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Inpatient rehabilitation did not positively affect 6-month patient-reported outcomes after hip or knee arthroplasty

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1 **Inpatient rehabilitation did not positively affect 6-month patient reported outcomes after hip or**
2 **knee arthroplasty.**

3

4 **Running head:** Rehabilitation after Arthroplasty

5

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ABSTRACT

Aim:

The aim of this study was to compare patient reported outcomes 6 months after hip or knee arthroplasty in subjects who were discharged to home compared to those who attended inpatient rehabilitation.

Methods: 748 consecutive total hip or knee replacement patients were identified from a prospective database. Preoperative and 6-month postoperative patient reported outcome measures were recorded. 44 patients discharged directly to home were cohort matched by age, gender, procedure and surgeon to 44 patients from the cohort who received inpatient care. Patient outcomes were compared using SPSS version 24 software.

Results: Both cohorts saw significant improvements from baseline at 6 months. Median length of stay for the inpatient group was 7 days (6-14). There was no significant difference between the groups based on patient reported outcomes. There was a clinically significant difference ($p=0.047$) in the body mass index of the Home Group (mean = 27) to Rehab Group (mean = 29).

Conclusion: Our study has shown that inpatient rehabilitation after hip or knee arthroplasty did not positively affect 6-month patient reported satisfaction, expectation, pain, quality of life, ADL scores, when compared with subjects who were discharged direct to home. A significant average saving of \$5,600 per patient with the use of home discharge is a promising avenue for health cost reduction, and health resource distribution.

Key words:

- Patient Discharge
- Length of Stay
- Patient Reported Outcome Measures
- Arthroplasty, Replacement, Knee
- Arthroplasty, Replacement, Hip
- Arthroplasty, Replacement, Hip/rehabilitation*
- Arthroplasty, Replacement, Knee/rehabilitation*
- Hospital Costs

67 **Introduction**

68 Over two million Australians suffer from osteoarthritis (OA), rising to 8.1% of the population in the
69 2014-15 period, with the majority of diagnoses occurring at 45 years of age and older ^{1,2}. In 2015 there
70 were 44,710 total hip replacements and 57,687 knee replacements reported to the National Joint
71 Replacement Registry (NJRR), with 60-70% of these performed within private practice ³. With both an
72 ageing population and an obesity epidemic, osteoarthritis is set to become an even larger issue ⁴ with
73 joint replacements an effective treatment option ⁵. The growing practice of joint replacement has
74 heralded advancements in all domains of care as improved surgical techniques, pain management,
75 early mobilization and rehabilitation programs decrease length of stay (LOS) ⁶.

76

77 After arthroplasty, postoperative inpatient rehabilitation is used to varying degrees nationally and
78 internationally. Canada reports use of such services between 3-79% for THR and TKR postoperative
79 care ⁷, whilst in Australia recent reports suggest public and private use of inpatient rehabilitation for
80 TKR reaches 20% and 40% respectively ⁸. Private data has shown significant variability of inpatient
81 rehabilitation uptake across Australian states. THR inpatient care was used as little as 6% in Tasmania
82 and as high as 57% in the Northern Territory, whilst TKR inpatient care ranged from 9% (Tasmania) to
83 75% (Northern Territory) ⁹. Early discharge to home with home-based rehabilitation has been
84 associated with reduced cost, improved clinical outcomes and increased patient satisfaction and can
85 safely and feasibly occur with a length of stay (LOS) in hospital of 4 days or less in up to 90% of TKR
86 and THR subjects ^{8,10}. There is now a growing evidence base to use outpatient rehabilitation where
87 appropriate to decrease costs without sacrificing outcomes ⁷.

88

89 The aim of this study was to compare patient reported outcomes 6 months after THR or TKR in subjects
90 who were discharged to home compared to those who attended inpatient rehabilitation.

91

92

93 **Methods**

94 In the 2016 financial year, 748 consecutive patients treated at the Mater Private Hospital, Sydney for
95 primary elective THR or TKR under the care of the investigating surgeons were entered into a
96 prospective database of hip and knee arthroplasty and formed the study group. Of these, 643 (86%)
97 patients completed preoperative and 6-month postoperative Patient Reported Outcome
98 Measures(PROMs). The PROMs included the Hip Osteoarthritis and Outcome Score (HOOS) and Knee
99 Osteoarthritis and Outcome Score (KOOS) which use 42 and 40 questions respectively, to determine
100 quality of life, pain, symptoms and activities of daily living⁷. The EQ-5D index is widely used as a
101 generic measure of health status, measuring mobility, self-care, activity, pain and anxiety¹¹. The
102 satisfaction and expectation components of the Knee Society score¹² were included, as well as a 2
103 additional questions relating to satisfaction: would they have the same surgery again under the same
104 circumstances, and a grading of their satisfaction with results of surgery on 5 point Likert Scale from
105 very disappointed to very satisfied.

106

107 After arthroplasty, 44 patients were discharged direct to home (Home Group). These subjects were
108 matched for age, gender, procedure, and surgeon to 44 patients who attended inpatient rehabilitation
109 (Rehab Group).

110

111 The primary endpoint of the study was the comparison between the Home Group and the Rehab
112 Group of the 6 month mean scores on the HOOS/KOOS subscales, and patient satisfaction. Descriptive
113 statistics are presented as means and standard deviations for continuous variables such as mean
114 patient reported scores, and counts and percentages for categorical variables. Means were compared
115 between treatment groups with independent t tests. Difference in proportions of patients between
116 treatment groups was assessed with the Chi test (χ^2 test). Statistical significance was set at $p=0.05$.
117 Analysis was performed using SPSS version 24 software.

118

119

120 **Results**

121 Of the 748 patients who met the inclusion criteria, 643 (86%) completed PROMs before surgery and 6
122 months after arthroplasty. Of the 643 arthroplasty subjects, only 44(7%) were discharged straight to
123 home (Home Group), with the remaining 599 attending formal inpatient rehabilitation (Rehab Group).
124 There were 40 separate sites used for inpatient rehabilitation, with 47% receiving care at the same
125 hospital as the index surgery.

126

127 Each group of 44 patients consisted of 24 males and 20 females and a mean age of 63 years, with 29
128 THR and 15 TKR performed. There was no statistically significant difference between the two groups
129 for pre-operative demographic variables or PROMS (see Table 1). The Home Group had a significantly
130 lower mean Body Mass Index (BMI) of 27, compared to the Rehab Group mean of 29 ($p=0.047$). The
131 mean length of stay for acute care was 5 days, for both groups. The median length of stay for inpatient
132 rehabilitation was 7 days (4-16 days) at a cost of AUD \$5,600 (range \$3,200 to \$12,800).

133

134 At 6 months, there was no significant difference between the two groups for any of the mean
135 HOOS/KOOS sub-scores (see Figure 2). There was no significant difference between the Home and
136 Rehab Group for any of the mean EQ5D sub-scores at 6 months ($p>0.3$).

137

138 At 6 months after arthroplasty, the mean Knee Society Expectation Score was 10.1 for the Home group
139 and 9.7 for the Rehab Group ($p=0.43$), out of a possible 15. The mean Knee Society Satisfaction Score
140 was 35 for the Home Group and 34 for the Rehab Group ($p=0.60$), out of a possible 40. The proportion
141 of subjects in each group that reported they were satisfied or very satisfied with the results of surgery,
142 and would undergo the same surgery again are shown in Figure 2.

143

144

145

146 **Discussion**

147 In this study, inpatient rehabilitation after hip or knee arthroplasty did not positively affect 6-month
148 patient reported satisfaction, expectation, pain, quality of life, ADL scores, when compared with
149 subjects who were discharged direct to home.

150

151 It has been well established that hip and knee arthroplasty is an effective means of treatment for
152 osteoarthritis, with excellent functional and pain outcomes being reported widely in literature ^{13 14}.
153 With the increasing age of the population, rising obesity levels and increasing access to healthcare,
154 arthroplasty rates are increasing. Likewise, postoperative rehabilitation services are in high demand,
155 with an average of 32% of THR patients and 39% of TKR patients receiving inpatient rehabilitation in
156 Australia ¹⁵. It is imperative an effective and affordable treatment is found, with outpatient therapy
157 being raised as one possible solution ¹⁶.

158

159 Whilst TKR has been shown to be an effective solution to OA, there is ample literature that suggests
160 that between 11-18% of patients are unsatisfied with primary TKR. In fact, Bourne et al. reported only
161 72-86% pain relief satisfaction when performing activities of daily living post TKR ¹⁷. The authors
162 concluded that further methods should be used to screen patients at risk of lower pain satisfaction,
163 including discussions regarding expectations of surgery and realistic outcomes. Hamilton et al.
164 reported on 4709 THR and TKR patients over a 4 year period, whereby satisfaction was 90% and 82%
165 respectively, at 12 months ¹⁸. In line with the previously reported findings, the authors identified three
166 further patient satisfaction determinants: meeting preoperative expectations, pain satisfaction and
167 hospital experience. These determinants further broadens the scope with which at risk groups can be
168 identified preoperatively, in order to maximise satisfaction rates. Thus, a rigorous screening
169 preoperatively, including detailed discussions of patient expectations and realistic orthopaedic advice,
170 is necessary to dispel myths and prepare patients adequately for life after TKR or THR. In doing so, it
171 may be possible to see improvements in TKR satisfaction scores to equal those of THR.

172

173 Despite the high proportion of Australians using inpatient rehabilitation after arthroplasty, the efficacy
174 of this treatment has received little attention. Buhagiar et al. ⁸ recently conducted a randomised
175 controlled trial (RCT) of 165 Australian subjects comparing inpatient to a supervised 6-week home-
176 based rehabilitation program for TKR in a public hospital setting. At 6 months after surgery there were
177 no reported differences between the groups for 6-minute walk tests, pain, function, quality of life or
178 complications. Similar studies outside of Australia have also reported no differences in outcome
179 measures between inpatient and supervised home-based rehabilitation after hip or knee

180 arthroplasty^{4, 6, 7, 19}. The results of our study support these findings in an Australian population of
181 privately insured patients after arthroplasty.

182

183 There is now a significant body of evidence illustrating the cost-effective nature of outpatient
184 rehabilitation over inpatient for TKR and THR^{7, 8, 20}. The majority of arthroplasties are performed
185 privately in Australia, and with the trending increase in arthroplasties performed annually, a significant
186 change in practice to outpatient rehabilitation could significantly reduce both public expense and
187 private premium increases in the future^{20, 21}.

188

189 In Australia, inpatient rehabilitation, THR and TKR are three out of the top five most common
190 procedures paid by health funds⁹. In a recent report produced by the Royal Australasian College of
191 Surgeons (RACS) examining variations between surgeons and Australian states, total costs (inclusive
192 of procedure + inpatient stay) for THR ranged from AUD\$19,439 - \$42,007 (median \$26,350) and for
193 TKR from AUD\$17,797 - \$30,285 (median \$22,639), nationally. The average inpatient rehabilitation
194 cost alone for THR and TKR was calculated to be approximately AUD\$11,015¹⁵. Data from the United
195 States suggests inpatient costs can be as much as 10.5 times that of outpatient care⁷. Inpatient
196 rehabilitation in Australia has been reported by Hart et al.²¹ in 2014/2015 as much as \$970 per day.
197 In this series, the additional cost of using inpatient rehabilitation was an average of 7 days at a cost of
198 AUD\$5600 per patient. The significance in such costs is notable with limited resources fueling the need
199 for efficient health care delivery⁷.

200

201 The privately insured population examined in this study used inpatient rehabilitation in 93% of
202 subjects, which is much higher than the national (40%) or state (59%) averages. The utilization of
203 rehabilitation after arthroplasty varies considerably across Australian states. After knee arthroplasty
204 inpatient rehabilitation is used by as few as 9% in Tasmania but as high as 64% in NSW¹⁵. There is also
205 considerable variation between privately insured and public populations. These variations suggest
206 that, in many cases, need is not the driving factor for use of inpatient rehabilitation after arthroplasty.
207 We recognize that this very high rate of use of inpatient rehabilitation in our studied population is
208 driven largely by culture rather than need. In this institution inpatient rehabilitation has become the
209 accepted norm, with staff and patients expecting and supporting the practice routinely, without
210 consideration for a needs based decision. We do not advocate that the practice of inpatient
211 rehabilitation should be abandoned, but rather used more selectively. Home based rehabilitation is
212 likely to be inappropriate in the very elderly, those living alone, or those with very low mobility.

213

214

215 The ability to predict arthroplasty patients who can be successfully discharged to a home based
216 rehabilitation program is of obvious value. Oldmeadow et al. developed and validated a score that
217 identifies 3 levels of risk of needing extended inpatient rehabilitation after hip or knee arthroplasty,
218 with an accuracy rate of 89% for those most at risk²². The Risk Assessment and Prediction Tool (RAPT)
219 attributes a score based on age, gender, mobility, gait aids, use of community supports and whether
220 a care giver resides with the subject, to give a total score out of 12. Those who score >9 have an
221 expected discharge directly home, those who score between 6-9 have a medium risk, where additional
222 intervention to discharge home is indicated, and those with a score <6 are expected to be discharged
223 to extended inpatient rehabilitation. It is the current practice of the investigating orthopaedic
224 surgeons to use the RAPT score before surgery to identify arthroplasty patients that may be
225 successfully discharged to home. Further consideration is also given to the other major factors in a
226 patient's life and any depression or anxiety conditions. The use of this score facilitates patient
227 expectations to be discussed in advance and improved confidence can be given to arthroplasty
228 patients likely to be successfully discharged with a home rehabilitation program. This score can be
229 used as a guide to determine whether home based rehabilitation should be considered. In this series,
230 we matched the home and rehabilitation cohorts for gender, age and procedure. The lack of any
231 demonstrable positive effect of inpatient rehabilitation on 6 months outcomes supports the notion
232 that inpatient rehabilitation was overused in this population.

233

234 This study has some limitations. For both the Home Group and the Rehab Group there was no data
235 reported on type of rehabilitation therapy nor the frequency of patient attendance following
236 discharge. Subjects were not randomised to the groups, introducing the potential for bias. Over 90%
237 subjects in this study attended inpatient rehabilitation. This is significantly higher than the Australian
238 average of 40% and indeed abroad¹⁶. This may reflect the higher socioeconomic district the hospital
239 is situated in, resulting in higher rates of people being able to afford inpatient, private care.
240 Additionally, we recognize that a culture of expected inpatient rehabilitation exists in our hospital that
241 biases the likelihood that patients will elect to discharge to home. All subjects were from a single
242 centre, so may not be representative of national practices. Regardless of the high proportion attending
243 inpatient rehabilitation the lack of demonstrable positive effect is enhanced by our cohort matching
244 based on demographics such as age and procedure. There were no significant differences in the
245 baseline patient reported outcomes between the 2 matched groups. However, the rehabilitation
246 group did have a significantly higher BMI before surgery ($p=0.05$), which may reflect a lower activity
247 level biasing them to a longer inpatient stay. Additionally, although the preoperative ASA grades were

248 not significantly different between the groups, it is possible that they were not equal with respect to
249 medical comorbidities. Regardless we were unable to detect a difference between the groups at 6
250 months.

251

252 **Conclusion**

253

254 Our study has shown that inpatient rehabilitation after hip or knee arthroplasty did not positively
255 affect 6-month patient reported satisfaction, expectation, pain, quality of life, or ADL scores, when
256 compared with subjects who were discharged direct to home. A significant average saving of \$5,600
257 per patient with the use of home discharge is a promising avenue for health cost reduction, and health
258 resource distribution.

259

260 **Conflicts of Interest** Nil

261 FIGURE LEGENDS:

262

263 Figure 1: Mean Patient Reported Outcome Measures for KOOS or HOOS scores 6 months after
264 arthroplasty in the Home and Rehab Groups. There was no significant difference
265 between the Home and Rehab groups for any subscore.

266

267

268 Figure 2: Satisfaction after Arthroplasty in the Home and Rehab Groups. There was no
269 significant difference between the Home and Rehab group.

270

271

272 TABLES:

273

274 Table 1: Baseline Patient Reported Outcome Scores for the Home and Rehab Groups

	HOME GROUP (N=44)	REHAB GROUP (N=44)	p
Mean BMI	27	29	0.047
Mean preoperative ASA* Score	1.5	1.6	0.628
Mean age at surgery (years)	62.9	62.6	0.917
No of Males	24	24	0.999
PREOPERATIVE PATIENT REPORTED SCORES			
Mean HOOS/KOOS SYMPTOMS	42.4	42.0	0.834
PAIN	42.4	42.0	0.913
FUNCTION	52.9	51.1	0.682
QOL	31.7	30.8	0.834
Mean EQ5D MOBILITY/5	2.6	2.9	0.213
SELF CARE /5	1.6	1.8	0.216
USUAL ACTIVITIES /5	2.9	2.6	0.285
PAIN /5	3.1	3.2	0.594
ANXIETY/DEPRESSION /5	1.5	1.4	0.660
GENERAL HEALTH /10	6.7	6.9	0.601

275 *American Society of Anaesthesiologists Physical Status Classification System

276

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