

INSIDE

Introduction

Findings and Discussion

- ▶ Discharge destinations following total joint replacement
- ▶ Length of stay in acute care and inpatient rehabilitation following total joint replacement
- ▶ Characteristics of joint replacement patients by discharge destination
- ▶ Geographic variation in utilization of rehabilitation services following total joint replacement
- ▶ Home care utilization following total joint replacement
- ▶ Predictors of rehabilitation for patients with total joint replacement

Conclusions

Appendices

- ▶ A. How the research was done
- ▶ B. Diagnostic codes

References

7

Chapter

Rehabilitation for Total Joint Replacement

SB Jaglal, PhD, C MacKay, BScPT, MHSc, and L Corrigan, BHScPT, MSc





Key Messages

- From fiscal year 1995/96 to 2001/02, the percentage of patients with primary and revision total hip and knee replacements discharged to inpatient rehabilitation increased from approximately 30% to 40%. Less than 21% of patients received home care services following discharge from inpatient rehabilitation.
- Patients with primary total hip or knee replacements discharged to inpatient rehabilitation tended to have a shorter acute care length of stay (LOS) compared to patients discharged directly home.
- Older women with other health conditions were more likely to receive inpatient rehabilitation following total hip replacement and total knee replacement.
- In 13 of the 16 District Health Councils (DHCs), the percentage of patients receiving inpatient rehabilitation services increased. However, in 7 DHCs more than 75% of patients with total hip replacements, and 88% of patients with total knee replacements, were not transferred to inpatient rehabilitation. In almost one-half of the DHCs, more than 75% of patients were discharged to inpatient rehabilitation in the DHCs in which they resided.

Introduction

This chapter provides an update on previous findings regarding use of rehabilitation services following total joint replacement published in the 1998 ICES research atlas on *Patterns of Health Care in Ontario: Arthritis and Related Conditions*. Use of rehabilitation services by patients that received a primary or revision total hip replacement (THR) or total knee replacement (TKR) is examined for fiscal years 1995/96 to 2001/02. For the subgroup of patients that received home care services, type and intensity of services is also examined. Issues relating to accessibility and availability of services, as well as appropriate utilization of services, are covered in this chapter.

Background

After total joint replacement (TJR), rehabilitation is essential to minimizing disability.¹ A large majority of these patients receive rehabilitation following their acute care stay. Intense rehabilitation is required for total hip and knee replacements; therapy begins in the early post-operative period and continues in the post-acute care phase.² Based on available data, Ontario patients remain in the acute care setting for approximately one week before transfer to inpatient or home-based rehabilitation (home care). Without a standard approach to rehabilitation of these patients, existing services vary widely with respect to the setting and amount of services provided. Post-acute care rehabilitation settings include:

- Inpatient facility;
- Patient's home with home care rehabilitation;
- Patient's home with outpatient rehabilitation; and,
- Patient's home with independent exercise.

This chapter builds on information presented in the 1998 edition of *Patterns of Health Care in Ontario: Arthritis and Related Conditions* on the use of rehabilitation services for musculoskeletal patients, as well as work contributed by others.^{3,4} In the previous research atlas, using discharge abstract data for fiscal years 1993/94 to 1995/96, it was noted that compared to other musculoskeletal conditions, patients with total joint replacement had relatively short inpatient rehabilitation stays.³ Patients that required more home care services tended to be older women with higher levels of comorbidity, and also required longer inpatient stays in acute care and rehabilitation. Large variations were noted in the utilization of inpatient and home-based rehabilitation programs within Ontario for patients receiving a joint replacement.

More recent trends were examined in patient rehabilitation utilization in Ontario from 1995/96 to 1999/00.⁴ Length of stay (LOS) for inpatient rehabilitation decreased over this period. In 1999/00, inpatient rehabilitation was provided to 33% of patients with THRs and 30% of patients with TKRs overall, but there was variation depending on where patients lived. Trends in home care services for this patient population were not examined as data were not available during preparation of this report.

Current literature shows little conclusive evidence to define an optimal post-operative course to achieve the best possible outcomes for recipients of TJRs. A recent review article of studies published between 1988 and 2002 on post-operative management of patients with total joint replacements, noted that the reason post-operative care for TJR is so different is that there is scarce literature on the effectiveness of various post-operative interventions.⁵

This chapter examines the utilization of rehabilitation services by Ontario patients that received a primary or revision total hip or knee replacement by:

- Type of post-acute care rehabilitation;
- Acute care length of stay;
- Inpatient rehabilitation length of stay;
- Age;
- Sex; and,
- Comorbidity.

Geographic variation by District Health Council was examined for the subgroup that received inpatient rehabilitation. For the subgroup that received home care services, type and intensity of services were also examined.



Findings and Discussion

Discharge destinations following total joint replacement

7.1 Patient discharge destinations by joint replacement procedure, in Ontario, 1995/96 and 2001/02

From 1995/96 to 2001/02, the number of total hip replacements (THRs) and total knee replacements (TKRs) performed in Ontario increased steadily. Following surgery, patients were discharged directly home from acute care or transferred to inpatient rehabilitation.

Overall, the percentage of patients with primary total hip and knee replacements discharged directly home from acute care decreased from approximately 68% in 1995/96 to about 57% in 2001/02. From 1999/00 to 2001/02, the percentage of patients discharged directly home following surgery decreased consistently for all procedures.

Patient discharge destination varied depending on the type of surgery. Compared to other types of procedures, a greater percentage of patients with revision THRs was discharged to inpatient rehabilitation rather than directly home following their acute care stay. In contrast, following revision TKRs, a greater percentage of patients was discharged directly home from acute care. It is hypothesized that the differences in discharge destinations could be due to more mobility restrictions (such as weight bearing) for patients with THR (e.g. weight bearing restrictions).

Surgical Procedure	Patient Discharge Destination			
	1995/96		2001/02	
	Inpatient Rehabilitation	Home From Acute Care	Inpatient Rehabilitation	Home From Acute Care
Primary Total Hip Replacement	1618 (31.6%)	3498 (68.4%)	2748 (43.5%)	3575 (56.5%)
Revision Total Hip Replacement	404 (39.1%)	629 (60.9%)	639 (46.7%)	729 (53.3%)
Primary Total Knee Replacement	2003 (31.1%)	4443 (68.9%)	4171 (42.4%)	5675 (57.6%)
Revision Total Knee Replacement	162 (25.3%)	478 (74.7%)	370 (38.0%)	603 (62.0%)

©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

Length of stay in acute care and inpatient rehabilitation following total joint replacement

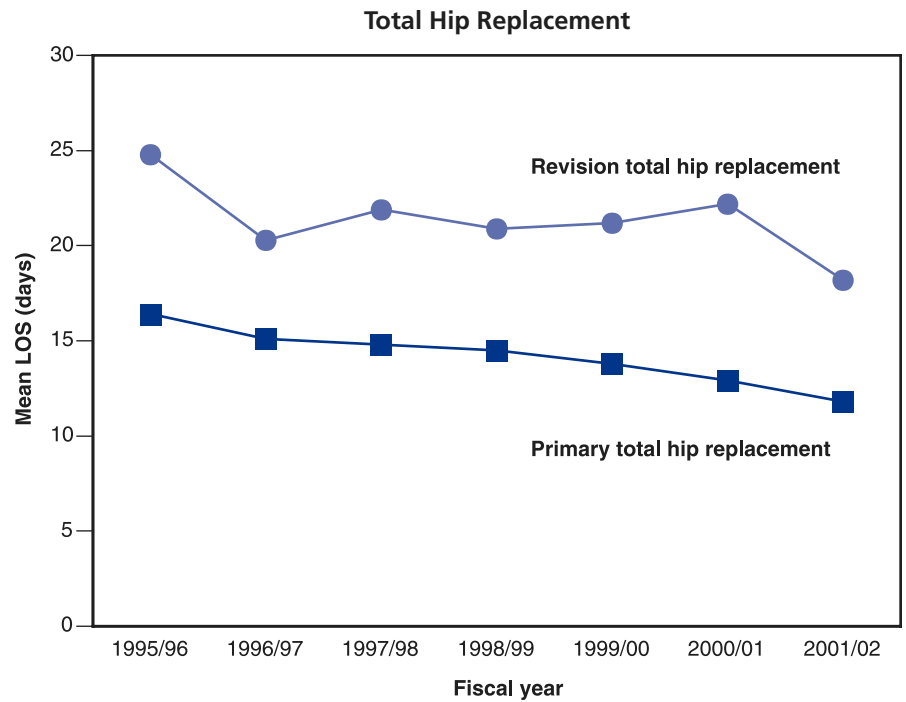
In Ontario, the mean acute care length of stay (LOS) decreased steadily from 1995/96 to 2001/02 for TKRs and THRs (both primary and revisions). This was most notable for primary TKR, where the mean acute care LOS decreased by 3.1 days, from 9.2 days in 1995/96 to 6.1 days in 2001/02. The median LOS decreased from 8 days to 6 days during this period.

Both the mean and median acute care LOS were longer for patients discharged directly home following primary THRs and primary TKRs compared to those who were transferred to inpatient rehabilitation. For example, in 2001/02 the mean acute care LOS was 6.4 days (median 6 days) for patients discharged directly home following primary TKR compared to 5.6 days (median 5 days) for patients transferred to inpatient rehabilitation. There were no differences in the median acute care LOS for patients discharged home or to inpatient rehabilitation following revision surgeries.

7.2 Inpatient rehabilitation length of stay for patients with total joint replacement, in Ontario, 1995/96 to 2001/02

The LOS in inpatient rehabilitation for primary THR decreased from a mean of 16.4 days (median 15 days) in 1995/96 to a mean of 11.8 days (median 10 days) in 2001/02. A similar trend was noted for primary TKR, for which the LOS in inpatient rehabilitation decreased from a mean of 17.3 days (median 15 days) to a mean of 11.0 days (median 9 days).

Overall, the mean rehabilitation LOS was shorter for primary surgeries compared to revision. It was also shorter for patients that received inpatient rehabilitation and home care services following discharge. For example, in 2001/02, the mean rehabilitation LOS was 8.3 days (median 7 days) for patients following primary TKR that also received home care services, compared to 11.5 days (median 10 days) for patients discharged from inpatient rehabilitation with no home care service provision.



©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

Characteristics of joint replacement patients by discharge destination

7.3 Age and sex of patients by joint replacement procedure and discharge destination, in Ontario, 2001/02

No substantial difference was observed in the mean age of individuals that received THRs and TKRs between the years of 1995/96 and 2001/02. Older individuals tended to receive inpatient rehabilitation following acute care hospitalization regardless of type of surgery. For example, in 2001/02, individuals that had inpatient rehabilitation following primary THRs were, on average, 68.6 years old compared to patients discharged directly home who had a mean age of 65.9 years.

Overall, a higher percentage of women than men received THRs and TKRs. For example, in 2001/02, 61.5% of primary TKRs were performed on women. Of the patients transferred to inpatient rehabilitation following surgery, 64.9% were women. In contrast, only 59.0% of patients discharged directly home were women.

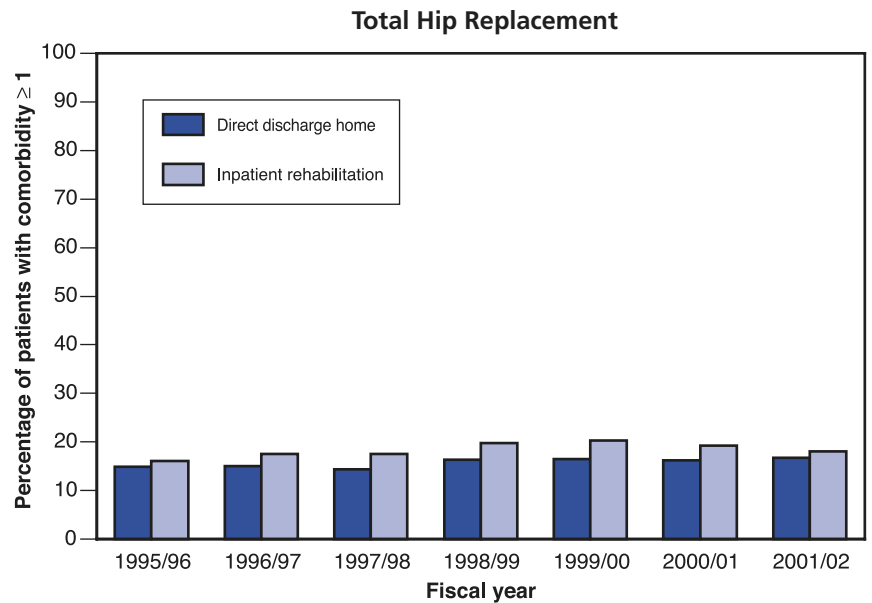
Discharge Destination	Age and Gender	Surgical Procedure			
		Primary Total Knee Replacement	Revision Total Knee Replacement	Primary Total Hip Replacement	Revision Total Hip Replacement
Home From Acute Care	Mean Age	68.4	69.4	65.9	66.6
	% Women	59.0%	50.3%	54.3%	52.5%
Inpatient Rehabilitation	Mean Age	69.3	70.7	68.6	70.6
	% Women	64.9%	63.5%	62.1%	63.4%

©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

7.4 Percentage of patients with primary total joint replacement and at least one comorbidity discharged home and transferred to inpatient rehabilitation in Ontario, 1995/96 to 2001/02

A higher percentage of patients that had inpatient rehabilitation following THR and TKR surgery had a Charlson comorbidity index equal to, or greater than, one (indicating presence of comorbidity), compared to patients discharged directly home. The percentage of patients transferred to inpatient rehabilitation with a Charlson comorbidity index of equal to, or greater than, one increased from 1995/96 (16.1%) to 1999/00 (20.3%) for primary THRs. A similar pattern was noted for primary TKRs. A higher percentage of patients with revision total hip and knee replacements had a Charlson comorbidity index equal to, or greater than, one, compared to patients with primary total hip and knee replacement surgeries. Overall, individuals that received inpatient rehabilitation following THR and TKR were more likely to be older women with comorbidity.



©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

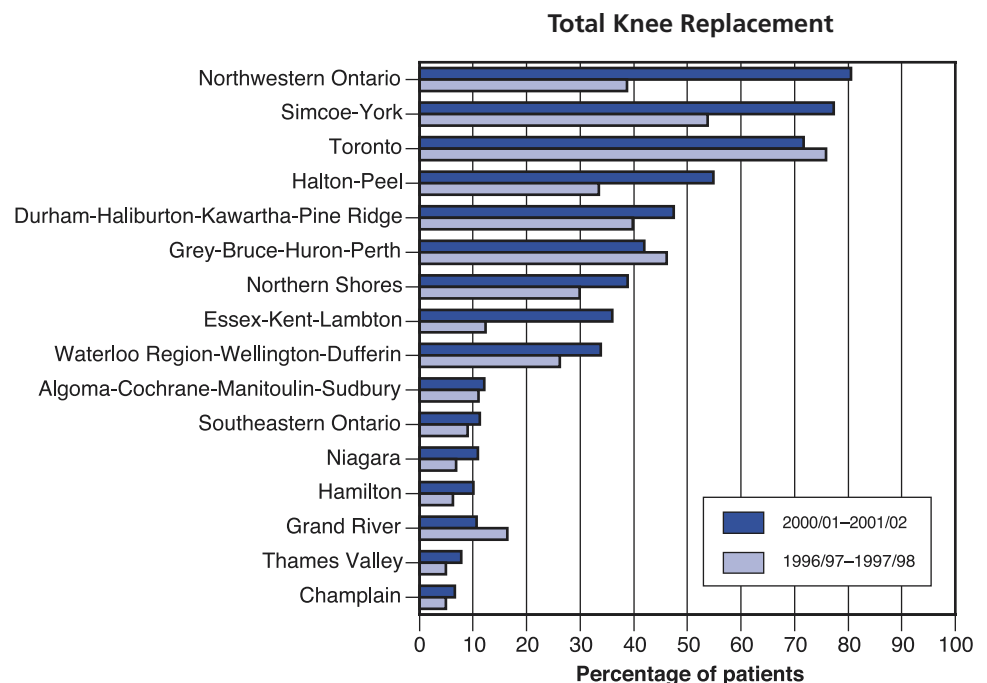
Geographic variation in utilization of rehabilitation services following total joint replacement

Primary and revision surgeries were combined for the analyses of geographic variation. Regional variation was evident in the utilization of inpatient rehabilitation services following THR and TKR.

7.5 Percentage of patients with total joint replacements transferred to inpatient rehabilitation by District Health Council, in Ontario, 1996/97 to 1997/98 and 2000/01 to 2001/02

There was variation by DHC in the percentage of patients with TKRs transferred to inpatient rehabilitation, and findings were similar for patients with THRs. The data illustrate practice changes over time in utilization of inpatient rehabilitation. During the study period, the percentage of patients that received inpatient rehabilitation services following THRs and TKRs increased in 13 of the 16 DHCs. However, in 7 DHCs, over 78% of patients with THRs and 88% of patients with TKRs were not transferred to inpatient rehabilitation during the years examined.

Practice patterns within DHCs also changed in the period. For example, in Northwestern Ontario the percentage of patients with TKRs transferred to inpatient rehabilitation doubled from 38.8% to 80.5%, while the percentage of patients with THRs receiving inpatient rehabilitation decreased from 66.3% to 55.6%. From these data, the reason for the change cannot be determined.



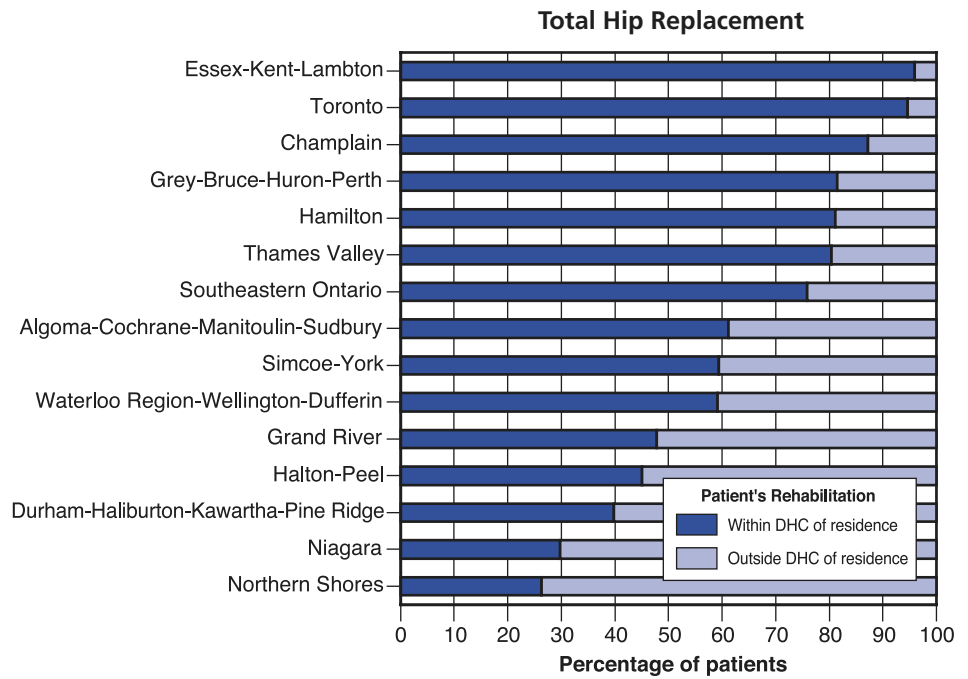
©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

7.6 Percentage of patients with total joint replacement that received inpatient rehabilitation in or outside their District Health Council of residence, in Ontario, 2000/01 to 2001/02

In total, more than 75% of patients with THRs and TKRs were discharged to inpatient rehabilitation within the DHCs of the acute care hospital in which they had surgery.

In 7 of the 16 DHCs more than 75% of patients with THRs were discharged to inpatient rehabilitation in their DHCs of residence. The highest percentages were in Northwestern Ontario (where data cannot be presented due to the small numbers of patients receiving rehabilitation outside the DHC of their residence), Essex-Kent-Lambton (95.9%) and Toronto (94.6%), compared to only 26.3% of patients in Northern Shores. Similar patterns were found for TKR.



©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

Home care utilization following total joint replacement

7.7 Percentage of patients with total joint replacement that received home care services, by discharge destination, in Ontario, 1995/96 and 2001/02

Home care services were available to patients discharged directly from acute care and patients that received inpatient rehabilitation. Patients were included in the analysis if they received one or more services from a home care program. Overall, a higher percentage of patients with primary and revision THRs received home care services compared to primary and revision TKRs.

Following all surgical procedures, patients were more likely to receive home care services if they were discharged directly home, compared to patients that had inpatient rehabilitation. Less than 21% of patients discharged from inpatient rehabilitation also received home care services. However, the percentage of patients that received home care services on discharge home from acute care decreased for primary THRs and primary TKRs from 1995/96 to 2001/02. This was most notable for patients with primary TKRs, where the percentage of patients receiving home care services decreased from 48.6% in 1995/96 to 30.5% in 2001/02. For all procedures from 2000/01 to 2001/02, there was an overall drop in the percentage of patients receiving home care services following discharge home and following inpatient rehabilitation.

Surgical Procedure	1995/96		2001/02	
	Inpatient Rehabilitation	Home From Acute Care	Inpatient Rehabilitation	Home From Acute Care
Primary Total Hip Replacement	21.4%	57.1%	20.3%	45.8%
Revision Total Hip Replacement	11.6%	46.3%	9.5%	24.1%
Primary Total Knee Replacement	18.3%	48.6%	14.9%	30.5%
Revision Total Knee Replacement	16.0%	43.1%	8.4%	18.7%

©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information



7.8 Standardized mean service intensity for patients with total joint replacement, in Ontario, 1996/97 to 1997/98 and 2000/01 to 2001/02

This exhibit illustrates the change in the standardized mean service intensity for THRs, including both primary and revision surgeries. The trend was similar for patients with TKRs. Patients discharged directly home with home care, or to inpatient rehabilitation followed by home care, received, on average, six to seven visits of rehabilitation therapy. The mean number of services increased for homemaking and nursing services and decreased slightly for rehabilitation services for patients discharged home following THRs and TKRs. In contrast, for patients that received inpatient rehabilitation, the mean number of services increased for rehabilitation and homemaking, but decreased for nursing services.

Discharge Destination	Home Care Service	Standardized Mean Service Intensity for Total Hip Replacements	
		1996/97 to 1997/98	2000/01 to 2001/02
Direct Discharge Home	Homemaking	10.6	12.4
	Nursing	6.3	7.6
	Rehabilitation	6.8	6.7
Inpatient Rehabilitation	Homemaking	11.6	14.0
	Nursing	10.0	8.3
	Rehabilitation	6.0	6.6

©Institute for Clinical Evaluative Sciences

Data source: Canadian Institute for Health Information

Predictors of rehabilitation for patients with total joint replacement

The results from the analyses demonstrate that whether patients receive inpatient rehabilitation following total hip or knee replacement may depend on age, sex, Charlson comorbidity index, LOS, and type of surgery, as well as area of residence. Some of the variation in the outcome was between DHCs, and significant interactions were found among the variables. These factors must be considered together to understand which factors may predict the use of inpatient rehabilitation after TJR. Please refer to Appendix 7.A for further details of the analyses.

Conclusions

Service demand

With the anticipated growth in total joint replacement (TJR) surgeries, an associated increase in the demand for rehabilitation services is expected from 1995/96 to 2001/02. The proportion of patients with primary and revision total hip replacements (THRs) and total knee replacements (TKRs) discharged to inpatient rehabilitation increased from approximately 30% to 40% between 1995/96 and 2001/02. There are a number of factors that may contribute to these findings.

1. Under hospital restructuring plans there has been the phasing in of additional short-term rehabilitation beds for patients with musculoskeletal conditions, since 2000.
2. The acute care and inpatient rehabilitation length of stay (LOS) decreased among all patients with TJRs. Another study reported similar findings that the acute care LOS of patients following TKR has decreased markedly, while rates of discharge to rehabilitation facilities increased.⁶
3. There has been a decrease in the availability of publicly-funded outpatient rehabilitation services.
4. There have been changes to the organization of home care services with the introduction of Community Care Access Centres (CCAC) during this period.

Determinants of inpatient rehabilitation

In studies examining outcomes of rehabilitation options, three patient characteristics were consistently reported among those that had inpatient rehabilitation: older age, living alone and having more comorbidity.⁷⁻⁹ The findings of this study are in agreement such that, patients that received inpatient rehabilitation following THR and TKR were more likely to be older and have some comorbidity. However, the data analysis showed significant geographic variation among the various discharge options. The percentage of patients that received inpatient rehabilitation services increased in 13 of the 16 DHCs. However, in 7 DHCs, more than three-quarters of patients with THRs and 88% of patients with TKRs were not transferred to inpatient rehabilitation during the years examined.

In almost one-half of the DHCs, more than 75% of patients discharged to inpatient rehabilitation received rehabilitation in their DHCs of residence. These findings suggest that if inpatient rehabilitation beds are available in a particular DHC then residents of that area are using them.

This study revealed that criteria for referral to inpatient rehabilitation may not be consistent across the province. Similarly, another study reported that revision surgery predicted worse physical function after knee replacement in a sample of patients

in Indiana, but not in Western Pennsylvania.¹⁰ This underscores the need to examine the variation reported in Ontario. Other factors, including professional practices, availability of resources, access to resources and patient preferences may also vary and contribute to inconsistencies across the province.

Outcomes following inpatient rehabilitation and home-based care

Studies that compare outcomes following inpatient rehabilitation to home-based care for patients recovering from TJR are limited. At present there are no published randomized controlled trials comparing the two rehabilitation settings. Results from several prospective studies conducted in the US indicate that patient outcomes did not differ by rehabilitation setting.⁷⁻⁹ A retrospective cohort study conducted at a Toronto teaching hospital compared characteristics and outcomes in patients that received inpatient rehabilitation versus those that received home care.¹¹ Of the 146 records reviewed, 98 patients completed the follow-up questionnaires. No significant differences were found in patient outcomes between the groups. Overall, the group that received home care tended to be men with greater social supports, more knowledge about TJR and a preference to receive care at home.

In another study, the estimated average costs in Ontario associated with the total continuum of care following TJR for the fiscal years 1991/92 to 1994/95 ranged from \$8,166 to \$13,569 depending on the rehabilitation strategy used; inpatient rehabilitation followed by home care was the most costly.¹²

Variation in use of rehabilitation services

The results of this study show variation in discharge destination, though a major limitation in interpretation is a lack of detailed clinical information. The literature consistently reports that preoperative physical function is a predictor of post-operative outcome. Other factors include weight less than 70 kg, strong social support and higher educational level.¹³⁻¹⁵ Age and comorbid conditions are also predictors, and were measured in this study. What is not clear in the literature is how much these factors influence amount, type and setting for rehabilitation services for recovery. It is also not apparent to what extent clinicians consider these factors when determining discharge destination.

There is clearly a subset of patients that require inpatient rehabilitation. In Edmonton, one of the admission criteria was that patients lack the ability to safely manage activities of daily living at home. Often these patients are unable to obtain home care services immediately after surgery or are in need of stabilization due to underlying medical, physical or social conditions.⁷



Depending on the surgical procedure, approximately 9%–20% of patients received home care services following discharge from inpatient rehabilitation in 2001/02. During the study period all patients received, on average, 6 to 7 home care visits for rehabilitation therapy, though there was no information on the appropriateness of therapy received or on the patient outcomes. Other studies have also reported uncertainty about the appropriate amount of rehabilitation, in acute care and post-discharge settings.^{7,8} Another study compared typical post-operative management in 12 orthopaedic centres in US, UK and Australia.¹⁶ Length of acute care stay ranged from 4 to 16 days, with the US having the shortest LOS and the UK the longest. Use of home physical therapy was significantly higher in the US (65%) than in the UK (5%) or Australia (6%), whereas the use of outpatient physical therapy was significantly greater in the latter two countries. Variation was strongly associated with the method of hospital reimbursement, which differs in all three countries.

In conclusion, these findings indicate that the utilization of inpatient rehabilitation rose and mean acute care and rehabilitation LOS fell for patients following TJR. There is geographic variation in use of rehabilitation services, and contributing factors may include professional practices, availability of resources, access to resources and patient preferences. Future work should examine admission and discharge criteria for rehabilitation for this population, and quantify the cost and outcomes of varying processes of care for patients with TJR. In addition, from a health care system perspective, there is a need to determine the optimal management for this population.



Appendices

7.A How the research was done

Data sources

The data for this chapter were obtained from two primary sources, the Discharge Abstract Database (DAD) of the Canadian Institute for Health Information (CIHI) and the Ontario Home Care Administrative System (OHCAS). The DAD contains data on hospital discharges (inpatient acute, chronic and rehabilitation) for a given fiscal year. Hospitals submit demographic, administrative and clinical data for hospital discharges and day surgeries to CIHI. Ontario patients that received total hip replacement (THR) and total knee replacement (TKR) surgeries, were identified in the DAD by the Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures (CCP) codes, procedural classification to be used in conjunction with International Statistical Classification of Diseases, Injuries, and Causes of Death, Ninth Revision (ICD-9). Codes were further analyzed to determine if the THR or TKR was a primary surgery or a revision. Please refer to Appendix 7.B for detailed information on diagnostic codes.

Patient records were categorized into two post-acute care discharge destinations: inpatient rehabilitation and home. A second hospitalization record in the DAD, in which the institution type was recorded as general or specialty rehabilitation, identified patients that received inpatient rehabilitation following acute care. If the hospital was not identified as rehabilitation, the record was checked to determine if the subsequent hospitalization was for inpatient rehabilitation as identified by select V-codes, a classification used in the DAD when circumstances other than disease or injury are recorded as diagnosis. Please refer to Table 7.1 for a list of the V-codes included in the analysis.

Diagnostic Category	V Codes
Orthopaedic aftercare NEC	V548
Orthopaedic aftercare NOS	V549
Physical therapy NEC	V571
Occupational/vocational therapy	V572
Rehabilitation proc NEC	V5789
Rehabilitation proc NOS	V579
Convalescence NEC	V665
Surgical convalescence	V660
Surgical follow-up	V670

Following discharge directly home from acute care or discharge from inpatient rehabilitation, patients may receive home care services. Linkages to the OHCAS using patients' unique identifying numbers were made to determine who received home care services. The OHCAS contains demographic, diagnostic and treatment information about patients of the Ontario Home Care Program.

Analyses

All patients in Ontario that had a procedure code indicating TKR or THR for fiscal years 1995/96 to 2001/02 were included in the analysis. Primary joint replacements and revisions were examined. Data were examined for trends over time. For each type of procedure, the percentages of patients discharged from acute care to inpatient rehabilitation and directly home were calculated. The mean and median acute care length of stay (LOS) was calculated for each procedure type relative to discharge destinations (home and inpatient rehabilitation). For all patients that received inpatient rehabilitation, the mean and median rehabilitation LOS was calculated for each procedure type.

Mean age of patients was calculated for each procedure and for each discharge destination. The percentages of women and men were also calculated for these groups. To assess comorbidity, the Charlson comorbidity index, which is based on the ICD-9 diagnosis codes and CCP codes in the DAD, was used. The percentage of patients that had a Charlson comorbidity index score of one or greater was calculated for each procedure and for each discharge destination. A Charlson comorbidity index of one or greater indicates the presence of at least one comorbid condition.

Utilization of inpatient rehabilitation by geographic location was determined through analysis of patient records for each Ontario District Health Councils (DHCs). The percentage of patients that received inpatient rehabilitation following acute care hospitalization was determined for each DHCs. Further, the data were examined to determine the distribution of patients that received rehabilitation at hospitals in or outside the DHCs in which they lived. The distribution of patients that had inpatient rehabilitation in the same DHCs in which they had their acute care hospitalization was also determined.

The percentage of clients that received one or more services from an Ontario home care program was calculated for patients that received home care services within 30 days of discharge from acute care hospitalization or inpatient rehabilitation. The percentage of home care clients that utilized specific services, including nursing, rehabilitation (physiotherapy and occupational



therapy), homemaking and other professionals (e.g. social work, speech language pathology), was calculated. The standardized mean service intensity was determined by calculation of the mean number of specific services received by home care clients. Direct standardization was used to adjust post-acute care home care rates to account for regional variation in age and sex composition.

Multivariate logistic regression was performed to examine predictors of inpatient rehabilitation after THR and TKR. A one-way ANOVA with random effects was used to test the significance of the variation in DHCs. Factors that may predict the use of inpatient rehabilitation after THR and TKR were examined by various statistical techniques, including multilevel modelling.

Limitations

Limitations in the data should be considered when interpreting the results.

V-codes were examined to capture rehabilitation activity that occurred in acute care beds. Although this method captured some rehabilitation activity that occurred in acute care, it is possible that some of these data were not coded appropriately, and consequently, the results may underestimate the true utilization of inpatient rehabilitation activity in the province.

Only data for patients that received rehabilitation care through home care services following acute care hospital stay were analyzed. Data for patients that received rehabilitation services from other sources (e.g. The Arthritis Society, publicly-funded outpatient rehabilitation services and private outpatient clinics) following inpatient rehabilitation are not captured in the data sources used. Therefore, the results underestimate the amount of rehabilitation occurring with patients after discharge from their inpatient hospitalization. As an increasing amount of rehabilitation occurs in non-publicly funded settings, the collection of reliable data on rehabilitation activity in the community is a significant challenge.

A unique identifying number was used to link the patients from their inpatient hospitalization to home care services. Any coding errors in the database may have resulted in some recipients not being identified. This would have resulted in an underestimate of home care service utilization. It was also possible that patients were receiving home care services before surgery. If continued, it was possible that this service provision was unrelated to the surgery and resulted in an overestimate of home care service utilization.

7.B Diagnostic codes

Records were selected from the CIHI DAD when the following CCP codes were identified in the procedure fields: 93.51 and 93.59 for THRs, and 93.41 for TKRs. Records were excluded if the patient did not live in Ontario, had invalid residence codes, was missing a unique identifying number, died in the hospital, was under 20 years of age, or had a diagnosis of cancer or fracture. The diagnoses of cancer were excluded using the ICD-9 diagnostic codes 140.x through 208.x (malignant neoplasms) and 235.x through 239.x (neoplasms of uncertain behaviour). Fractures were excluded using the ICD9 codes 800.x through 899.x and the following E-codes (non-medical causes of injury) were also excluded: E800-E869, E880-E928 and E950-E999.

Primary and revision TJRs were differentiated using diagnostic codes. Any of the following ICD-9 codes indicated a revision replacement: osteomyelitis of joint (730.0 through 730.3, 730.8, and 730.9), mechanical complications of internal prosthetic device (996.4 and 996.7), dislocation of the joint (835.0 for hip and 836.3 and 836.5 for knee), or post-operative infections (996.6, 998.5 and 998.6). The remaining records were considered to be primary THRs and TKRs. A coding addendum was added in 2000/01 to the CCP to capture revisions of TJR. In addition to records selected above, any 2000/01 records were considered revision hip replacements if any of the valid procedure fields had the CCP code 93.52, 93.53, 93.65, 93.66, 93.67 or 93.68. Also 2000/01 CIHI records were considered revision knee replacements when any of the valid procedure fields had the CCP code 93.40.



References

1. Munin MC, Rudy TE, Glynn NW, Crossett LS, Rubash HE. Early inpatient rehabilitation after elective hip and knee arthroplasty. *J Am Med Assoc* 1998; 279:847–852.
2. Brander VC, Stulberg D, Chang RW. Rehabilitation following hip and knee arthroplasty. *Phys Med and Rehabil Clin of N Am* 1994; 5(4):815–836.
3. Coyte P, Axcell T. The use of and regional variations in post-acute rehabilitation services for musculoskeletal patients. In: Badley EM, Williams JI, editors. Patterns of health care in Ontario: arthritis and related conditions. An ICES practice atlas. Toronto: Institute for Clinical Evaluative Sciences; 1998.
4. Jagal S, Walker J, Markel F, Naglie G, Steele C, et al. Epidemiological variables and utilization in rehabilitation in Ontario. Final Report, 2002. Ontario Neurotrauma Foundation and Ontario Ministry of Health and Long-Term Care. Ref Type: Report.
5. Roos E. Effectiveness and practice variation of rehabilitation after joint replacement (rehabilitation medicine in rheumatic diseases). *Curr Opin Rheumatol* 2003; 15(2):160–162.
6. Oldmeadow LB, McBurney H, Robertson VJ. Hospital stay and discharge outcomes after knee arthroplasty: implications for physiotherapy practice. *Aust J Physiother* 2002; 48:117.
7. Kelly KD, Malone B, Hempel P, Voaklander DC. Orthopaedic subacute rehabilitation-predictors of functional income and resource utilization. *Int J Rehabil Health* 2000; 5(3):165–176.
8. Munin MC, Kwok CK, Glynn N, Crosset L, Rubash HE. Predicting discharge outcome after elective hip and knee arthroplasty. *Am J Phys Med Rehabil* 1995; 74(4):294–301.
9. Jones CA, Voaklander DC, Johnston WC, Suarez-Almazor ME. The effects of age on pain, function, and quality of life after total hip and knee arthroplasty. *Arch Intern Med* 2001; 161:454–460.
10. Hawker GA, Wright JG, Coyte P, Paul J, Dittus R, Croxford R et al. Health related quality of life after knee replacement: results of the knee replacement patient outcomes research study team. *J Bone Joint Surg Am* 1998; 80-A(2):163–173.
11. Mahomed NN, Koo Seen Lin MJ, Levesque J, Ian S, Bogoch ER. Determinants and outcomes of inpatient versus home-based rehabilitation following elective hip and knee replacement. *J Rheumatol* 2000; 27:1753–1758.
12. Coyte PC, Young W, Croxford R. Costs and outcomes associated with alternative discharge strategies following joint replacement surgery: analysis of an observational study using a propensity score. *J Health Econ* 2000; 19(6):907–929.
13. Young NL, Cheah D, Waddel JP, Wright JG. Patient characteristics that affect the outcome of total hip arthroplasty: a review. *Can J Surg* 1998; 41(3):188–195.
14. Fortin PR, Clarke AE, Joseph L, Liang MH, Tanzer M, Ferland D et al. Outcomes of total hip and knee replacement; preoperative functional status predicts outcomes at six months after surgery. *Arthritis Rheum* 1999; 42(8):1722–1728.
15. MacWilliam CH, Yood MU, Verner JJ, McCarthy BD, Ward RE. Patient related risk factors that predict poor outcome after total hip replacement. *Health Serv Res* 1996; 31(5):623–638.
16. Linguard EA, Bervan S, Katz J, and the Klinemax Outcomes Group. Management and care of patients undergoing total knee arthroplasty: variations across different health settings. *Arthritis Care Res* 2000; 13(3):129–136.