

RESEARCH PAPER

Selection of patients for inpatient rehabilitation or direct home discharge following total joint replacement surgery: a comparison of health status and out-of-pocket expenditure of patients undergoing hip and knee arthroplasty for osteoarthritis

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Objectives: To analyse the differences in patient health outcomes and out-of-pocket costs following hip and knee joint replacement for osteoarthritis between patients who went home immediately after the acute care hospital stay and those who were admitted to inpatient rehabilitation care before going home.

Methods: One hundred and eighteen patients undergoing total hip or knee replacement in Sydney, Australia completed cost diaries, SF-36 and WOMAC Index, pre-operatively and for one year post-operatively.

Results: The health status of all groups improved significantly from before surgery to 12 months post-surgery. No significant difference in health status at 12 months post-surgery was seen between home and rehabilitation patients for either hip or knee replacement. Both hip replacement home and rehabilitation patients and knee replacement home patients reported lower out-of-pocket expenditure from before surgery to 1 year post-surgery.

Discussion: The majority of total joint replacement patients can be discharged directly home and achieve excellent outcomes at 12 months post-surgery. We would recommend more focused randomized studies to explore the most suitable patient selection for rehabilitation.

Keywords: Inpatient rehabilitation, Home discharge, Patient expenditure, Total hip arthroplasty, Total knee arthroplasty

INTRODUCTION

Osteoarthritis (OA) is a chronic debilitating disease that is the most common cause of disability in adults.¹ Joint replacement surgery has been shown to be an effective means of reducing pain and improving function in patients with end-stage arthritis of the hip

or knee,^{2,3} and the number of these procedures performed has increased over the last decade.^{4–6} In Australia in 2000–2001, each acute hospital stay associated with total hip replacement (THR) or total knee replacement (TKR) was estimated to cost between AU\$12,500 and AU\$26,400,⁷ representing a substantial cost to the healthcare system. Inpatient rehabilitation care costs are additional to these costs. In a similar manner to diagnosis-related group costs for acute

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hospital stays, the Australian National Sub-acute and Non-acute Patient (AN-SNAP) classification estimated the cost of rehabilitation care to be AU\$357 per day in 2001.⁸ This adds an additional \$4800 to \$6400 to the cost of hospitalization. While these health system costs are substantial, the patients themselves may also incur substantial out-of-pocket costs. No studies have reported the patient out-of-pocket costs associated with rehabilitation following joint replacement surgery.

Increasing pressure on hospitals to provide services to the maximum number of patients has resulted in a shortened length of stay following many procedures. Early-discharge programmes are common, with an increasing number of patients being discharged approximately 1 week after joint replacement. Patients are discharged from the acute hospital to either a rehabilitation hospital or to home, with or without home care services.

As people age, recovery from major surgery such as hip and knee replacement may take longer. Moreover, improvement in pain and function continues to occur for up to 12 months post-surgery,⁹ so many patients require assistance for some time after surgery. The increased demand for joint replacement as the population ages will increase the demand for rehabilitation facilities, and better selection of the most appropriate patients for inpatient rehabilitation will be required.

This paper examines the characteristics as well as out-of-pocket costs and health outcomes for patients undergoing total hip and knee replacement following inpatient rehabilitation care compared with those of joint replacement patients who went home immediately after the acute hospital stay.

METHODS

This study is a sub-set of a larger ongoing non-randomized prospective cohort study, the Arthritis Cost and Outcome Project.¹⁰ Participants involved in this sub-study were consecutive patients who were booked to

undergo THR or TKR surgery for OA from 1994 to 1999 in two public and two private hospitals in Sydney; ten orthopaedic surgeons were involved, six of whom operate in both the public and private hospital sectors. There were no age requirements or gender restrictions. Only patients having primary joint replacement for OA were included. Ethical approval was obtained for the study from the relevant institutional bodies.

Data on costs, demographic factors and co-morbidities were obtained through specifically designed questionnaires — the Cost Questionnaire and Cost Diary — which have been previously described by the Arthritis Cost and Outcome Project Group.^{2,11} The baseline Cost Questionnaire was completed pre-operatively in the patients' homes by the research officer to obtain data on expenditure and healthcare use during the previous 3 months. Subsequent prospective Cost Diaries were posted to participants for self-administration, and covered expenditure over a 3-month period. Costs recorded in the questionnaire and diary included prescription and non-prescription medications, visits to health professionals, tests, services (both community-provided and private, including home care and transport), equipment and further hospitalization. In addition to costs, patients were asked to record in their diary visits to health professionals even if they were not charged for the visit, e.g. if the visit was covered under the government's Medicare scheme. Four cost diaries were completed during the post-operative year, with each one covering a 3-month period. As this study was conducted during a period of low inflation, no adjustments were made to the costs over the 5 years of recruitment.

Two health status questionnaires were completed at the end of each 3-month period. These were the generic Short Form-36 (SF-36),¹² which gives eight scores, i.e. Physical Function, Role Physical, Bodily Pain, General Health, Vitality, Social Function, Role Emotional and Mental Health — a higher score on the 0–100 SF-36 scales indicates a better health status; and the disease-specific Western Ontario and

McMaster Universities Osteoarthritis Index (WOMAC),¹³ which gives scores for Pain, Stiffness and Function. WOMAC scores have been transformed into a 0–100 scale, a higher score indicating a better health status. Both the SF-36 and WOMAC Index have been shown to be valid, reliable and relevant for measuring the outcome of joint replacement surgery.^{9,12,13}

In addition to these patient-reported questionnaires, the medical records from both the acute hospital and rehabilitation facility were viewed if patients gave their consent. Data obtained from these records included length of stay, discharge destination (home or inpatient rehabilitation facility), and number of visits by practitioners. The authors acknowledge that, while length of stay and discharge destination as recorded in the medical records are likely to be accurate, all visits by practitioners may not have been recorded, so the total number of visits may be underestimated. However, there should not be a difference between home and rehabilitation patients in this regard.

Costs were compared using Mann–Whitney *U* and Wilcoxon tests. SF-36 and WOMAC scores were compared with the use of independent sample *t*-tests and paired samples *t*-tests. In order to determine whether discharge destination impacted on 12-month post-operative pain and function and out-of-pocket expenditure, backwards multiple regression models were assessed to determine predictors of these variables for THR and TKR. The following variables were entered into the models: age at operation, gender, discharge destination, live alone/with others, pre-operative pain or function, and pre-operative mental health. Variables remained in the model if they were significant at the 0.05 level.

RESULTS

Hip Replacement Patients

Forty-eight THR patients (27 females and 21 males) (51.5% of those eligible) provided cost data for the post-operative year and

participated in this study. Thirteen of these patients (27%) attended a rehabilitation facility after their acute hospital stay. Those in the THR rehabilitation group were more likely to live alone than those going directly home (Table 1). There were no differences in gender, mean age, disease duration or proportion with private health insurance between those going home and those going to an inpatient rehabilitation facility. Only one THR patient required readmission to hospital during the post-operative year, for drainage of an infected hip. The pre-operative questionnaires were completed by the THR patients at an average of 27.7 days prior to surgery (SD 52.9 days).

No significant difference was seen in mean age (63.48 *v.* 63.47 years) or gender (56% female *v.* 40% female) between THR responders and non-responders. There was also no significant difference in the proportion being discharged to an inpatient rehabilitation facility between responders and non-responders (27.1% *v.* 19.5% to inpatient rehabilitation, $p=0.460$).

Clinical comparison

Pre-operatively, no significant difference was seen between the home and rehabilitation groups in SF-36 or WOMAC scores (data not shown). Both the home and rehabilitation groups undergoing THR reported significantly better scores on most of the SF-36 scales from before surgery to 12 months post-surgery (Fig. 1). The only scale on which a significant difference was seen in the improvement from before surgery between the home and rehabilitation groups was Role Emotional; the rehabilitation group reported significantly worse scores pre-operatively, but their post-operative scores were similar to those of the home group.

Post-operatively, both the THR home and rehabilitation groups reported significantly less ($p<0.01$) WOMAC Pain and Stiffness, and better Function, than before surgery (Fig. 2). Mean improvement scores for the WOMAC scales at 3 months post-surgery ranged from 33.3 to 36.6 for home patients and from 12.5 to 23.7 for rehabilitation

TABLE 1. *Patient details*

	Hip replacement			Knee replacement		
	Home	Rehabilitation	<i>p</i> -value	Home	Rehabilitation	<i>p</i> -value
<i>N</i>	35	13		49	21	
Female: <i>N</i> (%)	17 (48.6)	10 (76.9)	0.107	23 (46.9)	16 (76.2)	0.035
Age (years): mean (SD)	61.8 (9.4)	67.9 (11.1)	0.150	70.4 (6.7)	71.5 (7.1)	0.496
Range	39–78	53–89		54–87	55–82	
Disease duration– (years): mean (SD)	11.8 (9.3)	13.0 (12.9)	0.858	14.6 (10.7)	20.1 (15.5)	0.197
Live alone: <i>N</i> (%)	6 (17.1)	8 (61.5)	0.005	10 (20.4)	8 (38.1)	0.143
Have private health insurance: <i>N</i> (%)	25 (71.4)	9 (69.2)	0.882	26 (53.1)	13 (61.9)	0.603
No. of co-morbidities						
0	17 (48.6)	6 (46.2)		16 (32.7)	5 (23.8)	
1	11 (31.4)	5 (38.5)		22 (44.9)	9 (42.9)	
2	6 (17.1)	2 (15.3)		5 (10.2)	6 (28.6)	
>2	1 (2.9)	0		6 (12.2)	1 (4.8)	

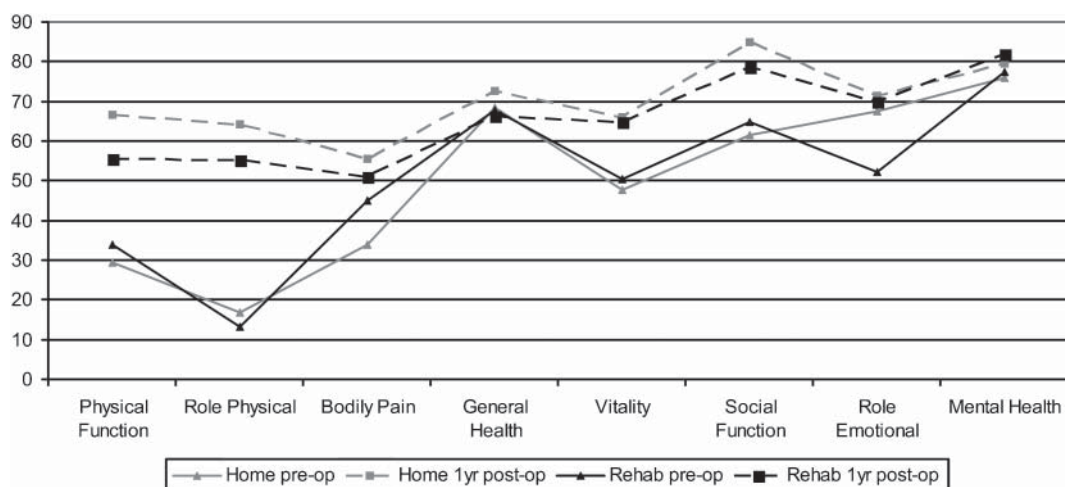


FIG. 1. SF-36 total hip replacement Home and Rehabilitation groups before surgery and 1 year post-surgery.

patients. At 3 months post-surgery, home patients had improved significantly more than rehabilitation patients in WOMAC Stiffness (mean difference 20.59, $p=0.029$, 95% CI 2.21–38.97). To 12 months post-surgery, mean improvements in WOMAC scores ranged from 38.7 to 39.0 for home patients and from 31.2 to 35.3 for rehabilitation patients. Differences in the WOMAC scores of 9–12 points on a 100-point scale have been shown to be perceptible to patients and are clinically meaningful.^{14,15} At 12 months post-surgery, there were no significant differences between the home and rehabilitation groups in WOMAC Pain, Stiffness or Physical Function improvement scores.

Cost comparison

No significant difference was seen in acute hospital length of stay between THR patients who underwent inpatient rehabilitation and those who went directly home post-surgery (14.8 *v.* 13.6 days) (Table 2). There was also no statistical difference in length of acute stay or discharge destination between THR patients with and without private health insurance.

Medical records were examined for 40 THR patients (83.3%). While in the acute hospital, the home group had a significantly

greater number of visits from surgeons than the rehabilitation group, but there was no significant difference in the number of physiotherapy visits or tests, such as radiography and pathology (Table 2).

Out-of-pocket expenditure during the first 3 months post-surgery was greater than in the 3 months leading up to surgery for both the home and rehabilitation groups, but not significantly so (home — AU\$90.00 pre-surgery *v.* AU\$145.44 to 3 months post-surgery, $p=0.635$; rehabilitation — AU\$82.00 *v.* AU\$116.15, $p=0.345$). As shown in Fig. 3, the home and rehabilitation groups had similar out-of-pocket costs pre-operatively and 12 months post-operatively, with median expenditure for the 3-month period to 12 months being significantly less than that for the 3 months pre-surgery (AU\$10.50 for the home group, and AU\$3.00 for the rehabilitation group).

Components of the total average out-of-pocket expenditure for the 12 months post-surgery for hip replacement patients are shown in Table 3. For the home group, expenditure on alterations to the home was the main component of total out-of-pocket expenditure, comprising 40% of total average expenditure; the next largest component was expenditure on private services, at 23%. For the rehabilitation group, expenditure on

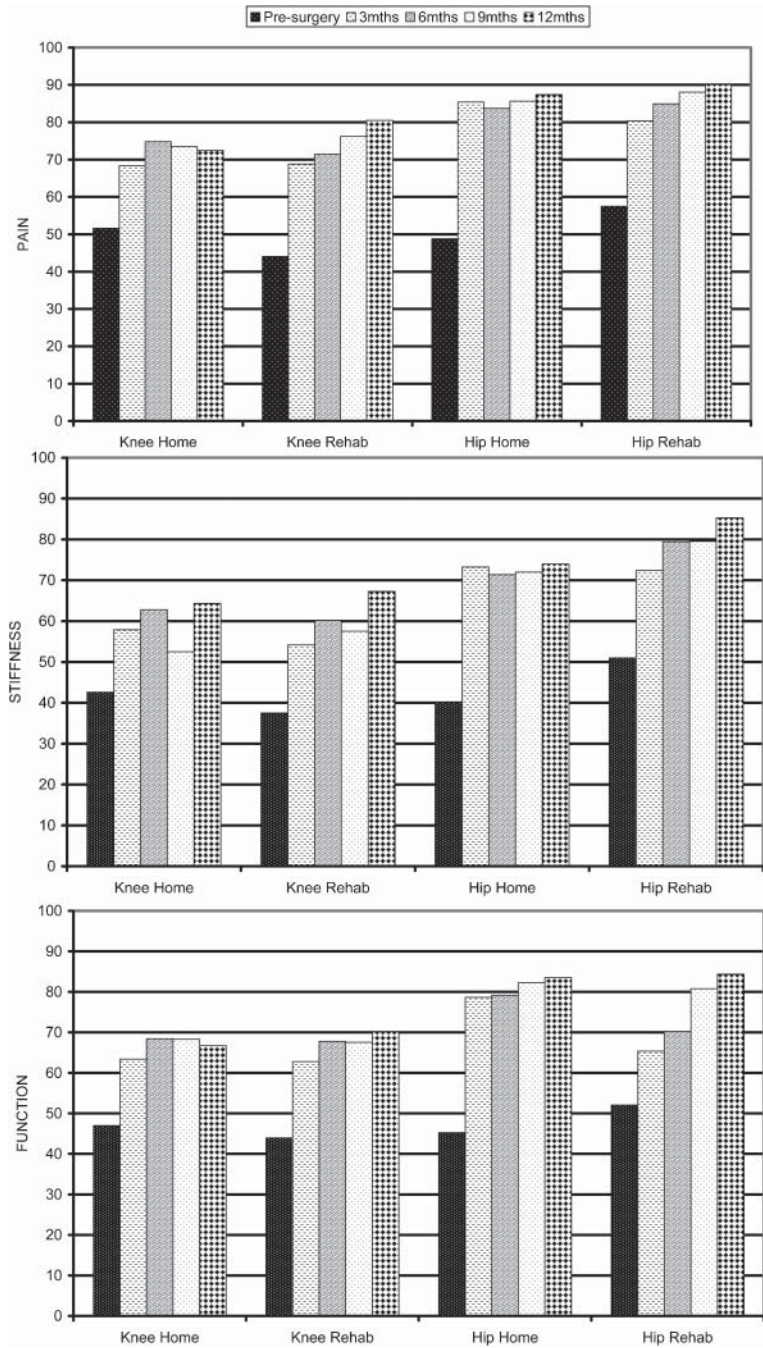


FIG. 2. Mean WOMAC Pain, Stiffness and Function before surgery and over 12 months post-surgery.

private services comprised 39% of the total, and costs of special equipment comprised 28% of the total average out-of-pocket expenditure.

During the first 3 months post-discharge, a significantly greater proportion of rehabilitation patients reported visits to physiotherapists (42.6% *v.* 11.4%, $p=0.016$).

TABLE 2. Hospital stay details

	Hip replacement			Knee replacement		
	Home	Rehabilitation	p-value	Home	Rehabilitation	p-value
N	29	11		35	15	
Private hospital patient: N (%)	27 (93.1)	7 (63.6)		25 (71.4)	13 (86.7)	
Acute length of stay– (days): mean (SD)	14.79 (4.7)	13.56 (2.0)	0.157	13.89 (3.4)	13.4 (3.1)	0.443
Median (interquartile range)	13.0 (6)	14.0 (4)	0.108	13.0 (4)	14.0 (5)	0.858
Total length of stay– (days): mean (SD)	14.79 (4.7)	27.11 (5.4)	<0.000	13.89 (3.4)	31.38 (7.1)	<0.000
Median (interquartile range)	13.0 (6)	26.0 (9)		13.0 (4)	29.0 (10)	
Number of surgeon visits: mean (SD)	6.4 (4.1)	2.7 (2.5)	0.009	4.1 (3.4)	5.2 (3.9)	0.310
Number of physiotherapy visits: mean (SD)	7.2 (2.7)	6.3 (2.6)	0.350	6.7 (4.6)	7.9 (4.2)	0.385
Number of tests: mean (SD)	13.4 (7.4)	12.4 (4.1)	0.659	13.3 (8.3)	12.7 (5.1)	0.804

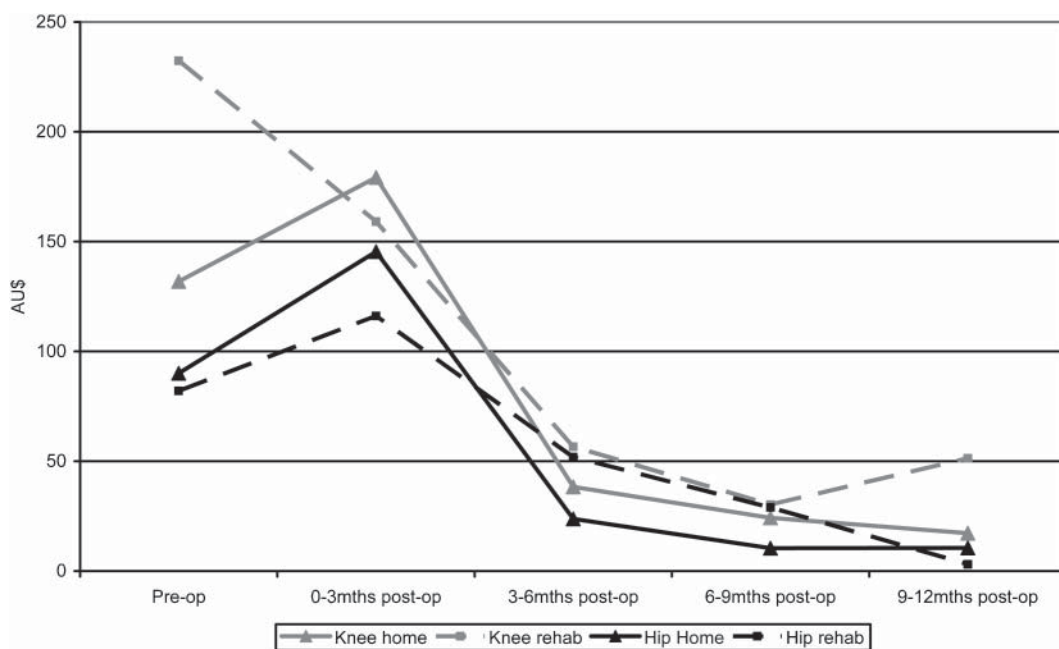


FIG. 3. Median out-of-pocket costs before surgery and during the first post-operative year for total hip replacement and total knee replacement (Australian dollars).

Rehabilitation patients reported an average of 2.3 visits (SD 3.7), while home patients reported an average of 0.6 visits (SD 1.74). This difference did not persist during the whole of the post-operative year, during which there was no significant difference in the proportions of home and rehabilitation patients attending physiotherapy (62.9% of home patients made at least one visit to physiotherapy during the year, compared with 76.9% of rehabilitation patients; $p=0.288$).

Regression models

For THR patients, the significant independent predictor of 12-month post-operative WOMAC function was baseline function — those with better pre-operative function had better 12-month function. It should be noted that this model accounted for only 16% of the variance. Pain at baseline was the only significant independent predictor of improvement in WOMAC Pain from before surgery to 12 months post-surgery — those with lower pain scores at baseline

had greater improvement to 12 months. Discharge destination did not predict pain or function in either of the models.

Gender and living arrangements were the independently significant predictors of log-transformed out-of-pocket expenditure, with females experiencing costs 3.6 times greater than those of males, and those living with others having 3.29 times greater out-of-pocket expenditure than those living alone (Table 4). Again, discharge destination was not a significant predictor.

Knee Replacement Patients

Seventy TKR patients (39 females, 31 males) (51.9% of those eligible) provided cost data for the post-operative year and participated in this study. Twenty-one of these TKR patients (30%) went to an inpatient rehabilitation facility before going home. Patients undergoing rehabilitation were more likely to be female than those going directly home. There were no differences in age, disease duration, proportion who lived alone or proportion with private health

TABLE 3. Out-of-pocket costs over first 12 months post-surgery (AU\$)

	Hips						Knees					
	Home			Rehabilitation			Home			Rehabilitation		
	Range	Mean	Median	Range	Mean	Median	Range	Mean	Median	Range	Mean	Median
Prescription medications	432	37.61	12.40	107	25.26	8.23	227	62.35	43.70	367	54.57	26.90
Non-prescription medications	293	28.49	2.20	84	34.36	18.40	592	43.96	6.57	185	33.77	19.90
Visits to health professionals	259	42.55	3.40	199	57.67	0.00	3,235	170.56	10.00	1,805	156.20	6.00
Tests	213	18.19	0.00	24	4.35	0.00	95	6.11	0.00	24	3.38	0.00
Special equipment	329	73.65	59.00	498	123.17	120.00	2,190	122.64	28.00	3624	211.65	20.00
Alterations to house	5754	242.11	0.00	65	7.97	0.00	950	55.35	0.00	180	18.25	0.00
Community services	864	24.69	0.00	265	20.39	0.00	746	32.26	0.00	352	34.95	0.00
Private services	1406	137.27	0.00	652	173.72	56.00	4,390	204.58	0.00	3727	365.65	48.00
Hospitalization	0.00	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Total		604.56			446.89			697.81			878.42	

TABLE 4. *Hip replacements: regression models for WOMAC Function at 12 months post-surgery, improvement in WOMAC Pain to 12 months post-surgery, and log-transformed out-of-pocket costs over 12 months post-surgery*

Variable	B	Sigma	Adjusted R ²
Model 1: WOMAC Function at 12 months post-surgery*			
Pre-operative function	0.356	0.009	0.164
Model 2: Improvement in WOMAC Pain — baseline to 12 months post-surgery†			
Pre-operative pain	−0.819	0.000	0.537
Model 3: Log-transformed out-of-pocket expenditure for 12 months post-surgery‡			
Gender	1.281 ($e^x = 3.60$)	0.014	0.138
Living arrangements	1.190 ($e^x = 3.29$)	0.034	

*Variables entered into model 1: age at operation, gender, discharge destination (home or rehabilitation), pre-operative WOMAC Function score, pre-operative SF-36 mental health score.

†Variables entered into model 2: age at operation, gender, discharge destination (home or rehabilitation), living arrangements (1 = live alone, 2 = live with others), and pre-operative WOMAC Pain score.

‡Variables entered into model: age at operation, gender, discharge destination (1 = home, 2 = rehabilitation), number of co-morbidities, and living arrangements (1 = live alone, 2 = live with others).

insurance between the TKR patients who went home and those who underwent rehabilitation (Table 1). Five TKR patients were re-admitted to hospital during the first post-operative year for reasons related to the initial replacement. These included three patients who had been discharged home and two patients who had attended a rehabilitation facility. Reasons for admission were arthroscopy, manipulation of the knee joint (two patients), removal of the patella, and quadriceps repair. Knee replacement patients completed the pre-operative questionnaires at an average of 25.6 days prior to surgery (SD 40.1 days).

No significant difference was seen in mean age (70.7 *v.* 72.7 years) or gender (56% female *v.* 62% female) between TKR responders and non-responders. There was also no significant difference in the proportion being discharged to an inpatient rehabilitation facility between responders and non-responders (27.9% *v.* 36.7%, $p = 0.323$).

Clinical comparison

No significant difference was seen between the TKR home and rehabilitation groups in pre-operative SF-36 or WOMAC scores (data not shown). Both the home and rehabilitation TKR groups improved

significantly in all SF-36 scales from before surgery to 12 months post-surgery, with the exception of General Health, which was high pre-operatively (Fig. 4). There were no significant differences in improvement between the home and rehabilitation groups in the remaining SF-36 scores.

Both the home and rehabilitation groups reported significantly less ($p < 0.01$) WOMAC Pain and Stiffness and better Physical Function post-operatively in comparison to their pre-operative scores, as shown in Fig. 2. Mean improvement scores at 3 months post-surgery for TKR patients ranged from 15.2 to 17.7 for home patients and from 16.6 to 24.8 for rehabilitation patients. No significant differences in improvement between the home and rehabilitation groups were seen for TKR at 3 months post-surgery. At 12 months post-surgery, however, those who underwent rehabilitation had improved significantly more from before surgery than the home group in WOMAC Pain scores (mean difference = −15.61, $p = 0.020$, 95% CI −28.73, −2.49), while there were no significant differences between the home and rehabilitation groups in improvement in WOMAC Stiffness or Physical Function. Up to 12 months post-surgery, mean improvements ranged from 19 to 21.7 for home

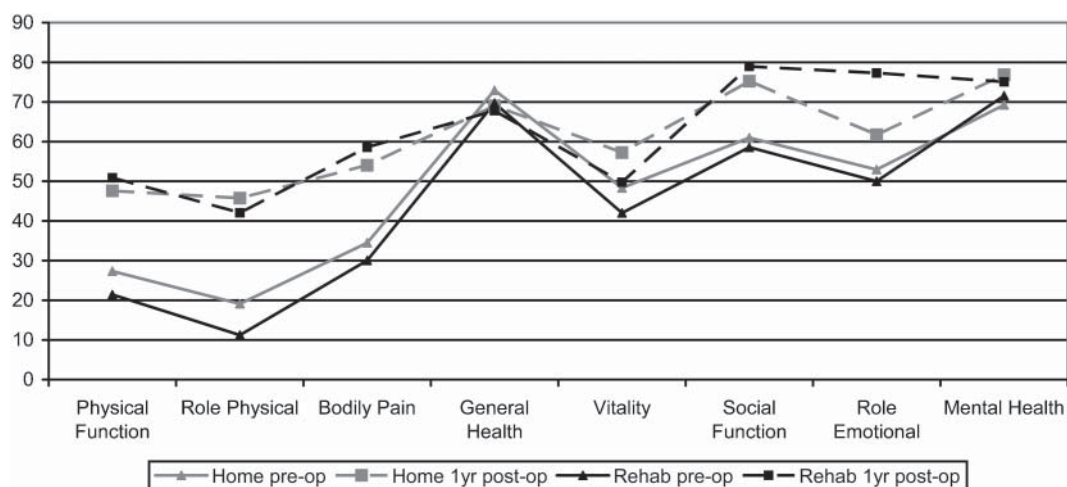


FIG. 4. SF-36 total knee replacement Home and Rehabilitation groups before surgery and 1 year post-surgery.

patients and from 26 to 36 for rehabilitation patients. Differences in the WOMAC scores of 9–12 points on a 100-point scale have been shown to be perceptible to patients and are clinically meaningful.^{14,15}

Cost comparison

For TKR patients, there was no difference in length of stay between the home and rehabilitation Groups (13.9 v. 13.4 days) (Table 2). However, TKR patients with private health insurance had a significantly longer acute care hospital stay than those admitted under the publicly funded Medicare programme (14.8 v. 12.4 days, $p=0.004$).

Medical records were examined for 50 TKR patients (71.4%). No significant difference was found between the home and rehabilitation groups in the number of visits made by surgeons and physiotherapists, or the number of tests performed while patients were in the acute hospital (Table 2).

Median out-of-pocket expenditure of the TKR home group increased from before surgery to the first 3 months post-surgery (AU\$131.81 v. AU\$179.20). However, after the initial 3-month period, expenditure was significantly reduced up to 12 months post-surgery (AU\$17.20 for the period 9–12 months post-surgery). Median out-of-pocket expenditure by the rehabilitation

group decreased from before surgery to 3 months post-surgery (AU\$232.29 before surgery to AU\$159.10 3 months post-surgery). This expenditure then decreased further to the period 9–12 months post-surgery (Fig. 3).

Components of the total average out-of-pocket expenditure for the 12 months post-surgery for TKR patients are shown in Table 3. For the home group, expenditure on private services was the main component of total out-of-pocket expenditure, comprising 29% of total average expenditure, followed by 24% of the total being spent on visits to health professionals. For the rehabilitation group, expenditure on private services comprised 42% of the total, and special equipment comprised 24%.

During the first 3 months post-discharge, 61.2% of home patients and 61.9% of rehabilitation patients reported visits to physiotherapists ($p=0.588$). Home patients made an average of 7.4 visits and rehabilitation patients an average of 8.1 visits during this first 3 months post-discharge. There was no difference in physiotherapy throughout the whole post-operative year; 79.6% of home patients and 66.7% of rehabilitation patients made visits to physiotherapists ($p=0.196$, average number of visits 9.3 and 12.1 for home and rehabilitation respectively).

Regression models

The only significant independent predictor of TKR 12-month post-operative WOMAC function was baseline function — those with better pre-operative function had better 12-month function. In the model for improvement in WOMAC Pain, pain at baseline was the only significant independent predictor — those with better pain scores at baseline experienced greater improvement to 12 months. Discharge destination did not significantly predict pain or function in either of the models.

Gender was the only predictor of log-transformed out-of-pocket expenditure, with females having twice the out-of-pocket expenditure of males (Table 5). Again, discharge destination was not a significant predictor.

DISCUSSION

Regardless of discharge destination, total hip and knee joint replacement patients reported significant improvement in pain and physical function over the first post-operative year. Discharge destination did not significantly predict improvement in pain, function or total out-of-pocket expenditure for the first post-operative year. One interpretation of these data may be that rehabilitation does

not provide any benefit; however, patients were not randomized, and those who were older and had more co-morbidities were more likely to undergo rehabilitation. These patients still had similar outcomes at 12 months post-surgery to those going directly home. Significant clinical gains were seen in pain relief among TKR patients undergoing rehabilitation.

A study by Coyte *et al.* modelled health system costs of rehabilitation following joint replacement using propensity scores.¹⁶ Costs differed significantly between the different discharge strategies assessed, with patients discharged to rehabilitation hospitals incurring health system costs that were almost \$5000 (or between 50% to 60%) greater than those for patients discharged home. The increased health system costs associated with use of rehabilitation hospitals were associated with better outcomes as measured through lower acute care re-admission rates in the Coyte study. Our study showed very little difference in acute hospital stay, an average of 16 days in rehabilitation and no advantage in outcome at 12 months post-surgery.

A limitation of the cost results in this study is that Cost Diary data were not available from over half the eligible patients. It is possible that those who have done well are more likely to reply and so we have not seen

TABLE 5. Knee replacements: regression models for WOMAC Function at 12 months post-surgery, improvement in WOMAC Pain to 12 months post-surgery, and log-transformed out-of-pocket costs over 12 months post-surgery

Variable	B	Sigma	Adjusted R ²
Model 1: WOMAC Function at 12 months post-surgery*			
Pre-operative function	0.509	0.000	0.177
Model 2: Improvement in WOMAC Pain — baseline to 12 months post-surgery†			
Pre-operative pain	−0.801	0.000	0.413
Model 3: Log transformed out-of-pocket expenditure for 12 months post-surgery‡			
Gender	0.753 ($e^x = 2.12$)	0.057	0.0368

*Variables entered into model 1: age at operation, gender, discharge destination (home or rehabilitation), pre-operative WOMAC Function score, pre-operative SF-36 mental health score.

†Variables entered into model 2: age at operation, gender, discharge destination (home or rehabilitation), living arrangements (1 = live alone, 2 = live with others), and pre-operative WOMAC Pain score.

‡Variables entered into model: age at operation, gender, discharge destination (1 = home, 2 = rehabilitation), number of co-morbidities, and living arrangements (1 = live alone, 2 = live with others).

a difference. However, no difference was seen in the proportion attending inpatient rehabilitation between participants and non-participants.

A greater proportion of the rehabilitation group consisted of females and patients who lived alone. This is consistent with the results of previous studies, which showed that female sex, worse post-operative functional status, insurance, number or severity of co-morbidities, older age, complications and living alone are associated with discharge to a rehabilitation facility.^{17,18} Patients who live alone could conceivably experience higher post-operative costs if they are discharged home rather than to a rehabilitation facility, as they may require more services and devices than those who have readily available support from family or friends. Indirect costs associated with home discharge were not addressed in this study. Time spent by carers for patients who have been discharged home may be considerable.

This study commenced in 1994 and continued recruiting until 1999. During this time, the length of acute hospital stay was 12–14 days, which is relatively long compared with current lengths of stay. The length of hospital stay has decreased over the years, and in Australia in 2002–2003 was 7.5 days for uncomplicated knee replacement and 7.85 days for uncomplicated hip replacement.⁷ This trend may actually increase the need for inpatient rehabilitation and rehabilitation in the home programmes. Current Australian length of stay figures are similar to those in Canada, with average lengths of stay for hip replacement and knee replacement of 9.7 days and 7.7 days, respectively,⁶ and in the UK, where the average length of stay for a primary hip replacement is 8 days.¹⁹ There is a belief in the UK that the length of stay could be further reduced by up to 3.5 days through easier access to rehabilitation and physiotherapy services, improved discharge planning and improved patient education.¹⁹ It is possible that if patients are being discharged at 3–4

days post-surgery, then inpatient rehabilitation might be more valuable than reported here.

While proponents of rehabilitation suggest that it may decrease the acute length of stay, it has been suggested that some patients achieve sufficient functional independence in the time of their acute stay and are being unnecessarily discharged to rehabilitation facilities.²⁰ Inpatient rehabilitation was readily available for these patients, with no restrictions according to public or private health insurance status. Referral to inpatient rehabilitation was made at the discretion of the orthopaedic surgeon. Our study demonstrated that a significant proportion of patients are able to go directly home, with excellent short- and longer-term outcomes, and we found no difference in acute care length of stay.

Alternatives to intense inpatient rehabilitation may include a step-down, lower cost care strategy within the hospital for a few days prior to discharge, or the provision of greater rehabilitation support in the home rather than discharging the patient to a separate rehabilitation facility. It has been shown that discharges to a separate facility for rehabilitation following fracture of the neck of the femur result in a much greater total length of stay overall, perhaps in part due to the philosophical approach to it as a new episode of care rather than as a continuation.²¹ Inpatient rehabilitation care in place of, rather than in addition to, the final days of acute care may lead to greater cost gains for rehabilitation patients.

CONCLUSION

The majority of patients can be discharged directly home following primary total hip and knee joint replacement, and achieve excellent outcomes at 12 months post-surgery. Joint replacement patients being discharged to an inpatient rehabilitation facility rather than directly home tended to be older, be female, have more co-morbidities and be more likely to be living

alone. Rehabilitation appears to offer benefit to TKR patients, allowing them to achieve similar outcomes to the home discharge group. For rehabilitation to be cost-effective, these patients should be identified early and have significantly reduced acute care length of stay. We would recommend more focused randomized studies to explore this.

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