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ARTICLE

Return to work after spinal cord injury: a Singaporean pilot community-based rehabilitation program

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Abstract

Study design Retrospective analysis of data collected as part of a pilot program.

Objectives The primary objective of our study was to document the return-to-work rate of individuals with SCI who participated in a community-based interdisciplinary vocational rehabilitation program. The secondary objectives were to assess changes in their levels of community integration and functional independence.

Setting A community-based rehabilitation center in Singapore.

Methods Participants were individuals with SCI between 21 and 55 years. They identified return to work as a rehabilitation goal, and were certified fit to undergo rehabilitation by their physicians. Primary outcome was the return-to-work rate at discharge from the program. Secondary outcomes were community integration and functional independence, measured by the Community Integration Questionnaire (CIQ) and the Spinal Cord Independence Measure III (SCIM-III), respectively. We summarized participants' clinical and socio-demographic characteristics descriptively, and used inferential statistics to compare pre- and postprogram scores for secondary outcome measures.

Results Thirty-nine participants were included for this study. Thirty-two completed the program, of which 84% ($n = 27$) reported returning to work. Participants who completed the program had mean change in total CIQ and SCIM-III scores of 7 (95% CI, 5–8) and 11 (95% CI, 7–15), respectively. There were differences ($p < 0.05$) between pre- and postprogram scores for both secondary outcome measures.

Conclusions Our findings suggest that our vocational rehabilitation program facilitated participants with SCI in Singapore to return to work and was beneficial to enhance their levels of community integration and functional independence. Future interventional studies are recommended to estimate the efficacy of such programs.

Introduction

Every year about half a million individuals sustain a spinal cord injury (SCI) globally, many being younger and working aged individuals [1]. Survival rates following SCI have improved over the last 50 years due to medical and technological advances. Over 90% of individuals in higher-income countries (e.g., North America and Europe) are reported to survive the injury, which is almost three times higher than rates in low- and middle-income countries (e.g., Africa) [2]. SCI negatively impacts the individuals' physical functions [3] and mental health [4]. These negative impacts may lead to secondary health conditions, activity limitations, and participation restrictions, as well as reduced quality of life [5, 6].

Regaining the ability to participate in activities of choice is an important antecedent for good quality of life following

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SCI [5, 7]. Work is one such activity that individuals with SCI value [8–10], because being employed and productive can have positive effects on their physical, psychological, and financial health, as well as on their personal development [11, 12]. As such, when possible, vocational rehabilitation (VR) is provided to individuals with SCI to optimize their return to work [13, 14]. For example, two studies conducted in North America found that individuals with SCI who participated in VR demonstrated improvements in levels of functional independence and community integration [15] and were more likely to return to work [16].

When individuals with SCI return to their community, they may face a range of challenges in the areas of self-care, mobility (including transportation), finances, and employment [17]. Eliminating or minimizing such multifaceted challenges requires comprehensive approaches. The existing literature has thus highlighted the importance of comprehensive VR [8, 9, 17]. Comprehensive VR are often multi- or interdisciplinary in nature and include a range of services, such as physical and occupational therapy, counseling, and employment support.

The transition to employment (TTE) was a pilot program designed to provide interdisciplinary VR services for individuals with SCI in Singapore [18]. It was implemented by SPD, a local community-based rehabilitation center and is offered in a community setting which is not a part of hospital-based or inpatient services.

The primary aim of our study was to document the return-to-work rate of individuals with SCI who participated in the TTE. The secondary aims were to assess changes in their levels of community integration and functional independence in performing activities of daily living after participating in the program.

Methods

Design

This was a retrospective analysis of data collected as part of a pilot VR program.

Participants

Individuals who fulfilled the following eligibility criteria were enrolled during the pilot phase of the program, between February 2014 and January 2017. They were (i) Singaporean citizens or permanent residents, (ii) between 18 and 55 years old, (iii) formally diagnosed with SCI, and (iv) certified fit for rehabilitation by their physicians. Individuals were not eligible for the program if they were (i) permanently certified unfit for work by their physicians or (ii) not willing to consider return to work as a rehabilitation goal. As the legal age of consent in Singapore is 21, the data analyzed for our study were limited to those collected from participants who were 21 years or above.

Program

The TTE was a community-based interdisciplinary VR program established in 2014 by SPD, a Singaporean voluntary welfare organization. It was piloted between 2014 and 2017. The program aimed to facilitate individuals with acquired physical disability, including those with a diagnosis of stroke or SCI, in returning to mainstream employment [18]. The program administrators conducted a series of outreach presentations at the public hospitals in Singapore to raise awareness about the TTE among healthcare professionals and individuals with SCI. All referrals to the TTE were managed by a local agency coordinating such services across healthcare and social organizations in Singapore.

Key components of the program included physical rehabilitation, psychosocial support, employment support, assistive technology exploration, and caregiver support. These services were individualized, and delivered by a team of occupational therapists, physiotherapists, social workers, and employment support specialists. Each participant was assigned to a case manager who coordinated their care and routinely reviewed their progress. For this pilot program, participants were discharged when they had returned to work and sustained employment for 3 months, or when they had received rehabilitation services for a maximum duration of 2 years. Further details of the program are included in Table 1.

A team of trained occupational therapists and physiotherapists interviewed the participants upon enrollment (preprogram) to and at discharge (postprogram) from the program to collect socio-demographic data and administer outcome measures. An administrative staff created and managed the database.

Outcome measures

Return to work was the primary outcome of our study and defined as returning to paid employment (regardless of competitive or sheltered employment, full-time or part-time status) or returning to school.

The Community Integration Questionnaire (CIQ) and Spinal Cord Independence Measure III (SCIM-III) were the secondary outcome measures of our study. The CIQ was designed to assess the frequency and level of independence in performing activities related to community integration [19]. It is a self-report measure that consists of 15 items, within three subscales of home integration, social integration, and integration into productive activities [19].

Table 1 Details of TTE program.

Aspects of TTE program	
Frequency of sessions	Typically twice a week
Duration per session	3 h
Professionals involved	Employment support specialists, social workers, occupational therapists, physiotherapists
Components of vocational rehabilitation	Psychological readiness, social readiness, physical readiness, work readiness, compensatory strategies, accessibility, functional skills training, use of assistive technology, commuting on public transport, negotiating physical environment.
Mode of delivery	Individual or group
Frequency of sessions	Typically twice a week
Duration per session	3 h
Professionals involved	Employment support specialists, social workers, occupational therapists, physiotherapists
Nature of intervention	Psychological readiness, social readiness, physical readiness, work readiness, compensatory strategies, accessibility, functional skills training, use of assistive technology, commuting on public transport, negotiating physical environment
Mode of delivery	One-to-one sessions and groups

Individual item scores are summed to attain a total score ranging from 0 to 29. The maximum scores for subscales of home integration, social integration and integration into productive activities are 10, 12, and 7, respectively. A higher total score represents a greater level of community integration [20]. The CIQ is reported to have adequate internal consistency ($\propto \geq 0.7$) [21], high interrater reliability ($r \geq 0.9$, $p < 0.01$) [22], and high construct validity with Craig Handicap Assessment and Reporting Technique Short Form ($r \geq 0.8$, $p < 0.05$) [23].

The SCIM-III was designed to assess the level of functional independence in performing activities of daily living for individuals with SCI [24, 25]. It consists of 19 items within four subscales of self-care, respiration, and sphincter management, mobility (room and toilet) and mobility (indoor and outdoor) [24]. Individual item scores are summed to attain a total score ranging from 0 to 100. The maximum scores for subscales of self-care, respiration, and sphincter management, mobility (room and toilet) and mobility (indoor and outdoor) are 20, 40, 10, and 30, respectively. A higher total score represents a greater level of functional independence. The SCIM-III is reported to have high internal consistency ($\propto \geq 0.8$), adequate interrater reliability ($r \geq 0.6$, $p < 0.01$) [26], and high criterion validity with Functional Independence Measure ($r \geq 0.8$, $p < 0.001$) [25].

Statistical analysis

Participants' socio-demographic characteristics were summarized using descriptive statistics. Return-to-work rate was calculated as the proportion of participants who returned to work out of all participants who completed the TTE. Other outcome measures were summarized using descriptive statistics, such as mean, standard deviation (SD), and 95% confidence interval (95% CI). The mean score differences of pre- and postprogram outcome measures were compared using paired-samples *t*-tests. All statistical analyses were performed using IBM SPSS Statistics Version 25 for Windows [27].

Results

Participant demographics

The database included 39 participants who enrolled in the program between 2014 and 2017. Thirty-two participants (82%) completed the program and were included in the analysis. The sample size was too small to statistically compare the characteristics between individuals who did and did not complete the program. However, there were no noticeable differences in characteristics between the two groups.

Of the 32 participants, 26 (81%) were male. Their median age preprogram was 35 years old (IQR = 26–43). Six (19%) were diagnosed with complete paraplegia, ten (31%) with incomplete paraplegia, seven (22%) with complete tetraplegia, and nine (28%) with incomplete tetraplegia. Their median duration from onset of injury to program enrollment was 9 months (IQR = 4–40). Participants spent a median duration of 9 months (IQR = 8–17) in the program. The participants' characteristics are summarized in Tables 2 and 3.

Return-to-work rate

Twenty-seven participants (84%) returned to work. There appeared to be a longer duration between onset of injury to program enrollment between participants who did not return to work (median = 48 months, IQR = 29–84) and returned to work (median = 8 months, IQR = 3–24).

Table 2 Descriptive information of individuals with SCI who participated in the TTE program.

	Total ($n = 39$) *n* (%)	Completed ($n = 32$, 82%) *n* (%)	Withdraw ($n = 7$, 18%) *n* (%)
Gender			
Male	31 (79)	26 (81)	5 (71)
Female	8 (20)	6 (19)	2 (29)
Type of injury			
Complete paraplegia	7 (18)	6 (19)	1 (14)
Complete tetraplegia	8 (20)	7 (22)	1 (14)
Incomplete paraplegia	13 (33)	10 (31)	3 (43)
Incomplete tetraplegia	11 (28)	9 (28)	2 (29)
	Median (IQR)	Median (IQR)	Median (IQR)
Age preprogram (years)	33 (25–41)	35 (26–43)	30 (23–35)
Months in program	11 (8–18)	10 (8–17)	16 (8–20)
Months between onset to enrollment	9 (4–36)	9 (4–40)	5 (2–16)
MBI score preprogram	66 (32–80)	68 (27–81)	59 (38–76)

MBI Modified Barthel Index, *IQR* inter-quartile range.

Impact of rehabilitation on outcome measures

CIQ

Preprogram, participants had a mean (SD) total score of 11 (4). Their mean (SD) subscale scores for home integration, social integration, and integration into productive activities were 2 (2), 6 (2), and 3 (2), respectively. Postprogram, participants had a mean total score of 18 (4). Their mean (SD) subscale scores for home integration, social integration, and integration into productive activities were 3 (2), 9 (2), and 5 (1), respectively. The change in total score was 7 (95% CI, 5–8). In home integration, social integration and integration into productive activities, changes were 1 (95% CI, 0*–2), 3 (95% CI, 2–4), and 2 (95% CI, 2–3), respectively. Total and subscale scores between pre- and postprogram were significantly different at $p \le 0.05$.

SCIM-III

Preprogram, participants had a mean (SD) total score of 55 (21). Their mean (SD) subscale scores for self-care, respiration, and sphincter management, mobility (room and toilet) and mobility (indoor and outdoor) were 13 (7), 28 (10), 7 (4), and 9 (7), respectively. Postprogram, participants had a mean (SD) total score of 66 (27). Their mean (SD) subscale scores for self-care, respiration, and sphincter management, mobility (room and toilet) and mobility

Table 3 Descriptive information of individuals with SCI who participated in, and completed the TTE program.

	Completed TTE ($n = 32$) *n* (%)	RTW ($n = 27$, 84%) *n* (%)	N-RTW ($n = 5$, 16%) *n* (%)
Gender			
Male	26 (81)	23 (85)	3 (60)
Female	6 (19)	4 (15)	2 (40)
Type of injury			
Complete paraplegia	6 (19)	5 (18)	1 (20)
Complete tetraplegia	7 (22)	5 (18)	2 (40)
Incomplete paraplegia	10 (31)	10 (37)	0 (0)
Incomplete tetraplegia	9 (28)	7 (26)	2 (40)
	Median (IQR)	Median (IQR)	Median (IQR)
Age preprogram (years)	35 (26–43)	36 (25–46)	33 (26–40)
Months in program	10 (8–17)	10 (9–18)	8 (7–16)
Months between onset to enrollment	9 (4–40)	8 (3–24)	48 (28–84)
MBI score preprogram	68 (27–81)	71 (34–81)	32 (16–85)

TTE transition to employment, *RTW* return to work, *N-RTW* not return to work, *MBI* Modified Barthel Index, *IQR* inter-quartile range.

Table 4 Mean CIQ and SCIM-III scores.

	Pre-TTE score mean (SD)	Post-TTE score mean (SD)	Change score mean (95% CI)
Community Integration Questionnaire ($n = 32$) (out of 29)	11 (4)	18 (4)	7 (5–8)
Home integration (out of 10)	2 (2)	3 (2)	1 (0[a]–2)
Social integration (out of 12)	6 (2)	9 (2)	3 (2–4)
Integration into productive activities (out of 7)	3 (2)	5 (1)	2 (2–3)
Spinal Cord Independence Measure III ($n = 31$[b]) (out of 100)	55 (21)	66 (27)	11 (7–15)
Self-care (out of 20)	13 (7)	14 (6)	2 (1–3)
Respiration and sphincter management (out of 40)	28 (10)	30 (10)	1 (0[a]–3)
Mobility (room and toilet) (out of 10)	7 (4)	7 (4)	1 (0[a]–1)
Mobility (indoor and outdoor) (out of 30)	9 (7)	14 (10)	5 (2–8)

Total and subscale scores between pre- and postprogram were significantly different at $p \le 0.05$.

Change in score was calculated by subtracting preprogram scores from postprogram scores.

TTE transition to employment, *SD* standard deviation, *95% CI* 95% confidence interval.

[a]These values have been rounded down to 0, but are >0.

[b]One participant had missing postprogram SCIM-III scores.

(indoor and outdoor) were 14 (6), 30 (10), 7 (4), and 14 (10), respectively. The change in total score was 11 (95% CI, 7–15). In subscale scores for self-care, respiration, and sphincter management, mobility (room and toilet) and mobility (indoor and outdoor) changes were 2 (95% CI, 1–3), 1 (95% CI, 0*–3), 1 (95% CI, 0*–1), and 5 (95% CI, 2–8), respectively. Total and subscale scores between pre- and postprogram were significantly different at $p \le 0.05$. The participants' CIQ and SCIM-III scores are presented in Table 4.

Discussion

While SCI is a life-changing event that poses a challenge to employment [28], individuals with SCI desire to work, and deem themselves capable to work [14]. Our study documented a high return-to-work rate of individuals with SCI who participated in community-based VR, and found trends of improvement in the levels of community integration and functional independence pre- and postprogram. Similar results were found by Ottomanelli et al. [16], where participation in community-based vocational activities as a part of rehabilitation was associated with a higher rate of return to work.

Return to work

According to a literature review, the return-to-work rates of individuals with SCI ranged from 15 to 76% [29]. In Singapore, three studies reported return-to-work rates of 12, 22, and 53% [30–32]. To our knowledge, participants in these three studies did not receive any VR. Two of the three Singaporean studies [30, 32] were published more than two decades ago; there could have been different levels of awareness and provision of services for individuals with SCI then. This may explain the higher return-to-work rate (84%) found in our study.

A higher level of functional independence is reportedly associated with return to work [28]. Participants in our study demonstrated an adequate level of functional independence preprogram, as indicated by their Modified Barthel Index scores. In other words, they required less assistance to perform activities of daily living. Conversely, individuals with SCI who were certified unfit for rehabilitation by their physicians were not eligible to participate in the program, potentially indicating that they had a lower level of functional independence that prevented them from commencing their rehabilitation. This may suggest a selection bias for our study, where only individuals with a moderate to high level of functional independence were enrolled thus leading to the higher return-to-work rate in our study. Individuals with SCI who have a lower level of functional independence could have benefitted from a similar VR program to optimize their return-to-work process. Future studies are needed to understand the presence and impact of VR for individuals with SCI who have a lower level of physical independence. This may help us expand the existing program to serve a wider population.

Community integration

Individuals with SCI want to reintegrate into their community to rebuild their lives [7]. Callaway et al. [33] suggested that a cutoff total CIQ score of 15 was a sign of a lower level of community integration for individuals with SCI. Preprogram, five of our participants (16%) had scores above the suggested cutoff score. Postprogram, the number of our participants who had scores above the suggested cutoff increased to 26 (81%). Our finding thus suggests that the program had optimized the participants' level of independence and frequency of participation in home integration, social integration, and integration into productive activities. As the CIQ subscale of integration into productive activities includes participation in work, and a majority of our participants returned to work, it was not surprising to observe that their total CIQ score increased postprogram. Community integration and return-to-work status are closely related [7, 34]. Our data (on return-to-work status and CIQ) were collected concurrently postprogram, thus, it was not possible to ascertain how these two factors influenced each other. It is important to conduct future studies to understand the relationship between community integration and return to work so that the information can be utilized to enhance the VR program.

Functional independence

Having an adequate level of functional independence is an important factor that contributes to return-to-work post-SCI [5, 28]. The SCIM-III is a tool that is commonly used to measure the level of functional independence among individuals with SCI. Scivoletto et al. [35] suggested that a ten-point change for the total SCIM-III score is an indication of a substantial clinically significant difference. A clinically significant difference is defined as the change in score that is enough to have a positive implication on a patient's treatment plan [36]. While a majority of our participants returned to work postprogram, interestingly, 20 of our participants (64%) did not achieve a substantial clinically significant difference on the SCIM-III. It is reported that the most significant functional recovery occurs during the 6 months immediately following SCI [37]. Over half of our participants were enrolled to the VR program at 9 months postinjury. The SCIM-III is a measure of basic functional independence which may be less suitable for evaluating more complex skills required for work performance. In other words, the SCIM-III may not be able to capture functional improvements above the basic level which may happen during the VR period. Considering that, it may be pertinent for VR programs to utilize more comprehensive outcome measures, which include items related to both function and participation, such as Craig Handicap Assessment and Reporting Technique [38] or Functional Assessment Inventory [39]. These measures can potentially assess work-related abilities of individuals with SCI more accurately, beyond their level of functional independence.

We acknowledge that a key limitation of our study is a lack of a control group. As such we are unable to estimate the extent to which the TTE contributed to improvements observed in levels of community integration and functional independence. We recommend future interventional studies, such as randomized control trials, to estimate the impact of VR on these outcomes. Qualitative studies to explore the lived experience of individuals with SCI undergoing VR may also provide valuable insights to how specific services can be useful during their return-to-work journey. We understand that various factors (i.e., biomedical, demographic, and environmental) may influence how these individuals remain at work. To our knowledge, there is limited research on sustaining employment following SCI and VR. Therefore, longitudinal studies are recommended to understand long-term impacts of VR and other factors on the sustainability of work following SCI.

Practical implications

We have to interpret our findings cautiously to suggest practical implications, as they are based on a pilot program with small sample size. We have two implications to discuss. First, to our knowledge, the number of VR programs in Singapore for individuals with SCI is limited. Consequently, only a small number of individuals with SCI may have the opportunity to receive VR to optimize their return-to-work process. Our findings suggest that VR programs such as the TTE are beneficial for individuals with SCI; thus, it is important to continue promoting and implementing similar programs locally. Second, our participants who did not return to work appeared to have had a longer period of time from their onset of injury to VR program enrollment. This may suggest that introducing VR to individuals with SCI earlier in their recovery may optimize return to work.

Conclusions

Returning to work after SCI is often a challenge. The findings of this study support that our community-based, interdisciplinary VR program facilitated return to work amongst the participants. Beyond employment, our program positively impacted participants' levels of functional independence and community integration. Our study adds to the existing literature supporting the benefits of VR for individuals with SCI. Future interventional studies are recommended to estimate the efficacy of such VR programs in this population.

Data availability

The access to the dataset collected and used for the current study may be granted upon request by SPD.

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Author contributions KK and NM were responsible for writing the paper and data analysis. PK and JK organized the program, collected data, managed the database, and contributed to the paper development. JY and YN contributed to the paper development. MA was the principal investigator and was responsible for the research design and writing the paper.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The affiliated Institutional Review Board approved the study.

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