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ORIGINAL ARTICLE

Prevalence of cigarette smoking and attempts to quit in a population-based cohort with spinal cord injury

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Objective: The purposes of this study were to assess (i) prevalence of smoking in a population-based cohort of persons with spinal cord injury (SCI), (ii) history of quit attempts and (iii) the relationship between access to health care, socioeconomic status (SES), smoking status and history of quit attempts.
Study design: Cross-sectional study.
Setting: Population-based SCI cohort.
Methods: A total of 833 adults with SCI of at least 1-year duration were identified through a population-based surveillance system. Current smoking status, attempts to quit smoking in the past year and seeking professional help to quit smoking were assessed.
Results: Over one-third (35.3%) of the sample were current smokers, of whom 75.4% had ever tried to quit, and of these, only 27.9% had ever sought professional help. Those with lower SES were more likely to be current smokers, as were those with less access to health care. Access to care was positively related to likelihood of having sought professional help.
Conclusions: We found rates of smoking among persons with SCI to be well above national prevalence rates. We also found poorer access to care related to a greater likelihood of being a current smoker, had no association with trying to quit smoking, but decreased likelihood of using cessation support among those who did attempt to quit.
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INTRODUCTION

Traumatic spinal cord injury (SCI) leads to increased risk of secondary health conditions and early mortality.[1,2] For these individuals, there is an increased risk of respiratory complications, which are a leading cause of mortality,[3] especially among those with high level SCI. However, even with increased respiratory issues, rates of cigarette smoking in this population are high.[4,5] Smoking can exacerbate the respiratory complications,[6] prolong the course of pressure ulcers,[7,8] contribute to other negative health outcomes like edema[4] and urinary tract infections,[9] and increase risk of mortality.[10] Estimates of current cigarette smoking among persons with SCI range from 24 to 48%, but studies are limited by small sample sizes or samples solely drawn from clinical samples.[4,5,11,12]

Research in the general population has found a lower socio-economic status (SES) to be associated with increased smoking rates[13] and greater severity of chronic obstructive pulmonary disease.[14] Persons with lower SES are less likely to receive smoking cessation counseling.[15] Those in rural areas, where health-care accessibility is generally decreased, were found to have a higher likelihood of smoking.[16] Recently, we[11] investigated other risk factors in relation to cigarette smoking among persons with SCI identified through a rehabilitation setting and found persons with lower SES were more likely to be current smokers.

Smoking cessation is particularly important in this vulnerable population but has not been assessed. Persons with SCI are often limited with respect to access to care[17] and have motor and/or sensory

impairment that may impact the effectiveness of cessation interventions that have established efficacy in non-SCI smokers.[18] Saunders *et al.*[11] reported that among current smokers with SCI, 77.2% had ever tried to quit. Among persons who had attempted to quit, 50% made an attempt in the past year, and 29.9% had sought professional help. However, this study was focused in a clinical participant sample identified through a rehabilitation hospital and did not assess factors associated with smoking cessation.

Purpose

Limited research exists on cigarette smoking among those with SCI, and the existing studies have been conducted solely using participant samples identified through clinical settings, like inpatient rehabilitation, which can often exclude individuals with limited access to appropriate care. We herein sought to expand on the existing literature while at the same time minimizing sampling bias. Using a *population-based cohort* of persons with SCI, we aimed to (i) assess the prevalence of smoking, (ii) evaluate attempts to quit smoking and (iii) identify the relationship of access to care and SES with smoking status and attempts to quit smoking.

METHODS

Population

We identified participants through the South Carolina SCI Surveillance System Registry (SCISSR), a population-based registry of SCI occurring in the state each year. All nonfederal hospitals in South Carolina are mandated to report

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discharge data on all hospitalizations involving SCI to the State Budget and Control Board through uniform billing discharge data (UB-04). The SCISSR does not include information from military or veteran hospitals and therefore represents the civilian population of South Carolina. Data in the SCISSR are validated through verification of randomly selected medical charts and have been shown to be 99% accurate and complete.[19] International Classification of Diseases, 9th Revision, Clinical Modification codes of 806 [.0-.9] and 952 [.0-.9] were used to identify incident cases of SCI as defined by the Centers for Disease Control and Prevention for surveillance of SCI.[20] Duplicate admissions were eliminated using personal identifiers. Nonresidents of South Carolina were excluded, as were nonincident cases. Participants were recruited based on hospital discharge from 1998 to 2012, and were eligible if at the time of the study they: (i) were ⩾18 years, (ii) were ⩾1 year post injury and (iii) had traumatic SCI with residual effects (that is, did not have a complete recovery).

Procedures

Data were collected through mail-in survey between 2010 and 2013. Prospective participants were sent an introductory letter describing the study and alerting them to materials that were sent 4–6 weeks later. Second mailings and phone calls were made to nonresponders. Participants returning surveys with large sections of missing data (usually by pages sticking together) were called as a follow-up to obtain missing information. Participants were offered $50 remuneration. All study procedures were approved by an institutional review board. Of 2063 participants meeting eligibility criteria, 833 responded to the postage paid mail-in survey (40.4%). Nonresponse was primarily due to inability to confirm current addresses, and a lack of phone numbers to contact potential participants. Respondents were more likely to be female ($P=0.0475$) and more likely to be white ($P=0.0107$). Nonrespondents were more likely to have a diagnosis of unspecified level of injury ($P=0.0192$) There were no differences in age at injury ($P=0.7928$).

Measures

Measurement of smoking and predictive factors were identical to those used with a clinical participant sample by Saunders et al.[11] Briefly, smoking behavior was assessed using items from the Behavioral Risk Factor Surveillance System (BRFSS): (i) have you smoked at least 100 cigarettes in your entire life?, (ii) do you smoke right now, (iii) on average, about how many cigarettes a day do you now smoke and (iv) if you don't currently smoke but smoked at one time, about how long has it been since you last smoked cigarettes regularly?[21] Quitting history was assessed via two items developed for the survey: (i) if you are a current smoker, have you ever tried to quit smoking, (ii) if yes, did you seek professional help (such as counseling, a quit-smoking program, or receive prescription medication), and two items from the Smoking Information Questionnaire:[22] (i) how long has it been since you tried to quit; and (ii) since you started smoking regularly, what is the longest time you have gone without smoking. Participants were defined as never smokers (had never smoked 100 cigarettes), former smokers (had smoked 100 cigarettes but did not currently smoke) and current smokers.

SES was measured by annual household income (<$15 000, $15 000–24 999, $25 000–74 999, $75 000+). Level of education was categorized as: less than a high school degree, high school or associates degree, bachelor's degree or higher.

Demographic characteristics included age, age at injury, years post injury, gender and race. Injury severity was based on established categories of: (i) C1–C4, non-ambulatory, (ii) C5–C8, non-ambulatory, (iii) non-cervical non-ambulatory or (iv) ambulatory.[23]

Health-care access was measured using several indices. From the BRFSS, participants were asked 'do you have one person you think of as your personal doctor or health care provider?' and 'if no, do you have more than one?' With respect to check-ups, 'about how long has it been since you last visited a doctor for a routine check-up?' was categorized as in the past year, or more than a year ago/never. Insurance status was assessed through: 'was there any time in the past year when you were completely without any health plan or health insurance coverage?' Lastly, participants were asked 'what kind of place do you go to most often for your health care?' which was categorized as (i) clinic/health center/health maintenance organization, (ii) hospital emergency room and (iii) hospital outpatient department/other.

Analysis

All analyses were conducted using SASv9.4. Descriptive statistics were generated for smoking and smoking cessation variables. We then assessed the bivariate relationships of demographic, SES and health-care access variables with: (i) smoking status, (ii) attempting to quit in the past year and (iii) sought professional help to quit. The analyses of attempts to quit and seeking professional help focused only on current smokers. Chi-square tests were used for the categorical variables and Wilcoxon–Mann–Whitney tests for the continuous variables (Kruskal–Wallis test was used for smoking status as it is a 3-level variable). As our outcome was a 3-level variable, we used logistic regression to distinguish which groups differed for each level.

STATEMENT OF ETHICS

We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteer were followed during the course of this research.

RESULTS

The majority of the participants were white, non-Hispanic (60.4%), male (71.9%) with a mean age of 49.4 (16.8) years. Sixty-five percent of the participants reported being able to walk at all, 6.2% had a C1–C4 non-ambulatory, 12.0% C5–C8 non-ambulatory, and 16.9% non-cervical non-ambulatory. Average age at injury was 43.6 (17.2) and average years post injury was 5.8 (3.8). Of the participants, 35.3% were current, 29.5% former and 35.2% never smokers (Table 1). Of the current smokers, 75.4% had ever tried to quit, and of these, only 27.9% of those who had ever attempted to quit sought professional help.

Injury severity was related to current smoking, with those with less severe injuries reporting higher rates of current smoking (Table 2). Demographic variables were also found to be associated with smoking, with males (36.6%) and races other than black or white (42.5%) reporting higher rates of current smoking. Additionally, current smokers were younger at survey and at injury. Those with lower SES were more likely to be current smokers, as were those with less access to health care (no regular doctor, no check-up in the past year, time in the past year with no insurance, use emergency room most often for care).

Among current smokers, only younger age and lack of insurance coverage were associated with attempts (any vs none) to quit smoking in the past year (Table 3). Among quit attempters, use of cessation assistance was associated with (Table 4): female gender, white race, older age and having insurance. Clinically, individuals in need of physical assistance, who identified as having a personal doctor, and who received a check-up in the past year, were each more likely to use cessation support.

DISCUSSION

This study aimed to describe the prevalence of smoking and associated correlates of smoking behavior within an SCI population. Unlike prior studies examining smoking among SCI populations, this analysis is based on a population-based cohort, derived from a statewide registry of incident cases, thereby minimizing sampling bias that has been common in the literature to date. The rate of current smoking in this population-based cohort (35.3%) was higher than a recent report from a clinical cohort with SCI (22.6%),[11] and higher than the rate of smoking in the general population in South Carolina (22.5%).[24] The rate observed here also far exceeds other reports of persons with disability in the US (22.7%).[25] As with previous research,[11] we found

Table 1 Smoking characteristics

Characteristics among all participants	% (unless otherwise indicated)
Among all participants (n = 833)	
Smoking Status	
Current	35.3
Former	29.5
Never	35.2
Ever smoked 100 cigarettes	
Yes	64.2
No	35.9
Among those who have smoked at least 100 cigarettes (n = 526)	
Ever smoke on a regular basis	
Yes	88.3
No	11.7
Smoke now	
Not at all	46.2
Some days	17.3
Every day	36.5
Started smoking	
Before SCI	97.6
After SCI	2.4
Average age started smoking (mean (s.d.))	17.8 (5.4)
Among current smokers (n = 288)	
Number of cigarettes smoked per day	
None	1.1
1–9	43.8
10–19	30.4
20–40	24.0
41+	0.7
Ever tried to quit	
Yes	75.4
No	24.6
Among those who have tried to quit (n = 216)	
Ever sought professional help	
Yes	27.9
No	72.1
How long has it been since tried to quit	
Past 6 months	30.1
6–12 months	25.4
1–5 years	30.1
5+ years	14.4
Longest time without smoking	
<1 week	22.3
1 week–1 month	19.9
1–3 months	16.6
3–12 months	20.9
1+ years	20.4

Abbreviation: SCI, spinal cord injury.

Table 2 Bivariate analyses between smoking status (current, former, never) and participant characteristics

	Current	Former	Never	P-value [a]
	Mean (s.d.) or row%			
Gender				0.0011
Male	36.6	32.0	31.5	
Female	32.2	23.0	44.8	
Race				0.0056
White	35.8	32.8	31.4	
Black	33.5	26.3	40.2	
Other	42.5	10.0	47.5	
Age at injury	39.3 (14.8)	48.2 (16.6)	42.9 (18.2)	<0.0001
Current age	45.0 (14.4)	53.9 (16.6)	49.0 (17.5)	<0.0001
Injury severity				0.0002
C1–C4, non-ambulatory	25.5	27.5	47.1	
C5–C8, non-ambulatory	22.9	36.5	40.6	
Non-C, non-ambulatory	34.6	19.1	46.3	
Ambulatory	38.8	31.4	29.8	
Need physical assistance				0.0005
Yes	27.9	29.2	43.0	
No	39.3	29.9	30.8	
Income				<0.0001
<$15 000	44.8	22.7	32.5	
$15 000–24 999	35.3	31.1	33.6	
$25 000–74 000	26.2	36.0	37.8	
$75 000+	21.8	42.5	35.6	
Education				<0.0001
<High school	43.3	24.2	32.5	
High school/associates	37.0	30.5	32.6	
Bachelors+	17.2	32.0	50.8	
Regular doctor				0.0009
No	56.0	18.7	25.3	
Yes, one	32.7	31.9	35.4	
Yes, more than one	32.8	26.0	41.2	
Check-up in past year				0.0002
No	45.4	22.7	31.9	
Yes	30.8	32.9	36.3	
Time past year no insurance				<0.0001
Yes	55.6	15.0	29.4	
No	29.1	33.4	37.6	
Place go most often for care				<0.0001
Emergency room	69.0	15.5	15.5	
Doctor's office/clinic	30.6	31.1	38.3	
Other	38.2	29.4	32.4	

[a]Chi-square or Kruskal-Wallis *P*-value

smoking rates to be higher among those with less severe injuries. This may be due to increased physical disability among those with severe SCI which could limit independent smoking. Our cohort had a larger proportion of less severe injuries than most SCI cohorts owing to participants being identified through a surveillance system and not through a rehabilitation setting. However, smoking rates among the most severely injured in our study (25.5%) were still higher than in previous research (16.9%).[11]

This study was conducted in a state with a high rural population. Previous research has linked smoking with poor access to care in rural communities.[16] Additionally, persons with disability are significantly more likely to live in poverty.[26] In this cohort, 60.2% had a total household income of less than $25 000 per year, which is higher than previous reports within populations with SCI.[23] In the general population, there are differences in smoking rates by income, with persons living below poverty level being more likely to be current smokers than those at or above poverty level.[25] Additionally, when income increases above poverty level, persons are less likely to continue smoking.[27] We also found poorer access to care related to a greater likelihood of being a current smoker, no association to trying

Table 3 Relationship of demographics, SES and health-care access to trying to quit smoking in the past year[a]

Characteristic	Tried quit past year		
	Yes (n = 96)	No (n = 116)	P-value[b]
Demographics and injury			
Gender			0.5911
Male	55.8	44.2	
Female	51.7	48.3	
Race			0.5826
White	52.6	47.4	
Black	60.0	40.0	
Other	50.0	50.0	
Age	43.5 (14.8)	47.7 (14.7)	0.0471
Years post injury	5.2 (3.7)	5.7 (3.9)	0.2515
Injury severity			0.2619
Cervical, non-ambulatory	40.7	59.3	
Non-cervical, non-ambulatory	56.3	43.7	
Ambulatory	57.7	42.3	
Need physical assistance			0.8188
Yes	52.9	47.1	
No	54.6	45.4	
Socioeconomic status			
Income			0.1307
<$15 000	58.8	41.2	
$15 000–24 999	55.2	44.8	
$25 000–74 000	37.2	62.8	
$75 000+	63.6	36.4	
Education			0.1366
<High school	54.9	45.1	
High school/associates	57.5	42.5	
Bachelors+	31.3	68.7	
Health-care access			
Regular doctor			0.7207
No	51.8	48.2	
Yes, one	54.1	45.9	
Yes, more than one	61.3	38.7	
Check-up in past year			0.2318
No	59.7	40.3	
Yes	51.2	48.8	
Time past year no insurance			0.0045
Yes	69.9	30.1	
No	49.2	50.8	
Place go most often for care			0.0897
Emergency room	44.4	55.6	
Doctor's office/clinic	60.7	39.3	
Other	40.9	59.1	

Abbreviation: SES, socioeconomic status.
[a]Table includes persons who identify as current smokers and who have ever attempted to quit smoking.
[b]P-value for chi-square tests for categorical variables and Wilcoxon–Mann–Whitney tests for continuous.

Table 4 Relationship of demographics, SES and health-care access to having sought professional help to quit smoking[a]

Characteristic	Sought professional help		
	Yes (n = 58)	No (n = 150)	P-value[b]
Demographics and injury			
Gender			0.0343
Male	23.8	76.2	
Female	38.6	61.4	
Race			0.0235
White	34.1	65.9	
Black	15.6	84.4	
Other	22.2	77.8	
Age	50.6 (14.0)	45.3 (14.7)	0.0012
Years post injury	5.3 (3.8)	5.9 (3.9)	0.3145
Injury severity			0.7099
Cervical, non-ambulatory	34.6	65.4	
Non-cervical, non-ambulatory	28.1	71.9	
Ambulatory	26.7	73.3	
Need physical assistance			0.0048
Yes	41.2	58.8	
No	22.1	77.9	
Socioeconomic status			
Income			0.0973
<$15 000	23.2	76.7	
$15 000–24 999	24.1	75.9	
$25 000–74 000	40.0	60.0	
$75 000+	45.5	54.5	
Education			0.1223
<High school	26.5	73.5	
High school/associates	25.9	74.1	
Bachelors+	50.0	50.0	
Health-care access			
Regular doctor			0.0298
No	11.1	88.9	
Yes, one	33.8	66.2	
Yes, more than one	20.0	80.0	
Check-up in past year			0.0088
No	17.1	82.9	
Yes	34.1	65.9	
Time past year no insurance			0.0071
Yes	16.9	83.1	
No	34.9	65.1	
Place go most often for care			0.1149
Emergency room	11.5	88.5	
Doctor's office/clinic	31.3	68.7	
Other	31.8	68.2	

Abbreviation: SES, socioeconomic status.
[a]Table includes persons who identify as current smokers and who have attempted to quit smoking.
[b]P-value for chi-square tests for categorical variables and Wilcoxon-Mann-Whitney tests for continuous.

to quit smoking, but decreased likelihood of using cessation support among those who did attempt to quit. Research in the general population shows persons with lower SES and/or without health insurance are less likely to receive smoking advice from a physician;[15] therefore, those with poor access to care may want to quit but lack the essential resources and access to professionals that can enhance the likelihood of success.

In our study, of the current smokers who had ever tried to quit, 55.5% had made an attempt in the past year, and of these, 27.9% had ever sought professional help. The proportion reporting ever seeking professional help is higher than one study of persons with mobility impairments (5.3%), but that study only included counseling.[28] Of those in the general population who made an attempt in the past year, 36.1% had used behavioral or pharmacological treatments.[29] Similar

to our results, Borrelli *et al.*[28] found that 57.3% attempted to quit in the past year, and in the general population, 52% of smokers make a quit attempt each year.[25] These findings indicate a large portion of people would like to quit smoking and suggest the need for identifying effective, accessible interventions that account for the specific needs of those with mobility impairment related to SCI such as physical limitations and inadequate access to care. We found different variables to be associated with quit attempts (younger age, lack of insurance) compared with use of cessation assistance (female gender, white race, older age and having insurance). These results are partially supported in the general population, with those in younger age groups being more likely to have a quit attempt, but quit attempts did not differ by health plan type.[30] The same study also found women, those with older age, and having insurance to be more likely to receive professional advice to quit.

Limitations

Although this study provides valuable information on smoking in a population-based cohort of persons with SCI, there are limitations to be noted. First, the present study relied solely on self-reported data, without corroboration via medical records or other independent sources. However, we limited bias by relying on established population surveillance methods (BRFSS). Second, this study was cross-sectional in nature, and thus the nature of the data collection methods precluded any assessment of the identified associations over time (that is, longitudinally). Third, our response rate was 40.4%; therefore, we are not able to ascertain smoking status on those who did not respond. Lastly, we did not have information concerning military history as participants were recruited from a civilian rehabilitation hospital. Thus, findings may not be generalizable to a noncivilian population.

CONCLUSION

Rates of smoking within SCI populations far exceed national norms, but rates for making quit attempts are generally the same. Smokers with SCI face unique challenges to cessation, and thus future studies should examine the scope, reach and efficacy of cessation interventions, both pharmacologic and behavioral. Persons with SCI have physical impairments that may affect smoking cessation in various ways, such as the need for assistance from other persons or use of assistive devices. Additionally, professional help and medication for cessation may be inaccessible to those with SCI, especially those in rural areas. These considerations should be taken into account when creating interventions for smoking cessation in persons with SCI.

DATA ARCHIVING

There were no data to deposit.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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