p=0.001$; 95% CI: (3.06 to 93.53)). Patients who did not feel well rested on discharge (OR: 5.75; $p=0.001$; 95% CI: (2.13 to 15.55)) were significantly more likely to have an unplanned 30-day readmission than those who reported that they felt well rested on discharge (table 4). No independent variables were removed due to collinearity.

Wound problems and/or pain were the reasons provided by 26% (7 of 27) of participants for presenting to an emergency department (ED) in the ACT within 30 days of discharge. Forty-one per cent (11 of 27) of patients offered other reasons for presentation, including cellulitis, dislocation of the hip, infection and/or urinary

Table 3 Characteristics of all patients and those with an unplanned 30-day readmission

	Total observations (N=431)		Unplanned 30-day readmission (N=27)	
	No.	% (of the total)	No.	% (of the variable)
Demographic				
Age (years)	364	–	27	–
25–44	10	3	2	7
45–64	125	34	7	26
65–84	208	57	16	59
85–104	21	6	2	7
Sex	372	–	26	–
Male	151	41	13	50
Female	221	59	13	50
Living situation	380		27	
Living alone	87	23	9	33
Not living alone	293	77	18	67
Indigenous status	337	–	25	–
Aboriginal or Torres Strait Islander Origin (Indigenous)	7	2	1	4
Non-Indigenous	330	98	24	96
Education	371	–	27	–
No school certificate/other qualifications	27	7	1	4
School/intermediate certificate	60	16	2	7
Year 12/leaving certificate	53	14	5	19
Trade/apprenticeship	32	9	5	19
Certificate/diploma	70	19	3	11
University degree/higher	130	35	11	41
Language other than English	371	–	24	–
No	339	91	21	88
Yes	32	9	3	11
Body mass index	348	–	27	–
<21	20	6	1	4
21–25	88	25	3	11
26–40	226	65	21	78
41–60	14	4	2	7
Comorbidities	382	–	27	–
None	43	11	3	11

Continued

Table 3 Continued

	Total observations (N=431)		Unplanned 30-day readmission (N=27)	
	No.	% (of the total)	No.	% (of the variable)
One	197	52	9	33
Two	99	26	11	41
Three or more	43	11	4	15

retention. Nine patients (33%) did not identify any reason for presenting to the ED.

Being a public patient, measurements of enablement, GP follow-up and engagement with rehabilitation bore no relationship to unplanned 30-day readmissions following THA.

DISCUSSION

The objective of this study was to identify risk factors associated with unplanned 30-day readmissions that can be modified to improve patient outcomes following THA. Having PVD and feeling rested on discharge were significantly associated with unplanned 30-day readmissions.

Higher risk of perioperative morbidity and mortality from secondary cardiovascular complications have been associated with pre-existing PVD in previous research.²⁹ Vascular changes may affect vascularisation, tissue regeneration and removal of toxic waste from the surgical area.³⁰ These processes are necessary for effective wound healing and therefore, comorbid PVD may result in inhibition of healing after a THA. Patients suffering from PVD are also more likely to have comorbid congestive heart failure.²⁹ In this study, 20% of patients with PVD reported concomitant congestive heart failure. While the survey did not specify the extent of PVD, it is often undetected, hence the diagnosis may not be made until there is advanced blockage of the vascular architecture.³¹

The signs of PVD may be masked by the decrease in mobility seen in people with severe osteoarthritis of the hip prior to a THA. Furthermore, patients with PVD are at risk of experiencing nocturnal pain and leg cramping that negatively affect sleep. However, we did not find any correlation between the presence of PVD and feeling rested on discharge and were unable to explore the effects of pain and its interference with sleep.³² The loss of mobility resulting from hip pain may also contribute to the development of PVD,³³ which has implications for imposing long waiting times on this vulnerable population. Perioperative evaluation and treatment of PVD should be included for patients needing a THA. We recommend that prior to a THA, a thorough history and clinical examination for PVD should be conducted. If peripheral vascular pulses (eg, dorsalis pedis, posterior tibialis and popliteal pulses) are absent, the patient should be referred to a vascular surgeon for review and consideration of an angioplasty. The efficacy of PVD management would be guided by the treating vascular surgery

Table 4 Results of multiple logistic regression analysis examining the association between patient, hospital and transition to general practice factors associated with unplanned 30-day readmission to hospital

Variables	Full model			Reduced model		
	OR	P value	95% CI	OR	P value	95% CI
Patient demographics						
Lives with others	1.00					
Lives alone	0.38	0.139	(0.12 to 1.26)	–	–	–
Female	1.00					
Male	1.27	0.684	(0.54 to 4.52)	1.28	0.615	(0.49 to 3.30)
Age categories						
0–44	1.00					
45–64	0.32	0.343	(0.05 to 4.50)	0.24	0.137	(0.04 to 1.58)
65–84	0.30	0.340	(0.03 to 3.75)	0.25	0.137	(0.39 to 1.57)
85–104	0.50	0.678	(0.04 to 9.89)	0.59	0.656	(0.06 to 5.95)
Comorbidities						
Congestive heart failure	1.11	0.929	(0.72 to 25.63)	–	–	–
Peripheral vascular disease	34.58	0.004	(1.34 to 77.72)	16.91	0.001	(3.06 to 93.53)
Anxiety	1.68	0.516	(0.34 to 6.52)	–	–	–
Visual impairment	1.52	0.508	(0.48 to 4.84)	–	–	–
Osteoporosis	1.38	0.625	(0.47 to 5.56)	–	–	–
Self-rated health						
Poor – fair	1.00					
Good	0.86	0.829	(0.22 to 2.78)	–	–	–
Very good – excellent	1.08	0.929	(0.18 to 3.17)	–	–	–
Body mass index (kg/m ²)						
<21	1.00					
21–25	4.51	0.363	(0.18 to 115.72)	–	–	–
26–40	10.23	0.133	(0.49 to 213.13)	–	–	–
41–60	22.11	0.087	(0.64 to 764.10)	–	–	–
Hospital factors						
No pain medication	1.00					
Pain medication	0.21	0.164	(0.03 to 1.47)	–	–	–
Felt well rested on discharge	1.00					
Not well rested on discharge	9.96	0.001	(2.02 to 23.56)	5.75	0.001	(2.13 to 15.55)
Average or good sleep	1.00					
Poor sleep	1.09	0.881	(0.34 to 3.46)	–	–	–
Being a private patient	1.00					
Being a public patient	1.61	0.436	(0.41 to 3.84)	–	–	–
General practice factors						
No regular GP	1.00					
Regular GP	1.00	–	–	–	–	–

GP, general practitioner.

team. Current Australian guidelines in the management of PVD include prescribing pharmacotherapy such as lipid lowering agents (eg, simvastatin), phosphodiesterase II inhibitors or angiotensin I inhibitor.³⁴ Non-pharmacotherapy management includes exercise and

life-style management such as smoking cessation and a low-salt and low-fat diet.³⁴ Meta-analyses indicate that exercise therapy significantly increases walking distance³⁵ with a sustained benefit exceeding 7 years after a 28-week programme.³⁶

People who did not feel rested on discharge were 5.75 times more likely to have an unplanned 30-day readmission than those who did feel rested. Sleep duration and quality have been found to be significantly affected during hospitalisation with the duration of sleep reduced, number of awakenings during the night increased and earlier waking compared with habitual sleep at home.³⁷ Similarly, a patient interviewed for a recent Australian study said she went home too early because she wanted some rest and could not get it in hospital.³⁸ This has also been demonstrated in Canada where patient-reported quietness in their hospital environment was associated with a decrease in 30-day and 90-day readmission rates.³⁹ Our research adds to this evidence in quantifying an association between patients' perceptions of rest and unplanned readmissions. This finding provides a rationale for hospitals to ensure that patients receive adequate rest and sleep throughout their hospital stay. Hospitals are busy places that operate 24 hours a day. The sharing of a room, sounds of machines, temperature of the room and nursing activity may negatively affect patients' rest.⁴⁰ This can lead to disturbances in patients' sleep patterns and a reduced amount of sleep at a time when the body is working to recover from the assault of surgery, pain and medication.¹⁷ The combined effect of sleep, pain and diet manifesting as post-hospital syndrome was not significant in this cross-section of patients. This may be because pain and diet are not as significant as sleep in this context.

In this study, patient and medication enablement were not associated with 30-day readmissions. Patient enablement has primarily been studied in primary care settings, where continuity of care is a known contributor to high-quality outcomes.¹⁵⁻⁴¹ Care in hospitals is provided round the clock, with different nurses and doctors taking over every 8 or 12 hours. This has the potential to reduce continuity of the care provider and might explain why enablement was not found to be associated with readmissions. It is possible that enablement factors were more important after the acute post-surgical period where many supports are put in place to protect THA patients.

Several limitations may have influenced the results of this study. First, the study included only 40% of all patients who underwent a THA in the ACT during the survey period. It is also important to note that there were patients who travelled from regional areas outside of the ACT, especially New South Wales, to receive a THA in the ACT. Consequently, some readmissions might have occurred at regional hospitals and post-surgery check-ups with local GPs outside of the ACT. It is therefore unlikely that all readmissions were reported in this sample, and the readmission rates may be underestimated. However, this study had a large and diverse sample drawn from the two ACT public hospitals and two large private practices that encompassed a large proportion of THA patients in the ACT and thus should be representative of the population. Second, our study may be underpowered, as the number of patients with our outcome of interest was small (n=27) relative to the patients that did not have an

unplanned 30-day readmission. Due to the cross-sectional nature of this study, only associations may be identified; no causation may be implied. Third, as with many surveys, information was self-reported. Due to the anonymous nature of the survey, it was impossible to confirm the validity of these responses, in particular, readmissions. Interrogation of hospital records would have enabled confirmation of readmissions, including time to readmission. Fourth, while we have attempted to account for as many confounding factors as possible, there may have been other unaccounted factors that led to and exacerbated PVD or being poorly rested on discharge. Nevertheless, both the crude and adjusted OR for the two significant variables remained significant throughout our analysis. Furthermore, while length of stay¹⁰⁻¹² has previously been identified as a risk factor for readmission and we know that the Australian average length of stay after a THA is 5 days,¹ we did not include this independent variable due to the self-reporting nature of the survey. Finally, although surgeon volume⁴² and duration of surgical procedure⁷ have been previously identified as risk factors for readmissions, such information was inaccessible with this study design and was therefore not included in our models. Reasons for readmissions were also not accessible due to the nature of the study.

The survey was distributed at the 6-week post-THA consultation and although some questions were subjectively based on the patients' hospital experience, the primary outcome of interest of 30-day unplanned readmission rates could only be measured post-discharge. Furthermore, patients have differing lengths of stay and the 6-week consultation provided a consistent and standardised time frame in which patients had to recover post-surgery. Future studies may include a post-discharge survey and a 6-week consultation survey to better analyse both time points in patients' experiences post-THA, especially with regards to how well rested patients felt during their hospital stay and in the period post-discharge.

While post-hospital syndrome did not emerge as a significant variable in this study, we were able to validate and confirm the reliability of three scales measuring some aspects of the syndrome, namely sleep, pain and diet. These validated scales will be of use in future studies. Future studies may also classify the dependent variables to allow for more detailed analysis, and investigate other factors contributing to sleep and rest in hospital, for example, the presence of noise and light in and around patients' beds.

All three scales included in the post-hospital syndrome variable were equally weighted. Investigations into the weighting of pain, diet and rest may be warranted. While Krumholz described post-hospital syndrome as the 30-day vulnerable period following discharge,¹⁷ future studies could investigate shorter and/or longer times to readmission, for example, 5-7 days post-discharge or 60-day and 90-day unplanned readmission rate. Such information may enable researchers to understand the



potential short-term and long-term impacts of post-hospital syndrome on patients.

CONCLUSION

These results have implications for policy and practice prior to surgery and during patients' hospital stay that can be implemented to reduce readmission rates and improve patient outcomes. We recommend that PVD be considered as part of the preoperative work-up for patients, and that hospitals consider optimising strategies for sleep and rest after surgery. This may be achieved by minimising interruptions during the night such as by dispensing medications earlier in the evening, use of quieter equipment, dimming lights in the evening and placing immediately postoperative patients in semi-private or private rooms. Further studies may examine the subgroups for whom rest and sleep should be prioritised, and strategies to maximise sleep in hospitals.

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REFERENCES

- 1 Australian Institute of Health and Welfare. *Admitted patient care 2017–2018. Australian hospital statistics: health services series no. 90. Cat. no. HSE 225.* Canberra: AIHW, 2019.
- 2 Keeney JA, Nam D, Johnson SR, et al. The impact of risk reduction initiatives on readmission: THA and TKA readmission rates. *J Arthroplasty* 2015;30:2057–60.
- 3 AOA National Joint Replacement Registry. Reported hip procedures, 2018. Available: <https://aoanjrr.sahmri.com/hips> [Accessed 15 Oct 2018].
- 4 AIHW. Osteoarthritis, 2019. Available: <https://www.aihw.gov.au/reports/chronic-musculoskeletal-conditions/osteoarthritis> [Accessed 23 Apr 2020].
- 5 Belmont PJ, Goodman GP, Hamilton W, et al. Morbidity and mortality in the thirty-day period following total hip arthroplasty: risk factors and incidence. *J Arthroplasty* 2014;29:2025–30.
- 6 Pugely AJ, Callaghan JJ, Martin CT, et al. Incidence of and risk factors for 30-day readmission following elective primary total joint arthroplasty: analysis from the ACS-NSQIP. *J Arthroplasty* 2013;28:1499–504.
- 7 Tayne S, Merrill CA, Smith EL, et al. Predictive risk factors for 30-day readmissions following primary total joint arthroplasty and modification of patient management. *J Arthroplasty* 2014;29:1938–42.
- 8 Ali AM, Loeffler MD, Aylin P, et al. Factors associated with 30-day readmission after primary total hip arthroplasty: analysis of 514 455 procedures in the UK National Health Service. *JAMA Surg* 2017;152:e173949.
- 9 Avram V, Petrucelli D, Winemaker M, et al. Total joint arthroplasty readmission rates and reasons for 30-day hospital readmission. *J Arthroplasty* 2014;29:465–8.
- 10 Clement RC, Derman PB, Graham DS, et al. Risk factors, causes, and the economic implications of unplanned readmissions following total hip arthroplasty. *J Arthroplasty* 2013;28:7–10.
- 11 Saucedo JM, Marecek GS, Wanke TR, et al. Understanding readmission after primary total hip and knee arthroplasty: who's at risk? *J Arthroplasty* 2014;29:256–60.
- 12 Zmistowski B, Restrepo C, Hess J, et al. Unplanned readmission after total joint arthroplasty: rates, reasons, and risk factors. *J Bone Joint Surg Am* 2013;95:1869–76.
- 13 Mesko NW, Bachmann KR, Kovacevic D, et al. Thirty-day readmission following total hip and knee arthroplasty - a preliminary single institution predictive model. *J Arthroplasty* 2014;29:1532–8.
- 14 Barello S, Graffigna G, Vegni E. Patient engagement as an emerging challenge for healthcare services: mapping the literature. *Nurs Res Pract* 2012;2012:905934.
- 15 Howie JG, Heaney DJ, Maxwell M, et al. A comparison of a patient enablement instrument (PEI) against two established satisfaction

- scales as an outcome measure of primary care consultations. *Fam Pract* 1998;15:165–71.
- 16 Desborough J, Phillips C, Mills J, *et al.* Developing a positive patient experience with nurses in general practice: an integrated model of patient satisfaction and enablement. *J Adv Nurs* 2018;74:564–78.
 - 17 Krumholz HM. Post-hospital syndrome—an acquired, transient condition of generalized risk. *N Engl J Med* 2013;368:100–2.
 - 18 Verhaegh KJ, MacNeil-Vroomen JL, Eslami S, *et al.* Transitional care interventions prevent hospital readmissions for adults with chronic illnesses. *Health Aff* 2014;33:1531–9.
 - 19 Jones CE, Hollis RH, Wahl TS, *et al.* Transitional care interventions and hospital readmissions in surgical populations: a systematic review. *Am J Surg* 2016;212:327–35.
 - 20 Welfare, A.I.o.H.a. *Transition between hospital and community care for patients with coronary heart disease: New South Wales and Victoria, 2012-2015. Cat. no. CDK 9.* Canberra: AIHW, 2018.
 - 21 Hospitals in Canberra, 2018. Available: https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/1859/~/-/hospitals-in-canberra [Accessed 25 Jul 2019].
 - 22 Desborough J, Doi S, Glasgow N. *Examining the interface between acute and primary care: understanding unplanned 30-day readmissions, in Canberra Health Area Research Meeting.* Canberra, Australia, 2017.
 - 23 Desborough J, Banfield M, Phillips C, *et al.* The process of patient enablement in general practice nurse consultations: a grounded theory study. *J Adv Nurs* 2017;73:1085–96.
 - 24 Tayrose G, Newman D, Slover J, *et al.* Rapid mobilization decreases length-of-stay in joint replacement patients. *Bull Hosp Jt Dis* 2013;71:222–6.
 - 25 Groll DL, To T, Bombardier C, *et al.* The development of a comorbidity index with physical function as the outcome. *J Clin Epidemiol* 2005;58:595–602.
 - 26 StataCorp. *Stata statistical software: release 15.* College Station, TX: StataCorp LLC, 2017.
 - 27 Bowling A. *Research methods in health: investigating health and health services.* McGraw-hill education, 2014.
 - 28 Rowe PhD G. Psychometric properties of the new patients' expectations questionnaire. *Patient Exp J* 2014;1:111–30.
 - 29 Poredos P, Poredos P. Peripheral arterial occlusive disease and perioperative risk. *Int Angiol* 2018;37:93–9.
 - 30 Li WW, Carter MJ, Mashiach E, *et al.* Vascular assessment of wound healing: a clinical review. *Int Wound J* 2017;14:460–9.
 - 31 Belch JFF, Topol EJ, Agnelli G, *et al.* Critical issues in peripheral arterial disease detection and management: a call to action. *Arch Intern Med* 2003;163:884–92.
 - 32 Yiğit Set *et al.* Impact of exercise training on fatigue, severity of nocturnal leg cramps, and sleep quality in chronic venous insufficiency. *Turkish J Vascul Surg* 2021;30:141–7.
 - 33 Stoppler MC. Peripheral vascular disease, 2019. Available: https://www.medicinenet.com/peripheral_vascular_disease/article.htm [Accessed 11 June 2020].
 - 34 Au TB, Golledge J, Walker PJ, *et al.* Peripheral arterial disease: diagnosis and management in general practice. *Aust Fam Physician* 2013;42:397–400.
 - 35 Lane R, Ellis B, Watson L, *et al.* Exercise for intermittent claudication. *Cochrane Database Syst Rev* 2014:CD000990.
 - 36 Fakhry F, Rouwet EV, den Hoed PT, *et al.* Long-term clinical effectiveness of supervised exercise therapy versus endovascular revascularization for intermittent claudication from a randomized clinical trial. *Br J Surg* 2013;100:1164–71.
 - 37 Hekkert K, Borghans I, Cihangir S, *et al.* What is the impact on the readmission ratio of taking into account readmissions to other hospitals? A cross-sectional study. *BMJ Open* 2019;9:e025740.
 - 38 Considine J, Berry D, Sprogis SK, *et al.* Understanding the patient experience of early unplanned hospital readmission following acute care discharge: a qualitative descriptive study. *BMJ Open* 2020;10:e034728.
 - 39 Kemp KA, Quan H, Fairie P, *et al.* Patient reports of night noise in hospitals are associated with unplanned readmissions among older adults. *J Patient Exp* 2020;7:1425–31.
 - 40 DuBose JR, Hadi K. Improving inpatient environments to support patient sleep. *Int J Qual Health Care* 2016;28:540–53.
 - 41 Desborough J, Bagheri N, Banfield M, *et al.* The impact of general practice nursing care on patient satisfaction and enablement in Australia: a mixed methods study. *Int J Nurs Stud* 2016;64:108–19.
 - 42 Kurtz SM, Lau EC, Ong KL, *et al.* Hospital, patient, and clinical factors influence 30- and 90-day readmission after primary total hip arthroplasty. *J Arthroplasty* 2016;31:2130–8.