

ORIGINAL REPORT

ASSOCIATION OF DEPRESSION AND PAIN INTERFERENCE WITH DISEASE-MANAGEMENT SELF-EFFICACY IN COMMUNITY-DWELLING INDIVIDUALS WITH SPINAL CORD INJURY

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Objective: To determine factors influencing disease-management self-efficacy in individuals with spinal cord injury.

Design: A cross-sectional study.

Subjects/patients: Forty-nine community-dwelling individuals with chronic spinal cord injury (mean age 44 years) participated in the study.

Methods: Each subject was evaluated for disease-management self-efficacy (Self-efficacy for Managing Chronic Disease), depression (10-item Center for Epidemiologic Studies Depression Scale), pain interference (Pain Interference Scale), and availability of support (Interpersonal Support Evaluation List short form). Multiple regression analysis was performed to determine the relative contributions of these factors to disease-management self-efficacy.

Results: The mean disease-management self-efficacy score was 6.5 out of 10 (standard deviation 1.6). Bivariate correlation analysis showed that higher self-efficacy was significantly correlated with longer time since injury ($r=0.367$, $p=0.010$), better social support ($r=0.434$, $p=0.002$), lower pain interference ($r=-0.589$, $p<0.001$), and less severe depressive symptoms ($r=-0.463$, $p=0.001$). In multiple regression analysis, only lower pain interference and less severe depressive symptoms were significantly associated with higher disease-management self-efficacy ($F_{4,44}=10.249$, $R^2=0.482$, $p<0.001$).

Conclusion: Disease-management self-efficacy is suboptimal in many community-living people with spinal cord injury. This research suggests that rehabilitation of patients with spinal cord injury should include self-efficacy-enhancing strategies. Alleviation of depressive symptoms and pain self-management may be important for improving disease-management self-efficacy in this population, but this requires further study.

Key words: depression, pain, quality of life, spinal cord injury.

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INTRODUCTION

Spinal cord injury (SCI) is a debilitating condition that can result in devastating effects, not only on physical functioning and independence, but also on the psychological function of the injured person (1). One psychological variable that has received increasing attention in disability research is self-efficacy. A construct originally proposed by Bandura (2), self-efficacy represents an individual's beliefs or confidence in his/her capabilities to successfully execute the necessary course of actions to satisfy situational demands in the future, including those that are novel and stressful (2).

Self-efficacy has been shown to be an important determinant of health outcomes and quality of life in a multitude of chronic conditions (3–6). Decreased self-efficacy has also been identified as a major contributing factor to the lack of adherence with health and disease self-management (3). Increasing evidence has also demonstrated that self-efficacy is an important determinant of quality of life and physical performance in individuals with SCI (4, 7, 8). For example, in a sample of 100 patients with SCI, Hampton (7) found that self-efficacy is a more important predictor of quality of life than age, gender, education, and even physical disability. A recent study by Middleton et al. (9) revealed that a combination of low self-efficacy and high pain intensity was significantly associated with reduced quality of life in people with SCI. In view of the substantial influence of self-efficacy on quality of life and well-being in people with SCI, it is clinically relevant to identify the determinants of self-efficacy in this population.

There is evidence that self-efficacy is influenced by many different factors. For example, in people with knee osteoarthritis, self-efficacy for physical tasks is related to age, sensation of stiffness, leg muscle strength, and depressive symptoms (9). It is likely that the determinants of self-efficacy in people with SCI are also multi-factorial. Only one study has examined the determinants of self-efficacy in people with SCI. Horn et al. (10) showed that age, being divorced, and having less severe neurological impairments, were significantly associated with self-efficacy in patients with SCI. However, other potentially

important factors, such as social support, were not considered in their study.

Social support is an under-studied environmental factor among people with SCI. Higher level of social support has been associated with better physical well-being as well as better adjustment to disabilities in other patient populations (11–12). Among patients with SCI, those who reported higher levels of support facilitating social integration tend to have less psychosocial impairment (13). Social support has also been shown to be a significant predictor of quality of life in people with SCI (7). Recent studies have also demonstrated a strong relationship between social support and self-efficacy in other populations, including patients who have received percutaneous coronary intervention (14), and individuals with osteoarthritis (15). It is currently unknown whether those patients with SCI who perceive themselves as having more support from family, friends, and the community also tend to have better disease-management self-efficacy. The objective of this study was to identify the relative contributions of different factors (e.g. demographics, physical impairments, depressive symptoms, and social support) to disease-management self-efficacy in people with SCI.

METHODS

Subjects

A sample of people with SCI who were residing in the community of the Taipei City and Taipei County, Taiwan were recruited on a volunteer basis through spinal cord support groups and programmes. In contrast to North America, the majority of people in Taiwan live in apartments (16). The different living environments may impose unique challenge in functional performance on individuals with SCI. Taiwan has a universal healthcare system similar to Canada's and their system includes inpatient and outpatient care, as well as drug benefits, and traditional Chinese medicine. The family plays a dominant role in the care of a family member with a SCI in Taiwan and not all adjust well to the change and may have feelings of burden associated with their family member having a disability (17).

The inclusion criteria were: (i) aged 19 years or older; (ii) had had a SCI more than one year previously; (iii) were living in the community (i.e. not institutionalized); and (iv) used a manual wheelchair as the primary mode of mobility. Subjects took part in a 2-h evaluation and interview session. A total of 49 subjects were recruited, in the period between March and May 2007. This study was approved by the local university ethics board, and all the eligible subjects gave written informed consent prior to participating in the study. All experimental procedures were conducted according to the Declaration of Helsinki.

Measurements

The demographic data of each subject (i.e. age, gender, education, time since injury) were collected. The American Spinal Injury Association (ASIA) assessment was used to determine the level and completeness of the injury, as well as motor and sensory function (18). In particular, the ASIA Impairment Scale (AIS) category and ASIA motor scale were documented. Wheeled mobility was evaluated by the 8-category wheelchair mobility scale (19). The scoring of the wheeled mobility scale ranges from full-time power wheelchair users (Category 1) to those who can walk independently for most activities but rely on a manual wheelchair for wheeling long distances (Category 8).

Disease-management self-efficacy was the primary outcome (dependent variable) of this study. The independent variables were availability of social support, pain interference, and depressive mood.

Disease-management self-efficacy. Level of perceived disease-management self-efficacy was evaluated using the 6-item Self-efficacy for Managing Chronic Disease (Stanford Patient Education Research Centre 2007) derived from several self-efficacy scales developed for the Chronic Disease Self-Management study (20). Each item consists of a question asking how confident the subject feels in different aspects of disease self-management (e.g. how confident are you that you can keep any other symptoms or health problems you have from interfering with the things you want to do? How confident are you that you can do the different tasks and activities needed to manage your health condition so as to reduce your need to see a doctor?). The observed range is from 1 to 10, with a higher number indicating a greater level of perceived disease-management self-efficacy. The score for each item was summed and then averaged to yield the mean self-efficacy score. This self-efficacy score has been shown to be responsive to change following intervention in chronic disease self-management (21).

Availability of support. The perceived availability of support was evaluated using the Taiwanese version of the Interpersonal Support Evaluation List short form (ISEL) (22), which is derived from the original ISEL developed by Cohen et al. (23). The Taiwanese version of ISEL consists of a list of 16 statements regarding the perceived availability of potential social resources. The items fall into 4 subscales (*Tangible*: the perceived availability of material aid; *Appraisal*: the perceived availability of someone to talk to about one's problems; *Self-esteem*: the perceived availability of a positive comparison when comparing one's self to others; and *Belonging*: the perceived availability of people who they can do things with). Subjects were asked to respond to each statement, with possible responses including: 3 = definitely true, 2 = probably true, 1 = probably false or 0 = definitely false for the positive statements (e.g. there is someone I can turn to for advice about handling problems with my family) and 0 = definitely true, 1 = probably true, 2 = probably false or 3 = definitely false for the negative statements (e.g. if I wanted to go on a trip for a day, I would have a hard time finding someone to go with me). Scores ranged from 0 to 48 with higher scores indicating better availability of support. The 16-item Taiwanese version of ISEL has been shown to be a valid and reliable tool for assessing perceived availability of support in the Taiwanese population (22).

Pain interference. The extent to which pain interfered with daily activities (i.e. pain interference) was assessed using the 3-item disability scale derived from the Chronic Pain Grade questionnaire (CPG) (24). The items rated pain interference with ability to: (i) take part in daily activities; (ii) take part in recreational, social, and family activities; and (iii) work (including housework). All 3 items were scored based on a Likert scale ranging from 0 to 10 (0 = no interference; 10 = extreme change (unable to carry out activities)). The scores for the 3 items were averaged to provide a mean score, with a higher number indicating greater pain interference. The 3-item pain interference score has been shown to be a reliable and valid measure of pain-related interference in people with SCI (25). We used the pain interference score instead of the pain severity sub-score, as individuals with SCI may experience different types of pain and various body parts may be affected (26). Therefore it might be more relevant to examine how pain interfered with function. There is also a positive relationship between pain severity and pain interference in SCI ($r=0.61$) (27).

Depressive symptoms. Depressive symptoms were evaluated using validated Chinese version of the 10-item Center for Epidemiologic Studies Depression Scale (CESD-10) (28). CESD-10 contains 10 items, each of which describes a specific symptom associated with depression. The score from the 10 items were summed to yield a total score (range = 0–30) with 0 indicating no depressive symptoms. A CESD-10 score ≥ 16 is indicative of depression (29).

Statistical analysis

Descriptive statistics (e.g. mean, standard deviation (SD)) were used to indicate the central tendency and variability of the variables. Nor-

mality of data was checked by using the Kolmogorov-Smirnov test. The degree of association of self-efficacy with other variables was assessed by using the Pearson's correlation coefficients (for continuous variables) and Spearman's rho correlation coefficients (for categorical variables). In addition, independent *t*-tests were used to compare the self-efficacy level between: (i) men and women; (ii) those with complete SCI and those with incomplete SCI; (iii) those with tetraplegia and those with paraplegia; and (iv) those with high school education or more and those with less than high school education. Any variables that had significant association with self-efficacy as identified in the above analyses would be used as independent variables in the subsequent multiple regression analysis. Tolerance, a statistical method to detect multi-collinearity, was reported for the regression model. A tolerance value <0.2 indicates a multi-collinearity problem. All statistical analysis was performed using the Statistical Package for Social Sciences 16.0 version (SPSS Inc., Chicago, USA). A significance level was set at 0.05 for all statistical tests (two-tailed).

RESULTS

Subject characteristics are described in Table I. The male to female ratio was approximately 3:1. The majority of subjects had sustained a complete SCI, as reflected by the AIS level. Approximately half ($n=25$) of the subjects had a score of 5 out of 8 in the wheelchair mobility scale, indicating that they rely fully on manual wheelchair for mobility and are independent in both home and community activities. Eight subjects (16%) were considered to have substantial depressive symptoms (CESD score ≥ 16 out of 30).

The associations of self-efficacy with other variables are shown in Table II. Higher self-efficacy was associated with longer time since injury, better social support, lower pain interference and less severe depressive symptoms. There was

Table I. Subject characteristics

Variable	Mean (SD)	Range
<i>Basic demographics</i>		
Age, years, mean (SD)	43.7 (11.7)	18–64
Sex, men/women, <i>n</i>	37/12*	
Body mass index, kg/m ²	24.0 (5.0)	14.3–41.2
Education (high school and beyond/less than high school education), <i>n</i>	25/24*	
<i>Spinal cord injury characteristics</i>		
Traumatic/non-traumatic, <i>n</i>	45/4*	
Level of injury, cervical/thoracic/lumbar, <i>n</i>	15/27/7*	
Completeness of injury, complete/incomplete, <i>n</i>	30/19*	
Years since injury, years, mean (SD)	11.8 (9.2)	1–34
Age at injury, years, mean (SD)	32.0 (10.7)	2–53
AIS level (A/B/C/D), <i>n</i>	30/10/7/2*	
ASIA motor score, mean (SD)	50.7 (14.9)	14–79
Wheelchair mobility score (1–8), mean (SD)	5 (1)†	1–8
<i>Variables of interest</i>		
Self efficacy (1–10), mean (SD)	6.5 (1.6)	2–10
Pain interference score (0–10), mean (SD)	3.7 (2.8)	0–9.3
Center for Epidemiologic Studies Depression Scale (0–30), mean (SD)	11.0 (6.8)	1–29
Social support: Interpersonal Support Evaluation List (0–48), mean (SD)	29.1 (8.3)	7–45

*The values are expressed in the number of count in each category.

†The values are expressed as median (interquartile range).

ASIA: American Spinal Injury Association; AIS: ASIA Impairment Scale; SD: standard deviation.

Table II. Correlations with self-efficacy

Variable	Correlation	<i>p</i> -value
Age	0.167	0.250
Years since injury	0.367	0.010*
Age at injury	-0.134	0.360
Education	-0.100	0.495
Social support	0.434	0.002*
Pain interference score	-0.589	<0.001*
Depression	-0.463	0.001*
ASIA motor score	0.072	0.622

* $p < 0.05$.

ASIA: American Spinal Injury Association.

also significant association of social support with depressive symptoms ($r = -0.368$, $p = 0.009$) and pain interference ($r = -0.423$, $p = 0.002$). There was no significant difference in self-efficacy between men (6.3 (SD 1.5)) and women (7.1 (SD 1.7)) ($p = 0.133$), those with complete (6.4 (SD 1.7)) and incomplete SCI (6.5 (SD 1.3)) ($p = 0.892$), those with tetraplegia (6.1 (SD 1.8)) and those with paraplegia (6.6 (SD 1.4)) ($p = 0.262$), those who had high school education or more (6.2 (SD 1.7)) and those who did not (6.7 (SD 1.5)) ($p = 0.273$).

Multiple regression analysis was performed to identify which factors were independently associated with self-efficacy. Time since injury, social support, pain interference and depressive symptoms were entered as independent variables since these factors were significantly related to self-efficacy in the bivariate correlation analyses. The regression analysis revealed that these 4 factors combined to account for 48.2% of the variance in self-efficacy ($F_{4,44} = 10.249$, $p < 0.001$), with pain interference and depressive symptoms being the significant predictors. Among the independent variables entered, pain interference was the most important contributor to the prediction model, as reflected by the magnitude of the beta weight (-0.427). The tolerance values for the regression model were well above 0.2, indicating that multi-collinearity was minimal.

DISCUSSION

The most important finding of this study is that pain interference and depressive symptoms are significantly associated with disease management self-efficacy in people with SCI. The findings may have important clinical implications, as these factors are potentially modifiable.

Pain interference is independently associated with self-efficacy

In this study, we found that a substantial proportion of individuals with SCI report a moderate to high level of pain interference, and that pain interference is independently associated with self-efficacy. Chronic pain is one of the more common sequelae of SCI (30–31), and often poses limitations on engagement in activities of daily living, work, and social activities (32). Pain is also highly related to other psychosocial variables, such as depression and psychological stress in people with SCI (32–33). Thus, a strong association between pain interference and self-efficacy in the SCI population is not entirely

surprising. High level of pain interference experienced by the patient may lead to increased feeling of losing control of his/her condition and its impact. Our finding in people with SCI is thus consistent with that in other chronic conditions (i.e. lower limb amputations, chronic pain), where a similar association between pain-related disability and self-efficacy exists (4, 5, 34). Turner et al. (32) also showed that pain catastrophizing, a similar concept to low self-efficacy, is a strong predictor of pain interference in patients with SCI. Pain catastrophizing is the tendency of the patients to respond to pain with negative thoughts such as "It is terrible and I feel it is never going to get better" (32).

Interestingly, in a recent study based on the data from 30 subjects with SCI, Nicholson Perry et al. (33) did not find a significant correlation between self-efficacy and pain interference ($r=-0.193$). The discrepancies in findings may be related to the different concepts of self-efficacy being measured. In their study, self-efficacy in performing a wide range of activities in different life domains, including functional, leisure, social and vocational domains, was evaluated by using the 16-item Moorong self-efficacy scale. In contrast, our study measured disease-management self-efficacy, which is a more targeted concept than generalized self-efficacy. The sample size is also smaller in their study, which may have reduced the statistical power. In addition, the differences in sample characteristics may also contribute to the different findings. Their sample consisted of a greater proportion of patients with incomplete SCI (55%, compared with 39% in ours). Moreover, all our subjects are of Chinese ethnic origin. The difference in cultural background may also influence how the patients perceive pain interference and self-efficacy (10).

Depressive symptoms are independently associated with self-efficacy

Depression is the most common form of psychological impairment in SCI (35), and our results revealed that depressive symptoms were significantly associated with self-efficacy in patients with SCI. A similar association between the 2 variables was also reported in other populations (9, 11, 12, 32). For example, Bowling (36) showed that among men over the age of 65 years, those who have a high self-efficacy were greater than 6 times less likely to sustain psychological morbidity including depression, compared with those with middle-low self-efficacy. Maly et al. (8) also showed that depressive symptoms are among the significant determinants of self ef-

ficacy for physical tasks in people with knee osteoarthritis. Our finding is also consistent with that reported by Shnek et al. (6), who demonstrated a moderate negative relationship between depressive symptoms and self-efficacy ($r=-0.58$) in a sample of 80 individuals with SCI.

Due to the cross-sectional nature of the study, we are unable to determine whether increased pain interference/reduced depressive symptoms cause reduction in self-efficacy, or vice versa. For example, as the patient experienced more pain-related disability, his/her sense of control of their condition may be weakened. However, it is equally possible that those who have lower efficacy expectations about self-management of SCI may lead to reduced efforts to cope with the condition or engage in health-enhancing activities (6). Consequently, further deterioration in pain interference and social isolation may ensue, causing depressive symptoms (3).

Availability of support

Social support was no longer significantly associated with self-efficacy after depressive symptoms and pain interference were entered into the regression model (Table III, model 3). Firstly, it could also be partly due to the significant correlation of social support with depressive symptoms and pain interference. It is possible that those who perceive themselves to have more support from others may experience less depressive symptoms and pain interference (37–38), and may thus develop a stronger sense of control of their condition. Indeed, a number of studies in SCI have shown that those who have better social support are less depressed (13, 37).

Secondly, the relationship between social support and self-efficacy may be complex. We showed that less social support is associated with lower self-efficacy. However, too much social support may also be associated with low self-efficacy. For example, patients may get overprotected by their family and friends, and may not have the opportunities to perform the activities that they were capable of, thereby imposing a negative effect on self-efficacy (3). However, upon examining our data in more detail, we could not identify any trend of such a non-linear relationship between social support and self-efficacy.

Finally, the lack of independent association of social support with self-efficacy may also be due to the fact that social support is a multidimensional construct, which may consist of emotional (e.g. providing encouragement) and instrumental (e.g. help with housekeeping, provision of transportation)

Table III. Multiple regression analysis: Identifying possible factors related to self-efficacy

Independent variable	R ²	B (SE)	95% CI	β	p	Tolerance
	0.482					
Years since injury		0.035 (0.020)	-0.005, 0.075	0.205	0.087	0.855
Social support (ISEL)		0.015 (0.025)	-0.035, 0.065	0.079	0.550	0.687
Pain interference		-0.240 (0.069)	-0.378, 0.101	-0.427	0.001*	0.786
Depression		-0.061 (0.028)	-0.117, -0.005	-0.263	0.032*	0.830

* $p < 0.05$.

B: unstandardized regression coefficient; 95% CI: 95% confidence interval; ISEL: Interpersonal Support Evaluation List short form; SE: standard error; β: standardized regression coefficient (beta weight).

support, with both qualitative (e.g. satisfaction with support) and quantitative aspects (e.g. frequency of support) (39). The ISEL used in our study measures global social support. While emotional support may be protective of depressive symptoms, instrumental support may foster dependency in performance of daily activities rather than self-efficacy (6). It would be important to explore the relationship between self-efficacy and different dimensions of social support in future studies.

Neurological impairment

It is interesting that the perceived ability to cope with the consequences of SCI is not related to severity of neurological impairment. It has been demonstrated that that severity of impairment has only a weak impact on quality of life in people with SCI (1). Our finding, however, is in contrast with that reported by Horn et al. (10). In their study, less neurological impairment at onset of injury was significantly associated with higher self-efficacy at follow-up at 12 months. The discrepancies in results could be due to several reasons. Firstly, in the study by Horn et al. (10), the focus was on self-efficacy in performing specific activities of daily living. Thus, they measured self-efficacy using a 7-item index, in which all the items were adapted from the standard Functional Independence Measure (FIM) (i.e. eating, dressing, indoor mobility, getting out of bed, getting in and out of bathtub, getting in and out of shower, and using the toilet). In contrast, we measured disease-management self-efficacy. The Self-efficacy for Managing Chronic Disease 6-item scale that was used in our study covered other domains that are relevant to SCI such as self-management of fatigue, physical discomfort, and emotional distress, in addition to physical activities. Secondly, neurological impairment was treated as a nominal variable in their study (normal-minimal, incomplete paraplegia, complete paraplegia/incomplete tetraplegia, complete tetraplegia). In particular, the combination of complete paraplegia and incomplete tetraplegia into a single category is questionable, as these 2 groups of patients may have very different degree and pattern of neurological impairment. In our study, the AIS motor score was used to quantify the degree of neurological impairment (i.e. a continuous variable). While we could not rule out that severity of neurological impairment may have some influence on self-efficacy, it does not seem to be one of the key determinants. In fact, Horn et al. (10) also acknowledged that divergent perceptions of self-efficacy were observed among individuals with similar degree of neurological impairment.

There is a tendency that those with increased time since injury have better self-efficacy, but the results did not reach statistical significance ($p=0.087$) (Table III, model 3). It may take time for the newly injured to accept their own disabilities and learn to cope with the consequences of the condition. As time progresses, the patients may come to terms with their own disability, and thus develop a better sense of control.

Clinical implications

Self-efficacy is an important contributing factor to quality of life in patients with SCI (8). We have identified 2 major factors that were independently associated with self-efficacy, namely,

depressive symptoms and pain interference, which are potentially modifiable factors. Therefore, appropriate management of pain and depressive symptoms may have potential importance in enhancing self-efficacy. A multidisciplinary assessment and treatment algorithm has been proposed by Sidall and colleagues (31, 40). Individuals with SCI may sustain different types of pain (e.g. nociceptive, neuropathic). The first step towards successful management of pain following SCI is to correctly identify the type of pain, as well as the underlying biological and psychological contributors to pain (40). In particular, it is not only the pain intensity, but also the psychosocial aspects of pain (i.e. pain catastrophizing, coping styles, depression) that need to be addressed, as these factors are highly related to pain interference (32, 33). Depending on the type of pain and underlying pathology, appropriate treatments (i.e. antidepressants, cognitive behavioural modification, environmental modification, psychotherapy, spinal rehabilitation, etc.) may be used to modify the pain experience (31, 40). More study is required to examine the efficacy of different treatment approaches to pain management on pain-related behaviours, mental health and self-efficacy in patients with SCI.

Limitations

This study has several limitations. First, the subjects were recruited on a volunteer basis, which may lead to self-selection bias. These subjects may be more physically and socially active than their counterparts. Secondly, the sample size is small and the cross-sectional design could not establish causality. As mentioned, we are uncertain whether increased pain interference/depressive symptoms actually causes decline in self-efficacy, or vice versa. Further study is required to investigate the change in self-efficacy over time after injury. Intervention trials are also needed to establish the effects of depression- and pain-alleviating treatments on self-efficacy. Thirdly, our regression model only accounted for 48% of the variance in self-efficacy. Therefore, some potentially important determinants (i.e. employment, marital status) were not measured in this study. A larger sample size would be required if more predictors were entered into the regression model.

Conclusion

This study highlights the potential influence of depressive symptoms and chronic pain on self-efficacy. Intervention trials are warranted to further investigate whether self-efficacy can be enhanced by modifying these factors.

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