Association between seeking oral health information online and knowledge in adults with spinal cord injury: A pilot study

Hon K. Yuen¹, Andres Azuero², Steven London³

¹Department of Occupational Therapy, School of Health Professions, University of Alabama at Birmingham, AL, USA, ²School of Nursing, University of Alabama at Birmingham, AL, USA, ³Department of Oral Biology and Pathology, School of Dental Medicine, Stony Brook University, NY, USA

Objective: To characterize adults with spinal cord injury (SCI) who seek oral health information online, and investigate whether seeking oral health information online is associated with oral health knowledge and behaviors.

Methods: An online oral health survey was posted on the South Carolina Spinal Cord Injury Association website. Respondents were 192 adult residents of the US ages 19–83 years who identified themselves as having SCI occurring at least 1 year before the survey date.

Results: About 12% ($n = 23$) of the respondents searched oral health information online in the past 12 months. Significant associations between the proportion of respondents who searched for oral health information online and socio-demographic and the proportion of respondents who engaged in various oral health behaviors were not detected. However, multivariable logistic regression indicated that respondents who searched oral health information online in the past 12 months have 3.4 times the odds of possessing adequate oral health knowledge compared to respondents who did not search oral health information online (adjusted odds ratio = 3.41, 95% confidence interval = 1.35, 8.62, $P = 0.01$).

Conclusions: Given the significant association between seeking oral health information online and adequate oral health knowledge, this study suggests that online oral health information may be a potential avenue for dental health professionals to supplement oral health education in adults with SCI.

Keywords: Spinal cord injuries, Oral health, Prevention, Patient education, Internet

Introduction

For people with spinal cord injury (SCI), the combination of dry mouth from xerostomia-causing medications (drugs used to regulate neurogenic bladder problems and reduce muscle spasms), barriers (physical, fear, and cost) to dental care access, and poor hand function to perform thorough oral hygiene may adversely affect their oral health and significantly increase the risk of oral health problems.^{1,2} This phenomenon is supported by a recent study where approximately 47% respondents with SCI indicated they had oral problems that required dental treatment at the time of the survey.³

On the other hand, studies investigating health information needs among community-dwelling adults with

SCI did not identify oral health information as a need.^{4–6} This may be due to a variety of reasons, such as lack of prompts in the questionnaire and lack of awareness of respondents regarding oral health issues related to their injury and medication use. Finally, oral health may be perceived as low priority in light of other health problems in persons with SCI.

One way individuals with SCI could obtain information on oral health would be through Internet online searches. However, even with the exponential increase in Internet access in the last decade, searching for oral health information in the general population is very low. Among patients attending general dentistry clinic, only 5–6% who have access to the Internet reported seeking oral health information online; approximately 15% of those who use the Internet to search for health information sought oral health information online in the past 12 months.^{7,8} Of those

Correspondence to: Hon K. Yuen, University of Alabama at Birmingham, Birmingham, AL 35294-1212, USA. Email: yuen@uab.edu

attending restorative dentistry, dental surgery, and oral medicine clinics, 36.5% of those who have Internet access reported seeking oral health information online.⁹ The higher proportion of these patients who seek oral health information online may be due to their greater needs for understanding about particular dental/oral conditions or procedures.⁹

Health-related benefits such as improved understanding of health-care issues have been identified for people who sought health information online.¹⁰ Of individuals with multiple chronic conditions, those who searched for online health information reported better understanding of their chronic condition and treatment options.¹⁰ Some of the health information found on the Internet affected these individuals' decision making on health and use of health care.¹⁰ According to a national online survey of 10 000 people with chronic illnesses, about three quarters of respondents with paralysis of extremities (excluding stroke) reported that health information from the Internet had a major impact on their understanding of health-related problems and how well they managed their health.¹¹

In addition, research indicated that seeking health information online can enhance consumer health knowledge of illness and treatment. Online health information searching in the past 12 months was associated with answering more health knowledge questions correctly (e.g. screening, prevention, and lifestyle behaviors).^{12,13} For example, individuals living with HIV/AIDS who used the Internet to seek health information online also demonstrated significantly greater HIV/AIDS disease and treatment-related knowledge (i.e. correctly answered more questions).^{14,15}

Online health information seeking was also associated with adoption of healthy behaviors including treatment/medication adherence.¹⁴ According to the results of a nationally representative postal mail survey, individuals who searched for health-related (medical service, disease specific, and/or healthy lifestyle) information online were more likely to engage in healthy activities.¹⁶ Furthermore, the more frequently persons with chronic illnesses use the Internet as a source of health information, the more likely they are to change their health behaviors.¹⁷

Given the lack of our knowledge on online oral health information seeking and its effect on oral health knowledge and behaviors among adults with SCI, the purpose of this study was to characterize adults with SCI who seek oral health information online, and investigate associations between adults with SCI who seek oral health information online and their oral health knowledge and behaviors.

Methods

SCI oral health survey

An oral health survey of various oral health issues encountered by adults with SCI was posted on the South Carolina Spinal Cord Injury Association website. We informed (through e-mails and regular mails) members of the South Carolina Spinal Cord Injury Association, and patients in the South Carolina Traumatic Spinal Cord Injury Registry about the study and the website. Informing individuals with SCI living outside South Carolina about the survey was accomplished mainly through word-of-mouth communication via e-mail. Adults with SCI interested in completing the survey accessed it through the Internet. Potential respondents could also request a paper copy of the survey (by phone or mail) if they did not have access to the Internet. The study was approved by the Institutional Review Board at the Medical University of South Carolina (MUSC).

The survey contained several sections which included (1) dental care visit patterns, (2) oral hygiene behaviors, (3) oral health conditions, (4) sources of oral health information, (5) demographic and socioeconomic characteristics, (6) injury-related information, functional mobility, and upper extremity functioning, (7) smoking and sugar consumption habits, and (8) a test of oral health knowledge. Detailed description of the questions and their coding in each section (except sources of oral health information and a test of oral health knowledge) was reported previously.³

Sources of oral health information

In the sources of oral health information section, we asked whether the respondents had a computer at home with Internet connection (yes vs. no). Two additional questions specific to health/oral health information seeking were: 'In the past 12 months, did you use the Internet to access general health information?' (yes vs. no), and 'In the past 12 months, did you use the Internet to access oral health information?' (yes vs. no).

Oral health knowledge – test items development

In terms of testing for oral health knowledge, the initial item pool for the oral health knowledge section was assembled based on a review of existing literature related to oral health knowledge,¹⁸ informal interaction with adults with SCI, and the clinical experience of a dentist and two research dental hygienists. Twenty items were developed that measured knowledge of causes, signs, consequences, and prevention of periodontal diseases and caries, consequences and management of dry mouth, and practical components of daily

oral self-care to prevent oral complications. The response options for these items were: 'true', 'false', and 'do not know'. These items were then evaluated by three dental faculty members, including a periodontist and a dental epidemiologist, from the MUSC College of Dental Medicine. These three faculty members established the content validity of the items and selected 18 items from the pool to be further studied.

The response to each of the 18 items was re-coded as correct or incorrect (including the 'do not know' response). These 18 items were then validated using classical item analysis, which includes computation of item difficulty and item discrimination (item-discrimination index (*D*-index), and corrected item-total/point-biserial correlation).¹⁹ Item difficulty was measured as the percent of respondents who answered the item correctly. Eight items with difficulties greater than 0.8 or smaller than 0.2 were considered either too easy or too difficult, respectively, and thus deleted from the test.²⁰ Test scores, *D*-indexes and point-biserial correlations were computed on the remaining 10 items. *D*-indexes were calculated using the extreme groups method, and were used to measure the effectiveness of an item in differentiating between extreme high and low scorers on the whole test. Classification of the extreme groups was based on the 27% rule of the whole group.²¹ The *D*-index ranges from -1 to +1, with coefficients of 0.4 and above considered to be good.²²

Data analysis

Bivariate association analyses

We tested the bivariate associations between respondents' socio-demographic variables (age, time since injury, level of injury, race, gender, residence type, marital status, education level, employment status, having private health insurance, and annual household income), having a computer at home with Internet connection, and use of the Internet in the past 12 months to access general health information. In addition, we explored bivariate associations for the use of the Internet in the past 12 months to access oral health information as a function of the following potential explanatory variables: respondents' socio-demographic characteristics, having dental insurance, having a computer at home with Internet connection, current oral problems, oral pain in the past 12 months, and dry mouth symptoms.

To investigate the association between the use of the Internet in the past 12 months to access oral health information and oral health knowledge, respondents were divided into two groups according to the number

of correct responses on the oral health knowledge test: those above the median (seven or more items answered correctly) and those at or below the median (six or fewer items answered correctly). Respondents who scored above the median were categorized as having adequate knowledge of oral health, vs. those respondents who scored at or below the median who were identified as having inadequate knowledge of oral health. Placing the cutoff at the median is a commonly used technique in oral health knowledge tests because the median is not drastically affected by extreme scores.^{18,22-25} We then tested the association between adequate oral health knowledge and use of the Internet in the past 12 months to access oral health information.

We also explored associations between use of the Internet to access oral health information and oral health behavior variables such as oral hygiene behavior, dental care visiting pattern, tobacco consumption, and sugar-containing snack or soda consumption.

Bivariate association analyses were conducted using Chi-square tests and Fisher's exact tests (when appropriate) for categorical variables with two levels, extended Mantel-Haenszel mean score tests for ordinal categorical variables with more than two levels, and *t*-tests for continuous variables.

Multivariable analyses

Subsequent multivariable logistic regression models were developed for each of the three dependent variables: having a computer at home with Internet connection, using the Internet in the past 12 months to access general health information, and using the Internet in the past 12 months to access oral health information. We also used multivariable logistic regression analysis to model the probability that adults with SCI would have adequate oral health knowledge as well as various oral health behavior variables. For modeling oral health knowledge and oral health behavior variables, the use of the Internet in the past 12 months to access oral health information was the main explanatory variable of interest. Other potential explanatory variables used in modeling included respondents' socio-demographic characteristics.

Explanatory variables with a *P* value less than 0.25 in bivariate analyses were considered as candidates for inclusion in multivariable models.²⁶ Explanatory variables whose regression coefficients had *P* values less than 0.05 were retained in the multivariable models. All statistical analyses were performed using SAS software version 9.2 (SAS Institute Inc., Cary, NC, USA).

Results

Respondents

A total of 207 respondents identified themselves as having SCI and residing in the US completed an oral health survey between mid-August 2006 and mid-February 2007. The majority (82.1%) of respondents completed the survey online. Slightly more than half (51%) were from South Carolina, and the rest were from 26 other states. We excluded 3 respondents who indicated that they had completely recovered from their injury (i.e. ASIA-E) and an additional 12 respondents who sustained a SCI within a year before completing the survey because information on Internet use before their injury would confound the findings. Thus, a total of 192 eligible respondents were included in this study.

Of the 192 respondents, 142 reported that they sustained an injury in cervical segments, indicating tetraplegia. The mean and SD of the respondents' age was 43.9 ± 13.1 years (range: 19–83 years); the majority were male (59.9%) and white (77.6%). Detailed description of the socio-demographic and various oral health-related characteristics of this sample was reported in our previous study.³

The majority (87.5%, $n = 168$) of respondents had a computer at home with Internet connection, and 82.1% ($n = 138$) of the respondents with Internet access searched online for general health information in the past 12 months. There were five respondents who did not have in-home Internet access but reported searching general health information online in the past 12 months. However, only 12.5% ($n = 21$) of the respondents with Internet access searched oral health information online in the past 12 months. There were two respondents who did not have in-home Internet access but reported searching online oral health information in the past 12 months. All except two respondents who reported searching for oral health information online had also searched for online general health information in the past 12 months.

Factors associated with having a computer at home with Internet connection

Bivariate analyses indicated that race, annual household income, health insurance, education, time since injury were all significantly associated with having a computer at home with Internet connection (Table 1). Caucasian respondents, higher income level, having private health insurance, higher education level, and longer duration (in years) since injury were more likely to have a computer at home with Internet connection. In the multivariable logistic regression analysis, only race remained

significantly associated with having a computer at home with Internet connection. The odds of having a computer at home with Internet connection were 13.3 (odds ratio (OR) = 13.26; 95% confidence interval (CI) = 5.01, 34.15; $P < 0.001$) times higher for Caucasian respondents compared with minority respondents.

Factors associated with use of the Internet in the past 12 months to access general health information

Bivariate analyses indicated that race, gender, health insurance, annual household income, and in-home Internet connection were all significantly associated with use of the Internet in the past 12 months to access general health information (Table 2). Caucasian respondents, female, having private health insurance, higher income level, and having a computer at home with Internet connection were more likely to use the Internet in the past 12 months to access general health information. In the multivariable logistic regression analysis, race, gender, and having a computer at home with Internet connection remained significantly associated with use of the Internet in the past 12 months to access general health information. The odds of using the Internet in the past 12 months to access general health information were 3.1 (adjusted OR = 3.07; 95% CI = 1.28, 7.37; $P = 0.012$) times higher for Caucasian respondents compared with respondents of minority race, and 2.8 (adjusted OR = 2.81; 95% CI = 1.20, 6.58; $P = 0.017$) times greater for female, and 10.5 (adjusted OR = 10.46; 95% CI = 3.33, 32.80; $P < 0.001$) times higher for having a computer at home with Internet connection.

Factors associated with use of the Internet in the past 12 months to access oral health information

Descriptive statistics and results from bivariate tests of association with use of the Internet in the past 12 months to access oral health information for the explanatory variables of interest are shown in Table 3. Significant associations between using the Internet in the past 12 months to access oral health information and any of the available socio-demographic and oral problem variables were not detected.

Sensitivity analysis

In addition, we conducted sensitivity analyses with the subset of 168 respondents who had an Internet connection at home. The conclusions did not change with use of the Internet to access oral health information. For use of the Internet to access general health information,

Table 1 Descriptive statistics and bivariate association tests between having a computer at home with Internet connection and explanatory variables of interest (n = 192)

Variables	Having a computer at home with Internet connection		P value*
	No (n ₁ = 24)	Yes (n ₂ = 168)	
Age in years, mean ± SD	45.9 ± 13.8	43.7 ± 12.9	0.441
Years since SCI, mean ± SD	7.6 ± 6.7	13.4 ± 11.3	<0.001
Level of injury (tetraplegia)**	17 (85.0)	125 (74.4)	0.412
Race (Caucasian)	7 (29.2)	142 (84.5)	<0.001
Gender (male)	17 (70.8)	98 (58.3)	0.242
Residence type (urban)**	13 (54.2)	96 (57.5)	0.758
Marital status (married)	9 (37.5)	79 (47.0)	0.381
Education (beyond high school)	12 (50.0)	118 (70.2)	0.047
Employed (full- or part-time)	6 (25.0)	57 (33.9)	0.383
Annual household income**	—	—	0.001
< \$25 000	17 (73.9)	61 (36.7)	—
\$25 000–\$49 999	5 (21.7)	42 (25.3)	—
≥ \$50 000	1 (4.4)	63 (38.0)	—
Private health insurance	3 (12.5)	74 (44.0)	0.003

Percent is in parentheses.

*Chi-square, Fisher's, extended Mantel-Haenszel, or *t*-tests as appropriate.

**Counts not summing to 192 due to missing responses.

Table 2 Descriptive statistics and bivariate association tests between the use of Internet to access general health information in the past 12 months and explanatory variables of interest (n = 192)

Variables	Used Internet in past 12 months to access general health information		P value*
	No (n ₁ = 49)	Yes (n ₂ = 143)	
Age in years, mean ± SD	45.1 ± 13.1	43.6 ± 13.1	0.482
Years since SCI, mean ± SD	11.9 ± 10.9	13.0 ± 11.31	0.551
Level of injury (tetraplegia)**	35 (76.1)	107 (75.4)	0.919
Race (Caucasian)	26 (53.1)	123 (86.0)	<0.001
Gender (male)	37 (75.5)	78 (54.5)	0.009
Residence type (urban)**	27 (55.1)	82 (57.7)	0.747
Marital status (married)	21 (42.9)	67 (46.8)	0.628
Education (beyond high school)	28 (57.1)	102 (71.3)	0.067
Employed (full- or part-time)	11 (22.4)	52 (36.4)	0.073
Annual household income**	—	—	0.021
< \$25 000	27 (58.7)	51 (35.7)	—
\$25 000–\$49 999	9 (19.6)	38 (26.6)	—
≥ \$50 000	10 (21.7)	54 (37.7)	—
Private health insurance	11 (22.4)	66 (46.1)	0.003
In-home Internet connection	30 (61.2)	138 (96.5)	<0.001

Percent is in parentheses.

*Chi-square, Fisher's, Extended Mantel-Haenszel, or *t*-tests as appropriate.

**Counts not summing to 192 due to missing responses.

statistical significance was affected by the reduced sample size, and only race remained significantly associated with the outcome. For the other explanatory variables that were significant in the full sample size analysis (gender, income, and health insurance), the between-group differences changed in magnitude but were in the same direction compared to the full sample analysis.

Oral health knowledge item analysis

As indicated in Table 4, item difficulty of the 10 items ranged from 0.30 to 0.79 with an average difficulty level of 0.54, which meant the overall difficulty of the

items in this oral health knowledge test was desirable.²² The median of the number of oral health knowledge items answered correctly was six. The *D*-index of each item was calculated as the proportion of respondents who answered the item correctly among the top 27% who obtained the highest total test scores, minus the proportion of respondents who answered the item correctly among the bottom 27% who obtained the lowest total test scores. These 10 items had *D*-indexes ranging from 0.37 to 0.64 with an average discrimination value of 0.51, which meant the strength of the oral health knowledge test to differentiate high and low scorers was adequate.²² The corrected item-total correlations

Table 3 Descriptive statistics and bivariate association tests between the use of Internet to access oral health information in the past 12 months and explanatory variables of interest (n = 192)

Variables	Used Internet in past 12 months to access oral health information		P value*
	No (n ₁ = 169)	Yes (n ₂ = 23)	
Age in years, mean ± SD	44.0 ± 13.3	43.7 ± 11.2	0.922
Years since SCI, mean ± SD	12.4 ± 11.0	14.9 ± 11.3	0.304
Level of injury (tetraplegia)**	129 (77.7)	13 (59.1)	0.056
Race (Caucasian)	130 (76.9)	19 (82.6)	0.539
Gender (male)	105 (62.1)	10 (43.5)	0.087
Residence type (urban)**	93 (55.4)	16 (69.6)	0.197
Marital status (married)	74 (43.8)	14 (60.9)	0.123
Education (beyond high school)	112 (66.3)	18 (78.3)	0.249
Employed (full- or part-time)	57 (33.7)	6 (26.1)	0.464
Annual household income**	—	—	0.810
< \$25 000	69 (41.6)	9 (39.1)	—
\$25 000–\$49 999	40 (24.1)	7 (30.4)	—
≥ \$50 000	57 (34.3)	7 (30.4)	—
Private health insurance	68 (40.2)	9 (39.1)	0.919
Dental insurance	103 (61.0)	12 (52.2)	0.421
Current oral problems	79 (46.7)	13 (56.5)	0.379
Oral pain in the past 12 months	67 (39.6)	13 (56.5)	0.123
Dry mouth	98 (58.0)	17 (73.9)	0.144
In-home Internet connection	147 (87.0)	21 (91.3)	0.557

Percent is in parentheses.

*Chi-square, Fisher's, Extended Mantel-Haenszel, or *t*-tests as appropriate.

**Counts not summing to 192 due to missing responses.

Table 4 Difficulty and discrimination index (D-index) for the 10 oral health knowledge items (n = 192)

Item	Difficulty	D-index
People with dry mouth are more likely to have sores in the mouth	0.30	0.62
People with dry mouth are more likely to have tooth decay	0.31	0.64
Gum disease is an infectious disease	0.33	0.37
Dental sealant is a common preventive measure for tooth decay	0.43	0.42
It is natural for some teeth to fall out as people age	0.50	0.50
Drinking non-diet soda is likely to get tooth decay	0.59	0.56
You should stop brushing or flossing if your gums bleed	0.70	0.47
Smoking is linked to gum disease	0.71	0.61
If your gums bleed every time you brush your teeth, it's an early sign of gum disease	0.73	0.48
Dental tartar may lead to gum disease	0.79	0.44

of these 10 items ranged from 0.16 to 0.45, with an average correlation of 0.33, which meant the items were moderately correlated with the overall total score of the oral health knowledge test.²² The readability of the oral health knowledge test was measured by the Flesch/Flesch-Kincaid Readability Tests.²⁷ The reading level of these items was at the fourth grade and the Flesch Reading Ease score was 81.8 which is in the easy range of reading comprehension.

Association between adequate oral health knowledge and access to online oral health information

The percentage of respondents who achieved adequate oral health knowledge – defined as above the median of items answered correctly (i.e. seven or more items) – was 31.8. Results of bivariate analyses indicated that

adequate oral health knowledge had a statistically significant relationship with the following variables: gender, marital status, current oral problems, and use of the Internet in the past 12 months to access oral health information (Table 5). In the multivariate logistic regression analysis, use of the Internet in the past 12 months to access oral health information, marital status, and current oral problems remained significantly associated with adequate oral health knowledge. Respondents who searched for oral health information online in the past 12 months have 3.4 times the odds of possessing adequate oral health knowledge compared to respondents who did not search oral health information online (adjusted OR = 3.41, 95% CI = 1.35, 8.62, *P* = 0.01); the odds of possessing adequate oral health knowledge were 1.9 (adjusted OR = 1.90; 95% CI = 1.01, 3.57; *P* = 0.048) times higher for married respondents compared with

Table 5 Descriptive statistics and bivariate association tests between adequacy of oral health knowledge in adults with SCI and explanatory variables of interest (n = 192)

Variables	Adequate of oral health knowledge		P value*
	No (n ₁ = 129)	Yes (n ₂ = 63)	
Age in years, mean ± SD	44.3 ± 13.8	43.1 ± 11.2	0.551
Years since SCI, mean ± SD	12.4 ± 10.8	13.2 ± 11.6	0.631
Level of injury (tetraplegia)**	97 (77.0)	45 (72.6)	0.509
Race (Caucasian)	95 (73.6)	54 (85.7)	0.059
Gender (male)	84 (65.1)	31 (49.2)	0.035
Residence type (urban)**	70 (54.3)	39 (62.9)	0.259
Marital status (married)	52 (40.3)	36 (57.1)	0.028
Education (beyond high school)	82 (63.6)	48 (76.2)	0.079
Employed (full- or part-time)	39 (30.2)	24 (38.1)	0.276
Annual household income**	—	—	0.769
< \$25 000	53 (41.4)	25 (41.0)	—
\$25 000–\$49 999	30 (23.4)	17 (27.9)	—
≥ \$50 000	45 (35.2)	19 (31.1)	—
Dental insurance	53 (41.1)	24 (38.1)	0.691
Current oral problems	55 (42.6)	37 (58.7)	0.036
Oral pain in the past 12 months	79 (61.2)	33 (52.4)	0.242
Dry mouth	74 (57.4)	41 (65.1)	0.306
In-home Internet connection	112 (86.8)	56 (88.9)	0.684
Used Internet in past 12 months to access oral health information	9 (7.0)	14 (22.2)	0.002
Used Internet in past 12 months to access general health information	92 (71.3)	51 (80.9)	0.151

Adequate knowledge = oral health knowledge test score above median (i.e. answer ≥ 7 items correctly).

Percent is in parentheses.

*Chi-square, Fisher's, Extended Mantel-Haenszel, or *t*-tests as appropriate.

**Counts not summing to 192 due to missing responses.

unmarried respondents, and 1.9 (adjusted OR = 1.92; 95% CI = 1.02, 3.62; *P* = 0.044) times greater for respondents who reported current oral problems compared to those who did not. No significant associations between use of the Internet to access oral health information in the past 12 months and any oral health behavior (including dental care visiting pattern) variables were detected.

Discussion

Results of our study were consistent with the findings in the literature that being Caucasian, higher education, and income levels were significantly associated with Internet use; whereas, being Caucasian, and having Internet access were significantly associated with searching general health information online among adults with SCI.^{6,28} Race was the key predictor for Internet access and searching general health information online in adults with SCI after controlling for other socio-demographic variables.

The higher proportion of respondents who had Internet access (87.5% in the present study vs. 80.2% in Matter *et al.* study or 65.2% in Goodman *et al.* study) and searched online health information (82.1% in the present study vs. 58.5% in Matter *et al.* study or 61.1% in Goodman *et al.* study) may be because the present study was administered primarily via the

Internet, as well as conducted more recently (at least 1–2 years later) than the previous two studies.^{6,28}

The proportion of online health seekers who searched for oral health information in the present study were consistent with the findings of two previous studies,^{7,8} which is approximately 15% or about one in six or seven individuals who sought online health information accessed oral health information. In terms of the proportion of Internet users searching for oral health information, two previous studies surveying patients from general dentistry found it was 5–6%;^{7,8} the present study found 14%; Ni Riordain and McCreary⁹ found 36.5%. Severity of the dental/oral problems and the unique socio-cultural situation in Ireland where the use of Internet to search for dental tourism is high may explain the higher proportion of respondents in the Ni Riordain and McCreary study.⁹

It is somewhat surprising that none of the socio-demographic variables and oral problems were associated with searching oral health information online. One possible reasons is that the proportion of respondents who sought oral health information was relatively small, which may preclude detection of small- and medium-sized statistical associations. In the present study, the observed frequency of 23 (~12%) respondents who used the Internet in the past 12 months to access oral health information provided 80% power to detect

an OR of 2.8, assuming a probability of event of 0.5 among the 169 respondents who did not report using the Internet to access oral health information in the past 12 months. Thus, only very large associations were detectable between use of the Internet to access oral health information in the past 12 months and other variables. A future study of this particular outcome can be planned with a more accurate estimate of sample size. Assuming a 12% of affirmative response rate, and a binary explanatory variable with probability of event of 0.5 among those who did not use the Internet in the past 12 months to access oral health information, a sample size of 433 is required to achieve 80% power to detect a proportion of events of 0.7 (difference = 0.2) among those who did use the Internet in the past 12 months to access oral health information, at a significance level of 0.05.

However, the significant association between searching oral health information online and adequate oral health knowledge suggested that respondents do learn the information from the Internet. This may have important clinical implications. Since patient education on specific oral health issues such as dry mouth from dental health professionals were traditionally inadequate,²⁹ dental health professionals can supplement their patient education by directing them to high-quality websites for more information regarding a particular oral health issue or problem. The Internet will definitely be a future source of oral health information. As indicated in the study of Harris and Chestnutt,⁸ only 3% of general dentistry patient respondents reported searching the Internet for oral health information, but 43.5% of respondents indicated that they would be interested in the Internet as a source of oral health education information. In addition, more than 40% of the respondents in Harris and Chestnutt indicated that they would like to be directed to appropriate online resources by their dental health professional to learn more about various oral health issues.⁸

There was no significant association between the proportion of respondents who searched oral health information online and the proportion of respondents who engaged in various oral health behaviors. This finding may be attributed to the fact that typical oral health behaviors (dental visit in the past 12 months, brushing twice daily, and flossing daily) do not reflect information the respondents searched for. We did not ask respondents to report the type of websites or oral health topics that they searched online. In order to better understand the impact of seeking online oral health information on oral health care and behaviors (including treatment adherence), the specific types/

topics of oral health information that the respondents have searched would be needed, as would the frequency and duration they spent searching these topics. Future studies should explore the influence of online oral health information on oral health care products or services purchased by adults with SCI, and determine if the Internet will serve as a surrogate for dental advice among adults with SCI who lack dental insurance coverage or otherwise find it difficult to obtain professional dental care.

Limitations

We acknowledge that the sample in this study is a convenience sample which may or may not represent the SCI population; however, it should be noted that the demographic characteristics (gender, race, education, and age) of the SCI respondents in the present study are similar to those reported in Matter *et al.*⁶ Since the study of Matter *et al.* was based on a representative sample of SCI from 2 of the 10 Model SCI Systems in the US, and the demographics of respondents of the present study were similar to those of Matter *et al.*, it may improve the generalizability of the findings. However, confirmation of the results should come with a population-based study using the National Spinal Cord Injury Statistical Center database in which a wider range of ages, and education levels is expected. With a wider age ranges, comparison of seeking oral health information online between different age cohorts will be possible.

Conclusion

The Internet is an important source of oral health information, which is likely to increase in the years to come. With the significant association between seeking oral health information online and adequacy of oral health knowledge, this study suggests that online oral health information may be a potential avenue for dental health professionals to supplement the education for adults with SCI on various oral health issues. Furthermore, with the various issues related to dental care access (architectural barriers to dental offices, fear, and high cost) that were identified in our previous study,³⁰ the Internet can be a potential way to educate this population on preventive oral care.

Acknowledgements

The authors thank dentists: Drs Carlos F Salinas, Susan G Reed, and Renata Leite, and dental hygienists: Pemra Hudson, Lisa Summerlin, for their valuable suggestions on the content of the oral health knowledge questions; and Dr Laura K Vogtle for her input. The authors appreciate the support from South Carolina

Spinal Cord Injury Association. This study was completed with support from the South Carolina Centers of Biomedical Research Excellence (COBRE) for Oral Health with funding provided by the National Institutes of Health (NIH), and the National Center for Research Resources (NCRR) with (P20 RR-017696). The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

References

- 1 Lancashire P, Janzen J, Zach GA, Addy M. The oral hygiene and gingival health of paraplegic inpatients – a cross-sectional survey. *J Clin Periodontol* 1997;24(3):198–200.
- 2 Stiefel DJ, Truelove EL, Persson RS, Chin MM, Mandel LS. A comparison of oral health in spinal cord injury and other disability groups. *Spec Care Dent* 1993;13(6):229–35.
- 3 Yuen HK, Shotwell MS, Magruder KM, Slate EH, Salinas CF. Factors associated with oral problems among adults with spinal cord injury. *J Spinal Cord Med* 2009;32(4):408–15.
- 4 Estores IM. The consumer's perspective and the professional literature: what do persons with spinal cord injury want? *J Rehabil Res Dev* 2003;40(4 Suppl 1):93–8.
- 5 Gontkovsky ST, Russum P, Stokic DS. Perceived information needs of community-dwelling persons with chronic spinal cord injury: findings of a survey and impact of race. *Disabil Rehabil* 2007;29(16):1305–12.
- 6 Matter B, Feinberg M, Schomer K, Harniss M, Brown P, Johnson K. Information needs of people with spinal cord injuries. *J Spinal Cord Med* 2009;32(5):545–54.
- 7 Aydin U, Ozturk M, Kirbiyik S. Prevalence of internet usage and access to health information among dental school outpatients. *Telemed J E Health* 2004;10(4):444–8.
- 8 Harris CE, Chestnutt IG. The use of the Internet to access oral health-related information by patients attending dental hygiene clinics. *Int J Dent Hyg* 2005;3(2):70–3.
- 9 Ni Riordain R, McCreary C. Dental patients' use of the Internet. *Br Dent J* 2009;207(12):583–6; 75.
- 10 Baker L, Wagner TH, Singer S, Bundorf MK. Use of the Internet and e-mail for health care information: results from a national survey. *J Am Med Assoc* 2003;289(18):2400–6.
- 11 Millard RW, Fintak PA. Use of the internet by patients with chronic illness. *Dis Manag Health Outcomes* 2002;10(3):187–94.
- 12 Shim M. Connecting internet use with gaps in cancer knowledge. *Health Commun* 2008;23(5):448–61.
- 13 Tian Y, Robinson JD. Incidental health information use on the Internet. *Health Commun* 2009;24(1):41–9.
- 14 Kalichman SC, Benotsch EG, Weinhardt LS, Austin J, Luke W. Internet use among people living with HIV/AIDS: association of health information, health behaviors, and health status. *AIDS Educ Prev* 2002;14(1):51–61.
- 15 Kalichman SC, Cain D, Cherry C, Pope H, Eaton L, Kalichman MO. Internet use among people living with HIV/AIDS: coping and health-related correlates. *AIDS Patient Care STDS* 2005; 19(7):439–48.
- 16 Dutta-Bergman MJ. Health attitudes, health cognitions, and health behaviors among Internet health information seekers: population-based survey. *J Med Internet Res* 2004;6(2):e15.
- 17 Ayers SL, Kronenfeld JJ. Chronic illness and health-seeking information on the Internet. *Health (London)* 2007;11(3):327–47.
- 18 Yuen HK, Wolf BJ, Bandyopadhyay D, Magruder KM, Salinas CF, London SD. Oral health knowledge and behavior among adults with diabetes. *Diabetes Res Clin Pract* 2009;86(3): 239–46.
- 19 Lei PW, Wu Q. CTTITEM: SAS macro and SPSS syntax for classical item analysis. *Behav Res Methods* 2007;39(3):527–30.
- 20 Golden CJ, Sawicki RF, Franzen MD. Test construction. In: Goldstein G, Hersen M (eds.) *The handbook of psychological assessment*. New York: Pergamon Press; 1984. p. 19–37.
- 21 Kelley TL. Selection of upper and lower groups for the validation of test items. *J Educ Psychol* 1939;30:17–30.
- 22 Ebel RL, Frisbie DA. *Essentials of educational measurement*. 5th ed. Englewood Cliffs, NJ: Prentice Hall; 1991.
- 23 Livingston SA, Zieky MJ. *Passing scores: a manual for setting standards of performance on educational and occupational tests*. Princeton, NJ: Educational Testing Service; 1992.
- 24 Mills GN, Melican GJ. Estimating and adjusting cutoff scores: features of selected methods. *Appl Meas Educ* 1988;1:261–75.
- 25 Yuen HK, Wiegand RE, Slate EH, Magruder KM, Salinas CF, London SD. Dental health knowledge in a group of black adolescents living in rural South Carolina. *J Allied Health* 2008;37(1): 15–21.
- 26 Mickey RM, Greenland S. The impact of confounder selection criteria on effect estimation. *Am J Epidemiol* 1989;129(1):125–37.
- 27 Flesch R. A new readability yardstick. *J Appl Psychol* 1948;32(3): 221–33.
- 28 Goodman N, Jette AM, Houlihan B, Williams S. Computer and internet use by persons after traumatic spinal cord injury. *Arch Phys Med Rehabil* 2008;89(8):1492–8.
- 29 Yuen HK, Mountford WK, Magruder KM, Bandyopadhyay D, Hudson PL, Summerlin LM, et al. Adequacy of oral health information for patients with diabetes. *J Public Health Dent* 2009;69(2):135–41.
- 30 Yuen HK, Wolf BJ, Bandyopadhyay D, Magruder KM, Selassie AW, Salinas CF. Factors that limit access to dental care for adults with spinal cord injury. *Spec Care Dent* 2010;30(4):151–6.