



(RESEARCH ARTICLE)



Wheelchair Skills, Capacity and Performance of Manual Wheelchair Users with Spinal Cord Injury in a Selected Rehabilitation Centre of Bangladesh

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Abstract

Introduction: There is growing recognition that Occupational Therapist has a significant role along with other professional in wheelchair skills training. In rehabilitation center, wheelchair skills are provided as a part of community re-integration process of people with spinal cord injury. However, individual capacity, confidence, performance in wheelchair skills should be prioritized in collaborative treatment plan to ensure occupational functioning of people with spinal cord injury in the community.

Objectives: The objectives are to find out the level of wheelchair skills capacity, confidence, and performance of persons with SCI and determine correlation among capacity, confidence and performance.

Methodology: This cross-sectional descriptive study was carried out in the community among purposively selected ninety manual wheelchair users using the WST-Q version 4.3. Non-parametric test was used to determine correlation among wheelchair skills capacity, confidence and performance.

Result: The median (inter-quartile range) values for WST-Q capacity, WST-Q confidence, and WST-Q performance were 74.26% (57.02%-78.78%), 75.75% (66.66%-80.01%), and 72.00% (54.54%-76.47%). The total WST-Q capacity scores correlated significantly with the total WST-Q confidence scores ($r=.955$; $p<.000$) and total WST-Q performance scores ($r=.888$; $p<.000$). Success rates were $<70\%$ for 12 of the 34 individual skills on the WST-Q.

Conclusion: Wheelchair skills training enhance confidence and participation among people with spinal cord injury. Occupational therapist should focus on improving participation in occupational functioning at community level.

Keywords: Spinal cord injury; Wheelchair; Capacity; Occupational Functioning

1. Introduction

Spinal cord injury (SCI) is a serious condition that results in loss of motor, sensory and autonomic function below the lesion level.¹ After the injury most of the people cannot be able to walk independently. People with spinal cord injury who are independent in mobility have better long-term outcomes, including well-being and participation, than those who haven't mobility independence.² People with SCI are not able to walk, a wheelchair is one of the most important

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mobility aids for this people.³ Approximately 50–80% People with SCI use a manual wheelchair for independent mobility in the world.⁴ However, people with spinal cord injury often depend on manual wheelchairs to complete daily mobility tasks in the community.⁵

Manual wheelchairs may enhance the mobility of people with SCI and allow them to engage in major life activities by increasing independence, providing more choice in activities and improving satisfaction with participation in many activities.⁶ But community barriers can prevent mobility in communal participation for persons with wheelchair users.³ Wheelchair users face many mobility challenges which are created by the natural environment. A study by Meyers et al found that wheelchair users reported curbs, uneven terrain, and travel surface as barriers to their mobility.⁵

Manual wheelchair users must need wheelchair skills for being accomplished with their daily living activities independently, such as ability to use a wheelchair indifferent ways and circumstance, moving forward and backward, training around, and negotiating a curb to deal with the physical barriers. They will inevitably encounter in various environments. Mastering wheelchair skills can make a difference between dependence and independence in daily life of the SCI patients.⁴ Spinal cord injury patient needs a specialized and comprehensive rehabilitation services and also needed to influence training and rehabilitation to get back to their own community.⁷ Rehabilitation program is one of primary goals for people with spinal cord injury⁸ and wheelchair is the most important of rehabilitation interventions. Wheelchair skills training can lead to improvements in wheelchair skills during initial rehabilitation⁹ and that is very much important in their every aspect of life. Wheelchair skills training reflect the wheelchair skills capacity, confidence and performance to the manual wheelchair users.¹⁰

In Bangladesh, there are no specialized government hospitals for the treatment and rehabilitation of people with SCL. The only one non-government organization is the Centre for the Rehabilitation of the Paralysed, which has been working in this field for the last 30 years.¹¹ CRP has been working with both the Multi-Disciplinary Team (MDT) and Inter-Disciplinary Team (IDT) approach to promote the most possible independence to their community after getting discharges from rehabilitation program.¹² In CRP approximately 390 patients with spinal cord injury were admitted every year.¹³ A study has recently shown that 349 people with spinal cord injury patients were discharged from the CRP in 2011. 59% patients with SCI were wheelchair-dependent. 93% were male wheelchair users and 7% female¹⁴ and that's why wheelchair skills training program is the important part of the rehabilitation program at CRP. This study was intended to identify find out the level of wheelchair skills capacity, confidence, and performance of persons with SCI and determine correlation among capacity, confidence and performance.

2. Material and methods

This study was designed as a cross sectional survey. 90 participants were selected purposively from the community according to inclusion and exclusion criteria. The WST-Q version 4.3 scale was used to collected data which was take permission from the author. This study also takes permission from the Institution Review Board (IRB) of the Bangladesh Health Profession Institute.

The data were collected from the participants by using a translate “Bengali final version” of the Wheelchair Skills Test-Questionnaire version 4.3 (WST-Q version 4.3). It was preferred as a data collection instrument by researcher due to this is massively used for find out the level of wheelchair capacity, confidence and performance. Data input and analysis process were performed by using the Statistical Packages for Social Science (SPSS) version 20.0 (SPSS Inc., Chicago, IL, USA) to increase the trust worthiness of the analysis and lessen the influence of the missing value. Descriptive analysis was used to find out the frequency and percentage the socio-demographic data. The investigator checked the normally distribution of data by using the Kolmogorov-smirnov and Shapiro-wilk test. Individual skills capacity and performance success rates were calculated for each skills. The total percentage WST-Q capacity, WST-Q confidence, and WST-Q performance were examined for their relation to the sex and level of injury by using Mann-Whitney U test. Investigator used the Spearman ρ -test for find out the correlation between total wheelchair skills capacity and the wheelchair skills confidence, performance. A chi-square test was conducted at with $P < .05$, to find out the association between demographic factor (age, causes of injury, pressure sore, duration of a wheelchair use) and wheelchair skills capacity, confidence, performance.

3. Results

The study was conducted with 90 participants. Table-I show that most of the participant age range was 26-35 years and mean (35±12).

Table 1 Socio-demographic characteristics of the participants

Socio-demographic characteristics		Frequency	(%)	
Age	15-25 years	22	24	Mean=35±12
	26-35 years	34	38	
	36-45 years	18	20	
	46-55 years	10	11	
	56-65 years	6	7	
Sex	Male	80	88.9	
	Female	10	11.1	
Marital status	Married	56	62	
	Unmarried	31	35	
Occupation	Small business	35	39	
	Service holder	21	23	
	Students	6	7	
	House wife	3	3	
	Unemployed	25	28	
Educational status	Illiterate	13	14.4	
	Primary school certificate	14	15.6	
	Secondary school certificate	46	51.1	
	Higher secondary certificate	9	10	
	B.sc	4	4.4	
	M.sc	4	4.4	

Table 2 Distribution of the participants according to their physical and medical characteristics

Physical and medical characteristics		Frequency	%
Initial diagnosis	Tetraplegia	27	30
	Paraplegia	63	70
Causes of injury	Traumatic	84	93.3
	Non-traumatic	6	6.7
Pressure sore	Yes	5	5.6
	No	85	94.4
Duration of wheelchair use	Less than 1 year	18	20
	1-9 years	41	45.6
	10-19 years	27	30
	20 years above	4	4.4

Among the participant 88.9% was male, 62% was married. This table demonstrated that 51.1% participant was secondary school, whereas 15.6% PSC, 14.4% illiterate, 10% HSC, 4.4% were B.sc and M.sc. The study participants in

different Occupation 39% were small business, 23% were service holder, 7% student, 3% house wife and 28% were unemployed.

Table II, showed that among the participants 70% were paraplegia and 30% tetraplegia. Most of the participant’s causes of injury was traumatic and had no pressure sore. 45.6% participant’s wheelchair user uses the wheelchair from 1 to 9 years.

Among the participants the median (interquartile range) values of WST-Q Capacity, WST-Q Confidence and WST-Q Performance were 74.26% (57.02%-78.78%), 75.75% (66.66%-80.01%), and 72.00% (54.54%-76.47%). The mean value of the WST-Q capacity 63.34%, WST-Q confidence 65.89% and WST-Q performance 60.47% .The standard deviation (SD) of WST-Q Capacity, WST-Q Confidence and WST-Q Performance were 26.03%, 25.43%, and 24.98%. The minimum value of WST-Q capacity, confidence and performance were 0%. On the other hand the maximum value of WST-Q capacity, confidence and performance were 100%, 100% and 92.82%. (Table-III)

Table 3 Total WST-Q Capacity, Confidence and Performance

Measure	WST-Q Capacity	WST-Q Confidence	WST-Q Performance
Range of possible value	0%-100%	0%-100%	0%-100%
N	90	90	90
Minimum value	0%	0%	0%
Maximum value	100%	100%	92.82%
Mean	63.34%	65.89%	60.47%
SD	26.03%	25.43%	24.98%
Median	74.26%	75.75%	72.00%
IQR	(57.02-78.78) %	(66.66-80.01)%	(54.54-76.47) %

In this study table IV showed that there had no significant association between sex and wheelchair capacity, confidence, and performance on the other hand this study found the significant association between type of injury and wheelchair capacity, confidence and performance. See table-IV

Table 4 The association of WST-Q Capacity, Confidence and Performance among the sex and level of injury

Parameter	WST-Q capacity	P	WST-Q confidence	P	WST-Q Performance	P
Sex						
Male	75%(55.92-78.78) %	< .537	75.75%(66.66-81.81)%	< .315	72.00%(52.21-76.47) %	<.939
Female	71.65%(64.33-72.27) %		72.72%(64.70-78.78)%		71.65%(64.50-76.48) %	
Type of injury						
Tetraplegia	25.75%(8.82-55.88) %	<.000	29.41%(8.82-55.88)%	<.000	26.51% (15.15-55.30) %	<.000
Paraplegia	76.47%(72.05-80.30) %		76.47%(72.05-80.30)%		75% (70.45-78.30) %	

The researcher found that there was no significant association between demographic factor (age, causes of injury, pressure sore, and duration of a wheelchair use) and wheelchair skills capacity, confidence, performance. (See the table-V)

Table 5 The association between demographic factor (age, causes of injury, pressure sore, duration of a wheelchair use) and wheelchair skills capacity, confidence, performance

		Capacity %(n)	χ^2	<i>p</i>	Confidence %(n)	χ^2	<i>P</i>	Performance %(n)	χ^2	<i>p</i>
Age	15-25 years	24.4(22)	211.63	0.114	24.4(22)	211.63	0.164	24.4(22)	211.63	0.232
	26-35 years	37.8(34)			37.8(34)			37.8(34)		
	36-45 years	20(18)			20(18)			20(18)		
	46-55 years	11.1(10)			11.1(10)			11.1(10)		
	56-65 years	6.7(6)			6.7(6)			6.7(6)		
Cause of injury	Traumatic	93.3(84)	40.06	0.753	93.3(84)	19.98	0.973	93.3(84)	48.29	0.658
	Non-traumatic	6.7(6)			6.7(6)			6.7(6)		
Pressure sore	Yes	5.6(5)	47.75	0.442	5.6(5)	42.19	0.158	5.6(5)	51.88	0.518
	No	94.4(85)			94.4(85)			94.4(85)		
Duration of wheelchair use	Less than one year	20(18)	135.99	0.603	20(18)	107.73	0.330	20(18)	181.94	0.103
	1-9 years	45.6(41)			45.6(41)			45.6(41)		
	10-19 years	30(27)			30(27)			30(27)		
	20 years above	4.4(4)			4.4(4)			4.4(4)		

The total WST-Q capacity scores correlated significantly with the total WST-Q confidence scores ($r=.95$; $P<.00$). (See the figure-I)

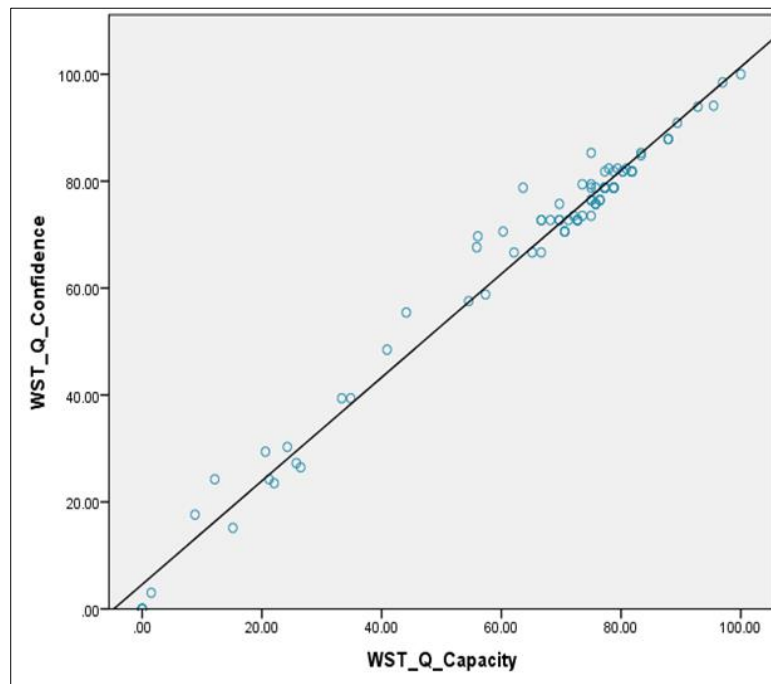


Figure 1 Correlation between the total WST-Q Capacity and WST-Q Confidence

The total WST-Q capacity scores correlated significantly with the total WST-Q performance scores ($r=.88$; $P<.00$). (See the figure-II)

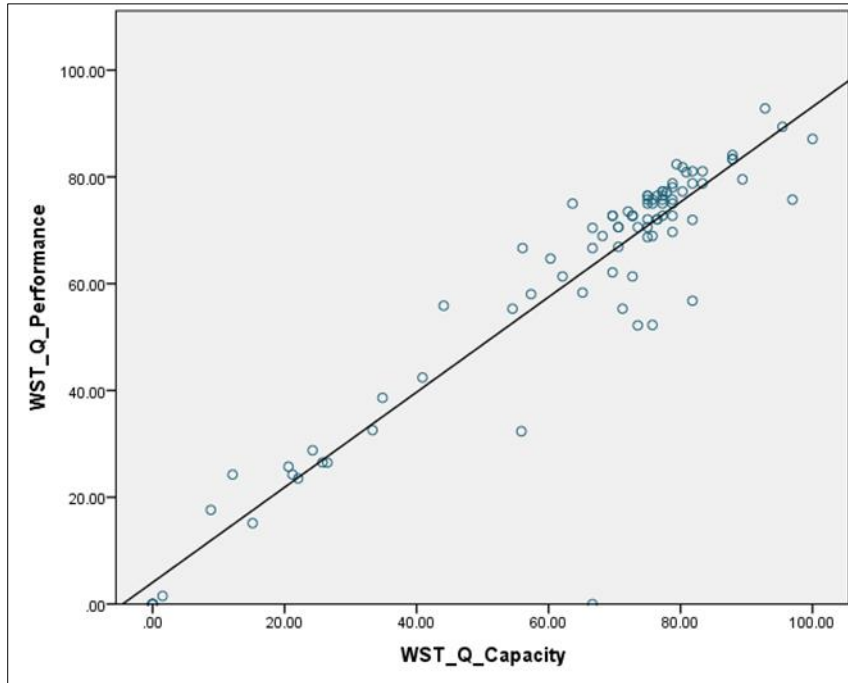


Figure 2 Correlation between the total WST-Q Capacity and WST-Q Performance

Table-VI showed that most of the participants advance level wheelchair skills capacity and confidence was not good in the community whereas they had good wheelchair capacity and confidence in basic level. (See the table-VI)

Table 6 Individual wheelchair skills capacity and performance in the community

Individual Skill	WST-Q Capacity and Confidence n (%)	
	Yes	No
Rolls forwards short distance	84(93)	6(7)
Rolls backwards short distance	85(94)	5(6)
Turns in place	84(93)	6(7)
Turns while moving forwards	84(93)	6(7)
Turns while moving backwards	84(93)	6(7)
Maneuvers sideways	83(92)	7(8)
Reaches high object	78(87)	12(13)
Picks object from floor	71(79)	19(21)
Relieves weight from buttocks	72(80)	18(20)
Operates body positioning options	81(90)	9(10)
Level transfer	69(77)	21(23)
Folds and unfolds wheelchair	11(33)	79(67)
Gets through hinged door	71(79)	19(21)
Rolls longer distance	76(84)	14(16)
Avoids moving obstacles	76(84)	14(16)
Ascends slight incline	74(82)	16(18)

Descends slight incline	74(82)	16(18)
Ascends steep incline	72(80)	18(20)
Descends steep incline	72(80)	18(20)
Rolls across side-slope	70(78)	20(22)
Rolls on soft surface	73(81)	17(19)
Gets over threshold	68(76)	22(24)
Gets over gap	68(76)	22(24)
Ascends low curb	67(74)	23(26)
Descends low curb	67(74)	23(26)
Ascends high curb	44(49)	46(51)
Descends high curb	44(49)	46(51)
Performs stationary wheelie	8(9)	82(91)
Turns in place in wheelie position	6(7)	84(93)
Descends high curb in wheelie position	4(4)	86(96)
Descends steep incline in wheelie position	4(4)	86(96)
Gets from ground into wheelchair	23(26)	67(74)
Ascends stairs	4(4)	86(96)
Descends stairs	8(9)	82(91)

This table demonstrated that most of the participants perform basic level of wheelchair skills daily but advance level wheelchair skills never perform. (See the table-VII)

Table 7 WST-Q individual skill performance scores

Individual Skill	WST-Q Performance Score				
	0 (Never) n (%)	1 (Yearly) n (%)	2 (Monthly) n (%)	3 (Weekly) n (%)	4 (Daily) n (%)
Rolls forwards short distance	7(8)	0(0)	1(1)	1(1)	81(90)
Rolls backwards short distance	6(7)	0(0)	2(2)	1(1)	81(90)
Turns in place	7(8)	0(0)	1(1)	1(1)	81(90)
Turns while moving forwards	7(8)	0(0)	1(1)	1(1)	81(90)
Turns while moving backwards	7(8)	0(0)	1(1)	1(1)	81(90)
Maneuvers sideways	8(9)	0(0)	1(1)	1(1)	80(89)
Reaches high object	13(14)	0(0)	1(1)	6(7)	70(78)
Picks object from floor	21(23)	0(0)	2(2)	4(5)	63(70)
Relieves weight from buttocks	9(10)	0(0)	1(1)	1(1)	79(88)
Operates body positioning options	10(11)	0(0)	1(1)	1(1)	78(87)
Level transfer	23(26)	0(0)	1(1)	1(1)	65(72)
Folds and unfolds wheelchair	25(28)	1(1)	3(3)	0(0)	4(5)

Gets through hinged door	23(25)	0(0)	2(2)	6(7)	59(66)
Rolls longer distance	16(18)	0(0)	3(3)	9(10)	62(69)
Avoids moving obstacles	16(18)	0(0)	3(3)	6(7)	65(72)
Ascends slight incline	17(19)	0(0)	2(2)	1(1)	70(78)
Descends slight incline	17(19)	0(0)	2(2)	1(1)	70(78)
Ascends steep incline	20(22)	0(0)	4(5)	3(3)	63(70)
Descends steep incline	20(22)	0(0)	4(5)	3(3)	63(70)
Rolls across side-slope	21(23)	0(0)	4(5)	6(7)	59(66)
Rolls on soft surface	18(20)	0(0)	5(6)	5(5)	62(69)
Gets over threshold	34(38)	2(2)	1(1)	2(2)	51(57)
Gets over gap	25(28)	0(0)	4(4)	9(10)	52(58)
Ascends low curb	26(29)	0(0)	4(4)	6(7)	54(60)
Descends low curb	26(29)	0(0)	4(4)	6(7)	54(60)
Ascends high curb	52(58)	2(2)	4(4)	10(11)	22(25)
Descends high curb	52(58)	2(2)	4(4)	10(11)	22(25)
Performs stationary wheelie	82(91)	2(2)	3(4)	0(0)	3(3)
Turns in place in wheelie position	85(95)	1(1)	1(1)	0(0)	3(3)
Descends high curb in wheelie position	88(98)	0(0)	1(1)	0(0)	1(1)
Descends steep incline in wheelie position	88(98)	1(1)	0(0)	0(0)	1(1)
Gets from ground into wheelchair	72(80)	3(3)	3(3)	5(6)	7(8)
Ascends stairs	87(97)	0(0)	2(2)	0(0)	1(1)
Descends stairs	85(95)	2(2)	2(2)	0(0)	1(1)

4. Discussion

The aim of this study was to determine the wheelchair skills capacity, confidence and performance of manual wheelchair users with SCI in the community. Although it was realized that the sample size was small; this study provides information about wheelchair skills capacity, confidence, and performance of manual wheelchair users with SCI in our country. Total 90 patients were taken in this study period. The study population consisted of 80 (88.9%) males and 10 (11.1%) females. Here show that most of the participants were males. Their age ranged from 15 to 65 years with a mean age of the patients was 35 years. The minimum and maximum ages among the participants were 16 years and 65 years. The majority of the patients were aged between 26-35 years. Most of the participants were young age. In this study most of the participants were married (62%), secondary school level (51.1%), paraplegia (70%), and traumatic (93.3%). Kirby et al.² found that most of the wheelchair users with SCI patients were men (85.5%), unmarried (58.1%), paraplegia (76.9%). Another study Islam¹¹ was found that participants were married (65.4%), traumatic (93%). Lemayet al.¹⁵ most of wheelchair users education level was high school (37.0%). In this study found that (39%) participants occupation was small business on the contrary (28%) was unemployed.

This study shows that the median value of WST-Q capacity 74.26%, WST-Q confidence 75.75% and WST-Q performance 72.00%. There have some different finding of median total value for WST-Q capacity, performance and confidence were 88%, 76% and 88.5% was finding by the Kirby et al in American manual wheelchair users with SCI.² Inkpen identify the total median value of the 76.6% WST-Q capacity and 60.9% WST-Q performance.¹⁶ Rushton found out the median confidence value among the manual wheelchair user was 84.6 %.¹⁷

The result found that in this study level of injury as paraplegia the median total WST-Q capacity, WST-Q confidence and WST-Q performance scores were 76.47%, 76.47% and 75%. The tetraplegia median total WST-Q capacity, WST-Q

confidence and WST-Q performance scores were 25.75%, 29.41%, and 26.51%. The male total median WST-Q capacity 75%, WST-Q confidence 75.75%, WST-Q performance 72.00% and the female total median WST-Q capacity 71.65%, WST-Q confidence 72.72%, and WST-Q performance 71.65%. Kibly et al.² found that paraplegia median total WST-Q capacity 91.0%, WST-Q performance 79.0% and tetraplegia median total WST-Q capacity 76.0%, WST-Q performance 68.0%. The male total WST-Q capacity 88.5%, WST-Q performance 79.0% and the female total median WST-Q capacity 76.0%, WST-Q performance 68.0%. Another study Rushton was identified the median value of wheelchair skills confidence were paraplegia 87.2% and tetraplegia 86.5%. The median value of wheelchair skills confidence was male 85.6% and female 80.7%.¹⁷

Kibly et al.² also found that the level of injury and sex was associated with the total WST-Q capacity, and WST-Q performance scores. Participants with paraplegia scored significantly higher than those tetraplegia ($P<.001$, and $P<.001$). Sex was associated with the total WST-Q capacity, and WST-Q performance scores; with female having lower scores than male ($P<.001$, and $P<.001$).¹⁸ Rushton also found that statistically significant difference was not found between the sexes ($P< 0.140$).¹⁷ In this study investigator found that the significant difference of wheelchair skills capacity, confidence, performance between the tetraplegia and paraplegia ($P<.000$, $P<.001$, and $P<.001$). But the investigator not found the significant difference of wheelchair skills capacity, confidence, performance between the male and female ($P<.537$, $P<.315$, $P<.939$).

In this study researcher not found the strong association of the wheelchair skills capacity, confidence, performance between ages, causes of injury, pressure sore. Researcher also found out in this study there have no strong association of the wheelchair skills capacity, confidence and performance between the duration of wheelchair use. Only one study Rushton found that statistically significant difference was not found the wheelchair skill confidence between ages.¹⁷ Researcher found in this study significantly correlation between the total scores WST-Q capacity and WST-Q confidence ($r=.95$; $P<.000$). Researcher also found that in this study significantly correlation between the total scores WST-Q capacity and WST-Q performance ($r=.88$; $P<.00$). Kirby et al.² reported that total WST-Q capacity scores significantly correlated with the total WST-Q performance scores were ($r=.63$; $P<.001$). Kirby et al. also found that total WST-Q capacity scores significantly correlated with the total WST-Q confidence were ($r=.610$; $P<.01$)

Hosseini et al.¹⁸ identified the individual skills for WST-Q capacity success rate was $> 75\%$. In this study researcher found that 12 individual skills were low success for WST-Q capacity out of 34 skills. Kirby et al.² reported that 6 individual skills was low success for WST-Q capacity. Inkpen said that wheelchair users may not perform skills that they are capable of for various reasons including low confidence, lack of opportunity, or infrequent need.¹⁶

5. Conclusion

The debilitating consequence of a SCI often leads to impairment in the ability to engage in everyday activities and limit mobility function and participation. So, most of the SCI people use the manual wheelchairs for their participation and community mobility. They face many problems to participate in community with wheelchair. However full community participation by the manual wheelchair they needed to advance level of wheelchair skills. From this study researcher got so many information about the wheelchair skills capacity, confidence and performance level of the manual wheelchair users with SCI in the community. This study shows that people with SCI are unable to perform some of the advance level wheelchair skills that would allow participating more meaningful in the community. More advance level of wheelchair skills training enhances participation and quality of life with SCI patients. This study is helpful for the manual wheelchair users with SCI people and health professional

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

There is no conflict of interest.

Statement of ethical approval

This research study was approved by the Institutional Review Board of Bangladesh Health Professions Institute (BHPI)

Statement of informed consent

Informed consent was obtained from all participants using a detailed information sheet and consent form.

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