Original article

One-year follow-up of Chinese people with spinal cord injury: A preliminary study

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Background: A tertiary spinal cord injury (SCI) center was established in the northern region of Hong Kong, China and a multidisciplinary SCI rehabilitation program was developed to reintegrate patients into the community.
Objective: To investigate functional outcomes for Chinese people with SCI across a 1-year period.
Design: Longitudinal prospective design.
Methods: Thirty community-dwelling participants with traumatic SCI were recruited. Functional status was measured using functional independence measure (FIM) on admission, upon discharge, 1-month, 3-month, 6-month, and 1-year post-discharge. Information on use of assistive devices and life role were also obtained.
Results: Twenty-three (76.67%) participants were men. Seventeen participants (10 with tetraplegia and 7 with paraplegia) were classified ASIA A, B, or C; 13 (7 with tetraplegia and 6 with paraplegia) were classified as ASIA D. Significant differences in FIM motor scores were only found between the tetraplegia group and three other diagnostic groups using Bonferroni *post-hoc* tests of repeated measure ANOVA (analysis of variance) ($P < 0.05$). Longitudinally, contrast tests of repeated measure ANOVA showed significant differences during the hospitalization period for all diagnostic groups. People in the ASIA D group showed significant functional improvement even after 1-year post-discharge ($P < 0.05$). At 1-year post-discharge, only two participants were engaged in either remunerative employment or academic pursuit.
Conclusion: Despite functional status improvement, few people with traumatic SCI were re-engaged in productive life role 1 year after discharge. Studies with longer follow-up would be beneficial.

Keywords: Spinal cord injuries, Rehabilitation, Employment, Activities of daily living, Quality of life, Community reintegration, International Standards for Neurological Classification of Spinal Cord Injury, Treatment outcomes, Assistive technology, Tetraplegia, Paraplegia, Hong Kong

Introduction

Traumatic spinal cord injury (SCI) often leads to physical, functional, and psychosocial challenges for individuals. A high incidence of SCI among younger populations has been reported,[1,2] resulting in significant physical and financial burden for individuals and their caregivers.[1,3–5] People with SCI often need intensive rehabilitation in hospitals and rehabilitation centers, depending on the provisions of healthcare systems, to maximize function in daily activities. They often rely on different categories of assistive technology and personal attendance on a long-term basis. Living environments require major modifications in order to provide barrier-free environments for people with SCI.[6,7] They continue to adapt to the debilitating condition after they reintegrate into the community. The adaptation process usually continues after they are discharged from a rehabilitation institute. An increasing number of studies have been conducted to determine the long-term well being of people living with chronic SCI[8–14] and those who care for them.[15,16]

Since people with different levels and completeness of traumatic SCI experience different patterns or profiles of recovery, both neurological and functional, the American Spinal Injury Association (ASIA) established the Standard for Neurological Classification of Spinal Injured Patients to provide a more consistent standard of classification among clinicians and researchers.[17] It was revised in 1996 and 2000; the most recent revisions were published in 2009 and 2011.[18,19] Several studies have been conducted to investigate the validity of the

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classification system.[20–22] Paralyzed Veterans of America compiled consensus guidelines by the Consortium for Spinal Cord Medicine[6] not only to serve as guidelines for clinical intervention, but also to provide references on rehabilitation outcomes, including functional status and quality of life.

A number of studies have been conducted to investigate the neurological and functional recovery among people with different levels and completeness of injury. Waters *et al.*[23–26] focused on the motor and sensory recovery of individuals with different injury level and completeness of SCI. The series of studies substantiated that people with either complete or incomplete tetraplegia and paraplegia manifested different potential for motor and sensory recovery. Moreover, Ditunno *et al.*[27] studied the functional status of traumatic SCI based on the Frankel classification, the diagnostic classification system preceding the ASIA/IMSOP (International Medical Society of Paraplegia) classification system. They determined that people admitted with Frankel grades C and D (equivalent to ASIA grades C and D) showed more functional improvement upon discharge from the rehabilitation institute than those classified as Frankel grade A or B (equivalent to ASIA grades A and B). Various studies have been conducted in different countries to investigate functional outcomes during the rehabilitation stage to have consistent results.[28–33] The ASIA/IMSOP classification system was also adopted in these studies to measure rehabilitation outcomes.

Furthermore, possibly due to the length of time required for data collection, longitudinal studies to look at the functional changes appear to be limited. Although different research teams adopted different follow-up time frames, it was generally concluded that people with different levels and completeness of SCI showed neurological and functional improvements within 6 months to a year. In a 5-year long-term study, Hall *et al.*[34] studied the characteristics of functional measures on different levels of severity for traumatic SCI. It was revealed that the functional gain, reflected by the functional independence measure (FIM), was greatest between admission and discharge. One year after injury the functional status showed less dramatic improvement. A more recent study adopting a shorter 6-month time frame was conducted on an Asian sample showing a similar functional recovery pattern.[35] The authors also reported that participants classified as ASIA grade A or B also showed substantial functional improvement. Another study with a similar follow-up period also revealed that those with complete injury (not just those with incomplete injury) could proceed to a higher ASIA status.[33] Other studies with a different length of follow-up period also revealed significant functional improvement 12-month post-discharge.[36,37] Furthermore, a recent Hong Kong study by Chan and Chan[7] attempted to examine the functional characteristics of people with SCI in a tertiary rehabilitation center. The study explored a short-term functional profile of the people with SCI from admission phase to 3-month post-discharge. People with different levels and completeness of SCI were shown to have different profiles of functional recovery, and the discharge FIM motor scores were found to be similar to the data reported by the Consortium for Spinal Cord Medicine.[6] Participants with tetraplegia and paraplegia classified as ASIA grade D showed the greatest motor gain during the study period.

Owing to the long-term debilitating effects of SCI, people with the condition often require various types of assistive equipment in order to maximize daily functions. The Consortium for Spinal Cord Medicine[6] has established a guideline for assistive equipment that might be required by individuals with different levels of SCI. Literature on the use of assistive equipment among persons with SCI is limited, but studies have investigated the relationship among assistive technology, quality of life, and community integration.[38–40]

Apart from functional status and assistive technology, researchers have also looked at other characteristics of individuals with SCI. A number of studies investigated the complications of SCI, including pressure ulcers,[41] the effects of aging on the spinal cord,[8,42–45] spasticity,[45] and urinary tract infection.[44,46] Other groups of researchers investigated the issue of community integration and adaptation.[47–50] These studies showed that people with SCI usually experienced disturbances after a period of rehabilitation. They required extra effort to adapt to their new lifestyle. Following up on the study by Chan and Chan,[7] the aim of the present study is to adopt a longer follow-up period of 1 year in order to investigate further the longitudinal demographic and functional profiles of people with traumatic SCI in a Chinese community.

Subjects and methods

Thirty people with traumatic SCI were recruited for this longitudinal study. All of them newly acquired SCI and had been admitted to the tertiary SCI rehabilitation center in Hong Kong in 2002. Neurological level of injury and completeness (i.e., grades A, B, C, and D) of the SCI were determined by the case medical officer according to the ASIA/IMSOP classification.[6,22,51] In order to provide more interpretable results, the individuals were grouped according to their neurological manifestation. Since it was shown that people categorized as ASIA A, B, or C had similar recovery, they were grouped together for analysis. Based on the level of injury, people with ASIA A, B, or C status were divided into high-level or low-level tetraplegia and paraplegia. Moreover, since it was also shown that people with functional recovery under ASIA D had a similar pattern regardless of the level of injury,[27] participants in the ASIA D groups were further collapsed into one diagnostic group. As a result, four diagnostic groups were formed for statistical analysis: tetraplegia ASIA A/B/C, paraplegia ASIA A/B/C, tetraplegia ASIA D, and paraplegia ASIA D. The case medical officer regularly monitored neurological changes throughout the rehabilitation period in the tertiary SCI center. The ASIA classification reported was the status upon discharge.

The motor function of each participant was evaluated by an occupational therapist, a physiotherapist, and a nurse 1 week after each participant was admitted using the FIM. The participants had been discharged from the center for 1 year after completing a course of intensive rehabilitation intervention. A longitudinal study design was adopted in which outcome measurements were collected on admission, upon discharge, 1-, 3-, 6-, and 12-month post-discharge. Two main categories of data collected in the present study were demographic characteristics and functional status of the participants.

Demographic data

Apart from the level and completeness of the SCI, other demographic data were also collected. This included gender, age, reason of injury, premorbid and 12-month post-discharge life roles, premorbid and discharge home placement, and length of stay at the rehabilitation center. The types of assistive equipment issued by occupational therapists were also noted.

Motor scores of FIM

The FIM[52] is the most widely applied instrument to measure the functional status of people with SCI. It was also recommended as the key functional instrument by the Consortium for Spinal Cord Medicine.[6] It consists of 13 motor items and 5 cognitive items. The evaluator rates each item based on a 7-point ordinal scale with "1" denoting "complete dependence" (performs less than 25% of task) and 7 denoting "complete independence" (performs 100% timely, safely). A wide range of studies have been conducted to investigate the psychometric properties of the FIM.[53–60] Rasch analysis also confirmed the two-domain structure of the instrument.[53,54,61] Its applicability on SCI population has been reported in the previous studies.[34,62–64] The results concluded that the FIM is a reliable and valid instrument for SCI populations. In the present study, the cognitive scores were not included due to the substantial ceiling effect when applied to a sample of people with SCI.[34] The same ceiling effect of the cognitive scores was also found in a study applied to Chinese population.[7] The original FIM was rated by a trained clinician on a performance basis. More recently, a telephonic version of motor FIM has been established and a series of validity studies had been conducted. The Chang *et al.*[65] study recruited 132 patients from a geriatric rehabilitation program. The scores from the telephonic version of the FIM were found to be similar to those from the original observation version based on Rasch statistics.[65] Another validity study was conducted in a group of individuals with SCI. It was revealed that intraclass correlation was as high as 0.99. Other studies also revealed that self-rating scores were associated with those by trained clinicians.[63,64,66,67] These findings were beneficial for the longitudinal design of the present study since the functional status of each participant could be followed up by telephone based on the participant's self-rating.

Statistical analysis

Participants' demographic data were first analyzed using descriptive statistics. Owing to the limited sample size, the six diagnostic groups were collapsed into four groups: (1) tetraplegia ASIA A/B/C, (2) tetraplegia ASIA D, (3) paraplegia ASIA A/B/C, and (4) paraplegia ASIA D for further analysis. Repeated measure analysis of variance (ANOVA) was applied to investigate FIM motor score difference among three diagnostic groups across six measured points of study, i.e., admission, discharge, 1-, 3-, 6-, 12-month post-discharge. Missing data during the follow-up period were filled up by means of the directly preceding and succeeding FIM motor scores. A multiple comparison statistic, Bonferroni *post-hoc* test, was used subsequently to identify the functional differences across six measurement points between each diagnostic group. For within-group comparison, repeat contrast tests were applied to investigate FIM motor score changes between two successive data across six measurement points. Software SPSS 12.0® was used to conduct the data analysis described above. Despite small sample size with a four-group categorization, the parameter test of repeated measures was still applied instead of non-parameter tests due to the robustness of this statistical method. In order to reflect sufficient sample size, a power analysis was conducted, including observed power with the α value of 0.05 and partial η^2. Conventionally, observed power reaching the level of 0.8 or more is considered to be satisfactory.

All applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

Results

Table 1 summarizes demographic data for all four diagnostic groups. Among the 30 participants recruited for the present study, 10 were classified as tetraplegia ASIA A/B/C, whereas 7 were paraplegia ASIA A/B/C. Seven and six participants were classified under the tetraplegia and paraplegia ASIA D groups, respectively. Overall, 23 men (76.67%) were recruited in the present study, resulting in a male-to-female ratio of 3.3-to-1. The mean age ranged from 35.43 years (standard deviation = 12.47) for paraplegia ASIA A/B/C group to 56.40 years (18.28) for tetraplegia ASIA A/B/C group. As a whole, 11 (36.67%) of the participants had sustained SCI due to a traffic accident. In addition, eight (26.67%) and seven (23.33%) of them had sustained an SCI as a result of falling from a height and from slipping and falling, respectively.

The changes of placement among participants before and after the SCI are also summarized in Table 2. All participants lived in the community before the occurrence of SCI. Five of them were discharged to a private old-age home due to insufficient social support. Of the remaining 25 participants, 11 home assessments were conducted, and 3 new flats at public housing estates were allocated under the Hong Kong Housing Authority compassionate re-housing policy, followed by essential home modification. The mean and the standard deviation of length of stay for each diagnostic group are summarized in Table 1. The average appeared to be longest for the tetraplegia group (mean = 155.20 days and standard deviation = 98.75) and shortest for paraplegia ASIA D group (mean = 79.46 days and standard deviation = 50.44 days). However, one-way ANOVA showed no significant difference among four diagnostic groups ($P > 0.05$).

The mean motor scores across six measurement points are summarized in Table 3. In spite of limited sample size, repeated measure ANOVA showed that there were significant differences among three diagnostic groups (Mauchly's test of sphericity: $P < 0.05$; Greenhouse-Geisser test: $F(1.558, 40.51) = 112.697$; $P < 0.01$). Bonferroni *post-hoc* tests revealed significant differences in FIM motor scores only between tetraplegia A/B/C group and other three diagnostic groups ($P < 0.05$).

Furthermore, contrast tests (repeated) of the repeated measure ANOVA were applied to explore the differences between two consecutive FIM motor scores across measurement time in each of the three diagnostic

Table 2 Social data of participants with SCI

Life role (%)	Premorbid	At 12 months
Working	17 (56.67)	1 (3.33)
Retired for age	6 (20.00)	6 (20.00)
Retired for disability	0 (0.00)	14 (46.67)
Homemaker	3 (10.00)	1 (3.33)
Student	2 (6.67)	1 (3.33)
Unemployed	2 (6.67)	7 (23.33)
Premorbid accommodation (%)		
Public housing estate (PHE)		16 (53.33)
Privately owned flat		12 (40.00)
Rented flat		3 (10.00)
Discharge accommodation (%)		
Returning to previous PHE		10 (33.33)
Returning to previous private/rented flat		11 (36.67)
Moved to rehousing PHE flat		3 (10.00)
Transferring to old-aged home (%)		5 (16.67)

SD: standard deviation.

Table 1 Demographics of participants with SCI

	Tetraplegia ASIA A/B/C	Paraplegia ASIA A/B/C	Tetraplegia ASIA D	Paraplegia ASIA D
Male (%)	7 (23.33)	5 (16.67)	7 (23.33)	4 (13.33)
Age (SD)	56.40 (18.28)	35.43 (12.47)	51.29 (14.94)	35.84 (19.92)
Reason of injury (%)				
Traffic accident	4 (13.33)	4 (13.33)	1 (3.33)	2 (6.67)
Falling from height	4 (13.33)	2 (6.67)	2 (6.67)	0
Slipped and falling	3 (10.00)	2 (6.67)	1 (3.33)	1 (3.33)
Falling object	0	1 (3.33)	0	0
Stab injury	0	0	1 (3.33)	0
Days from accident to center admission (SD)	48.02 (23.67)	31.55 (20.85)	24.74 (16.97)	21.45 (12.28)
Length of stay (SD)	155.20 (98.75)	115.43 (44.41)	100.34 (56.88)	79.46 (50.44)

SD: standard deviation.

Table 3 Mean FIM motor scores on admission, discharge, and 1-, 3-, 6-, and 12-months post-discharge and results of repeated measure ANOVA

	FIM motor (SD)						***F* test***				
			Post-DC								
	Admission	Discharge	1 mo.	3 mo.	6 mo.	12 mo.	Adm. vs. DC	DC vs. 1 mo.	1 vs. 3 mo.	3 vs. 6 mo.	6 vs 12 mo.
Tetraplegia ASIA A/B/C ($n = 10$)	20.60 (12.63)	33.40 (21.11)	34.55 (23.35)	33.65 (21.34)	32.45 (19.16)	32.30 (19.24)	$F(1,9) = 15.56$**	$F(1,9) = 2.25$	$F(1,9) = 0.51$	$F(1,9) = 0.99$	$F(1,9) = 0.01$
Paraplegia ASIA A/B/C ($n = 7$)	34.29 (17.71)	74.29 (6.23)	76.57 (8.24)	76.14 (9.05)	75.36 (9.44)	75.43 (9.32)	$F(1,6) = 35.94$**	$F(1,6) = 6.56$***	$F(1,6) = 0.21$	$F(1,6) = 0.81$	$F(1,6) = 1.00$
Tetraplegia ASIA D ($n = 7$)	39.71 (18.53)	70.86 (11.55)	74.00 (13.13)	74.50 (13.03)	73.86 (13.23)	77.71 (14.48)	$F(1,6) = 27.00$**	$F(1,6) = 3.81$	$F(1,6) = 3.00$	$F(1,6) = 0.133$	$F(1,6) = 11.29$***
Paraplegia ASIA D ($n = 6$)	40.33 (10.60)	75.00 (13.13)	82.33 (4.84)	83.00 (4.43)	83.00 (5.40)	84.33 (6.12)	$F(1,5) = 13.52$***	$F(1,5) = 2.29$	$F(1,5) = 4.00$	$F(1,5) = 0.005$	$F(1,5) = 4.71$***

Adm. = admission; DC = discharge; mo. = month(s); *repeated contrast test of repeated measurement ANOVA; **$P < 0.01$; ***$P < 0.05$.

groups (Table 3). It was shown that, among participants in the tetraplegia A/B/C group, significant findings were obtained only between admission and discharge scores (F(1,9) = 15.56; $P < 0.01$). The scores were shown to reach a plateau after they were discharged from the SCI center. On the other hand, for the paraplegia A/B/C group, significant functional improvements were shown not only during the hospitalization period (F(1,6) = 35.94; $P < 0.01$), but also 1 month after they were discharged from the SCI center (F(1,6) = 6.56, $P < 0.05$). For both tetraplegia and paraplegia ASIA D group, the participants were shown to have improvements in FIM motor scores during the hospitalization period and between the 6th month and 12th month measurement points ($P < 0.05$) (Table 3).

Results of the power analysis were examined. The design achieved an observed power of 99.9% (partial $\eta^2 = 0.69$) for between-subject effect when a Greenhouse-Geisser corrected F test was applied with α level set at 0.05. As for an across-time interaction effect, the observed power fell in a wide range. Observed power ranged between 10.1% (partial $\eta^2 = 0.018$) (for contrast between the scores of 3- and 6-month post-discharge) and 82.9% (partial $\eta^2 = 0.343$) (for contrast between the scores of admission and discharge) when a Greenhouse-Geisser corrected F test was used.

Upon discharge from the SCI center, each participant was provided with assistive technology intervention from his or her case occupational therapist.

Table 4 summarizes the type of assistive equipment prescribed to participants in different diagnostic groups. Each participant was prescribed with devices based on his or her functional status, social environment in the community, and social support. This was also true when a participant relied on public funding for equipment purchase. Seven main categories of assistive equipment were prescribed namely wheelchair, seating cushion, lifter, bathing/toileting equipment, hospital bed, and pressure relief mattress overlay. Owing to different dependence levels, people in different diagnostic groups needed different types of equipment. Among 10 participants in the tetraplegia group, 7 of them were prescribed manual wheelchairs and 2 participants were issued power-driven wheelchairs. One of the power wheelchairs was equipped with a tilt-in-space function. All but two were prescribed with a type of seat cushion with air or foam-gel medium. Only five participants were prescribed with a type of commode/shower chair along with a mobile hoist for transfer. In addition, four hospital beds and seven pressure-relief mattress overlays were also purchased among 10 participants under the tetraplegia group. The types of equipment were found to be more consistent across seven participants in the paraplegia group. All of them were provided with manual wheelchairs, seat cushions, and commode/shower chair (either dependent type or self-propelling type depending on the social support and home environment situation). As for both ASIA D group ($n = 13$), the types of assistive equipment needed by each participant appeared to vary among individuals. Only six of them were prescribed a manual wheelchair and five were issued a kind of pressure-relief seat cushion. Furthermore, three commode/shower chairs were issued for the ASIA grade D groups. No abandonment was reported among participants during the study period.

In terms of life role before injury, 17 (56.67%) participants were employed in a full-time remunerative job. Six (20.00%) of them were retired. Two (6.67%) of them were studying and three (10%) of them worked as homemaker. At 12-month post-discharge follow-up, almost half of the participants recruited ($n = 14$) had retired because of disability. Only three participants had resumed roles as worker, student, and homemaker at 12 months follow-up (Table 2).

At the time of post-discharge follow-up, different types of complications experienced by the participants were also revealed. Eleven (36.67%) participants experienced urinary tract infection or other forms of urological infection, whereas six of them had pressure sores

Table 4 The type of assistive equipment prescribed among participants among diagnostic groups

	Type of assistive equipment					
	Manual wheelchair	Powered wheelchair	Commode/shower chair	Mobile hoist	Hospital bed	Mattress overlay
Tetraplegia ASIA A/B/C	5*	2*	8	5	5	7
Paraplegia ASIA A/B/C	7	0	7	6	0	0
Tetraplegia ASIA D	5	0	3	3	0	0
Paraplegia ASIA D	1	0	2	0	0	0

*One seating system was equipped with tilt-in-space function.

that required a period of bed rest. Five of them underwent orthopedic surgery after they were discharged from the tertiary SCI center. Three of them reported experiencing neurological deterioration that negatively affected their daily function and safety. Apart from the physically-related medical complications, seven participants reported they had anxiety or depression during the previous year. Two had a spasticity condition that required constant medication intervention, passive stretching, and application of splintage to maintain joint integrity.

Discussion

This study is one of the few studies to explore the characteristics and the longitudinal functional changes in a Chinese population after 1 year. In terms of demographic characteristics, the male-to-female ratio was found to be one female to about four males, similar to what had been reported in other studies.[1,31–33] The mean age of 46.22 years found in this study implied that a number of them had reached middle or old age which could adversely affect their potential in functional recovery.[8,13] Similar to previous studies,[7,32] the principle causes of traumatic SCI were road traffic accidents and falls from a height. While this is not the focus of the present study, this information suggests that improvements in road and occupational safety and community suicidal intervention services might prevent some cases of traumatic SCI.

The main merit of this study was the follow-up on the functional status of Chinese people with SCI in different diagnostic groups. Despite the sample size that limited us from creating a more detailed diagnostic group classification and make definite conclusions, the findings indicated that people with different injury severity and completeness had different functional recovery patterns. The current study reconfirmed that the most functional gain reflected by FIM motor scores was obtained between admission and discharge for participants in all diagnostic groups, including those in the tetraplegia A/B/C group. This finding was consistent with those from studies in Western[34,41,68] and Asian countries.[35] The functional status of people in the tetraplegia A/B/C group remained at a similar level after they had been discharged. As for those under the paraplegia A/B/C group, they continued to show significant improvement 1 month after discharge. Even with a much larger size in Hall *et al.*'s[34] study and with a follow-up period up to 5 years, it was suggested that there were "only modest changes in motor scores" for participants with ASIA A/B/C. Furthermore, the functional profile was shown to be different for people under ASIA D groups. They could still have functional improvement even 1 year beyond the time of discharge. One noteworthy point was that both tetraplegia and paraplegia ASIA D groups and the paraplegia A/B/C group did not manifest differences in longitudinal functional profiles. This implied that the severity or completeness of SCI would be a more prominent parameter to determine long-term functional potential. To the researchers' knowledge, there have been no previous studies to follow-up functional changes of people with paraplegia or tetraplegia ASIA D up to 1-year time or beyond. The preliminary results from this study should serve as a reference for future studies. Although community-based services and an outpatient referral system already exist in Hong Kong, further enhancement of these policies would be beneficial for people with SCI in order to maximize their functioning after discharge.

It is noteworthy that these functional improvements found in different diagnostic groups were not only attributed to the neurological recovery found previously,[23–26] but also to the provision of assistive technology. In the practice guideline compiled by the Consortium for Spinal Medicine,[6] a list of durable medical equipment and adaptive devices was recommended. Participants in the tetraplegia ASIA grade A group required more assistive equipment when they were reintegrated into the community. Apart from mobility equipment and seating systems, people required hospital beds and pressure relief mattresses for prevention of pressure ulcers and commode/shower chairs for bathing and toileting. On the other hand, the types of assistive equipment tended to vary among people in the two ASIA D groups since they tended to have better potential for recovery. Six out of 13 were in an ambulatory state and did not need any wheelchair for mobility. The previous studies revealed that the abandonment phenomenon of assistive equipment was rather common among people with disability.[69,70] This means that people discontinue assistive equipment prescribed by therapists mainly due to lack of practice and mismatching of equipment with their needs during the prescription process. Yet, this phenomenon was not revealed at the time of a 1 year follow-up in this study. This could be because users and their assistive equipment were well matched, and users still found the equipment essential in their daily living. One might also note that the equipment prescribed was mainly home care equipment. Other high-end assistive technology, such as special computer access and an environmental control unit, were not issued to the participants recruited for this study, except power wheelchairs. The explanation was two-fold. This was partly due to the limitation of funding availability and funding policy. In

Hong Kong, public funding often only covers so-called basic and essential assistive equipment; high-end equipment is often not considered. On the other hand, high-end technology is not as commonly accepted in Chinese populations. Chinese people tend to prefer human assistance to technical support, especially while performing self-care activities. This finding might give an insight to psychiatric or rehabilitative clinicians who deal with Chinese clients. Maximization of independence and respect for personal preference should be well balanced when prescribing high-end assistive equipment.

The length of stay for different diagnostic groups was somewhat comparable to what was reported in the previous study conducted on a similar SCI sample,[7] especially in the paraplegia group. The current study showed that the length of stay was not significantly different among three diagnostic groups. Although this might be due to the small sample size, this also implied that the duration of hospitalization was purely related to neurological and functional factors. When one examines length-of-stay data from different countries, a wide variation is often revealed. This would be attributed to different medical systems in different countries. For example, in one of the earlier US studies by Ditunno *et al.*[27] the length of stay ranged from 50.3 days for Frankel grade D to 93.4 days for the high tetraplegia group. In a study conducted in Australia,[31] length of stay was reported to range from 43 to 206 days for incomplete paraplegia and complete tetraplegia groups, respectively. As discussed previously, in Hong Kong, the length of stay is often determined by the extended time required for arrangement of home equipment and accommodation (which included relocation of living placement and subsequent architectural modifications) since multiple parties are involved in these processes.[7] Despite the fact that it has not been specifically recorded, some specific psychosocial factors would also be important to determine the length of stay in Hong Kong. This issue is highlighted by two case studies illustrated below.

Case 1

One participant, Mr Y, acquired high tetraplegia at C4 level with classification of ASIA A. He worked as a waiter in a Cantonese-style bistro before his injury in a traffic accident. Post-injury, he was totally dependent on activities of daily living (ADL) due to absence of upper and lower limb control despite 2-month intensive training. He required a mobile hoist for transfer and tilt-in-space-type commode/shower chair for bathing activity. Originally, he planned to use a power-driven wheelchair with chin control for mobility. Owing to his inability to safely maneuver a powered wheelchair system, he decided to use a manual wheelchair instead. Since he was not eligible to apply for social welfare (which is called the comprehensive social security allowance in Hong Kong), he had to purchase all the home equipment with his own savings. In terms of home environment, Mr Y was living with his girlfriend in a rented apartment, which was found to be accessible for all home equipment after a home assessment. No major modifications were needed. His partner acted as the main caregiver. As a result, without extra time for flat allocation and equipment prescription and sufficient social support, the total length of stay at the tertiary SCI center was only 77 days.

Case 2

The scenario was completely different for another patient, Mr L. Mr L also acquired a high-level tetraplegia at C4 level with central cord syndrome after falling from a height. After 6 months of intensive training, he could perform self-feeding with a universal cuffed spoon. He could also propel a lightweight wheelchair with capstan hand-rim projections for short distances. However, his social support was inadequate. He lived alone in a suburban village house before the injury. He was married but his wife and an infant son were citizens of a town in Mainland China. According to Hong Kong immigration policy, his wife and son could only visit him for short periods of time – no longer than 3 months. Besides, there was a flight of stairs at the entrance of his rented flat, which was not wheelchair accessible. An extended period was required for home equipment prescription via public funding. Since no modifications could be done at the flat entrance, Mr L needed neighbors to carry him along the staircase while he was sitting on a wheelchair. As an extended period would also be required for his wife and son to apply for right of abode in Hong Kong, Mr L needed to rely on his relatives or neighbors to take turns to provide assistance in daily activities when his wife went back to China for permit extension. In the end, Mr L stayed at the SCI center for 214 days.

These two cases illustrated that functional status alone does not determine the duration of hospitalization, i.e., the patient with better functional status required a longer stay because of social and environmental factors.

Continual collaboration of patients and their significant others and a multidisciplinary team approach are the keys for smooth community re-integration of people with SCI. Furthermore, the long-term effects of extended stay in a hospital institute have not been intensively addressed in the literature. Yet studies have found that community integration is positively related to subjective well being.[71–76] Although further studies would be required to explore the issue, one might expect possible adverse effects from staying in a hospital environment for an extended period. Different ways could be sought to facilitate community integration. Transitional home placement might be one of the ways. Examples of transitional homes can be found in other countries.[30,46,77] In addition, a more comprehensive community integration program could be established in which community trips would be encouraged so that individuals become familiar with the community facilities before actual discharge from the hospital.

Twenty five (83.33%) of the participants returned to the community; yet, only two (out of 30) participants engaged in either remunerative employment or academic pursuit at a 1 year follow-up. Among seven unemployed participants, two had attempted to resume a working role, but they failed to continue in the job for medical reasons. A previous study conducted with a Taiwan population reported a 47% employment rate.[78] The low percentage of employment rate obtained in this study could be due to the fact that the follow-up period is merely 1 year after injury, and it was reported that it may take several years for people with SCI to engage in a first post-injury job.[47] Also the small sample size limited us from making definite conclusions. Data from this preliminary study indicated that people with SCI may encounter tremendous "hurdles" after they are discharged into the community. Different aspects could be explored to stipulate factors for a low employment rate. There are two levels of factors contributing to the low employment phenomenon among people with SCI after rehabilitation: individual and societal factors. The first aspect was more on an individual basis, and related to one's physical and psychological factors resulting from SCI. Despite intensive rehabilitative training provided during the hospitalization phase, people with SCI and their caregivers still needed time to become accustomed to the new daily routine at home and in the community after discharge. Consistent with previous findings,[46,48,79] the current study also found that a number of participants experienced different types of complications. These might lead to readmission to hospital for medical intervention. Furthermore, as discussed previously, participants' mean age fell within the mid-age range, and it could be expected that a number of them would experience the effect of aging.[8,13,44,80] A number of participants also experienced emotional problems after discharge from the rehabilitation center. Thus, people with SCI need to deal with these personal issues before employment or academic engagement. The second aspect that might affect the outcome of employment and educational activities appeared to be more "macroscopic", concerning the societal level of the problem. This includes societal access and social policy. As barrier-free access and universal design was only introduced in Hong Kong in the 1990s, the implementation of these concepts in public facilities is still in progress. Public transport facilities are not yet comprehensibly accessible to wheelchair and transport services (locally called RehabBus Service and EasyBus) are not readily available.[81] In terms of governmental policies, the Disability Discrimination Ordinance was promulgated in Hong Kong only in the 1990s.[82] One would expect that societal attitude toward people with disability should become more positive. The selective placement division of the Labor Department also provides employment assistance and recruitment service for job seekers with disability. Yet, the unemployment rate increased to the level of 6.5% in Hong Kong during the study period.[78] This was considered to be relatively high in the region as the unemployment rate had seldom exceeded 5%. Thus, this would be a hindrance for people who are physically challenged to re-enter the mainstream job market. This is a possible explanation for the low employment rate among people with SCI after rehabilitation. Another reason for some people with SCI not being engaged in any remunerative employment was that they were still going through worker's compensation procedures and were waiting for monetary compensation. This would further confound the employment situation. Future studies with a longer follow-up period would be beneficial to obtain a fuller picture of the employment situation among people with SCI.

Conclusion and implications

The current study highlighted the functional recovery pattern of people with different levels and severity of SCI after they had been discharged from a rehabilitation center for 1 year. On one hand, significant functional improvement was revealed for all SCI diagnostic groups during the hospitalization period; on the other hand, people in two ASIA D groups showed further improvement even 1-year post-discharge. On the other hand, the findings related to community integration were found to be specific to the context of Hong Kong. Few were engaged in more productive life roles at 1-year time post-discharge. This reflected that, after they were reintegrated into the community, people with SCI still needed to adapt to a new daily routine with their new physical conditions. Besides, they also needed to face physical complications and psychological distress. In order to facilitate their integration into the community in a smoother manner and to adopt a more productive life role, clinicians could serve as resource personnel whenever they encountered difficulties in their daily routine. Besides, various community services and self-help groups for people living with SCI could be introduced so that referral could be made whenever it is applicable. At the societal level, occupational therapists could play a role in liaising with the government to further promote a barrier-free concept in society. In terms of employment, supported or transitional work placements could be established with support from the Labor Department and potential employers. This would enhance the employment rate of people with SCI after rehabilitation. Finally, one of the weaknesses of this preliminary study would be the sample size. Yet, in order to explore the longitudinal changes of functional status among Chinese people with SCI, a repeated measure ANOVA was still attempted. The aim was to look at the emerging phenomenon instead of drawing definite conclusions. Encouragingly, most power analysis results still showed a satisfactory level, suggesting that the results can be considered reliable. Hopefully, results from this study will serve as a foundation for future studies with larger sample sizes and longer follow-up periods. It would be also worthwhile to conduct studies to incorporate other parameters such as community integration and quality of life as suggested by the Consortium for Spinal Medicine.[6]

References

1 Ackery A, Tator C, Krassioukov A. Global perspective on spinal cord injury epidemiology. J Neurotrauma 2004;21(10):1355–70.
2 O'Connor PJ. Trends in spinal cord injury. Accid Anal Prev 2006; 38(1):71–7.
3 Fiedler IG, Laud PW, Maiman DJ, Apple DF. Economics of managed care in spinal cord injury. Arch Phys Med Rehabil 1999;80(11):1441–9.
4 McKinley WO, Jackson AB, Cardenas DD, DeVivo MJ. Long-term medical complications after traumatic spinal cord injury: a regional model systems analysis. Arch Phys Med Rehabil 1999; 80(11):1402–10.
5 Ramer MS, Harper GP, Bradbury EJ. Progress in spinal cord research – a refined strategy for the International Spinal Research Trust. Spinal Cord 2000;38(8):449–72.
6 Consortium for Spinal Cord Medicine. Outcomes following traumatic spinal cord injury: clinical practice guidelines for health-care professionals. J Spinal Cord Med 2000;23(4):289–316.
7 Chan SC, Chan AP. Rehabilitation outcomes following traumatic spinal cord injury in a tertiary spinal injury centre: a comparison with an international standard. Spinal Cord 2005;43(8):489–98.
8 Charlifue SW, Weitzenkamp DA, Whiteneck G. Longitudinal outcomes in spinal cord injury: aging, secondary conditions, and well-being. Arch Phys Med Rehabil 1999;80(11):1429–34.
9 Craig A, Hancock K, Dickson H. Improving the long-term adjustment of spinal cord injured persons. Spinal Cord 1999;37(5): 345–50.
10 Franceschini M, Di Clemente B, Rampello A, Nora M, Spizzichino L. Longitudinal outcome 6 years after spinal cord injury. Spinal Cord 2003;41(5):280–5.
11 Johnston MV, Diab ME, Kim SS, Kirshblum S. Health literacy, morbidity, and quality of life among individuals with spinal cord injury. J Spinal Cord Med 2005;28(3):230–40.
12 Kennedy P, Rogers B. Reported quality of life of people with spinal cord injuries: a longitudinal analysis of the first 6 months post-discharge. Spinal Cord 2000;38(8):498–503.
13 McColl MA, Arnold R, Charlifue S, Glass C, Savic G, Frankel H. Aging, spinal cord injury, and quality of life: structural relationships. Arch Phys Med Rehabil 2003;84(8):1137–44.
14 Westgren N, Levi R. Quality of life and traumatic spinal cord injury. Arch Phys Med Rehabil 1998;79(11):1433–9.
15 Manigandan C, Saravanan B, Macaden A, Gopalan L, Tharion G, Bhattacharji S. Psychological wellbeing among carers of people with spinal cord injury: a preliminary investigation from South Indian. Spinal Cord 2000;38(9):559–62.
16 Ünalan H, Gençosmanoğlu B, Akgün K, Karamehmetoğlu S, Tuna H, Ones K, *et al.* Quality of life of primary caregivers of spinal cord injury survivors living in the community: controlled study with short form-36 questionnaire. Spinal Cord 2001;39(6): 318–22.
17 American Spinal Injury Association. Standards for Neurological Classification of Spinal Injured Patients. Chicago, IL: American Spinal Injury Association; 1982.
18 Kirshblum SC, Burns SP, Biering-Sorensen F, Donovan W, Graves DE, Jha A, *et al.* International standards for neurological classification of spinal cord injury (revised 2011). J Spinal Cord Med 2011;34(6):535–46.
19 Waring WP III, Biering-Sorensen F, Burns S, Donovan W, Graves D, Jha A, *et al.* 2009 review and revisions of the international standards for the neurological classification of spinal cord injury. J Spinal Cord Med 2010;33(4):346–52.
20 Burns AS, Ditunno JF. Establishing prognosis and maximizing functional outcomes after spinal cord injury: a review of current and future directions in rehabilitation management. Spine (Phila Pa 1976) 2001;26(24 Suppl):S137–45.
21 Jonsson M, Tollbäck A, Gonzales H, Borg J. Inter-rater reliability of the 1992 international standards for neurological and functional classification of incomplete spinal cord injury. Spinal Cord 2000; 38(11):675–9.
22 Kirshblum SC, Memmo P, Kim N, Campagnolo D, Millis S. Comparison of the revised 2000 American Spinal Injury Association classification standards with the 1996 guidelines. Am J Phys Med Rehabil 2002;81(7):502–5.
23 Waters RL, Yakura JS, Adkins RH, Sie I. Recovery following complete paraplegia. Arch Phys Med Rehabil 1992;73(9):784–9.
24 Waters RL, Adkins RH, Yakura JS, Sie I. Motor and sensory recovery following complete tetraplegia. Arch Phys Med Rehabil 1993;74(3):242–7.
25 Waters RL, Adkins RH, Yakura JS, Sie I. Motor and sensory recovery following incomplete paraplegia. Arch Phys Med Rehabil 1994;75(1):67–72.
26 Waters RL, Adkins RH, Yakura JS, Sie I. Motor and sensory recovery following incomplete tetraplegia. Arch Phys Med Rehabil 1994;75(3):306–11.
27 Ditunno JF Jr, Apple DF, Burns AS, Donovan WH, Hagglund KJ, Lammertse DP, *et al.* A view of the future Model Spinal Cord Injury System through the prism of past achievements and current challenges. J Spinal Cord Med 2003;26(2):110–5.
28 Curt A, Keck ME, Dietz V. Functional outcome following spinal injury: significance of motor-evoked potentials and ASIA scores. Arch Phys Med Rehabil 1998;79(1):81–6.
29 Maynard FM Jr, Bracken MB, Creasey G, Ditunno JF Jr, Donovan WH, Ducker TB, *et al.* International Standards for Neurological and Functional Classification of Spinal Cord Injury. American Spinal Injury Association. Spinal Cord 1997; 35(5):266–74.
30 Post MW, Dallmeijer AJ, Angenot EL, van Asbeck FW, van der Woude LH. Duration and functional outcome of spinal cord

injury rehabilitation in the Netherlands. J Rehabil Res Dev 2005; 42(3 Suppl. 1):75–85.
31 Tooth L, McKenna K, Geraghty T. Rehabilitation outcomes in traumatic spinal cord injury in Australia: functional status, length of stay and discharge setting. Spinal Cord 2003;41(4): 220–30.
32 Pagliacci MC, Celani MG, Zampolini M, Spizzichino L, Franceschini M, Baratta S, *et al.* An Italian survey of traumatic spinal cord injury. The Gruppo Italiano Studio Epidemiologico Mielolesioni study. Arch Phys Med Rehabil 2003;84(9):1266–75.
33 Yilmaz F, Sahin F, Aktug S, Kuran B, Yilmaz A. Long-term follow-up of patients with spinal cord injury. Neurorehabil Neural Repair 2005;19(4):332–7.
34 Hall KM, Cohen ME, Wright J, Call M, Werner P. Characteristics of the functional independence measure in traumatic spinal injury. Arch Phys Med Rehabil 1999;80(11):1471–6.
35 Jongjit J, Sutharom W, Komsopapong L, Numpechitra N, Songjakkaew P. Functional independence and rehabilitation outcome in traumatic spinal cord injury. Southeast Asian J Trop Med Public Health 2004;35(4):980–5.
36 Akmal M, Trivedi R, Sutcliffe J. Functional outcome in trauma patients with spinal injury. Spine (Phila Pa 1976) 2003; 28(2):180–5.
37 Ota T, Akaboshi K, Nagata M, Sonoda S, Domen K, Seki M, *et al.* Functional assessment of patients with spinal cord injury: measured by the motor score and the functional independence measure. Spinal Cord 1996;34(9):531–5.
38 Scherer MJ, Cushman LA. Measuring subjective quality of life following spinal cord injury: a validation study of the assistive technology device predisposition assessment. Disabil Rehabil 2001; 23(9):387–93.
39 Cushman LA, Scherer MJ. Measuring the relationship of assistive technology use, functional status over time, and consumer-therapist perceptions of ATs. Assist Technol 1996;8(2):103–9.
40 Jutai J. Quality of life impact of assistive technology. Rehabil Eng RESJA (Japanese) 1999;14:2–7.
41 Yarkony GM, Roth EJ, Heinemann AW, Lovell L. Spinal cord injury rehabilitation outcome: the impact of age. J Clin Epidemiol 1988;41(2):173–7.
42 Charlifue S, Lammertse DP, Adkins RH. Aging with spinal cord injury: changes in selected health indices. Arch Phys Med Rehabil 2004;85(11):1848–53.
43 Scivoletto G, Morganti B, Ditunno B, Ditunno JF, Molinari M. Effects on age on spinal cord lesion patients' rehabilitation. Spinal Cord 2003;41(8):457–64.
44 Liem NR, McColl MA, King W, Smith KM. Aging with a spinal cord injury: factors associate with the need for more help with activities of daily living. Arch Phys Med Rehabil 2004;85(10): 1567–77.
45 Maynard FM, Karunas RS, Waring WP III. Epidemiology of spasticity following traumatic spinal cord injury. Arch Phys Med Rehabil 1990;71(8):566–9.
46 Dijkers MP, Abela MP, Gans BM, Gordon WA. The aftermath of spinal cord injury. In: Stover SL, DeLisa JA, Whiteneck GG (eds.) Spinal cord injury: clinical outcomes from the model system Gaithersburg, MD: Aspen Publications; 1995. p. 185–212.
47 Krause JS. Years to employment after spinal cord injury. Arch Phys Med Rehabil 2003;84(9):1282–9.
48 Krause JS, Broderick L. Patterns of recurrent pressure ulcers after spinal cord injury: identification of risk and protective factors 5 or more years after onset. Arch Phys Med Rehabil 2004;85(8): 1257–64.
49 Larsson Lund M, Nordlund A, Nygård L, Lexell J, Bernspång B. Perceptions of participation and predictors of perceived problems with participation in persons with spinal cord injury. J Rehabil Med 2005;37(1):3–8.
50 Pentland W, Harvey AS, Smith T, Walker J. The impact of spinal cord on men's time use. Spinal Cord 1999;37(11):786–92.
51 Ditunno JF Jr, Young W, Donovan WH, Creasey G. The international standards booklet for neurological and functional classification of spinal cord injury. Paraplegia 1994;32(2):70–80.
52 Guide for the Uniform Data Set for Medical Rehabilitation (including the FIM Instrument), version 5.1 Buffalo: State University of New York; 1997.
53 Dodds TA, Matrin DP, Stolov WC, Deyo RA. A validation of the functional independence measurement and its performance among rehabilitation inpatients. Arch Phys Med Rehabil 1993; 74:531–6.
54 Granger CV, Hamilton BB, Linacre JM, Heinemann AW, Wright BD. Performance profiles of the functional independence measure. Am J Phys Med Rehabil 1993;72(2):84–9.
55 Hamilton BB, Laughlin JA, Fiedler RC, Granger CV. Interrater reliability of the 7-level functional independence measure (FIM). Scand J Rehabil Med 1994;26(3):115–9.
56 Heinemann AW, Kirk P, Hastie BA, Semik P, Hamilton BB, Linacre JM, *et al.* Relationships between disability measures and nursing effort during medical rehabilitation for patients with traumatic brain and spinal cord injury. Arch Phys Med Rehabil 1997; 78(2):143–9.
57 Heinemann AW, Linacre JM, Wright BD, Hamilton BB, Granger C. Relationships between impairment and physical disability as measured by the functional independence measure. Arch Phys Med Rehabil 1993;74(6):566–73.
58 Linacre JM, Heinemann AW, Wright BD, Granger CV, Hamilton BB. The structure and stability of the functional independence measure. Arch Phys Med Rehabil 1994;75(2):127–32.
59 Marino RJ, Graves DE. Metric properties of the ASIA motor score: subscales improve correlation with functional activities. Arch Phys Med Rehabil 2004;85(11):1804–10.
60 Segal ME, Ditunno JF, Staas WE. Institutional agreement of individual functional independence measure (FIM) items measured at two sites on one sample of SCI patients. Paraplegia 1993;31(10): 622–31.
61 Lundgren-Nilsson Å, Grimby G, Ring H, Tesio L, Lawton G, Slade A, *et al.* Cross-cultural validity of functional independence measure items in stroke: a study using Rasch analysis. J Rehabilitative Med 2005;37(1):23–31.
62 Dijkers MP, Yavuzer G. Short versions of the telephone motor functional independence measure for use with persons with spinal cord injury. Arch Phys Med Rehabil 1999;80(11): 1477–84.
63 Masedo AI, Hanley M, Jensen MP, Ehde D, Cardenas DD. Reliability and validity of a self-report FIM (FIM-SR) in persons with amputation or spinal cord injury and chronic pain. Am J Phys Med Rehabil 2005;84(3):167–76.
64 Karamehmetoğlu SS, Karacan I, Elbaşi Demirel G, Koyuncu H, Döşoğlu M. The functional independence measure in spinal cord injured patients: comparison of questioning with observational rating. Spinal Cord 1997;35(1):22–5.
65 Chang WC, Slaughter S, Cartwright D, Chan C. Evaluating the FONE FIM: Part 1. Construct validity. J Outcome Meas 1997; 1(3):192–218.
66 Grey N, Kennedy P. The functional independence measure: a comparative study of clinician and self ratings. Paraplegia 1993;31(7): 457–61.
67 Jensen MP, Abresch RT, Carter GT. The reliability and validity of a self-report version of the FIM instrument in persons with neuromuscular disease and chronic pain. Arch Phys Med Rehabil 2005; 86(1):116–22.
68 Yarkony GM, Roth EJ, Heinemann AW, Wu YC, Katz RT, Lovell L. Benefits of rehabilitation for traumatic spinal cord injury. Multivariate analysis in 711 patients. Arch Neurol 1987;44(1): 93–6.
69 Kittel A, Di MA, Stewart H. Factors influencing the decision to abandon manual wheelchairs for three individuals with a spinal cord injury. Disabil Rehabil 2002;24(1–3):106–14.
70 Phillips B, Zhao H. Predictors of assistive technology abandonment. Assist Technol 1993;5(1):36–45.
71 Charlifue S, Gerhart K. Community integration in spinal cord injury of long duration. NeuroRehabilitation 2004;19(2): 91–101.
72 Kennedy P, Lude P, Taylor N. Quality of life, social participation, appraisals and coping post spinal cord injury: a review of four community samples. Spinal Cord 2006;44(2):95–105.
73 Schönherr MC, Groothoff JW, Mulder GA, Eisma WH. Participation and satisfaction after spinal cord injury: results of a vocational and leisure outcome study. Spinal Cord 2005;43(4): 241–8.

74 Tasiemski T, Kennedy P, Gardner BP, Taylor N. The association of sports and physical recreation with life satisfaction in a community sample of people with spinal cord injuries. NeuroRehabilitation 2005;20(4):253–65.
75 Whiteneck GG, Harrison-Felix CL, Mellick DC, Brooks CA, Charlifue SB, Gerhart KA. Quantifying environmental factors: a measure of physical, attitudinal, service, productivity, and policy barriers. Arch Phys Med Rehabil 2004;85(8):1324–35.
76 Whiteneck G, Meade MA, Dijkers M, Tate DG, Bushnik T, Forchheimer MB. Environmental factors and their role in participation and life satisfaction after spinal cord injury. Arch Phys Med Rehabil 2004;85(11):1793–803.
77 DeVivo MJ. Discharge disposition from model spinal cord injury care system rehabilitation programs. Arch Phys Med Rehabil 1999;80(7):785–90.
78 Hong Kong 2004. Hong Kong: Information Services Department of the Hong Kong SAR Government; 2004.
79 Yarkony GM, Heinemann AW. Pressure ulcer. In: Stover SL, DeLisa JA, Whiteneck GC (eds.) Spinal cord injury: clinical outcomes from the model system Gaithersburg, MD: Aspen Publications; 1995. p. 170–84.
80 McColl MA, Charlifue S, Glass C, Lawson N, Savic G. Aging, gender, and spinal cord injury. Arch Phys Med Rehabil 2004;85(3):363–7.
81 Lim BV, Cheung D. From barrier free access to universal design: toward the inclusion of all ages and human diversity. Transport for All Seminar, Hong Kong, China [assessed 2007 Mar 13]. Available at: http://www.hkota.org.hk/document/Continuing%20Education/Transport%20for%20All%20Seminar%20cum%20Exhibition%20-%20Handouts%20-%20Part%202%20(05Nov2005).pdf.
82 Disability Discrimination Ordinance & I: The disability discrimination ordinance and people with a physical disability. Equal Opportunities Commission. Available at: http://www.eoc.org.hk/EOC/GraphicsFolder/showcontent.aspx?itemid=4783.