Original Article

Factors influencing discharge location following high lesion spinal cord injury rehabilitation in British Columbia, Canada

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Study design: Retrospective chart review.

Objective: To identify and describe factors that influence discharge location – extended care unit (nursing home) or other (private home, group home, or acute care) – following rehabilitation for individuals with a new high lesion spinal cord injury (SCI) (C1–C4) in British Columbia, Canada.

Setting: GF Strong Rehabilitation Centre, Vancouver, British Columbia, Canada.

Methods: Eligible clients were adults admitted to the GF Strong Rehabilitation Centre Spinal Cord Program between 1994 and 2003, with a new C1–4 lesion (traumatic or nontraumatic), and an ASIA score of A–C at time of discharge. Medical charts of 52 individuals were reviewed and data regarding individual characteristics, health-related characteristics, personal context, hospitalization factors, health resources, and other contextual factors were extracted.

Results: In total, 40% of clients were discharged to extended care units post rehabilitation. Seven variables were associated at a univariate level: age, employment at the time of injury, pre-existing medical conditions, social support, preinjury living situation, and insurance (worker's compensation or motor vehicle) or private funding for equipment. Four variables were associated at the multivariate level: age, preinjury living situation, and insurance or private funding for equipment.

Conclusion: A range of individual, health-related, family and social policy variables influence discharge location following rehabilitation for high lesion SCI in British Columbia. The unique combination of variables presented by each individual should be considered by the rehabilitation team in the discharge planning process.

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Introduction

Discharge to the community, rather than to an extended care unit/nursing home (ECU), is considered a positive outcome of spinal cord rehabilitation.^{1–4} In fact, location of discharge is given the most significance of all possible rehabilitation outcomes by the Uniform Data System for Medical Rehabilitation.² Hammel⁵ highlights the importance of discharge to the community in regard to persons with high lesion spinal cord injuries (SCI): '... life enhancing accomplishments were contingent upon the opportunity to live in the community with self-managed assistance' (p 611).

Several studies have examined the discharge destinations of persons with SCI from rehabilitation centers.^{6–8} In 1999, DeVivo's study of 16 633 patients with all levels of traumatic SCI admitted to the United States (US) model spinal cord injury (SCI) systems within 1 year of injury and discharged between 1973 and 1996 found that 4.3% were discharged to nursing homes. High lesion SCI (C1–4) and ventilator dependency were very strong predictors of discharge to nursing homes, with 9% of persons with C1–4 injuries and 15.7% of persons with ventilator dependency discharged to nursing homes. Factors within the high lesion and ventilator-dependent subgroups were not examined. Variables significantly associated with place of discharge for all study subjects included age, race, employment

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status at injury, bladder management method, education level, marital status, Frankel grade, functional independence, ambulation, geographic region, level of injury, ventilator dependency, and third party sponsor of rehabilitation.

More recently, a retrospective review (1994–2001) of the Uniform Data System for Medical Rehabilitation (UDSMR) data,⁹ which reflects 'a large portion of the Medicare rehabilitation cases from most States' (p 1688), found that 87% of SCI patients were discharged home with the remaining 13% discharged to board and care, intermediate care, skilled nursing facility, hospital, rehabilitation facility, and other. An Australian study⁸ found results similar to the American model system studies, with only 2.4% discharged to a 'skilled nursing facility.' The Midlands Centre for Spinal Injuries in the United Kingdom (UK) discharged 76% of patients to a 'private residence' while 24% were discharged to alternate locations (details not provided).⁷ Unfortunately the above UDSMR, Australian, and UK studies did not separate out high lesion clients or report on factors that influenced discharge location.

An extensive literature review from rehabilitation in Canada did not locate any publications regarding discharge location and associated factors. This study identifies and describes the factors that were associated with whether individuals with a new high lesion SCI at GF Strong Rehabilitation Centre were discharged from rehabilitation to an ECU *versus* all other settings – including private homes, group homes, and acute care. Understanding and addressing these factors during the course of rehabilitation and discharge planning will hopefully enable a greater number of individuals who desire independent living to avoid ECU placement. Furthermore, in examining these factors, it is of interest to consider which are primarily related to physical limitations and which are linked to broader societal factors such as level of community support, lending some insight to current discussion and understanding regarding social *versus* individual determinants of disability.

Methods

A retrospective chart review of 52 patients was conducted. All clients aged 18 years and over admitted to the GF Strong Spinal Cord Program between 1994 and 2003, with a new SCI (either traumatic or nontraumatic) between C1 and C4 levels, and an ASIA score of A, B, or C at the time of discharge were eligible.

A former employee of the Spinal Cord Program at GF Strong, who had an understanding of the charting system, the clients served, and the challenge of discharge planning, was responsible for data collection. A data collection tool was developed based on both the literature^{2,10} and clinical practice. The tool was piloted using five cases and refined to improve clarity and data extraction. Variables collected were organized into the following categories: individual characteristics, health-related characteristics, personal context, hospitalization factors, available health resources, and other contextual factors. The variables are listed in Table 1. We obtained ethics approval from both the university and hospital research ethics boards.

Analysis

Means, standard deviations and proportions were calculated in order to describe the population and study results. Univariate logistic regression analyses were conducted to produce odds ratios (ORs) and 95% confidence intervals (CIs) for each factor. Multivariable logistic regression analysis was also conducted using variables that were significant ($P < 0.05$) at the univariate level.

Independent variables (such as age and time from injury to rehab. admission) were entered into the regression model as interval level variables, while all remaining variables were entered as categorical variables. The dependent variable of interest was whether subjects had been discharged to an extended care unit or not after their rehabilitation. Statistical significance was set at $P < 0.05$. Data analysis was conducted using SPSS version 11.5.

Table 1 Data collection categories and variables

<i>Individual characteristics</i>	<i>Health-related characteristics</i>	<i>Personal context</i>	<i>Hospitalization factors</i>	<i>Health resources</i>	<i>Other contextual factors</i>
Age at d/c	Level of injury at d/c	Ability to	Length of stay	Funding options for	D/c community size
Gender	ASIA classification	direct care	in rehab.	equipment	Home community
Race	Ambulation status at d/c	ECU	Time from	Workers	size
Education level	Ventilation status at d/c	recommended	injury to rehab.	compensation and	Home region
Employment status at the time of injury	Bladder management at d/c	as placement?	admission	motor vehicle insurance	Discharge region
Social support	Pre-existing medical conditions			Social assistance	Client's 1st choice?
Marital status	Concomitant injuries			Private	Changes in region
Preinjury living situation	Medical concerns at d/c			Self-funded	post d/c
	Cause of SCI			Other	

rehab. = rehabilitation

Results

Of the 52 adults in the sample, the average age of the mainly male (77%) sample was 45.3 years (SD = 17.8). A total of 54% of the subjects were single; however, most were living with someone (73%), either family or friends, at the time of their SCI. A total of 63% had a grade 12 or higher level of education, and 46% were employed at the time of injury. The majority of the sample had a lesion at the C4 level (63%), and were categorized as ASIA A (60%). Part- or full-time ventilation was required by 37% of the sample.

In all, 21 subjects (40%) were discharged to an ECU after rehabilitation, 12 as a permanent destination, and nine as an interim placement. Of the nine interim placements, two died in the ECU before they could move on, four moved on to their first choice for discharge location (three returned to the community and one moved to a different ECU), and the final discharge outcome of the remaining three is unknown.

A total of 31 subjects (60%) were not discharged to ECU's following rehabilitation with 25 subjects discharged to a home/apartment, two to a group home, one to a shared care apartment, and three subjects went to acute care.

Seven factors were associated with discharge to an ECU at the univariate level (Table 2). Age, employment at the time of injury, pre-existing medical conditions, social support, preinjury living situation, and insurance (workman's compensation or motor vehicle) or private funding for equipment were all statistically significant as related to an ECU discharge. Age was statistically important ($P < 0.05$) when entered into the analysis as an interval or categorical variable. Older individuals were observed to have a 4% increased risk (OR = 1.04 95% CI 1.006–1.077) of going to an ECU after rehabilitation. Good levels of social support and living with friends or family (ie, not living alone) prior to SCI were observed to be protective of being discharged to an ECU. Of the other risk factors, having a pre-existing medical condition was associated with a 10 times greater risk of being discharged to an ECU while unemployment prior to the SCI and not having funding from insurance (worker's compensation or motor vehicle) for equipment were associated with a five times greater risk.

Of the seven variables found to be significant at the univariate level, four were found to be significant in the multivariable logistic regression. As displayed in Table 3, living with someone prior to the SCI and having insurance or private funding for equipment were found to decrease the risk of being discharged to an ECU, while increasing age was observed to increase the risk of discharge to an ECU.

Discussion

This study identified factors that influenced whether individuals with a new high lesion SCI at GF Strong were discharged from rehabilitation to an ECU *versus* other locations (private home, group home, or acute

care). Four of the factors found to be significant related to individual characteristics or context (age, employment at the time of injury, social support, and living situation), one was a health-related characteristic (pre-existing medical conditions), and two related to health resources (insurance or private funding for equipment). The factors are, however, interconnected and difficult to clearly tease apart.

Despite universal health care being provided for all Canadian citizens, it was interesting to observe that third party funding (worker's compensation, automobile, or private disability insurance) is especially important to persons with high lesion injuries because the funding provided by these organizations for mobility, personal care, and environmental control equipment is considerably more generous than government funding. Third party funding ties into the factors of employment at the time of injury and age, as neither unemployed nor retired persons would qualify for worker's compensation. Age, as a factor, likely relates to pre-existing medical conditions, which generally increase with age. With this in mind assessment of a statistical interaction between variables such as age and pre-existing medical conditions would have been very interesting; however, we simply did not have the power (sample size) to assess this relationship. Persons with high level quadriplegia who have pre-existing medical conditions likely require greater and more ready access to medical services than would be available if they lived independently in the community. It is of interest that DeVivo's 1999 study did not capture pre-existing medical conditions and this was noted as a shortcoming of that study.²

A lack of social support and history of living alone may impact on ability to obtain adequate care to live in the community. Government funded care for home support is limited and generally needs to be supplemented. Few individuals have the fiscal resources to rely exclusively on professional care. With poor social support and a history of living alone, there may be few family or friends available to provide the additional personal care that an individual with a high SCI would need to live in the community.

Although not found to be significant, an additional point of note was that four persons of aboriginal descent were living on native reserves at the time of their injuries and all four bands refused to contribute to housing, equipment, or care to enable these individuals to return to the reserves. Three went to ECU's, and one returned to a different community. Rehabilitation length of stay for these persons was considerably longer than the average (310 *versus* 220 days) as persistent attempts were made to obtain funding from the bands. Interestingly, DeVivo (1999) found that Native Americans were 2–3 times more likely to be discharged to a nursing home than all other racial groups combined.²

When comparing the findings of this study to those from the US, the UK, and Australia, it is important to understand the health care system in BC. GF Strong is the only provider of comprehensive rehabilitation

Table 2 Univariate analyses of factors influencing discharge location ($n = 52$)

<i>Variable</i>	<i>Community</i>	<i>ECU^a</i>	<i>Odds ratio</i>	<i>95% confidence interval</i>	<i>P-value</i>
Individual characteristics					
<i>Age (at discharge) (years)</i>					
19–33	13	4	1.041	1.01–1.08	0.022
34–66	11	9			
67+	7	9			
<i>Gender</i>					
Male	24	16	0.933	0.252–3.461	0.918
Female	7	5			
<i>Race</i>					
White	23	12	2.156	0.662–7.002	0.202
Other	8	9			
<i>Education level</i>					
No high school	10	9	0.635	0.202–1.998	0.437
High school or more	21	12			
<i>Employment status (at injury)</i>					
Employed	19	5	5.067	1.470–17.460	0.010
Not employed	12	16			
<i>Social support</i>					
Not good	4	11	0.135	0.035–0.522	0.004
Good	27	10			
<i>Marital status</i>					
Single	17	11	1.104	0.364–3.352	0.862
Married	14	10			
<i>Preinjury living situation</i>					
Living with others	27	11	0.198	0.051–0.770	0.019
Living alone	4	10			
Health-related characteristics					
<i>Injury level at d/c</i>					
C1–C3	11	8	0.894	0.284–2.816	0.848
C4	20	13			
<i>ASIA classification at d/c</i>					
ASIA B, C	11	10	0.605	0.196–1.871	0.383
ASIA A	20	11			
<i>Ambulation status at d/c</i>					
Ambulation/need aid	1	1	1.500	0.09–25.392	0.649
No ambulation	30	20			
<i>Ventilation status at d/c</i>					
Not ventilated	21	12	1.575	0.501–4.956	0.437
Ventilated	10	9			
<i>Foley use at d/c</i>					
Yes	19	17	2.684	0.726–9.920	0.139
No	12	14			
<i>Condom catheter use at d/c</i>					
Yes	6	1	0.208	0.023–1.875	0.162
No	25	20			
<i>Intermittent catheter use at d/c</i>					
Yes	10	2	0.221	0.043–1.140	0.071
No	21	19			

Table 2 Continued

<i>Variable</i>	<i>Community</i>	<i>ECU^a</i>	<i>Odds ratio</i>	<i>95% confidence interval</i>	<i>P-value</i>
<i>Pre-existing medical conditions</i>					
Yes	15	19	10.133	2.009–51.121	0.005
No	16	2			
<i>Concomitant injuries</i>					
Yes	21	12	0.653	0.202–1.998	0.437
No	10	9			
<i>Medical concerns at d/c</i>					
Yes	26	20	3.846	0.416–35.583	0.235
No	5	1			
<i>Cause of injury</i>					
Nontrauma	2	5	0.221	0.38–1.270	0.091
Trauma	29	16			
<i>Personal context</i>					
<i>Able to direct own care</i>					
Yes	17	10	1.34	0.440–4.056	0.610
No	14	11			
<i>ECU recommended</i>					
Yes	2	13	0.042	0.008–0.228	0.000
No	29	8			
<i>Hospitalization factors</i>					
<i>LOS (rehab.)</i>					
<161	8	9	1.00	0.994–1.004	0.661
161–233	12	6			
>233	11	6			
<i># of days from injury to rehab.</i>					
<51	11	6	1.00	0.995–1.001	0.620
51–91	10	8			
≥91	10	7			
<i>Health resources – equipment funding</i>					
<i>Workers compensation and motor vehicle insurance</i>					
No	17	18	0.202	0.049–0.831	0.027
Yes	14	3			
<i>Social assistance</i>					
No	24	12	2.571	0.769–8.594	0.125
Yes	7	9			
<i>Private/extended</i>					
No	21	19	0.191	0.037–0.979	0.047
Yes	11	2			
<i>Self-funded</i>					
No	25	15	1.667	0.454–6.116	0.441
Yes	6	6			
<i>Other funder</i>					
No	19	11	0.524	0.469–4.414	0.524
Yes	12	10			
<i>Other contextual factors</i>					
<i>Discharge community size</i>					
≤99 999 residents	16	9	1.422	0.466–4.337	0.536
≥100 000	15	12			

Table 2 Continued

<i>Variable</i>	<i>Community</i>	<i>ECU^a</i>	<i>Odds ratio</i>	<i>95% confidence interval</i>	<i>P-value</i>
<i>Home community size</i>					
≤99 999 residents	19	14	0.792	0.248–2.525	0.693
≥100 000	12	7			
<i>Home region</i>					
Lower mainland	13	8	0.852	0.274–2.647	0.782
Rest of BC	18	13			
<i>Discharge region</i>					
Lower mainland	18	14	1.44	0.455–4.581	0.532
Rest of BC	13	7			
<i>Discharge from rehab. (first choice)</i>					
Yes	21	12	1.575	0.501–4.956	0.437
No	10	9			
<i>Change in region post d/c</i>					
Yes	19	9	2.111	0.684–6.513	0.194
No	12	12			

^aECU = extended care unit; rehab. = rehabilitation

Table 3 Logistic regression: variables associated with discharge to an extended care unit

<i>Variable</i>	<i>Odds ratio</i>	<i>95% confidence interval</i>	<i>P-value</i>
Age (years)	1.055	1.001–1.105	0.026
Workers compensation or motor vehicle insurance equipment funding	0.129	0.022–0.769	0.025
Preinjury living situation	0.099	0.015–0.657	0.017
Private equipment funding	0.046	0.005–0.429	0.007

following SCI in BC and all persons in BC who require rehabilitation following SCI are admitted to GF Strong. Need is the exclusive admission criterion; there are no criteria based on income, insurance funding, or discharge plans. As the hospital system in BC is government funded, there is no cost to individuals for inpatient rehabilitation. (To the best of the authors' knowledge, GF Strong is currently one of two rehabilitation facilities in Canada providing comprehensive rehabilitation to persons with SCI who use ventilators.)

Additionally, BC has two significant government funded community-based programs that offer support to persons with high lesion SCI who wish to live in the community. The Choices in Support for Independent Living (CSIL) Project¹¹ provides individuals with a disability the financial resources in order to employ and train anyone (except a family member) whom they wish to have as a personal assistant, thereby giving individuals considerable choice and control. For those persons who are ventilator users, the Provincial Respiratory Outreach Program¹² provides respiratory equipment and supplies, respiratory education for attendants and family, and in-home technical support, at no cost.

In this study, 40% of individuals with new high lesion SCI who were admitted for comprehensive rehabilitation were discharged to an ECU setting. This is markedly higher than the numbers reported in the US, Australia, and the UK.^{2,7,8} One possible explanation is that, in BC, individuals who require rehabilitation following SCI are admitted to GF Strong regardless of level of injury, discharge plan, or funding circumstance. Our study data, which might be termed population-based, reflects all adults who sustained a high lesion SCI in BC between 1994 and 2003, and who could benefit from rehabilitation. The US model system data are not population-based in that it does not reflect service to all persons who sustained an SCI in a given geographic area in a given time frame. Many individuals who sustain an SCI are served in other medical settings. There are 16 model system centers in the US, each with its own admission criteria, some relating to funding and discharge plans. These admission criteria may well have an impact on discharge opportunities and outcomes. Additionally, while the report on UDSMR data 'has been found to be representative of Medicare patients receiving inpatient rehabilitation across the United States, it is not a complete record of all rehabilitation

facilities nationally and the representativeness for non-Medicare patients is unknown⁹ (p 1694).

The reports from Australia and the UK^{7,8} do not state whether the services described are population or otherwise based, or whether there are admission criteria that might influence discharge opportunities. Furthermore, the reports do not note whether they have included individuals who have been readmitted, that is, those who do not have new injuries. Persons who are readmitted for wound care, for example, are less likely to pose discharge challenges.

In BC, there is great reluctance to discharge individuals to locations where care, equipment, and accessibility needs are not adequate. Few clients of GF Strong are able to return to their preinjury homes as there is rarely adequate money to renovate for wheelchair accessibility. As such, securing wheelchair accessible housing becomes a necessary goal of the individual and rehabilitation team. When combined with the need for paid non-family care, these needs are challenging to meet.

As well, the varying numbers of persons returning home may reflect complex differences in expectations of families providing care between the various countries. Lastly, funding for ECU's may well differ in Canada, the US, the UK, and Australia. If private funding is required in some of these locales, it may be beyond the means of some persons and they may be 'forced' to return to homes with inadequate care or accessibility. Understanding these differences requires further investigation.

Limitations of the study

A number of issues may have influenced the results of this study. It may be difficult to generalize the findings of this study to other provinces or countries because of the unique nature of health care systems in different locations. Moreover, the limited number of subjects involved in this study makes it difficult to have reasonable power to detect small but potentially important indicators of outcome. Mostly, this limited the number of variables that we were able to model in the multivariable regression analysis and the opportunity to conduct subgroup analyses and interaction terms.

We also relied on the use of an administrative database. While we were quite successful overall, we were unable to collect sufficient data on several factors which we thought might be of interest due to the limited amount of information charted in the medical records. These included recommended care hours for individuals discharged to ECU's, funding sources for care, hours of care offered by funders, providers of care, problematic drug/alcohol use, and availability of non-ECU housing and care models in discharge communities.

Conclusion

It is important to question how knowledge of factors that predispose individuals with new high lesion SCI to ECU placement might be used by rehabilitation centers in terms of models of rehabilitation service delivery and

best clinical practices. For instance, if it is the desire of the individual to live in the community, knowledge of these factors prior to admission may be used as a springboard for advocacy and goal setting. Accordingly, the rehabilitation team would need to devote increased energy and ingenuity to put resources in place to manage the individual's SCI and pre-existing health conditions in the community and obtain adequate funding for equipment and care.

Alternatively, if discharge from rehabilitation is likely to be to an ECU, there may be limited reasons for admission to an inpatient rehabilitation center, which requires considerable resources. Instead, the necessary rehabilitation services may be able to be provided at the ECU or on an outpatient basis at the rehabilitation center. The authors are reluctant to recommend denying rehabilitation entirely to these individuals, as many facets of the rehabilitation experience will likely prove beneficial, even if delivered in an ECU (eg, experience of accessible public transportation and recreational interventions). Furthermore, special care must be taken when considering reduction of services to individuals with high lesion injuries as, despite reports that persons with high lesion injuries rate their quality of life as high, or higher, than those with lower levels of injury,^{4,13-16} '...the belief that life with a high SCI would not be worth living pervades Western culture, the courts, and the health-care professions'¹⁷ (p 491).

It is without question that honoring both an individual's desire for independence and the value of equitable distribution of health care resources is a difficult task. Shrinking health care budgets demand rehabilitation centers be prudent about the use of their resources, and balance an individual's need with outcomes. This is an ongoing challenge, notably because of the high cost of care for persons with high lesion SCI.

It is the hope of the authors that information from this study will be used to advance the quality of services offered in SCI rehabilitation and inspire further social advocacy efforts on behalf of individuals with high lesion SCI who desire to live independently in the community. Further research directly comparing the American, Canadian, and other systems of rehabilitation and care (as related to discharge destination), would be of interest, especially if the various data bases were congruent and reflected all persons with SCI in a given geographic area. As little information is available on nursing homes as a discharge destination for persons with SCI, quality of life studies for persons with high lesion SCI living in ECU's would be of interest and might offer some enlightenment on means to improve the quality of life in these settings.

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