Hospital Readmissions in the First Two Years After Initial Rehabilitation for Acute Spinal Cord Injury

Kiley Pershouse, Ruth Cox, and Pat Dorsett

A retrospective analysis of the incidence, length of stay (LOS), and reasons for rehospitalization in the first 2 years after discharge from an Australian spinal injuries unit was undertaken. Of the 68 participants, 31% were readmitted at least once. There were a total of 60 readmissions accounting for 598 bed days and with an average LOS of 10 days. Conditions related to spinal cord injury, such as pain, spinal surgery, and urological complications, accounted for 75% of readmissions and 81% of bed days. LOS data rather than counts of admission episodes may be more useful for designing community-based prevention programs. Key words: *complications, rehospitalization, secondary conditions, spinal cord injury*

HIGH RATES of hospital readmission following initial rehabilitation after spinal cord injury (SCI) are well documented in the literature with incidence ranging from 19% to 57%.[1–11] Such high rates of readmission to hospital are of concern as frequent hospitalizations place great stressors on peoples' ability to maintain meaningful relationships with families and friends and impede their participation in vocational and leisure activities. This results in potentially significant impacts on individuals' overall quality of life.[3] The increasing economic cost of hospital care in an environment of resource constraint is also an important consideration.

Meyers and associates,[2] in a cross-sectional analysis, found that 57% of their sample were readmitted to hospital at least once in the year prior to the study. Participants ranged from 1 to 41 years post-SCI. Ivie and De Vivo,[3] in another cross-sectional study involving 2,305 participants enrolled in the National Spinal Cord Injury Statistical Center (NSCISC) data set, found that 26% of people were hospitalized during the most recent follow-up year. Participants ranged from 1 to 7 years post-onset of SCI. Comparison of these cross-sectional studies is problematic because other research suggests that readmission rates decrease as time postinjury increases[10,11] but that incidence of pressure sores may increase over time.[12]

Kiley Pershouse, B Soc Work, *is Social Worker, Spinal Outreach Team, Spinal Injuries Unit, Princess Alexandra Hospital, Brisbane, Queensland, Australia.*

Ruth Cox, MBA, B Occ Thy (Hons), *is Program Manager, Spinal Outreach Team, Spinal Injuries Unit, Princess Alexandra Hospital, Brisbane, Queensland, Australia.*

Pat Dorsett, B Soc Work, *is Program Manager, Transitional Rehabilitation Program, Spinal Injuries Unit, Princess Alexandra Hospital, Brisbane, Queensland, Australia.*

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Studies that investigate the first 2 years postinjury suggest that readmission rates are high in these early years. DeVivo and associates[6] found a readmission rate of approximately 33% and 36% in the first and second years, respectively, postdischarge. Tate and Forchheimer[9] noted a higher 51% rehospitalization rate in the first 2 years postdischarge. Johnson and associates[11] reported a 27% readmission rate in year 1. Davidoff and associates[1] reported a 39% readmission rate in the first year postdischarge from hospital; 34% of these admissions were considered to be potentially preventable.

There is little data on readmission rates for individuals with SCI in Australia, and existing studies[4,5] are hampered by small sample sizes. Unpublished data from an Australian longitudinal study of SCI by Dorsett[5] ($n = 49$) documents a readmission rate of 27% for the first year postdischarge from initial rehabilitation and 37% in the first 2 years postdischarge. From another Australian sample, Craig et al.[4] reported a 2-year readmission rate of 41% for a cognitive behavioral therapy (CBT) treatment group ($n = 28$) and 55% for the study control group ($n = 31$).

It is difficult to determine whether variations in the incidence of rehospitalizations after SCI are due to real differences in readmission rates, differences in study methodology, or variations in clinical practice. This variability suggests that the collection of incidence data alone may be of limited use. As Johnson and associates[11] state, the impact of complications on individuals' quality of life and productivity plus the preventability of complications are key issues that need to be investigated. Thus, length of stay (LOS) data that is infrequently reported or discussed in the literature may be a key factor in determining the impact of complications both economically and socially. In addition, discovering whether the reasons for readmission are actually related to SCI and whether they are preventable may give researchers much more useful information when designing prevention programs.

The sample for this study was drawn from the Spinal Injuries Unit (SIU) in Brisbane, Queensland, Australia. This SIU is 1 of only 6 specialist spinal injuries units in Australia and services the state of Queensland and northern New South Wales with a catchment area population of over 3,500,000.[13] The Queensland SIU treats approximately 100 new SCIs each year and is responsible for managing the acute, medical, surgical, and rehabilitation needs of these individuals. Queensland is a large state covering an area of 1,728,000 square kilometers or an area equivalent to one fifth of the United States,[13] hence issues requiring follow up are often dealt with in regional centers close to where people live.

This research forms the first stage of a two-part evaluation of two new community-based services designed to better meet the needs of individuals returning to the community after sustaining a SCI. The current study aimed to quantify the incidence of rehospitalization for a sample of individuals with SCI in the first 2 years after discharge from their initial rehabilitation program. In addition, reasons for readmission were examined to determine whether they were related to SCI and were preventable in nature. LOS data for readmissions was also collected to give an indication of the true economic and social impact of rehospitalization. A secondary aim of the study was to identify any significant differences between the participants who were readmitted to hospital and

those who were not with respect to specific injury and functionally related variables.

The second stage of the two-part evaluation is a 2-year prospective study, with a comparable sample of SCI individuals who have participated in the new community-based rehabilitation and support services. Readmission patterns and LOS data will be compared between the two groups. It is thought that more appropriate rehabilitation services and enhanced community support in the first 2 years postinjury may be reflected in fewer preventable rehospitalizations and shorter LOS for those admissions that do occur. The second stage data is currently being collected.

Method

Participants

The medical records of 166 individuals consecutively discharged from the SIU between December 1, 1991, and January 31, 1994, were reviewed retrospectively. Specific exclusion criteria were developed for this study to ensure that participants were eligible for the two community-based services, which were being evaluated. Thus, only individuals who sustained a SCI with subsequent neurological deficit and who were resident in Queensland for 2 years after initial rehabilitation were included. In addition, people who were ventilator dependent were excluded because of their unique and complex needs. Consequently, 10 individuals with a diagnosis of spinal cord concussion, 4 with a diagnosis of psychiatric conversion disorder, 2 with diagnoses other than SCI, and 1 individual who was ventilator dependent were excluded. In addition, 35 individuals who were no longer resident in the state, 7 who died during initial rehabilitation, and 5 who were discharged to long-term institutional care were also excluded. Thus, a total of 64 individuals were excluded.

Of the remaining 102 people who were eligible for inclusion, a nonparticipant group was formed from 29 participants who were not able to be located (through SIU records, electoral rolls, or telephone directory listings) and 5 people who did not give consent ($n = 34$). The remaining 68 individuals participated in a telephone survey. The demographic, injury, LOS, and functional details of the 68 participants are shown in Table 1. The participant group was compared to all SIU admission data for level of lesion for the years 1992 and 1993 and was found to be representative.

Procedures

Participants were asked, through a telephone call, if they had been readmitted to hospital in the first 2 years after their discharge from initial rehabilitation at the SIU. If participants recalled readmission to hospital, they were asked to specify hospital name and location and the approximate date of any readmission. Participants were also asked to complete a written consent form that was sent with a cover letter and a copy of ethics committee approval to the identified hospital. The identified hospital was asked to provide details of date of admission, LOS, and reason for each readmission. In addition, the medical discharge summary completed at the time of the readmission was requested from the participants' medical records. Validity of the self-report data on incidence of readmission was checked through this process of corroboration with relevant hospital records.

Each episode of readmission to hospital was assessed by a spinal rehabilitation specialist (director of the SIU), who reviewed

Table 1. Participant demographic and injury characteristics (n = 68)

Demographic and injury characteristics	Number	% of total sample	Average	Range
Gender				
Male	51	75		
Female	17	25		
Age at injury			39 yrs	16–81 yrs
Level				
Paraplegia	33	49		
Tetraplegia	35	51		
Complete	19	28		
Incomplete	49	72		
Etiology				
Vehicle	22	32		
Nontraumatic	18	27		
Fall	11	16		
Sports	6	9		
Diving	4	6		
Crush	4	6		
Violence	2	3		
Unknown	1	1		
LOS initial rehabilitation			128 days	6–400 days
Mobility				
Manual wheelchair	32	47		
Walking with aids	16	24		
Walking without aids	15	22		
Power wheelchair	5	7		
Bladder management				
Intermittent catheterization	33	49		
Normal	20	29		
Indwelling catheter	7	10		
Near normal	4	6		
Unknown	4	6		
Modified Barthel Index (n = 63)[a]			75	4–100
Functional Independence Measure (n = 60)[a]			106	54–126

Note: LOS = length of stay.

[a] Not all participants completed Modified Barthel Index and Functional Independence Measure assessments.

the medical discharge summaries. The specialist undertook a two-step classification process. First, each episode of readmission was classified as to whether it was linked to a secondary condition that was causally related to SCI. A condition was classified as related to SCI if, after reviewing the medical evidence, the specialist was of the opinion

that the participant, because of SCI, was at a greater than normal risk for developing the specific secondary condition.[12,14]

If the episode of readmission was for a secondary condition, the specialist then considered whether the rehospitalization was potentially preventable. This second step of the classification process was guided by Davidoff and associates' definition: "… [A] rehospitalization could be potentially preventable if the admitting diagnosis was most likely the result of inadequate compliance or problem solving (e.g., burning an extremity by application of a hot water bottle)."[1(p122)] The specialist reviewed the discharge summaries and considered whether there was evidence of a person's compliance with accepted management regimes for that secondary condition. If the specialist was of the opinion that the person was noncompliant, the admission was rated as "potentially preventable."

Data analysis

Data analysis initially involved identifying differences between participants and nonparticipants. Chi-square analysis was used to determine whether there were differences on the variables of level of injury and bladder management. Independent sample *t* tests were used to determine differences between these groups on the variables of age at time of injury, length of initial rehabilitation stay, Modified Barthel Index (MBI) scores, and Functional Independence Measure (FIM) scores.

Data analysis also involved identifying differences between participants who were readmitted within the 2-year period and participants who were free of readmissions during this period. Chi-square analysis was used to determine whether there were differences on the variables of method of bladder management and level of injury. Independent sample *t* tests were used to determine differences between these groups on variables of age at time of injury, length of initial rehabilitation stay, MBI scores, and FIM scores.

Results

The participant group ($n = 68$) was compared to the nonparticipant group ($n = 34$). No significant difference was found for level of injury ($\chi^2 = 0.359$, $P = .549$) or method of bladder management ($\chi^2 = 4.879$, $P = .087$). The nonparticipant group were found to be younger at age of injury ($t = 2.682$, $P < .01$), had shorter LOS for initial rehabilitation ($t = 2.404$, $P < .05$), and had significantly higher MBI scores ($t = 2.023$, $P < .05$). FIM scores were also higher, however the difference was not statistically significant ($t = 1.889$, $P = .062$).

A 100% response rate was obtained from hospitals that were approached for information regarding rehospitalizations. Ten participants had an error of recall when self-report of incidence of readmission was checked against hospital records. The majority of errors (8) related to participants recalling a readmission to hospital when the medical records indicated the readmission fell outside the 2-year period under review. Two participants had not recalled a readmission to hospital in the first 2 years when medical records indicated one had occurred.

Twenty-one participants (31%) were readmitted at least once in the first 2 years postdischarge from initial rehabilitation. There were 60 episodes of readmissions. LOS for readmissions is detailed in Table 2. The average LOS for the total readmissions

Table 2. Length of stay for readmissions

Readmission category	Length of stay (LOS)			
	Average	**Range**	**Total**	**% of total**
Total readmissions (n = 60)	10 days	Day[a] – 120 days	598 days	100
			Subtotal	
Related to SCI (n = 45)	11 days	Day[a] – 120 days	483 days	81
Potentially preventable (n = 4)	41 days	9 – 120 days	162 days	27
Not preventable (n = 41)	8 days	Day[a] – 62 days	321 days	54
Not related to SCI (n = 15)	8 days	Day[a] – 28 days	115 days	19

[a] Day denotes that admission was less than 24 hours.

was 10 days, ranging from 1 day to 120 days. The average LOS for the episodes related to secondary complication of SCI was 11 days, ranging from 1 day to 120 days. The average LOS for the episodes that were potentially preventable was 41 days, ranging from 9 days to 120 days.

Eighty-one percent (81%) of the total LOS was for readmissions related to SCI. Of the readmissions related to SCI, which were considered to be nonpreventable, removal of spinal instrumentation and postsurgical complications accounted for the highest proportion of bed days (26%). Although approximately 7% (n = 4) of the readmissions were for potentially preventable complications, these readmissions accounted for 27% of the total LOS. One of the potentially preventable readmissions for pressure area care was particularly long at 120 days.

Of the total 60 episodes of readmission, only 2 (3%) were to the SIU. A further 20 (33%) readmissions were to the medical and surgical wards of the hospital where the SIU is located and 38 (64%) readmissions were to other hospitals throughout the state.

Participants who were readmitted to hospital were compared to participants who were not readmitted for level of injury (χ^2 = 2.809, P = .094), age at injury (t = -0.494, P = .624), LOS for initial rehabilitation (t = 1.028, P = .309), bladder management method (χ^2 = 2.184, P = .336), MBI scores (t = 0.966, P = .340), and FIM scores (t = 0.558, P = .580) using independent sample t tests or chi-square analysis as outlined in the methodology. No statistically significant differences were found.

Reasons for readmission are detailed in Table 3. The most common reason for readmission was related to pain (8 episodes, 21 bed days), followed by removal of spinal instrumentation (5 episodes, 79 bed days), postsurgical complications (5 episodes, 76 bed days), and then urinary tract infections (UTIs; 4 episodes, 17 bed days).

Table 3. Reasons for readmissions

Reason for readmission	No. of readmissions (% of total)	Total length of stay in days (% of total)
Nonpreventable		
Pain	8 (13.3)	21 (3.5)
Removal of spinal instrumentation	5 (8.3)	79 (13.2)
Postsurgical complications	5 (8.3)	76 (12.7)
Urinary tract infection	4 (6.6)	17 (2.8)
Indwelling catheter complication	3 (5.0)	18 (3.0)
Review of bowel and bladder function	3 (5.0)	36 (6.0)
Haemorrhoidectomy	3 (5.0)	13 (2.2)
Cystoscopy & lithaloscopy	2 (3.3)	19 (3.2)
Deep vein thrombosis	1 (1.6)	9 (1.5)
Joint fusion	1 (1.6)	3 (0.5)
Utereric calculus	1 (1.6)	3 (0.5)
Tendon transfer	1 (1.6)	3 (0.5)
Social admission	1 (1.6)	1 (0.2)
Transurethral resection	1 (1.6)	7 (1.2)
Injury/fall	1 (1.6)	1 (0.2)
Removal of recurrent schwannoma	1 (1.6)	15 (2.5)
Subtotal	41 (68.3)	321 (53.7)
Potentially preventable		
Pressure area	3 (5.0)	152 (25.4)
Respite care	1 (1.6)	10 (1.7)
Subtotal	4 (6.6)	162 (27.1)
Readmission not related to SCI		
Melanoma	9 (15.0)	84 (14.0)
Cardiac condition	2 (3.3)	9 (1.5)
Complication old ankle fracture	2 (3.3)	13 (2.2)
Gastroscopy	1 (1.6)	Day (0)[a]
Retinal detachment	1 (1.6)	9 (1.5)
Subtotal	15 (25.0)	115 (19.2)

[a] Day denotes that admission was less than 24 hours.

Discussion

The results of this study confirm that readmissions are commonplace affecting nearly one third of the study sample in the first 2 years postinitial rehabilitation. This high rate of rehospitalization is particularly important, because these individuals had substantial hospital stays for their initial period of rehabilitation (average LOS for this group was 128 days). It is acknowledged that frequent rehospitalizations are disruptive to activities associated with independent living goals, which contribute to quality of life.[2,3,9,15] In

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addition, rehospitalizations pose a continuing financial burden to the individual and society.[1,8,11]

Reasons for readmission were examined to determine whether they were related to SCI and whether the rehospitalization was preventable in nature and therefore amenable to changes in rehabilitation and follow-up practices. In the current study, 25% of rehospitalizations and 19% of the total LOS within the first 2 years postinitial rehabilitation discharge were not related to a secondary condition of SCI. Identifying this category of readmission is important because these conditions are outside the scope of SCI services and therefore would not be included in the evaluation of the impact of community-based services.

The results from the present study found that only 7% of the readmissions related to SCI were potentially preventable. This study also collected the LOS of readmissions to provide an indication of the economic and social impact of rehospitalizations. The potentially preventable admissions accounted for a high 27% of readmission bed days. This is an important finding because it indicates that evaluating incidence alone does not demonstrate the significance of episodes of rehospitalization for individuals with SCI or economically for society. It also highlights that an important focus for community-based programs is not only on preventing incidence of rehospitalizations but also on reducing the LOS for these episodes.

The most common reason for nonpreventable readmission was related to pain, followed by removal of spinal instrumentation, postsurgical complications, and UTIs. Chronic pain is a major sequela to SCI, with incidence rates between 47% and 90% being reported.[16] Although pain was the most common reason for readmission, it accounted for a relatively small proportion of bed days (3.5%) and thus may not be a focus for prevention of rehospitalization, but it clearly negatively influences quality of life.[11,16,17]

After pain, removal of spinal instrumentation and postsurgical complications were the next highest reasons for readmission (17% of episodes) and accounted for a total of 26% of bed days. Johnson and associates[11] noted that readmission for removal and repair of spinal fixation hardware was common but decreased in frequency over time. Davidoff and associates[1] also noted that 13% of rehospitalizations in their study were for this surgery. It is likely that this portion of readmissions is largely unavoidable and is therefore not amenable to community-based strategies.

Although mortality from urinary system complications has markedly declined, morbidity continues to have a significant impact on the lives of people with SCI.[18,19] In a retrospective analysis, Gallien and associates[20] reported that 75% of their sample had developed urinary complications at some time postdischarge, with UTIs being the most common complication. In Davidoff and associates'[1] study, urinary complications accounted for 21% of hospital readmissions in the first year postdischarge. Similarly, urinary complications or investigations ac-

counted for 23% of readmission episodes and 17% of the total bed days in the current sample making this a key area for early detection and prevention in the community. Community-based intervention may be more cost-effective and have less negative impact on the quality of life for the individual with SCI. However, this requires further investigation because, for some individuals, long periods of hospitalization may be preferable to the isolation resulting from rest in bed at home. Adequacy of resourcing for community-based services is another issue that must be addressed.

A limitation of this study is that classification of secondary conditions relied on one expert's opinion. For example, depending on the individual's circumstances as noted in the medical discharge summary, a rehospitalization for UTI could have been rated as preventable or nonpreventable depending on the rater's subjective opinion regarding compliance. It is recommended that in future studies the reliability should be assessed and enhanced by a second expert rater who uses more objective criteria with specific measures of assessment.

In addition, this study highlights the subjective nature of the classification of readmissions and the difficulty in adopting Davidoff and associates'[1] definition, which focuses on compliance. Further consideration needs to be given to this issue. A new approach may be to define *preventable hospitalizations* as those that could be effectively avoided through community-based management and/or that result from conditions that are avoidable with compliance and to define *nonpreventable hospitalizations* as those that are unavoidable and require hospital-based treatment. Even though these proposed definitions are more appropriate for evaluating community-based interventions, they are limited by the subjectivity required for rating some conditions such as UTIs and chest infections. For example, a readmission due to a UTI resulting from infrequent indwelling catheter changes and inadequate fluid intake would be classified as a preventable hospitalization. However, a readmission due to a UTI that occurred even when there was clear evidence of compliance with appropriate indwelling catheter management regimes would be classified as a nonpreventable hospitalization.

To reduce the risk of rehospitalization, researchers need to identify the most frequent causes of readmission and the people at greatest risk of rehospitalization.[3] Davidoff and associates[1] found that readmission was more likely for patients who had longer initial rehabilitation stays, who were less educated, and who were more functionally dependent. The current study did not support this. There were no significant differences between participants who had been readmitted and participants who had not in LOS for initial rehabilitation, independence as measured by MBI or FIM, level of injury, age at onset of SCI, and bladder management method. Education level was not included as a variable. A limitation of this study was that the small sample size prevented predictive multivariate analysis and therefore more risk factors could not be investigated. There is a large body of research regarding risk factors associated with readmission.[1,3,12,15] Results from this type of research may assist in the design of prevention programs, especially if factors such as type of complication and length of time postinjury are taken into account.

Many authors have raised concerns re-

garding the negative impact of decreasing rehabilitation LOS after SCI on hospital readmission.[1,12,21] Eastwood and associates[22] examined NSCISC data and demonstrated a small but statistically significant relationship between lower LOS and lower incidence of rehospitalization in the first year postrehabilitation discharge. The average initial rehabilitation LOS for the current sample was 128 days versus approximately 61 days[22] and 79 days[1] in United States samples. The LOS for the current study includes acute management of the SCI and therefore is longer than in free-standing rehabilitation units. This highlights another difficulty in comparisons between centers where clinical practices are different.

A limitation of this study is the number of participants lost to follow-up. These findings may be a conservative estimate of the readmission rate. However, the nonparticipant group may have experienced fewer problems than the participants, because they appeared to have higher levels of functional independence. This is consistent with other authors[3,11] who reported that their participants for readmission research had a higher level of disability than nonparticipants, probably because the nonparticipants required less support and therefore were lost to follow-up.

The current study has attempted to capture readmission information for all hospitals in Queensland. Our data reveals that 64% of readmissions were to regional hospitals. It is acknowledged that the Australian health care system is markedly different from the United States' system, but our data suggest that readmission outside specialist spinal injuries centers may be high and therefore should be investigated. It is also important to corroborate the self-report incidence of rehospitalization with medical record data to account for error in recall.

The second stage of this research will examine readmission data after the introduction of two new programs focusing on community-based end-stage rehabilitation and long-term outreach and follow-up. The programs will use the readmission data collected from this first stage of the research to target specific areas for prevention, early detection, and community intervention.

Conclusions

This study has further highlighted that rehospitalizations in the first 2 years after discharge from initial rehabilitation for SCI are commonplace. This has implications in terms of ongoing economic costs, quality of life, and productivity. The majority of rehospitalizations were for secondary conditions related to SCI, accounting for 81% of bed days. Although definitional issues arise when determining whether readmissions are preventable or not, we found that 7% of readmissions and 27% of total LOS were potentially preventable. In addition, at least a further 30% of readmissions and 20% of bed days may be amenable to community-based prevention, early detection, and intervention programs. Further investigation of risk factors would aid in designing these programs. Future readmission research should include LOS information and should categorize readmissions with respect to their relation to SCI and the preventability of hospitalizations.

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