Research Article

Does attendance in SCI education courses impact health outcomes in acute rehabilitation?

Milagros Evardone^{1*}, Catherine S. Wilson¹, Diana Weinel², Jason R. Soble^{1†}, Younghee Kang²

¹Mental Health & Behavioral Service, James A. Haley Veterans Hospital & Clinics, Tampa, FL, USA, ²Spinal Cord Injury Nursing Service, James A. Haley Veterans Hospital & Clinics, Tampa, FL, USA

Objective: Though education about secondary complications following spinal cord injury (SCI) is a component of many rehabilitation programs, there is little research on their success in promoting healthier outcomes. This study examined 1) whether greater education course attendance was associated with improved health outcomes and quality of life and 2) whether completion of bladder management and skin care courses was associated with decreased incidence of urinary tract infections (UTIs) and pressure ulcers (PUs).

Design: Retrospective medical record review.

Setting and Participants: Patients ($N = 106$) in a Veterans Administration (VA) SCI rehabilitation program who completed at least one education class from August 2008 to September 2012.

Methods and Outcome Measures: Records were reviewed to determine the number of education courses completed and patients' responses to the Satisfaction with Life Survey (SWLS), the short form of the Craig Handicap and Assessment Reporting Technique (CHART-SF), and Short Form Health Survey (SF-8) at admission, discharge, and 90 days post-discharge. Records were reviewed to determine frequency of UTIs and PUs from admission to discharge and from discharge to 90-day follow-up.

Results: Regression analyses revealed no association between number of classes and self-reported health and quality of life. Skin care class attendance was associated with a decreased number of PUs. Greater overall attendance at education courses was unexpectedly associated with a higher number of UTIs from admission to discharge.

Conclusion: Results of the study are mixed. Multiple factors appear to impact the success of education interventions. Future research is needed to clarify the best approach.

Keywords: Spinal cord injury, Education, Health outcomes, Acute rehabilitation

Introduction

Spinal cord injury (SCI) is a life-altering event that impacts the physical and emotional well-being of individuals world-wide. The annual incidence of SCI in the United States (US) averages around 12,000 cases per year, and the prevalence is approximately 240,000 to 337,000.¹ Of these cases, 20% are estimated to be veterans.²

Although the survival rate in individuals with SCI has improved over the years, this has increased the incidence of other medical issues. Secondary complications are highly prevalent in this population and are associated with increased rates of health care utilization and recurrent hospital admissions.^{3,4} DeJong *et al.*⁵ reported that over one-third of subjects were hospitalized at least once in the year following SCI rehabilitation. In addition, approximately 95.6% of the SCI population experiences at least one medical complication during routine annual check-up.⁶ Among the most common secondary complications are pressure ulcers (PUs) and urinary tract infections (UTIs).

*Milagros Evardone is now affiliated with MH Service, Orlando VA Medical Center, Orlando, FL, USA.

†Jason Soble is now affiliated with Psychology Service, South Texas Veterans' Healthcare System, San Antonio, Texas, USA.

Correspondence to: Milagros Evardone, Mental Health Service, Orlando VA Medical Center, Orlando, FL, USA. Email: milagros.evardone@va.gov

PU occur in 25–30% of individuals within the first 5 years of injury and have a lifetime prevalence of 80%.^{7,8} An alarming rate (7–8%) of casualties in the SCI population is also attributed to PU-related complications.⁹ PUs and their treatment are associated with a number of negative consequences including lower quality of life, depression, and difficulty achieving educational, vocational, and social goals, as well as increased health care utilization.^{9,10} The cost of caring for PUs can reach as high as one fourth of total medical expenses in the SCI population, and the total cost is estimated to be 1.2 billion dollars per year.^{11–13} In addition, annual treatment costs for patients with SCI and a PU were 260% higher than costs for SCI patients without PUs.¹⁴

Neurogenic bladder dysfunction and the use of catheters also predispose individuals with SCI to develop UTIs. Approximately 50–80% of individuals with SCI develop UTIs at some point in their life and require hospital readmission.¹⁵ In fact, DeVivo and Farris reported that urinary tract complications were the most common cause of hospital readmissions for individuals with SCI.¹⁶

These secondary complications are not only physically debilitating, but also incur significant emotional and financial costs on the patient, the patient's family, and the healthcare system. Average annual rehospitalization charges have been estimated to be \$79,759 per person.¹⁷ In the Veterans Administration (VA) system of care alone, total annual medical costs were found to exceed \$14.47 million for 675 patients with SCI, and approximately half of these costs (\$7.19 million) were incurred by recurrent hospital admissions for a subset of 233 patients.¹⁸

The hardship placed by secondary complications following SCI highlights the need for prevention programs to reduce the frequency of medical problems in this population and promote overall well-being. Health promotion/disease prevention methods are recommended by clinical guidelines and are cost effective.¹⁹ It is estimated they require just one-tenth the financial resources, compared to the treatment of secondary complications.¹² One common prevention strategy widely adopted by rehabilitation programs has been education on SCI-related health topics during the acute rehabilitation phase. The aim of these education programs has been to raise patients' awareness of medical complications and teach strategies to maintain a healthy lifestyle. By learning this information in the early phase of their injuries, it is hoped individuals will enact positive health behaviors in the long-term (i.e. pressure relief/weight shifts, appropriate bladder management, regular exercise program), resulting in

successful health outcomes (i.e. less PUs and fewer UTIs).

The question then arises whether education provided during rehabilitation is effective in improving health outcomes. Little research has addressed this issue and the literature available appears to yield inconsistent findings.^{13,20–23} Thus, researchers recommended further studies examining the association between education and patient outcomes.^{22,24} Consistent with this recommendation, the present study evaluated the impact of attendance at education courses on patients' health outcomes and quality of life.

The purpose of this study was focused on three objectives: 1) To determine whether attendance at a greater number of education classes during rehabilitation was associated with better self-reported health and quality of life on psychosocial measures 2) To determine whether attendance at a greater number of education classes was associated with decreased frequency of PUs and UTIs at two time periods (from admission to discharge and from discharge to 90-day follow-up) and 3) To determine whether completion of two specific education courses (bladder management and skin care) was associated with decreased incidence of PUs and UTIs for the same time periods. It was hypothesized that individuals completing a greater number of total education courses would report better health and quality of life on self-report measures, as well as decreased incidence of secondary complications. In addition, those that completed specific education classes (e.g., bladder management) were expected to have fewer complications relevant to that topic (e.g. UTIs) than those who did not complete the specific course.

Method

Participants

Medical records were reviewed for 166 participants at a southeastern Veterans' hospital SCI center, who completed at least one SCI group education class from August 2008 to September 2012. Sixteen participants were excluded from the study, as they were not enrolled in acute rehabilitation. Forty-four participants did not complete self-report measures at 90-day follow-up and were also excluded from the study. Non-completers differed significantly from completers on the following variables: mental health disorder other than depression, $\chi^2 (1, N = 150) = 5.78, P < 0.05$, and number of completed classes, $t (148) = -2.48, P < 0.05$ (completers: $M = 9.33$, non-completers: $M = 7.41$). The final sample thus consisted of 106 participants with a new spinal cord injury enrolled in the acute rehabilitation program.

Demographic information was collected on participants' sex, race/ethnicity, age, active duty status, education level, injury level (paraplegia or quadriplegia), neurological classification (complete or incomplete), length of rehabilitation stay, history of traumatic brain injury (TBI), depression diagnosis at admission, diagnosis of other mental health disorder at admission, substance abuse/dependence diagnosis at admission, availability of caregiver (i.e. if a caregiver was identified by patient and was present and involved in their care during admission), and number of SCI group education courses completed. Participants' completion of two specific education classes, Skin Care and Bladder Care, was also obtained (Table 1).

Description of education program

While education courses may vary across rehabilitation programs in length and specific domains covered,²⁵ the SCI group courses in this study consisted of the following topics: bladder management, bowel management, autonomic dysreflexia, deep vein thrombosis, skin care, sexuality, pain, healthy lungs, diabetes prevention, autoregulation, healthy eating, safety, bone health, and spine anatomy and preventing further injury. Classes were held in group format and led by a nurse educator with specialty in SCI or by an invited speaker with specialty in a particular topic (e.g. dietitian for nutrition course). They were one hour in length, occurred three times per week, and were held on a five week rotation cycle. All participants in the acute rehabilitation program were scheduled to attend the classes beginning in week two of their admission. Most participants attended the skin care and bladder management classes at mid-cycle. Any missed classes could be attended during the next rotation cycle. Instructors used a variety of tools to promote learning and retention of information, including use of handouts, anatomical models, videos, and discussion among participants.

Measures

Several outcome measures were routinely obtained as part of participants' SCI admission. Data related to life satisfaction, perceived handicap, and self-reported health were obtained using questionnaires administered at discharge and/or 90 days following discharge.

Life satisfaction

Responses on the Satisfaction with Life Survey (SWLS) were collected at discharge and 90-day follow-up. The SWLS is a 5-item measure of life satisfaction which participants rate on a 7-point scale ranging from Strongly Disagree (1) to Strongly Agree (7). Total possible

scores range from 5–35, and higher scores indicate greater life satisfaction. Initial validation studies reported SWLS means ranging from 23.5–25.8, as well as good internal consistency ($\alpha = 0.87$) and test-retest reliability ($r = 0.82$).²⁶

Perceived handicap

Responses on the short form of the Craig Handicap and Assessment Reporting Technique (CHART-SF)²⁷ were collected at 90-day follow-up. The CHART-SF was used to measure the extent to which participants took part in various social roles in the following domains: physical independence (CHART-SF-PI), cognitive independence (CHART-SF-CI), mobility (CHART-SF-M), occupation (CHART-SF-O), social integration (CHART-SF-SI), and economic self-sufficiency (CHART-SF-ES). Each scale has a maximum score of 100, with higher scores indicating less handicap, or higher social and community participation.²⁸ The CHART has been found to have excellent internal consistency (ICC = 0.93) and test-retest reliability ($r = 0.93$).^{29–31}

Self-reported health

Responses on the Short Form Health Survey (SF-8) were also collected at 90-day follow-up. The SF-8 is an 8-item version of the SF-36 and is one of the most widely used health surveys.³² Participants describe their perceived health over the past 4 weeks in each of 8 domains: physical functioning, role limitations due to physical health, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. Summary scores are then obtained for two scales: physical component (PCS) and mental health component (MCS). Scores on these scales are normed, with mean of 50 and standard deviation of 10. Higher scores indicate better self-reported health. Prior studies found the SF-8 has demonstrated adequate to good internal consistency ($\alpha = 0.73$ – 0.84) and test-retest reliability (PCS, $r = 0.61$; MCS, $r = 0.68$), as well as strong convergent and construct validity.^{33,34}

Secondary complications

Information was collected on the number of PUs and UTIs developed by participants over two time periods, from admission to discharge (Rehab) and from discharge to 90-day follow-up (Follow-up) (Table 1). PUs was defined as the number of new PUs developed during the two time periods and documented in wound nurse notes. UTIs were determined by the number of new UTIs developed during the two time periods, as documented by physician notes and verified by urinalysis.

Table 1 Demographic characteristics.

Demographic Variable	Total Sample (N = 106)
Sex	
Male (%)	97.2
Female (%)	2.8
Race/ethnicity	
Caucasian (%)	72.6
African American (%)	20.8
Hispanic (%)	3.8
Other (%)	2.8
Duty status	
Active duty (%)	33.0
Veteran (%)	67.0
Injury level	
Paraplegia (%)	45.3
Quadriplegia (%)	54.7
Completeness of injury-admission	
Incomplete (%)	66.0
Complete (%)	34.0
Completeness of injury-discharge	
Incomplete (%)	68.9
Complete (%)	31.1
TBI	
Yes (%)	20.8
No (%)	79.2
History of depression	
Yes (%)	35.8
No (%)	64.2
Other mental health diagnosis	
Yes (%)	21.7
No (%)	78.3
Substance abuse diagnosis	
Yes (%)	23.6
No (%)	76.4
Caregiver available	
Yes (%)	43.4
No (%)	56.6
Completed bladder care class	
Yes (%)	72.6
No (%)	27.4
Completed skin care class	
Yes (%)	64.2
No (%)	35.8
	<i>M (SD)</i>
Age	52.28 (18.73)
Education (years)	13.12 (2.3)
Length of rehab stay (days)	121.51 (83.82)
Number of completed classes	9.33 (4.38)
Number of PUs (rehab)	1.18 (3.78)
Number of PUs (follow-up)	0.16 (0.60)
Number of UTIs (rehab)	1.36 (1.65)
Number of UTIs (follow-up)	0.40 (0.73)

TBI, Traumatic brain injury; PU, Pressure ulcer; UTI, Urinary tract infection.

Design

This study was approved by local IRB and conducted with waiver of consent. Participants completing at least one group education course from August 2008 to September 2012 were identified through education class rosters. A retrospective review of electronic medical records and spinal cord injury database was then conducted for these individuals for the period of

August 1, 2008 to August 25, 2013. Demographic characteristics, responses to questionnaire measures, and data on secondary complications were subsequently obtained from the participants' records.

Statistical analyses

Statistical analyses were conducted using SPSS.³⁵ Means and standard deviations were calculated for all demographic and primary outcome variables. Correlation analyses were conducted between each of the demographic variables and each of the dependent variables (e.g. psychosocial measures and secondary complications). Based on the correlational analyses, a data-driven approach was then used to identify demographic variables to be entered as covariates in regression analyses. This approach was selected because inclusion of all demographic variables in the regression analyses would severely limit the power to detect significant findings. Specifically, only those demographic variables found to be significantly correlated to a particular scale or secondary complication were then controlled for in individual regression analyses. Sex was not included in statistical analyses as the sample was almost exclusively male.

Two sets of primary analyses were then conducted, one for the psychosocial measures and one for secondary complications. In order to determine whether attendance at a greater number of education classes during rehabilitation was associated with better self-reported health and quality of life on psychosocial measures, hierarchical regression analyses were conducted with significantly correlated covariates entered at step one and number of group education classes completed entered at step two. If no demographic variables were significantly correlated with a particular outcome measure, then simple regression analyses were conducted for that measure. Dependent variables included scores on the SWLS at discharge and scores on the SF-8, CHART-SF, and SWLS at 90-day follow-up. Because the secondary complications were count data (i.e. the number of complications in a defined time period), a series of Poisson regression analyses were subsequently conducted.³⁶ The first set of Poisson regressions investigated whether the number of completed group education classes predicted secondary complications. A second set of Poisson regressions were then conducted for each specific education class (i.e. bladder care or skin care class). Dependent variables included number of PUs and UTIs at the two time periods: admission to discharge (Rehab) and discharge to 90-day follow-up (Follow-up). Any demographic variables that were found to significantly

correlate with a specific secondary complication were entered into the respective model as a covariate.

Results

Preliminary analyses

Correlational coefficients for demographic variables as well as psychosocial outcomes and secondary complications are presented in Tables 2 and 3, respectively. As noted in Table 2, age, military active duty status, injury level, TBI, substance abuse, and caregiver availability were significantly associated with several psychosocial outcome measures. As noted in Table 3, length of rehab stay, TBI, and caregiver availability were significantly correlated with number of UTIs, whereas PUs were not significantly correlated with any demographic variables.

Self-reported health and quality of life

For psychosocial measures, hierarchical regression analyses revealed no association between number of completed classes and scores on the SWLS, CHART-SF, or SF-8 (Table 4). Class attendance did not account for any significant variance above identified demographic characteristics. However, demographic variables accounted for a significant amount of variance with the majority of psychosocial outcome measures. Thus, results do not suggest there is a significant relationship between overall class attendance and self-reported health/quality of life.

Secondary complications

A series of Poisson regression analyses were conducted to determine if specific class attendance (Table 5) or total number of attended education classes (Table 6) predicted secondary complications (i.e. number of PUs and UTIs) during Rehab and Follow-up. As noted in Table 5, skin care class attendance was a significant predictor of a decreased number of PUs during Rehab. In contrast, as reported in Table 6, the number of completed classes significantly predicted a higher number of UTIs during Rehab, after controlling for length of rehab stay. All other findings in terms of specific classes and total number of completed classes were non-significant. Collectively, results partially support the hypothesis that participation in SCI courses is associated with reduced incidence of secondary complications. Interestingly, while participation in the specific skin care class was associated with reduced number of pressure ulcers, overall attendance in the course series was unexpectedly associated with a greater number of UTIs.

Discussion

Results of the present study are mixed. As expected, participants' attendance at the skin care class significantly predicted a decreased frequency of PUs during admission to discharge. In contrast, those who completed a greater overall number of education courses were found to have a greater number of UTIs from admission to discharge, even after controlling for length of rehabilitation stay. Significant findings for number of PUs and UTIs were not found at 90-day follow-up.

Contrary to expectations, all other analyses were non-significant. The number of education courses completed did not predict self-reported health or quality of life on psychosocial measures. Moreover, no association was found between number of education courses and incidence of PUs (during Rehab and Follow-up). There was also no association between completion of the bladder management course and development of UTIs.

The overall lack of association between education classes and health outcomes in this research and the counterintuitive findings in relation to UTIs is unexpected. One would presume that greater education would promote patients' awareness of potential medical problems and increase practice of preventive health behaviors. After all, this is the premise of clinical guidelines, which emphasize the need for education in order to promote long-term health in individuals with disabilities.¹⁹ However, the relationship between patient education, health behavior practices, and ultimately, health outcomes, appears to be more complex than anticipated. It may be dependent on various factors, including specific education intervention (e.g. handouts, videos, questioning), the type of health markers assessed, the timeframe in which education is delivered and health outcomes are measured, and patient characteristics (e.g. motivation, learning and retention of information).

Though our findings differ from previous research suggesting that education has been helpful in decreasing risk of UTIs and increasing patient's self-reported desire to quit smoking,³⁷⁻⁴⁰ they are consistent with prior studies examining the association between education and pressure ulcer incidence. Rintala *et al.* reported that patients with SCI who had PU surgery and attended an enhanced PU education group were more successful in preventing a recurrence of PU than the control group.⁴¹ Similarly, our findings suggest that attendance at PU specific education is associated with development of fewer PUs during rehab. However, this association did not extend to follow-up, consistent with a recent study which found a null association between the

Table 2 Correlations for psychosocial outcome measures and demographic variables.

	SWD	SWF	CP	CC	CM	CO	CS	CE	SP	SM
Age	0.06	-0.07	-0.22*	-0.25*	-0.40**	-0.45**	-0.18	-0.25*	-0.31**	-0.25*
Active duty	0.03	0.11	0.16	0.21*	0.47**	0.46**	0.23*	0.33**	0.31**	0.21*
Education	-0.09	-0.12	0.11	0.18	0.09	0.04	0.06	0.01	0.07	-0.01
Complete injury–admission	-0.16	-0.10	-0.06	0.08	0.06	0.13	0.03	0.04	0.02	-0.13
Complete injury–discharge	-0.14	-0.09	-0.05	0.03	-0.02	0.04	0.04	-0.02	-0.01	-0.18
Injury level	0.21*	0.21*	-0.19	-0.01	-0.03	-0.15	-0.01	-0.07	-0.02	0.12
Length of rehab stay	-0.11	-0.16	0.03	0.03	0.08	0.21*	-0.10	0.07	0.25*	-0.02
TBI	0.04	0.10	0.04	-0.03	0.22*	0.27**	-0.11	0.20*	0.13	0.05
Depression	-0.13	-0.10	0.16	-0.04	-0.05	0.17	-0.08	-0.03	0.02	-0.04
Other mental health diagnosis	-0.20	0.04	-0.06	-0.03	0.10	-0.09	-0.01	-0.03	0.11	-0.17
Substance abuse	-0.07	0.03	0.05	-0.08	-0.19	-0.19*	-0.20*	-0.26**	-0.03	-0.14
Caregiver available	-0.11	0.01	-0.34**	0.01	-0.19	-0.26**	-0.07	-0.05	-0.06	0.04
Number complete education classes	-0.03	0.01	-0.04	0.18	0.06	0.02	0.09	0.03	0.04	0.09

N = 106 for all variables except SWD (*N* = 94), CE (*N* = 104), SP and SM (*N* = 105). Education (years); Length of Rehab Stay (days); SWD = SWLS (discharge); SWF = SWLS (follow-up); CP = CHART-SF-PI; CC = CHART-SF-CI; CM = CHART-SF-M; CO = CHART-SF-O; CS = CHART-SF-SI; CE = CHART-SF-ES; SP = SF8-PCS; SM = SF8-MCS. **P* < 0.05; ***P* < 0.01. TBI, traumatic brain injury.

amount of time spent by nursing on PU education and prevalence of PUs at one-year post injury.⁴² That same study also noted an unexpected association between greater skin care education and increased hospitalizations due to PUs.

The positive association between attendance at education courses and UTIs in this research may illustrate the rehabilitation team's effort to rally around the problem by providing even more education to those who already have developed a particular complication. It is known, for instance, that learning catheterization skills requires increased nursing time.⁴³ It may be that if a patient develops a UTI, nursing may provide greater education on bladder care while rehab team members may encourage greater participation in group courses in order to aggressively promote future

preventive behaviors. Alternatively, the greater likelihood of UTIs among those with greater education may be representative of the patient's increased awareness of UTI symptoms following completion of courses. This may then result in more frequent reporting of these symptoms and subsequent medical treatment. It is also possible that patients' readiness for learning may be established once they have experienced a secondary complication.⁴⁴ Thus, they may be more motivated to seek education themselves on the management of these conditions.

The question then arises: Why would education efforts not be associated with better health outcomes in this and previous studies? One potential explanation may be patient-related variables, such as emotional, cognitive, and psychological factors affecting individuals

Table 3 Correlations of secondary complications and demographic variables.

	PUR	PUF	UTIR	UTIF
Age	-0.14	0.14	-0.02	0.01
Number complete education classes	0.05	0.08	0.31**	0.11
Bladder care class	0.11	0.06	0.10	-0.02
Skin care class	0.07	0.07	0.26**	0.14
Active duty	-0.001	-0.05	0.03	-0.05
Education	0.05	0.10	0.03	0.08
Complete injury–admission	0.04	0.01	0.09	-0.01
Complete injury–discharge	0.04	0.02	0.002	-0.002
Injury level	-0.12	-0.14	0.03	0.03
Length of rehab stay	0.07	0.04	0.32**	0.32**
TBI	-0.04	-0.06	0.07	-0.22*
Depression	0.14	0.13	0.10	0.11
Other mental health diagnosis	0.18	-0.10	0.05	0.03
Substance abuse	0.19	0.07	0.14	0.16
Caregiver available	-0.06	0.05	0.16	0.23*

N = 106. Education (years); Length of rehab stay (days); PUR = Number of pressure ulcers from admission to discharge; PUF = Number of pressure ulcers from discharge to follow-up; UTIR = Number of urinary tract infections from admission to discharge; UTIF = Number of urinary tract infections from discharge to follow-up; TBI, traumatic brain injury **P* < 0.05; ***P* < 0.01.

Table 4 Hierarchical regression models for psychosocial measures and total number of completed classes.

	Model	β	SE(β)	<i>t</i>	R ²	ΔR^2	ΔF
CHART-CI	Age ¹	−0.37	0.24	−1.53			
	Active duty ¹	−1.98	9.66	−0.21	0.06	0.06	3.36*
	Completed classes ²	1.01	0.55	1.82	0.09	0.03	3.30
CHART-PI	Age ¹	−0.17	0.14	−1.27			
	Caregiver ¹	−17.38	5.30	−3.28**	0.13	0.13	7.98**
	Completed classes ²	0.51	0.58	0.89	0.14	0.01	0.79
CHART-M	Age ¹	−0.01	0.25	−0.05			
	Active duty ¹	27.20	9.82	2.77**			
	TBI ¹	−0.65	6.79	−0.10	0.22	0.22	9.76***
	Completed classes ²	0.10	0.55	0.19	0.22	0.00	0.03
CHART-O	Age ¹	−0.33	0.30	−1.10			
	Active duty ¹	12.04	12.58	0.96			
	TBI ¹	3.57	8.00	0.45			
	Rehab length ¹	0.03	0.04	0.84			
	Substance abuse ¹	−7.27	7.39	−0.98			
	Caregiver ¹	−10.81	6.28	−1.72	0.26	0.26	5.69***
	Completed classes ²	0.20	0.70	0.29	0.26	0.001	0.08
CHART-SI	Active duty ¹	6.22	3.62	1.72			
	Substance abuse ¹	−5.32	3.99	−1.33	0.06	0.06	3.75*
	Completed classes ²	0.29	0.37	0.80	0.07	0.01	0.63
CHART-ES	Age ¹	0.16	0.38	0.42			
	Active duty ¹	25.56	16.35	1.56			
	TBI ¹	5.38	10.34	0.52			
	Substance abuse ¹	−14.61	9.33	−1.57	0.14	0.14	4.03**
	Completed classes ²	−0.01	0.82	−0.01	0.14	0.000	0.000
SF8-PCS	Age ¹	−0.07	0.10	−0.76			
	Active duty ¹	3.06	3.77	0.81			
	Rehab length ¹	0.02	0.01	1.57	0.13	0.13	4.85**
	Completed classes ²	−0.04	0.22	−0.19	0.13	0.000	0.04
SF8-MCS	Age ¹	−0.12	0.09	−1.39			
	Active duty ¹	−0.27	3.37	−0.08	0.06	0.06	3.23*
	Completed classes ²	0.16	0.19	0.81	0.07	0.01	0.65
SWLS-DIS	Injury level ¹	3.16	1.54	2.05*	0.04	0.04	4.07*
	Completed classes ²	−0.09	0.17	−0.50	0.05	0.01	0.25
SWLS-FU	Injury level ¹	3.07	1.40	2.20*	0.05	0.05	4.84*
	Completed classes ²	−0.03	0.16	−0.20	0.05	0.000	0.04

N = 106 for all variables except CHARTSF-ES (N = 104), SF8-PCS and SF8-MCS (N = 105), and SWLS-DIS (N = 94). *P < 0.05; **P < 0.01; ***P < 0.001.

TBI, traumatic brain injury.

¹denotes step 1 of the regression model.

²denotes step 2 of the regression model after controlling for pertinent demographic variables.

during rehabilitation. For example, patients in rehabilitation are adjusting to their new SCI and commonly experiencing a range of emotional reactions, including anger, sadness, fear, and denial. Their emotional resources are likely overwhelmed by the various demands of rehabilitation, thus limiting their ability to attend to educational courses and inhibiting their readiness to learn.^{44,45} As such, researchers have suggested the use of various educational strategies to overcome the challenge of readiness in rehabilitation.

Suggestions offered included using peer supports to disseminate information while assisting the patient to cope, delivering information in small chunks, and making use of “teachable moments” during routine encounters to increase relevance of information for the patient.^{24,46} Consideration of patients’ emotional state and readiness to learn also suggests the need to examine the timing and sequence in which education is delivered. Perhaps individuals will be more open and able to receive education in the latter stages of their admission, as

Table 5 Poisson regression models for secondary complication measures and specific class attendance.

	Model	β	SE	df	Wald χ^2
PU-Rehab	Skin care class	-0.49	0.21	1	5.60*
PU-Follow-up	Skin care class	-0.60	0.57	1	1.09
UTI-Rehab	Rehab length	0.003	0.001	1	19.86***
	Bladder care class	-0.24	0.20	1	1.41
UTI-Follow-up	Rehab length	0.007	0.002	1	23.35***
	TBI	-2.09	0.75	1	7.79**
	Caregiver	0.97	0.34	1	7.96**
	Bladder care class	0.06	0.36	1	0.03

N = 106. Variables that were found to significantly correlate with each secondary complication measure were entered into the respective models as covariates. **P* < 0.05; ***P* < 0.01; ****P* < 0.001.

PU, pressure ulcer; UTI, urinary tract infection; TBI, traumatic brain injury.

opposed to earlier on. Education about secondary conditions can also be provided following discharge via feasible strategies, such as e-learning, when patients may be more receptive to information.^{47,48}

Alternatively, even if patients are provided education and are ready to learn, poor problem-solving abilities may decrease their aptitude to engage in adaptive behavioral changes necessary for maintenance of health. For instance, one study found that individuals with SCI who exhibited ineffective social problem-solving also experienced a greater occurrence of pressure ulcers in the first three years of injury.⁴⁹ To address this issue, researchers have suggested the use of educational

interventions that enhance problem-solving skills, such as using case studies tailored to the needs of the individual and inviting feedback from patients on educational materials provided early in rehabilitation.²⁴

Thirdly, it may be that simply educating patients and caregivers on secondary complications is not sufficient to produce behavioral change that would lead to improved health outcomes. Rather, patients and caregivers may require ongoing behavioral reinforcement by rehabilitation staff to increase engagement in and maintain motivation for positive health behaviors. Jones *et al.* provides some evidence supporting the use of incentives to prevent secondary complications.⁵⁰ In their two

Table 6 Poisson regression models for secondary complication measures and total number of completed education classes.

	Model	β	SE	df	Wald χ^2
PU-Rehab	Completed classes	0.03	0.02	1	2.54
PU-Follow-up	Completed classes	0.08	0.06	1	1.65
UTI-Rehab	Rehab length	0.003	0.001	1	12.37***
	Completed classes	0.08	0.02	1	13.43***
UTI-Follow-up	Rehab length	0.007	0.002	1	23.03***
	TBI	-2.17	0.76	1	8.10**
	Caregiver	0.90	0.36	1	6.19*
	Completed classes	0.02	0.04	1	0.19
DVT-Rehab	Completed classes	0.03	0.04	1	0.45

N = 106. Variables that were found to significantly correlate with each secondary complication measure were entered into the respective models as covariates. **P* < 0.05; ***P* < 0.01; ****P* < 0.001.

PU, pressure ulcer; UTI, urinary tract infection; TBI, traumatic brain injury; DVT, deep vein thrombosis.

studies, patients received a graduated schedule of one-on-one visits with an advanced practice nurse and monetary rewards contingent upon remaining free of severe pressure ulcers. Although based on a small number of cases ($N = 6$), it was found that the use of individualized attention and financial reward was helpful in significantly decreasing the severity of pressure ulcers and hospitalization rates during the intervention phase. However, after the intervention phase completed and scheduled visits and monetary rewards were no longer available, only half the participants maintained gains, whereas the other half exhibited a worsening of pressure ulcer severity. Nevertheless, results suggest that behavioral plans and varying forms of positive consequences (e.g. prizes, verbal reinforcement, money) may be useful in promoting effective health behaviors in patients with SCI and perhaps even more important for those that are most non-compliant.

Limitations

Results of this study were based on a veteran sample that is primarily male and may not generalize to the overall SCI population. In addition, this research operationalized “education” as the number of group education courses completed or attendance at specific education courses. Perhaps attendance is not the optimal variable for measuring the effect of education, as this measures exposure to health information but does not necessarily reflect actual learning or retention of learned information by patients. Additional factors that may contribute to learning should be studied, such as individuals’ level of engagement and participation in class, evidence of learned information through pre and post-tests, and patient’s readiness to learn. Although this study did not examine the influence of education class timing or sequence on secondary complications, future studies may examine if education provided earlier vs. later in rehabilitation would be more effective.

This study was also subject to the limitations of a retrospective review. Factors that may have influenced education class attendance were not always documented in the medical record. Although each topic was offered multiple times during a patient’s inpatient hospitalization, some patients may have chosen not to attend specific education classes due to lack of interest, lack of motivation or a desire to participate in other activities. Other patients may have been unable to attend classes due to the very presence of secondary complications (e.g. feeling ill due to UTI or being placed on temporary bed rest due to pressure ulcer) and may have received education through a different avenue (e.g. one-on-one nursing education). In addition, data

on secondary complications was based on information obtained from the medical record. This may not represent the total number of secondary complications experienced by patients during the study period, as some may have gone unreported. Finally, the results of this study do not support the premise that persons completing a greater number of education courses would report better health and quality of life (i.e. SWLS) on self-report measures. However, the trajectory of SWLS following discharge is an important consideration. The 90-day follow-up assessment may not have been a sufficient timeframe to detect the effects of education on quality of life. Future longitudinal studies examining patient’s self-reported health on psychosocial measures, as well as development of secondary complications beyond 3 months post-discharge would be beneficial.

Conclusions

Clinical guidelines emphasize the need for education in the SCI population to raise awareness of potential secondary complications and provide strategies for prevention of these conditions. However, present and previous research suggests that the relationship between education courses and health outcomes is not as clear-cut as once anticipated. Many factors appear to contribute to the effectiveness of education in promoting behavior change and improved health in the SCI population, including but not limited to: method and source of education, individual’s readiness for learning following a recent injury, level of engagement in the courses, individuals’ social problem-solving ability, and the rehabilitation team’s response to a patient with a new secondary complication. Given the multiple factors impacting the association between education and desired health outcomes, further research is needed in order to clarify the appropriate timing, method of delivery, and approaches to education that will aid in the successful prevention of medical complications and promote sustained health in individuals with SCI.

Disclaimer statements

Contributors None.

Funding None.

Conflicts of interest There are no conflicts-of-interest for any of the authors on this submission.

Ethical approval Study was approved by local Institutional Review Board.

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