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Title Reasons for Cessation of Clean Intermittent Catheterization After Spinal Cord Injury: Results from the Neurogenic Bladder Research Group Spinal Cord Injury Registry

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Keywords: Urinary Bladder, Neurogenic; spinal cord injuries; urinary incontinence; Patient Reported Outcome Measures; Intermittent Urethral Catheterization; Catheters, Indwelling; quality of life.

Abstract:

Introduction: Clean intermittent catheterization (CIC) is recommended for bladder management after spinal cord injury (SCI) since it has the lowest complication rate.

However, transitions from CIC to other less optimal strategies such as indwelling catheters (IDC) are common. In individuals with SCI who stopped CIC, we sought to determine how individual characteristics affect bladder-related QoL and the reasons for CIC cessation.

Methods: The NBRG registry is an observational study, evaluating neurogenic bladder (NGB) related quality of life (QoL) after SCI. From 1479 participants, those using IDC or urinary conduit were asked if they had ever performed CIC, how long, and why they stopped CIC. Multivariable regression, among participants discontinuing CIC, established associations between demographics, injury characteristics, and SCI complications with bladder-related QoL.

Results: There were 176 participants who had discontinued CIC; 66(38%) were paraplegic, 110(63%) were male. The most common reasons for CIC cessation among all

participants were inconvenience, urinary leakage, and too many urine infections.

Paraplegic participants who discontinued CIC had a higher mean age, better fine motor scores and lower educational attainment and employment. Multivariable regression revealed years since SCI was associated with worse bladder symptoms (NBSS), ≥ 4 UTIs in a year was associated with worse satisfaction and feelings about bladder symptoms (SCI-QoL Difficulties), while tetraplegia was associated better satisfaction and feelings about bladder symptoms (SCI-QoL Difficulties).

Conclusions: Tetraplegics who have discontinued CIC have an improved QoL compared to paraplegics. SCI individuals who have discontinued CIC and have recurrent UTIs have worse QoL.

Introduction:

After spinal cord injury (SCI), most individuals develop neurogenic lower urinary tract dysfunction, which in the majority of cases requires assisted bladder emptying rather than volitional voiding. For most individuals with SCI, this assisted bladder emptying includes catheter based management such as an indwelling catheter (IDC) or clean intermittent catheterization (CIC). Indwelling catheters, either a suprapubic tube (SPT) or Foley catheter, are associated with more urologic and non-urologic complications, including: urinary tract infection (UTI), bladder and kidney stones, renal insufficiency, hydronephrosis, increased risk of bladder cancer, pressure ulcers, and all cause hospitalizations(1-4). Therefore, most clinicians and guidelines recommend CIC as the preferred bladder management strategy in individuals with SCI who require catheter based management(5-7). However, despite the increased risk of complications associated

with indwelling catheters, up to 70% of individuals with SCI who use CIC after their injury, transition to IDCs over time (8).

The common reasons for management transitions from CIC to IDC has not been thoroughly investigated. Factors such as age, female gender, obesity, and upper extremity motor impairment are known to affect ability to perform CIC (8-10). Clinical complications such as persistent urinary leakage, urethral erosion/stricture, perceived increased UTI risk, and autonomic dysreflexia have also been cited as reasons for management transitions(11). Recently, inconvenience with the frequency and time required to catheterize and dislike of the treatment modality have been associated with treatment transitions(12, 13). However, other than these small studies, there is very little that is known about patient-reported factors associated with dissatisfaction with CIC and the quality of life (QoL) among individuals that have discontinued CIC. Crescenze et al showed that female gender, earlier injury, recurrent UTIs, and severe bowel dysfunction was associated with dissatisfaction and worse QoL among SCI individuals currently performing CIC (14). There are no similar studies regarding factors associated with dissatisfaction among SCI individuals who have discontinued CIC.

We examined the Neurogenic Bladder Research Group (NBRG) prospective registry of SCI participants to better understand factors associated with discontinuation and dissatisfaction with CIC. We hypothesize that individuals with SCI who have discontinued SCI with recurrent UTIs, severe bowel dysfunction, and chronic pain have worse QoL. Additionally, tetraplegic individuals who have discontinued CIC are likely to have an improved QoL compared to paraplegics who have discontinued CIC.

Methods:

The Neurogenic Bladder Research Group (NBRG) registry is a prospective, observational study examining neurogenic bladder (NGB)-related quality of life among individuals after SCI. The study was conducted at the Universities of Michigan, Minnesota, and Utah and participants were recruited throughout the United States and Canada. Participants were allowed to enroll in the study through a telephone interview and by answering electronic questionnaires. The study protocol and methods have been previously published (15). Eligible participants included those with an acquired SCI who had discontinued CIC, and were also ≥ 18 years of age and English-speaking. Individuals with progressive neurologic disorders (i.e. Multiple Sclerosis) and congenital spinal cord malformations or neurologic injury (i.e. cerebral palsy, myelomeningocele, etc.) were excluded.

Our analysis cohort consisted of subjects who had discontinued CIC. Participants were asked about their current and past bladder management strategies during enrollment. Participants that reported IDC (suprapubic tube or Foley catheter) or urinary conduit (ileal or colon conduit) as their primary bladder management were asked if they had ever performed CIC. If the participants indicated they had done CIC in the past, they were asked about the timing of CIC cessation, categorized as duration of CIC for <1, 1-12, >12 months. We gathered information about the participants from their enrollment interview including: (1) *demographics and comorbidities*: age, gender, education (bachelor's degree or higher), employment (employed for wages including self-employed), Charlson Comorbidity Index (16), (2) *injury specifics*: time from injury, injury level (either tetraplegic [cervical level 1-8] or paraplegic [thoracic, sacral, cauda equina]), fine motor

function, and (3) *SCI complications*: number of UTIs in the last year (self-reported rate as 0,1-3, ≥ 4), hospitalization for UTI in the last year, chronic pain (“do you experience chronic pain?”), as well as severe bowel dysfunction (Neurogenic Bowel Dysfunction Score >14). The Neurogenic Bowel Dysfunction Score is a validated self-reported measure of bowel dysfunction (17).

Self-reported reasons for CIC discontinuation were gathered during enrollment interview. Participants were asked to select from a list of reasons for CIC discontinuation and multiple responses could be selected (**Table 3**). Participants were not asked to rank the reasons for CIC discontinuation. We stratified this data by duration of CIC prior to cessation, gender, and level of injury.

Outcome Measures:

Fine motor function was measured using the Spinal Cord Injury Quality of Life Measurement System (SCI-QoL) Fine Motor Functioning subdomain that has been validated in individuals with SCI (18, 19). This item bank has a calibrated mean score of 50 with score ranges between 0 to 100. A lower score conveys worse fine motor function. Symptoms and quality of life were assessed using the Neurogenic Bladder Symptom Score (NBSS) and the SCI-QoL Bladder Management Difficulties item bank(18, 20). The NBSS focuses on bladder related symptoms and complications with a score range between 0-74, with lower scores indicating fewer symptoms(20). The NBSS also assesses satisfaction with the urinary system with a single question: “If you had to live the rest of your life with the way your bladder (or urinary reservoir) currently works, how would you feel?” (range: 0-4)(20). The SCI-QoL difficulties item bank assesses feelings about bladder function and urinary incontinence(18). This item bank has a calibrated mean

score of 50 with score ranges between 0 to 100. A lower score indicates less bladder difficulties.

Statistical Methods:

Descriptive statistics of subjects who discontinued CIC were stratified by injury level (paraplegic and tetraplegic) including: means, standard deviations (SDs), medians, and interquartile ranges (IQRs) for the continuous variables and counts and column percentages for the categorical and ordinal variables were calculated. Comparisons with injury level for continuous variables were made using t-tests for the normally distributed variables and the Wilcoxon signed rank test for the non-normally distributed variables and categorical variables using chi-squared tests. Among the full cohort of SCI individuals who discontinued CIC, univariable and multivariable linear regression models were created using a pre-specified list of covariates that we hypothesized *a priori*. These models were used to determine whether the QoL outcome measures (NBSS total, NBSS satisfaction, and SCI QOL bladder management difficulties) were significantly associated with demographic, injury characteristics, or injury related complications among SCI individuals who discontinued SCI. Multivariable regression models were adjusted for duration of CIC, level of injury, age, sex, years since SCI, education, employment, severe bowel dysfunction, chronic pain, number of patient-perceived UTIs, and hospitalization for UTIs. Coefficients, 99.6% confidence intervals (CIs) and p-values were reported from the models. We adjusted the p-values and 95% CIs within each model for multiple comparisons using the Bonferroni correction. Statistical analyses were conducted using SAS software, version 9.4, SAS Institute Inc., Cary, NC.

Results:

There were 1479 participants who enrolled in the study. Of these participants, 309 (20.8%) identified their primary management as an indwelling catheter or a urinary conduit. In these participants, 176 (56.9%) had used CIC in the past and discontinued this management for SPT (113, 64%), Foley catheter (52, 29.5%), or urinary conduit (12, 6.8%). Baseline characteristics of these participants are shown in **Table 1** stratified by level of injury. In the unadjusted comparison between paraplegic and tetraplegic individuals who had discontinued CIC, paraplegic participants who had discontinued CIC had an older mean age and a larger proportion had a Charlson Comorbidity Index >1 compared to tetraplegic participants. A significantly lower proportion of paraplegic participants reported a bachelor's degree or higher or employment compared to tetraplegic participants. Paraplegic participants had higher (better) fine motor scores compared to tetraplegic participants. Paraplegic participants also performed CIC a longer duration prior to cessation.

A higher proportion of paraplegic participants who discontinued CIC reported chronic pain. Overall, 16% of the cohort reported hospitalization for a UTI in the last year. There was no difference in the number of patient-perceived UTI's and hospitalization for UTI when stratified by injury level.

The mean NBSS total score, NBSS satisfaction score, and SCI-QoL Difficulties scores were improved in tetraplegic participants who discontinued CIC compared to paraplegic participants (**Table 1**).

The reasons for CIC cessation among the 176 participants in our cohort are shown in **Table 2**. Among the entire cohort, convenience (36%), urinary leakage (20%), and number of urinary infections (19%) were the most common reasons for CIC cessation. The most common reasons were similar when stratified by gender. When responses were stratified by injury level, tetraplegic participants reported “I did not want to be dependent on others” as the second most common reason for CIC cessation compared to none of the paraplegic respondents. In participants who had discontinued CIC within 1 month of initiation, poor hand function and body positioning were more common reasons compared to longer duration of CIC prior to discontinuation.

Multivariate linear regression models examining the associations between demographics & comorbidities, injury characteristics, and SCI complications on the mean NBSS total score, NBSS satisfaction score, and SCI-QoL Difficulties scores are shown in **Table 3**. Among SCI participants who had discontinued CIC, years from SCI was associated with worse NBSS total scores. Additionally, participants who discontinued CIC who reported ≥ 4 patient-perceived UTI within the last year, had significantly worse NBSS total scores and SCI-QoL Difficulties scores. Tetraplegic participants had improved NBSS Satisfaction and SCI-QoL Difficulties scores.

Discussion:

Catheter based management is common after SCI. However, despite the established higher clinical complications associated with certain strategies such as IDC, there is little that is known about the characteristics of individuals with SCI who transition to IDC or urinary conduit from CIC or the reasons they make this decision. We examined the NBRG prospective registry to better understand reasons for CIC discontinuation and

factors associated with dissatisfaction among those SCI participants who have discontinued CIC. The top three self-reported reasons for CIC cessation for the entire cohort were inconvenience, urinary leakage, and too many urine infections. We found that despite lower fine motor scores among tetraplegic participants that discontinued CIC, these participants had improved bladder related QoL when compared to paraplegic participants who discontinued CIC. Participants who discontinued CIC and had recurrent UTIs (≥ 4 patient-perceived UTI within the last year) had worse bladder related QoL. Severe bowel dysfunction and chronic pain was not associated with changes in bladder-related QoL among SCI participants who discontinued CIC.

Prior studies evaluating the reasons for treatment transition among individuals with SCI have been limited in their number and scope. Afsar et al, explored reasons for discontinuation of CIC in retrospective review of recently injured individuals with SCI at a single institution (11). At discharge from rehabilitation, 104 (64%) individuals were performing CIC, while subsequent follow-up showed that only 60 (37.5%) of individuals continued CIC and 9 (21%) had transitioned from CIC to indwelling catheter for bladder management. The authors reported recurrent UTI, urinary incontinence, urolithiasis, dependence of caregivers, and urethral strictures as reasons for discontinuation of CIC. Age, gender, education and level of injury were not associated with compliance with CIC. In another study, 248 members of the Norwegian Spinal Cord Injuries Association were surveyed, and the leading reasons given for bladder management other than CIC included: “it suits me best” (24%) and “it gives me flexibility with more options” (21%)(21). When stratified by injury level (paraplegic vs. tetraplegic), the authors found a significant difference in responses, with tetraplegic individuals reporting “it gives me flexibility with more options,” “it doesn’t constrain my daily activities,” “it’s less time

consuming,” and “it suits me best” more often than paraplegic participants. Responses were not mutually exclusive and were not stratified by injury level.

More recently, Lane et al presented their survey results of 100 veterans with prior traumatic SCI at the Minneapolis Veterans Affairs Medical Center(12). The found that 22 of the 46 participants (48%) using IDC, had prior history of CIC which had been discontinued. The authors found that the most common reasons for transition from CIC was inconvenience (n=5), clinician recommendation (n=5), and dislike of CIC (n=4). Clinician recommendation was an unexpected reason for treatment transition given the well-established goals in SCI care of maintaining CIC when possible and may suggest knowledge gaps about the higher complications associated with IDCs.

Zlatev et al previously demonstrated that impairment in upper extremity motor function is an important predictor of long-term CIC adoption(10). For patients that performed CIC for shorter durations prior to discontinuation, patient reported reasons of “I could not catheterize because of poor hand function” and “I could not catheterize because positioning my body was too difficult” are reflective. However, overall the most common reasons for CIC discontinuation included inconvenience, urinary incontinence, and recurrent urinary infection. This suggests poor participant understanding of clinical complications associated with various bladder management strategies, as it is well known that IDC have the highest relative rate of urinary complications including recurrent urinary infection (1, 22). These self-reported reasons from a large cohort of SCI participants who discontinued CIC may be helpful in designing interventions to improve long-term CIC adoption.

Interestingly, we also found that tetraplegic participants who discontinued CIC had lower (improved) NBSS satisfaction and SCI-QoL Difficulties scores compared to paraplegic participants, although this association was relatively small. Myers et al show similar findings in another analyses performed using this registry(23). The authors found that both tetraplegic and paraplegic participants using IDC as primary bladder management strategy had lower (improved) NBSS total scores. However, tetraplegic participants reporting IDC as primary bladder management strategy had significantly lower (improved) SCI-QoL Difficulties scores. This association was not significant among paraplegic participants using IDC. Overall QoL among tetraplegic participants using CIC as the primary bladder management strategy is likely related to improvement in urinary concerns (24). In a study of SCI participants performing CIC alone, CIC with botulinum toxin, and CIC with augmentation cystoplasty, tetraplegia had lower (improved) NBSS total and SCI-QoL Difficulties (25). Conversely, there was no association between level of injury and fine motor hand function on dissatisfaction among participants reporting CIC as bladder management strategy, when patients who underwent any procedure to improve urinary-related QoL were excluded (14).

There are several notable limitations to this study. One limitation is that this study uses participant reported data based on their perception of their health, which not been corroborated with clinical data or chart review such as information regarding urinary infections. Also, we also did not ask participants to rank the most important reasons for discontinuation of CIC, which limits our analysis. We chose to stratify our findings based on injury level (paraplegia vs. tetraplegia) in the multivariable analysis as a proxy for upper extremity motor function rather than use fine motor scores as we felt there would be too much collinearity. Inclusion bias is also a common limitation of survey studies;

those participants with bladder problems are more likely to enter the study in hopes of learning more about their bladder. Lastly, there is potential for recall errors for specific reported variables such as duration of CIC prior to discontinuation, which may impact our findings.

However, this study is strengthened by a large, diverse study population and extensive yet robust data about demographics, injury characteristics, SCI complications, and patient-reported outcomes. Understanding how these characteristics influence QoL in individuals who transition their bladder management from CIC as well as the reasons that individuals decide to transition their management is paramount to developing shared decision making tools in order to individualize the optimal bladder management strategy for SCI. Decision aids may avoid management transitions to less optimal bladder strategies by educating, addressing individuals concerns and potential QoL issues with transitioning management. Discrepancies exist between clinical and patient reported outcomes for bladder management among individuals with SCI; however, a careful balance between avoiding complications and the best bladder-related QoL is essential.

Conclusions:

In this analysis of the NBRG prospective registry, we found that the most common self-reported reasons for CIC cessation among individuals with SCI was inconvenience, urinary leakage, and too many urine infections. Participants with tetraplegia who had discontinued CIC, had greater satisfaction with their urinary system and less impact of bladder symptoms in their QoL compared to participants with paraplegia. Participants who discontinued CIC and had recurrent UTIs (≥ 4 patient-perceived UTI within the last year) had worse bladder related QoL. An individualized approach aimed at balancing

clinical complications with quality of life concerns is needed when exploring treatment transitions for SCI bladder management.

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Table 1: Characteristics of spinal cord injury participants who discontinued clean intermittent catheterization.

Variable	Total (n=176)	Paraplegia (n=66, 38%)	Tetraplegia (n=110, 62%)	P value*
Demographics				
Sex, male, n (%)	110 (63%)	39 (59%)	71 (65%)	0.47
Age in years, mean (SD)	45.3 (12.8)	48.2 (13.8)	43.6 (11.9)	0.02
Education, bachelor's degree or higher, n (%)	57 (32%)	10 (15%)	47 (43%)	<0.001
Employment, n (%) ω	41 (23%)	9 (14%)	32 (29%)	0.02

Charlson Comorbidity Index, >1, n (%)	81 (46%)	38 (58%)	43 (39%)	0.02
Duration of CIC prior to cessation, n (%):				
<1 month	20 (11.4%)	6 (9.1%)	14 (12.7%)	0.01
1-12 months	54 (30.7%)	12 (18.2%)	42 (38.2%)	
>12 months	102 (58.0%)	48 (72.7%)	54 (49.1%)	
Injury Characteristics:				
Years since SCI, median (IQR)	15.2 (7.1, 23.7)	16.9 (7.2, 28.4)	14.9 (6.5, 23.0)	0.40
Fine motor T score, mean (SD)	47.3 (9.0)	55.8 (4.9)	42.2 (6.7)	<0.001
Current Bladder Management:				
Indwelling Catheter , n (%):				
SPT	113 (64.2%)	38 (57.6%)	75 (68.2%)	0.36
Foley	52 (29.5%)	23 (34.8%)	29 (26.4%)	
Urinary Conduit	12 (6.8%)	5 (7.6%)	7 (6.4%)	0.76
Injury Related Complications:				
Number of UTIs, n (%)				

0	37 (21%)	17 (26%)	20 (18%)	0.30
1-3	79 (45%)	25 (38%)	54 (50%)	
≥4	60 (34%)	24 (36%)	36 (32%)	
Hospitalization for UTI, yes	29 (16%)	9 (14%)	20 (18%)	0.40
Severe bowel dysfunction, n (%) γ	88 (58%)	26 (51%)	62 (62%)	0.19
Chronic pain, yes, n (%) δ	118 (67%)	51 (77%)	67 (61%)	0.03
Bladder Related QoL Outcomes:				
NBSS – mean (SD)	18.7 (10.1)	21.8 (11.7)	16.8 (8.6)	0.001
Median (IQR)	17.0 (11,25)	20.5 (15,28)	15.0 (10,23)	
NBSS Satisfaction ϕ – Mean (SD)	2.0 (1.3)	2.3 (1.3)	1.8 (1.3)	0.01
	Median (IQR)	2.0 (1.0, 3.0)	2.0 (1.0, 4.0)	2.0 (1.0, 2.0)
SCI-QoL Difficulties T Score – mean (SD)	57.0 (8.1)	59.8 (8.7)	55.3 (7.2)	<0.001
	Median (IQR)	57.5 (52.6, 61.6)	59.5 (57.5, 64.8)	57.0 (50.9, 59.9)

*Analysis of variance (ANOVA) or Chi square test as appropriate.

ω employment – making wages (including self-employment),

δ chronic pain – participants asked “do you experience chronic pain?”,

γ severe bowel dysfunction – Neurogenic Bowel Dysfunction Score ≥ 14 .

φ NBSS Satisfaction is the final question of the NBSS “If you had to live your life with the way your bladder (or urinary reservoir) currently works, how would you feel?”

Abbreviations: CIC (clean intermittent catheterization), IDC (indwelling catheter), UTI (urinary tract infection), NBSS (Neurogenic Bladder Symptom Score), SCI-QoL – (Spinal cord injury measurement system), SCI-QoL Difficulties – Bladder Management Difficulties item bank.

Missing values: SCI-FI Fine motor T score = 2, Severe bowel dysfunction = 25, Hospitalization for UTI = 1, SCI QOL Bladder Management Difficulties T score = 2.

Table 2: Self-report reasons for CIC cessation stratified by sex, level of injury, duration of CIC*.

Reason for CIC cessation	Total	Gender		Level of Injury		Duration of CIC		
		Female (n=66)	Male (n=110)	Paraplegic (n=66)	Tetraplegic (n=110)	<1 month (n=20)	1-12 months (n=54)	>12 months (n=102)
It was too inconvenient	64 (36%)	27 (41%)	37 (34%)	20 (30%)	44 (40%)	2 (10%)	28 (52%)	34 (33%)
I was leaking urine	35 (20%)	14 (21%)	21 (19%)	23 (35%)	12 (11%)	3 (15%)	6 (11%)	26 (26%)
I had too many infections	34 (19%)	9 (14%)	25 (23%)	15 (23%)	19 (17%)	1 (5%)	7 (13%)	26 (26%)
I did not want to be dependent on others	22 (13%)	8 (12%)	14 (13%)	0 (0%)	22 (20%)	1 (5%)	14 (26%)	7 (7%)
I had problems with passing a urethral catheter from obstruction	18 (10%)	2 (3%)	16 (15%)	8 (12%)	10 (9%)	2 (10%)	3 (6%)	13 (13%)
I could not catheterize	16 (9%)	3 (5%)	13	2 (3%)	14 (13%)	5	6 (11%)	5 (5%)

because of poor hand function			(12%)			(25%)		
Other Complications	11 (6%)	3 (5%)	8 (7%)	6 (9%)	5 (5%)	0 (0%)	1 (2%)	10 (10%)
I could not catheterize because positioning my body was too difficult	9 (5%)	7 (11%)	2 (2%)	7 (11%)	2 (2%)	4 (20%)	2 (4%)	3 (3%)
Bladder spasms	7 (4%)	4 (6%)	3 (3%)	2 (3%)	5 (5%)	2 (10%)	2 (4%)	3 (3%)
Pain with catheterization	6 (3%)	2 (3%)	4 (4%)	3 (5%)	3 (3%)	0 (0%)	3 (6%)	3 (3%)
Doctor told me to stop	5 (3%)	3 (5%)	2 (2%)	3 (5%)	2 (2%)	1 (5%)	1 (2%)	3 (3%)
Tried another therapy	4 (2%)	2 (3%)	2 (2%)	1 (2%)	3 (3%)	1 (5%)	0 (0%)	3 (3%)
I Don't remember	3 (2%)	1 (2%)	2 (2%)	2 (3%)	1 (1%)	1 (5%)	0 (0%)	2 (2%)
My kidneys were failing	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

*Bolded items, top three reasons for CIC cessation for each cohort.

Abbreviations: CIC – Clean intermittent catheterization

Table 3: Multivariate regression* of effects of demographics, injury characteristics, and injury related complications on NBSS total score, NBSS Satisfaction, and SCI-QoL Difficulties t score.

Variable	NBSS total Coefficients (99.6% CI)	P value (Bonferroni)	NBSS Satisfaction ϕ Coefficients (99.6% CI)	P value (Bonferroni)	SCI-QoL Difficulties Coefficients (99.6% CI)	P value (Bonferroni)
Demographics						
Sex, male	-1.6 (-6.1, 3.0)	1.00	-0.1 (-0.7, 0.5)	1.00	-1.1 (-4.8, 2.5)	1.00
Age in years	-1.4 (-3.4, 0.6)	0.46	-0.2 (-0.4, 0.1)	0.54	-0.6 (-2.2, 1.0)	1.00
Education, bachelor's degree or higher	-1.8 (-6.9, 3.2)	1.00	-0.2 (-0.8, 0.5)	1.00	-1.3 (-5.3, 2.7)	1.00
Employment ω	-2.1 (-7.6, 3.4)	1.00	0.2 (-0.5, 0.9)	1.00	-0.9 (-5.3, 3.5)	1.00
Duration of CIC prior to cessation:						
<1 month (reference)	-	-	-	-	-	-
1-12 months	4.2 (-3.7, 12.0)	1.00	0.3 (-0.7, 1.3)	1.00	0.6 (-5.6, 6.9)	1.00

>12 months	4.7 (-2.5, 12.0)	0.73	0.3 (-0.7, 1.2)	1.00	1.9 (-3.9, 7.7)	1.00
Injury characteristics						
Years since SCI	2.6 (0.3, 4.9)	0.01	-0.0 (-0.3, 0.3)	1.00	1.5 (-0.3, 3.3)	0.24
Injury Level						
Paraplegia (reference)	-	-	-	-	-	-
Tetraplegia	-4.7 (-9.8, 0.4)	0.09	-0.7 (-1.3, -0.0)	0.03	-4.3 (-8.4, -0.3)	0.03
Injury Related Complications						
Number of UTIs						
0 (reference)	-	-	-	-	-	-
1-3	4.3 (-1.6, 10.1)	0.45	0.5 (-0.2, 1.3)	0.55	4.0 (-0.7, 8.7)	0.19
≥4	7.6 (1.1, 14.1)	0.01	0.8 (-0.0, 1.6)	0.06	5.6 (0.4, 10.8)	0.02
Hospitalization for UTI, yes	-1.6 (-8.7, 5.4)	1.00	0.6 (-0.3, 1.5)	0.59	-1.7 (-7.4, 4.0)	1.00

Severe bowel dysfunction γ	1.9 (-2.9, 6.6) 1.00	0.0 (-0.6, 0.6) 1.00	1.5 (-2.3, 5.3) 1.00
Chronic pain, yes δ	0.4 (-4.4, 5.2) 1.00	0.1 (-0.5, 0.8) 1.00	-0.9 (-4.7, 2.9) 1.00

*adjusting for duration of CIC, level of injury, age, sex, years since SCI, education, employment, severe bowel dysfunction, chronic pain, number of UTIs, and hospitalization for UTIs

ω employment – making wages (including self-employment),

γ severe bowel dysfunction – Neurogenic Bowel Dysfunction Score ≥ 14 .

δ chronic pain – participants asked “do you experience chronic pain?”

ϕ NBSS Satisfaction is the final question of the NBSS “If you had to live your life with the way your bladder (or urinary reservoir) currently works, how would you feel?”

Abbreviations: NBSS (Neurogenic Bladder Symptom Score), SCI-QoL – (Spinal cord injury measurement system), SCI-QoL Difficulties – Bladder Management Difficulties item bank, CIC (Clean intermittent catheterization), SCI (spinal cord injury), UTI (urinary tract infection).