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ARTICLE

Exploring smoking cessation experiences among persons with spinal cord injury: Informing theory-based recommendations for interventions

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STUDY DESIGN: Qualitative study.
OBJECTIVE: Use an integrated knowledge translation (IKT) and theory-based approach, to (1) explore factors influencing smoking cessation behaviour among people with SCI, and (2) explore the preferred intervention and implementation options for smoking cessation interventions for persons with SCI.
SETTING: Community.
METHODS: Aligned with an IKT approach, an SCI organization was meaningfully engaged throughout the research process. Semi-structured interviews were conducted with people with SCI who have quit or tried to quit smoking. Barriers and facilitators to smoking cessation were extracted and deductively coded using the Theoretical Domains Framework (TDF) and inductively analysed. To identify intervention options, a behavioural analysis was conducted using the Behaviour Change Wheel. To identify implementation options, modes of delivery and intervention messengers were extracted. Modes of delivery were deductively coded, and themes relating to intervention messengers were constructed.
RESULTS: Among the 12 participants (7 males; 6 with tetraplegia), seven had quit and five had relapsed. Across the 12 interviews, 130 barriers and 218 facilitators were coded to the TDF. The prominent TDF domains were beliefs about consequences, social influences, environmental context and resources, and behavioural regulation, and served as themes in the inductive analysis. Multiple modes of delivery and intervention messengers were considered important for the delivery of smoking cessation interventions.
CONCLUSION: This study is the first to use IKT and theory-based approaches to explore factors influencing smoking cessation among persons with SCI. Findings from this study resulted in the co-development of practical recommendations for future SCI-specific smoking cessation interventions.

INTRODUCTION

Tobacco use is attributed to more than eight million deaths annually and is a leading cause of preventable disease and death [1]. The risks associated with smoking may be particularly concerning for persons with spinal cord injury (SCI) as they experience a disproportionate burden of tobacco-related health disparities, including an increased risk for urinary tract infections, more severe respiratory problems, and longer pressure injury recovery times compared to persons with SCI who do not smoke [2–5]. Furthermore, persons with SCI report smoking rates higher than those of the general population (19–48% vs. 13–15%, respectively) [3, 6–8].

High smoking rates among the SCI population may be partially attributable to low engagement with conventional smoking cessation services (i.e., behavioural counselling and nicotine replacement therapy). Among a population-based cohort of 833

adults with SCI in the US, 75.4% of current smokers with SCI reported trying to quit at least once [7]. However, of those attempting to quit, less than 30% sought professional help through counselling, pharmacotherapy, or both [7]. Comparatively, in a representative sample of 12,000 daily smokers in the US who attempted quitting in the past year, 36.1% reported using counselling, pharmacotherapy, or a combination of counselling and pharmacotherapy [9]. Despite high smoking rates, tobacco-related health disparities, and low smoking cessation treatment engagement, interventions have not been developed to support persons with SCI stop smoking.

Systematic application of behaviour change theory may be advantageous when designing, testing, and implementing behavioural interventions and may result in more effective interventions [10–12]. The Behaviour Change Wheel (BCW) is a theory-based intervention design tool developed from a synthesis of 19

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frameworks of behaviour change [13]. The BCW is comprised of three layers that aim to understand the target behaviour in context, and link mechanisms of action to evidence-based intervention strategies (e.g., behaviour change techniques, intervention functions).

The innermost layer is the Capability-Opportunity-Motivation Behaviour (COM-B) model that identifies sources of behaviour (capability, opportunity, motivation) to be targeted by interventions [13]. The BCW recommends using the Theoretical Domains Framework (TDF) to conduct interviews to understand the behaviour in context (i.e., COM-B analysis) and identify the sources of behaviour to target in an intervention [11, 14]. Barriers and facilitators of a behaviour are identified and coded to the 14 domains of the TDF, which have been linked to the COM-B model through expert consensus [15]. Together the BCW and TDF provide a systematic method for linking context-dependent behavioural outcomes to mechanisms of action to evidence-based intervention and implementation options.

However, being theory-based does not necessarily mean that the intervention will be implemented in practice or be relevant to the target population. Integrated knowledge translation (IKT) aims to address this gap by meaningfully involving research users as partners alongside researchers throughout the research process to co-create research that is relevant, useful, and usable to research users [16]. In previous studies using an IKT approach, the establishment of meaningful partnerships with SCI organizations aimed to eliminate tokenism, improve meaningful engagement, and co-create usable research among the SCI population [17, 18]. Therefore, the aims of this qualitative study were to use an IKT approach and the theory-based BCW and TDF to:

(1) Explore factors influencing smoking cessation behaviour among people with SCI; and
(2) Explore the preferred intervention and implementation options for a smoking cessation intervention for persons with SCI.

METHODS
Study design
This qualitative study uses IKT and theory-based approaches to explore barriers and facilitators to smoking cessation encountered by persons with SCI and explore the preferred intervention and implementation options for smoking cessation interventions for persons with SCI. As this study is based in British Columbia, Spinal Cord Injury British Columbia (SCI BC) was identified as a research user and was meaningfully involved as a partner throughout the entire research process. SCI BC is a not-for-profit organization dedicated to helping persons with SCI, and related disabilities, adjust, adapt, and thrive. SCI BC's connection with and supports for persons with SCI made them the appropriate research user and partner for this study. Regular meetings were held throughout this project to evaluate methods, share findings, gather feedback, and enhance the interpretation of the findings for persons with SCI. (Details of the meetings are available in Supplementary File 1).

Procedures
Recruitment was done in partnership with SCI BC. The study was promoted through emails by our partner and on a multi-disciplinary SCI research website. Individuals were eligible to participate if they: (1) had been living with an SCI for at least 2 years; (2) currently or formerly smoked cigarettes; (3) if currently smoking, had ever tried to quit; (4) were at least 18 years of age; (5) currently resided in British Columbia; and (6) did not have a diagnosed co-morbidity affecting cognitive function. Guidance for conducting TDF interviews [14], recommends conducting and analysing an initial ten interviews and then three more until data saturation is achieved. However, we were constrained by time and availability of participants and were only able to conduct 12 interviews.

Prior to the interview, participants completed a survey requesting demographic, injury, and smoking history information. Following the completion of the survey, participants were contacted to schedule an interview. Upon completion of the interview, participants received a $25.00 gift card or e-gift card to the retailer of their choice.

Co-development of the interview guide was informed by previous qualitative studies specific to the SCI population [19] and guidelines for using the TDF to investigate implementation problems [14] (see Supplementary File 2 for interview guide). To address aim 1, open-ended questions promoted a discussion of the lived experiences of individuals with SCI quitting smoking and provided an open forum for individuals to expand on those lived experiences. If needed, probing questions tailored to the COM-B model were used to gain a deeper understanding of the participant's identified barriers and facilitators. To address aim 2, we asked participant's how or in what format they would prefer the intervention be delivered (i.e., mode of delivery) and who they would prefer to deliver the intervention (i.e., intervention messenger). If participants did not have a clear preference, the participant was prompted with examples of modes of delivery (e.g., face-to-face counselling, nicotine patch) and intervention messengers (e.g., physician, peer counsellor). The interview guide was piloted with one research assistant and one researcher with expertise in TDF interviews.

One researcher (KRW) conducted all interviews via telephone. Interviews were audio-recorded and transcribed verbatim by one researcher and four undergraduate research assistants. Each transcript was reviewed for accuracy by the researcher (KRW) before data analysis commenced.

Data analysis
Research paradigm and methodology. We approached this study using a pragmatic perspective which focused on the usefulness of research findings for solving practical, "real-world" problems [20]. Pragmatism promotes flexibility of investigative techniques and collaboration between researchers and community partners with differing philosophical assumptions, aligning with an IKT approach [21].

This study used a crystallisation methodology which encourages the use of multiple types of analyses (e.g., inductive and deductive analyses) to generate a complex interpretation of the phenomenon [22]. Using an inductive and deductive analysis (i.e., abductive analysis) to deepen understanding of the problem and contrast findings has been used previously to develop practical recommendations within the SCI population [19]. Furthermore, our approach was guided by the eight "Big-Tent" criteria for trustworthiness in qualitative research [23] to enhance rigour. See Supplementary File 4 for information on rigour and methodological coherence.

Aim 1: Explore factors influencing smoking cessation behaviour
Deductive analysis. Barriers and facilitators to smoking cessation were extracted by two reviewers independently (KRW, JDB) until agreement reached 70% to enhance interrater reliability of barrier and facilitator extraction. One researcher (KRW) then extracted barriers and facilitators from the remaining transcripts. The double-extracted barriers and facilitators were independently coded by two reviewers (KRW, JDB) to the 14 TDF domains until agreement reached substantial ($\kappa = 0.61–0.80$) [24], at which point, coding of the remaining barriers and facilitators was accomplished by one researcher (KRW).

Inductive analysis. The inductive thematic analysis enabled a deeper understanding of the context around the barriers and facilitators identified in the deductive analysis. The most prominent TDF domains identified in the deductive analysis served as themes within the inductive analysis. Within each theme, subthemes were constructed from the barriers and facilitators coded to their respective TDF domain. The analysis and construction of the subthemes followed guidelines for conducting a reflexive thematic analysis [25].

Aim 2: Identify intervention and implementation options
Intervention options. Intervention options refer to intervention functions and policy categories. The prominent TDF domains were linked to the COM-B model to determine sources of behaviour (i.e., capability, opportunity, motivation). The sources of behaviour were mapped to intervention functions (i.e., broad categories, such as education and training, for changing behaviour) and policy categories (i.e., broad methods for supporting the delivery of intervention functions, such as service provision or guidelines) using previously developed matrices [11] (see Supplementary File 3 for the matrices).

Table 1. Participant demographics and smoking characteristics.

Variable	Overall (*n* = 12)		Formerly smoked (*n* = 7)		Currently smoke (*n* = 5)	
	n (%)	Mean ± SD	*n* (%)	Mean ± SD	*n* (%)	Mean ± SD
Demographics						
Age (years)		55.9 ± 9.9		56.0 ± 7.7		55.8 ± 13.4
Gender (Man)	7 (58.3)		5 (71.4)		2 (40.0)	
Marital status (Single)	6 (50.0)		4 (57.1)		2 (40.0)	
Ethnicity (White)	11 (91.7)		6 (85.7)		5 (100.0)	
Indigenous (No)	11 (91.7)		6 (85.7)		5 (100.0)	
Place of residence (Urban)	9 (75.0)		6 (85.7)		3 (60.0)	
Education (Highschool)	5 (41.7)		3 (42.9)		2 (40.0)	
Injury-related characteristics						
Years post-injury (years)		28.5 ± 15.4		32.0 ± 18.2		23.6 ± 10.3
Level of injury (Tetraplegia)	6 (50.0)		4 (57.1)		2 (40.0)	
Injury severity (Incomplete injury)	7 (58.3)		3 (42.9)		4 (80.0)	
Mode of mobility (Manual wheelchair)	6 (50.0)		2 (28.6)		4 (80.0)	
Smoking behaviour						
Age first started smoking (years)		16.2 ± 4.6		15.1 ± 2.1		17.6 ± 6.9
Average cigarettes/day		17.4 ± 9.2		–		17.4 ± 9.2
Started smoking prior to injury	11 (91.7)		6 (85.7)		5 (100.0)	
Time after waking to first smoke (1 h)	3 (25.0)		–		3 (60.0)	
Longest time quit						
Up to a week	3 (25.0)		1 (14.3)		2 (40.0)	
Longer than 12 months	6 (50.0)		6 (85.7)		–	
Quit attempt in the last 12 months						
Yes	5 (41.7)		1 (14.3)		4 (80.0)	
Have not smoked in last 12 months	6 (50.0)		6 (85.7)		–	
Ever used smoking cessation aid (No)	8 (66.7)		4 (57.1)		4 (80.0)	

Only the majority variable is presented. See Supplementary File 5 for more demographics details. Time after waking to first smoke is an indication of nicotine dependence. Shorter time after waking to first smoke is associated with a higher level of nicotine dependence.
SD standard deviation.

Implementation options. Implementation options refer to mode of delivery (i.e., "how" an intervention is delivered) and intervention messengers (i.e., "who" delivers the intervention). Modes of delivery and intervention messengers were extracted by two reviewers independently (KRW, JDB) until agreement reached 70%, at which point one researcher (KRW) extracted modes of delivery and intervention messengers from the remaining transcripts. The agreed-upon modes of delivery from four transcripts were coded to the Mode of Delivery Taxonomy version 0 (MoDtv0) [26] by two reviewers independently (KRW, JDB) until agreement reached substantial (κ = 0.61–0.80), at which point the remaining modes of delivery were coded to the MoDtv0 by one researcher (KRW). As no framework or taxonomy exists from which intervention messengers can be coded, intervention messengers were grouped into broad themes.

Disagreements between reviewers for all extraction and coding were resolved through discussion. If consensus could not be reached between the reviewers, a third reviewer (HLG) was consulted.

RESULTS
Nineteen individuals expressed interest in participating; however, only 12 individuals were interviewed (see Table 1 for participant demographics). One individual did not provide contact information (*n* = 1), three individuals provided contact information but were unable to be reached (*n* = 3), and three individuals did not meet eligibility criteria (resided outside of BC, *n* = 2; does not have an SCI that occurred more than 2 years ago, *n* = 1). Interviews were between 30 and 63 min long (Mean = 42.1 min). Details of

interrater reliability and methodological coherence can be found in Supplementary File 4.

Aim 1: Explore factors influencing smoking cessation behaviour—deductive analysis
A total of 265 factors (103 barriers, 162 facilitators) were extracted by two reviewers independently (KRW, JDB) from seven transcripts until 70% agreement was reached. From the remaining five transcripts, an additional 96 factors (61 facilitators, 35 facilitators) were extracted by KRW, resulting in a total of 361 factors (138 barriers, 223 facilitators). During TDF coding, 13 factors (8 barriers, 5 facilitators) were excluded as they were barriers/facilitators to smoking (*n* = 8), or they did not provide enough context to categorise to a TDF domain (*n* = 5), leaving a total of 348 factors (130 barriers, 218 facilitators) (see https://osf.io/k96nr/ for a detailed list of barriers and facilitators). Twenty-six factors (15 facilitators, 11 barriers) were coded to two TDF domains, resulting in a total of 374 TDF codes.

Figures 1 and 2 present the number and percent of barriers and facilitators identified across TDF domains. Figure 1 highlights environmental context and resources (*n* = 31, 22.0%), social influences (*n* = 24, 17.0%), behavioural regulation (*n* = 24, 17.0%), and beliefs about consequences (*n* = 23, 16.3%) as the most commonly coded domains among the barriers. As seen in Fig. 2, beliefs about consequences (*n* = 64, 27.6%), social influence (*n* = 47, 20.3%), behavioural regulation (*n* = 46, 19.8%), and
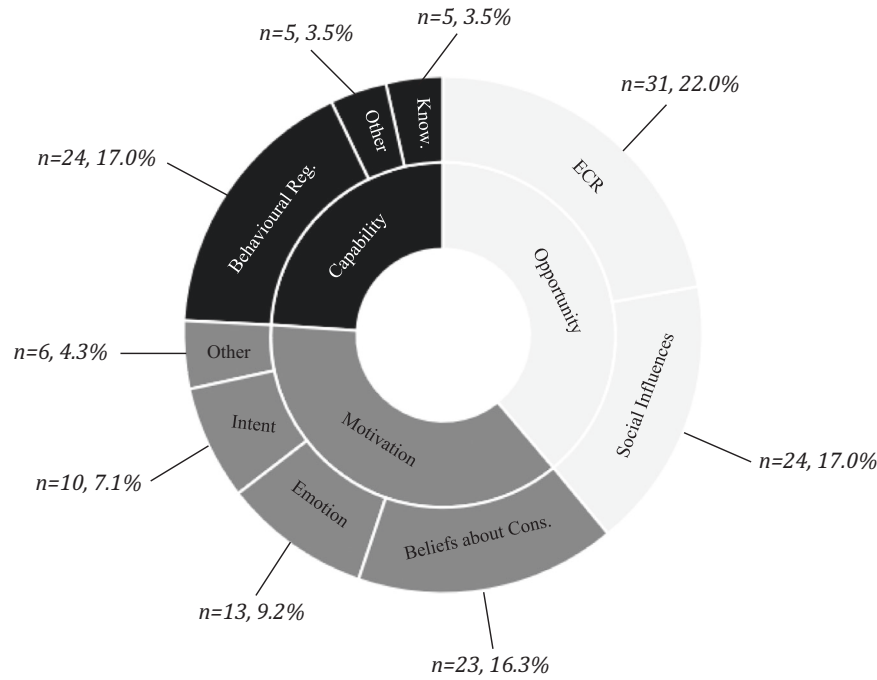
Fig. 1 Barriers to smoking cessation by COM-B source and TDF domain (*n* = 141). The inner ring is COM-B sources of behaviour and outer ring is TDF domains. Some barriers were coded to more than one domain. Capability category "Other" includes memory, attention, and decision processes, and skills. Motivation category "Other" includes goals, optimism, and social/professional roles and identity. Behavioural Reg. behavioural regulation, Know. knowledge, Beliefs about Cons. beliefs about consequences, Intent intention, ECR environmental context and resources.
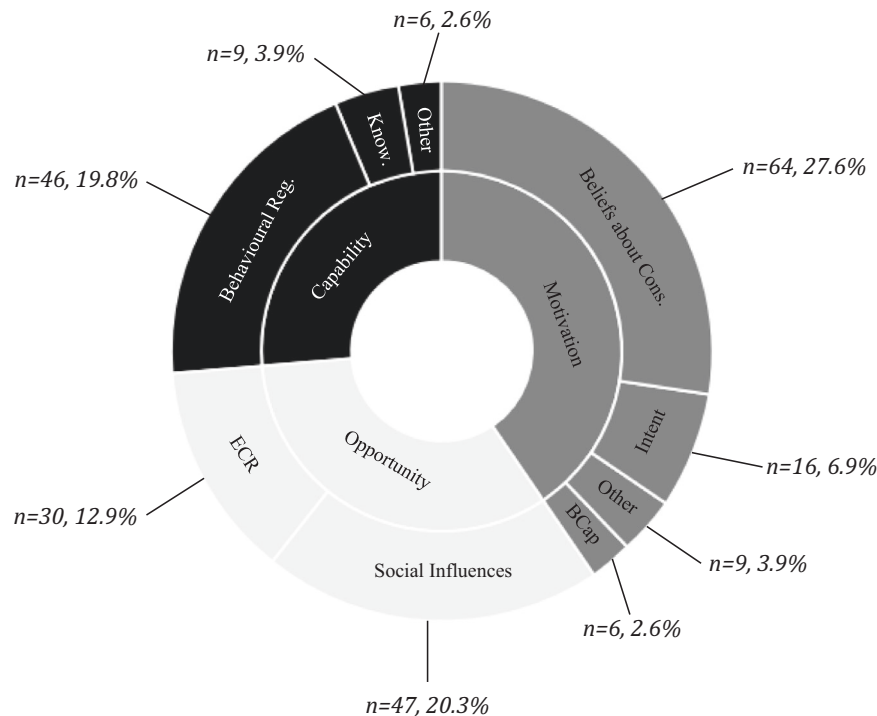

Fig. 2 Facilitators to smoking cessation by COM-B source and TDF domain (*n* = 233). The inner ring is COM-B sources of behaviour and outer ring is TDF domains. Some facilitators were coded to more than one domain. Capability category "Other" includes memory, attention, and decision processes, and skills. Motivation category "Other" includes emotions, goals, and social/professional roles and identity. Behavioural Reg. behavioural regulation, Know. knowledge, Beliefs about Cons. beliefs about consequences, Intent intention, BCap beliefs about capabilities, ECR environmental context and resources.

environmental context and resources ($n = 30$, 12.9%) were the most commonly coded TDF domains among the facilitators.

Aim 1: Explore factors influencing smoking cessation behaviour—inductive analysis

The four most prominent TDF domains (i.e., beliefs about consequences, social influences, environmental context and resources, and behavioural regulation) served as themes for the inductive analysis. A brief description of each theme is presented below. Table 2 describes each subtheme and provides accompanying quotes that characterises each subtheme.

Beliefs about consequences. This theme focusses on participants' motivation to quit smoking, whereby individuals weigh the perceived risks of continuing to smoke against the perceived risks of quitting smoking. When the risks of smoking outweighed the risks of quitting, participants often voiced intentions and efforts to stop smoking. Significant events (e.g., a loved one getting sick) served as "wake-up calls" for participants, in which they suddenly perceived a high vulnerability to the risks of smoking, and this often led to smoking cessation efforts. The beliefs about consequences theme includes three subthemes: (1) perceived risks of smoking; (2) the risks of quitting are more distressing than those of smoking; and (3) wake-up calls.

Social influences. This theme focusses on the crucial role that relationships play in altering one's smoking behaviour. Participants' decision to stop smoking was influenced by societal norms and values and their social network. However, the ability to stay quit was influenced by the accommodations made by others to support the individual while they stopped smoking. The social influences theme includes two subthemes: (1) adhering to social norms and values; and (2) expected and received support from others who smoke.

Environmental context and resources. This theme focusses on the environmental circumstances that may support smoking cessation. The introduction of smoke-free legislation and other tobacco control policies restricted participants' opportunity to smoke, and as a result, many chose to quit smoking at these times for convenience. Similarly, when persons with SCI sustain their injury, the hospital environment and life-altering circumstances force these newly injured individuals to stop smoking. While the above circumstances showcase how the environment can act as a facilitator, the environment can just as often act as a barrier to smoking cessation. Boredom, habitual smoking environment (i.e., places where participants regularly smoke), and easy access to cigarettes represent barriers that persons with SCI encounter that impede their smoking cessation efforts. The environmental context and resources theme contains two subthemes: (1) reconciling pre- and post-injury ways of life; and (2) government actions made it convenient to quit.

Behavioural regulation. This theme focusses on the concept of self-regulation, including challenges related to self-regulatory ability that often leads to relapse as participants struggle to overcome intense cravings and urges to smoke. The presence of stressful circumstances (e.g., secondary health conditions) or alcohol use can exacerbate self-regulation, which made some participants more susceptible to relapse. The behavioural regulation theme contains three subthemes: (1) managing cravings requires a tailored approach; (2) quitting smoking is just one more thing to cope with, and (3) alcohol and cigarettes go "hand-in-hand".

Aim 2: Identifying intervention and implementation options

Intervention options. When linked to the COM-B model of the BCW, the four prominent TDF domains suggest that all intervention functions and all policy categories are potentially relevant to support smoking cessation for persons with SCI.

Implementation options. A total of 98 implementation options (55 modes of delivery, 43 intervention messengers) were extracted. Somatic forms of delivery (e.g., pharmacotherapy), such as inhalers/vaporisers ($n = 10$), patches ($n = 8$), pills ($n = 7$), or other ($n = 2$), were identified most frequently by participants accounting for 45.0% of the total codes. Human forms of delivery, such as face-to-face ($n = 13$), audio and video calls ($n = 2$), or unspecified ($n = 4$), were the second most frequently identified mode of delivery accounting for 31.8% of the total codes. Digital and printed material comprised 15.0% and 8.4% of the total codes, respectively. Preferred intervention messengers included health care professionals, disability organizations, and peers with SCI. See Tables 3 and 4 for mode of delivery coding and intervention messenger themes, respectively.

DISCUSSION

This study used IKT and theory-based approaches, to (1) explore factors influencing the smoking cessation behaviour among persons with SCI and (2) explore the preferred intervention and implementation options for smoking cessation interventions for persons with SCI. This study found the factors participants most frequently discussed as influential to their smoking cessation behaviours were related to the TDF domains of beliefs about consequences, social influences, environmental context and resources, and behavioural regulation. Additionally, findings suggest that all intervention options (i.e., intervention functions and policy categories) are potentially relevant in developing smoking cessation interventions. Furthermore, persons with SCI indicated a preference for face-to-face interventions supplemented with pharmacotherapy delivered by a variety of intervention messengers. The findings from this study have important implications for what, when, how, and who delivers smoking cessation interventions for persons with SCI. Figure 3 summarises how findings might be used to inform an intervention. These recommendations were co-developed with SCI BC.

Our findings are similar to those found in a previous study exploring barriers and facilitators to smoking cessation among persons with SCI in the US [26]. Cost associated with smoking and health concerns were identified as facilitators to smoking cessation in both this study and the study by Saunders et al. [27], while co-morbid alcohol use was a commonly identified barrier among both studies. Although boredom was identified as a barrier in both studies, Saunders et al. [27] reported that participants related feelings of boredom with unemployment; whereas, in our study, unemployment was never discussed by participants and boredom was primarily related to returning home after their injury or coping with a secondary health condition. This difference in boredom may be related to a difference in national contexts and policies, and/or years post-injury as the participants in our study had on average been living with their injury for longer than those in Saunders et al. [27] (28.5 years vs. 6.5 years post-injury, respectively). Research suggests that employment among persons with SCI increases with time post-injury [28], therefore, the participants in our study may have been more likely to be employed. Furthermore, we identified barriers and facilitators not identified by Saunders et al. [27] including concerns about post-cessation weight gain, coping with secondary health conditions while stopping smoking, and the risk of relapse during rehabilitation and community reintegration after injury.

Our study expands on the work done by Saunders et al. [27] through the use of behaviour change theory and through the exploration of preferred intervention and implementation options. While similar barriers and facilitators were identified in both

Table 2. Themes and associated subthemes of the experiences of quitting smoking among persons with spinal cord injury.

Theme	Subtheme	Description	Quotes
Beliefs about consequences			
	Perceived risks of smoking (n = 12)	Participants discussed risks related to: (1) tobacco-related SCI-specific health complications (e.g., doctors refused to surgically treat pressure injuries if the patient smoked) (2) leading a life aligned with one's values (e.g., being around to celebrate milestones with family such as weddings, grandchildren); and (3) interpersonal conflict and the breakdown of relationships (e.g., quitting smoking to appease a spouse).	*Because the wounds would not heal if you were a smoker. I think a lot of it was fear. You know, I did get a [pressure injury], and it did… it frightened me quite a bit.* (Male, formerly smoked) *I also took a picture of my son and tacked it to the wall where I sit and just looked at [him], like, 'you don't wanna get cancer and die, and he's gonna have to go live with his dad.'* (Female, formerly smoked) *We were just newly married. He was getting really irritated [with my smoking] … to the point of being angry. And I am like, 'this is not how I want to start my marriage.'* (Female, formerly smoked)
	The risks of quitting are more distressing than those of smoking (n = 9)	Some participants described the risks of quitting as being equally or even more distressing than those associated with smoking. Focusses on two areas: (1) risk of post-cessation weight gain on independence; and (2) withdrawal and side-effects of pharmacotherapy use.	*Getting in the bathtub and then [I'm] out of breath, and I thought, 'well, I'm just gonna have to die smoking.'* (Female, currently smokes) *They say, 'oh, it gets better everyday after you stop.' Bullshit it does. Cause [you've got all that] phlegm and all that stuff that's coming off of your lungs, so you're spitting it up all the time. So, it's worse when you quit smoking.* (Female, currently smokes)
	Wake-up calls (n = 4)	Among the participants who had successfully stopped smoking, many spoke about experiencing a "wake-up call". A wake-up call was often related to a specific event (e.g., loved one getting sick) in which the participant suddenly perceived a high vulnerability to the risks of continuing to smoke.	*[The peer counsellor] just explained, you know, talked to me about having a healthy life and he knew people that were like me that smoked and were not very healthy, and he said they, you know, they passed on. That really made me open my eyes. To be in a wheelchair and then hearing that. I wanted to… I wanted to stick around a little bit longer.* (Male, formerly smoked)
Social Influences			
	Adhering to social norms and values (n = 10)	Many conveyed feelings of obligation to act in a manner that aligned with the norms and values of their social network. When their behaviour did not coincide with the perceived norms and values of the group, participants often felt embarrassed and pressured to change their behaviour to better fit within the group. Participants discussed their attempts to adhere to the norms and values of social groups such as friends and family, as well as society and the general public.	*[I started smoking for] the same reason I stopped… it was cool. I was very young. That's why I started, and that's why I quit* (Female, formerly smoked). *[…]like you're around national team guys and girls and [you're] at a Paralympic training facility. You don't go outside and have a cigarette. It's, you know, it's a little bit dumb it seems to me. […] You know, make sure you're with people who take their health like #1 sort of thing.* (Male, currently smokes)
	Expected and received support from others who smoke (n = 9)	Once participants chose to stop smoking, support from friends, family, peers, and co-workers who currently smoke was an important aspect that affected whether the participant was successful in their smoking cessation efforts. Participants distinguished different levels of expected and received support from others who currently smoke: (1) quitting together, (2) modification of smoking behaviour, or (3) no accommodation.	*In the last two years, we've been kind of dabbling in [quitting], but we both want to quit, so we're quitting together, so that's a good thing.* (Female, currently smokes) *I'm not going to stop smoking because [others are] trying to quit smoking. I mean, I'll still smoke in front of them. I mean, you can't quit [smoking] and expect people not to smoke in front of you.* (Male, currently smokes)
Environmental context and resources			
	Reconciling pre- and post-injury ways of life (n = 10)	Most participants had started smoking before their injury. Despite the apparent ease and success to quit smoking while recovering in the hospital and rehabilitation, all except one of the participants resumed smoking once they returned home.	*When I was in the hospital, I didn't even think about having a cigarette. I was there for six weeks. I didn't even think about it. I came home, and three days later, I'm sitting in the garden thinking, 'I gotta have a smoke.' […] And I said to my husband, 'get my smoke. I need my smoke.' […]. And that was the end of that.* (Female, currently smokes)
	Government actions made it convenient to quit (n = 7)	Many participants attributed their ability to stop smoking to the government's actions to make cigarette smoking more difficult to partake in and make smoking cessation supports (i.e. NRT) easier to obtain.	*I wanted to quit then because I knew it was coming where you couldn't smoke anywhere, and that [cigarettes] were gonna get really expensive, and I'm on a fixed income so I [couldn't] afford to buy cigarettes.* (Female, formerly smoked)
Behavioural regulation			
	Managing cravings requires a tailored approach (n = 12)	Participants described the ability to manage cravings as essential to their success in quitting smoking. While participants agreed that it was important to manage their cravings, the methods of management were diverse and individualised. Methods included: (1) NRT and prescription	*The patch is great because I put it on my back, and I forget about it, and it just does its own regulating of the nicotine, and it seems to work really well. It just seems like when you get a craving, and it's just over.* (Female currently smokes)

Table 2. continued

Theme	Subtheme	Description	Quotes
		medication, (2) behavioural substitution, (3) exercise, and (4) distractions.	*The vape was to help me quit smoking. And that's what it did for me. Just those few times where I was like, 'yeah, I just, I need a cigarette.' And it's like, 'okay, now I can use the vape.'* (Male, formerly smoked)
	Quitting smoking is just one more thing to cope with ($n = 3$)	Despite strong motivations to stop smoking and various craving management methods, some participants still struggled to stop smoking successfully. These participants experienced secondary health conditions that were emotionally, physically, and psychologically exhausting.	*Yeah, I mean being in a chair for seventeen years… ya know, I'm good in my chair. It's a manual chair. I'm really good at it – I go fast. Umm… now I have renal failure, and I'm on dialysis and… sometimes I just can't. I just think, 'one more thing. I can't cope [with quitting].'* (Female, currently smokes)
	Alcohol and cigarettes go "hand-in-hand" ($n = 5$)	Participants expressed that when they were drinking alcohol, they wanted a cigarette and struggled to regulate and overcome cravings to smoke, which sometimes led to relapse. Cigarette smoking and alcohol consumption were always discussed with a directionality; when participants drank alcohol, they also smoked cigarettes.	*I was so used to smoking when I would drink [alcohol]. It was one of those things, right. You just always [had] a cigarette if you had a beer in your hand or whatever you were drinking. So, for me, that was the most difficult [when I was stopping smoking].* (Male, currently smokes)

n number of participants who discussed each theme in their interview. *NRT* nicotine replacement therapy.

Table 3. Mode of delivery preferences among persons with spinal cord injury.

Mode of delivery	Quote example	Total (*n*)
Human		
Face-to-face	"Most definitely face-to-face, preferably. Other than.. uh.. reading it, I mean, I personally think it's always better if it was presented in person. Whether it be in a group, or one-on-one. I think it's more personal."	9
Distance		1
Audio or Video Call	"well you know, face-to-face is good too if you can get there, but uh I think uh.. SCI BC has a bunch of uh forums that I can dial up on a monthly basis on many, many topics"	1
Unspecified	"…a support group maybe. I dont know. See, cause I never used anything like that, I..I..that's a hard question for me."	2
Printed material		
Leaflet	"Online or newsletter. The [SCI community organization magazine] would be fine too"	2
Public Notice	"Um… probably if there was more 'no smoking' signs [in] some places? Then I wouldn't smoke."	1
Digital		
Phone or computer		0
Email	"there's email lists. A lot of people have access to them, you just need to contact [organization] or any of those type organizations - SCI, disability resource centres or stuff and they'll usually have someone who just sends out mass emails."	1
Website	"Online, you know for the people to read"	4
Television	"more commercials, that commercial really hit me. Like commercials are really, they send out messages that's why there's so damn many of them. You know they, you know if you keep seeing something popping up it starts coming to your head all the time. Since it associates it with ya."	1
Unspecified	"Online would be awesome. I spend a lot of time on my computer. …I don't go to [the city] very often… So yeah, online would be really great."	2
Somatic (pharmacotherapy)		
Patch	"Umm, the patch is great because I put it on my back and I forget about it and it just does it's own regulating of umm the nicotine that comes in me and umm it seems to work really well."	2
Pill	"We need som.. I need a pill. If.. that's all it is. Somebody needs to come up with this pill that tells us "oh we never smoked before".	2
Inhaler	"…like a nicotine vape or something, which I'd be totally for. I've bought them in the past, but that was before I started umm regularly smoking"	3
Other	"Well, have [nicotine] gums or whatever available."	2
Total		33

n = number of participants who discussed each mode of delivery. Participants expressed a preference for more than one mode of delivery, hence total *n* > 12.

studies, our study links the barriers and facilitators to behaviour change theory which may aid in the development of a future theory-informed smoking cessation intervention for persons with SCI [11]. Furthermore, our study explored preferred modes of delivery and intervention messengers which may enhance the likelihood that a smoking cessation intervention is relevant and addresses the needs and priorities of persons with SCI stopping smoking.

Table 4. Intervention messenger preferences among persons with spinal cord injury.

Intervention messenger	Description	Quotes
Health care professionals (n = 12)	Participants discussed developing strong and trusting relationships with their doctors and were, therefore, often the first source participants turned to for health information and advice. Participants considered doctors to be a credible source of health information.	[...] [my doctor] was an incentive [to stop smoking] all the way back from day one. I've had him for thirty-five years. So, he knows me better than he knows his kids, I think. [...] But he just keeps telling me, you're healthy and WAY better off with a few extra pounds than you are smoking (Male, formerly smoked)
Disability organizations (n = 9)	Participants felt that disability organizations could reach the highest number of people through their member email lists, peer talks, and other community supports and resources. Disability organizations were identified as a credible and trusted source because participants felt that disability organizations have their members' best interests at heart and understand the needs and priorities of their members.	It's the whole attitude of the folks inside. Whether or not they have an accessible washroom, all those types of things. [...] the whole issue of inclusivity is a much deeper concept [than just] accessibility. The mindset of the people doing the program, that they're not gonna talk down to us, just because we're shorter. (Male, formerly smoked)
Peers with SCI (n = 5)	As another person with SCI, peers were identified as a credible source of health information with the advantage of being able to provide support and advice based on their own lived experience.	[...] people who quit smoking, like [Sam] he's a peer counsellor, he could explain a lot too about health and [having] an SCI. (Male, formerly smoked)

n number of participants who discussed each theme during their interview.

Practical Implications with Description		
What	*SCI-Specific Tobacco-Related Health Information*	
	Smoking cessation interventions for persons with SCI may need to tailor health information for persons with SCI.	
	Smoking cessation interventions may need to focus on the benefits of stopping smoking for pressure injuries, kidney, bladder, and urinary tract infections, and respiratory function.	
	Management of Post-Cessation Weight Gain	
	Personalized exercise and diet counselling may need to be delivered concurrently with smoking cessation supports.	
	Health care professionals may play an important role in reframing the relative risk of cigarette smoking and weight gain.	
	Additional Supports for Those Coping with Secondary Health Conditions	
	Smoking cessation interventions for persons with SCI may need to provide support for secondary conditions through additional resources, counselling, and referrals to health care specialists, in addition to conventional NRT/prescription medication for stopping smoking.	
When	*Relapse Prevention During Rehabilitation Following SCI*	
	Supports and resources may be needed to help individuals with new injuries abstain from smoking as they adjust to their new life and identity.	
	Supports and resources may need to address feelings of boredom, familiar smoking environments, and interacting with friends and family who smoke.	
How	*Face-to-Face Interventions Supplemented with Pharmacotherapy*	
	Smoking cessation interventions will likely need to be delivered face-to-face with an option for audio or video calls, plus pharmacotherapy (i.e. NRT and prescription medication).	
	Smoking cessation interventions may need to assist persons in obtaining pharmacotherapy from government subsidization programs. If no government programs exist, interventions may need to supply or subsidize pharmacotherapy themselves.	
Who	*Interventions Delivered through a Collaborative Effort of Various Messengers*	
	Smoking cessation interventions may need to be delivered collaboratively by health care professionals, disability organizations, and peers with SCI.	

Fig. 3 Practical implications for designing and implementing smoking cessation interventions for persons with SCI.

Limitations

Our recruitment was constrained by convenience sampling. Specific demographic parameters were not represented in our sample (e.g., under the age of 30, those with injuries having occurred less than 5 years ago, individuals with SCI who ambulate, and persons of colour and indigenous persons with SCI).

Qualitative data is inherently situational and contextual, and therefore, not typically generalisable, but rather transferable (i.e., the story of the research evokes vicarious emotional experience in the reader and they intuitively transfer the research to their own actions) [23]. Using the eight "Big Tent" criteria [23], we have aimed to achieve thick and rich descriptions and findings that evoke transferability.

The frequency of TDF codes does not necessarily indicate the importance or lack of importance of TDF domains. Instead, frequency refers to the number of times across transcripts participants discussed each domain. As the TDF does not necessarily imply importance, we used a thematic analysis to illustrate important elements within the most heavily discussed domains. Another limitation of using the TDF is that the TDF is a framework and not a theory. As a framework, the TDF describes the factors that are suggested to influence behaviour but does not specify how the factors might relate to or influence each other [29]. Lack of clarity on the relationship between domains may provide difficulties when trying to develop future theory-based smoking cessation interventions. However, findings informed the selection of behaviour change theory that may be useful for developing smoking cessation interventions for persons with SCI, such as the Health Action Process Approach [30, 31].

Future directions
Future research efforts should focus on understanding the smoking cessation behaviours of individuals with injuries that occurred less than 5 years ago as our study revealed a susceptibility to relapse upon returning home from the hospital and rehabilitation after their injury. Additional demographic parameters that research should address include individuals with SCI under the age of 30, individuals with SCI who ambulate, and persons of colour and indigenous persons with SCI. Individuals within these demographic parameters may encounter different barriers to smoking cessation than those represented in this study. Also, further research is needed to explore the influence of sex and gender-related factors in smoking cessation among persons with SCI.

Future research should study the effects of theory-based and co-developed smoking cessation interventions for persons with SCI. Rigorous testing will be needed to ensure the efficacy, feasibility, and effectiveness of the interventions for persons with SCI.

CONCLUSION
To our knowledge, this study is the first to use an IKT approach and the BCW and TDF to explore factors influencing the smoking cessation behaviours of persons with SCI and identify the intervention and implementation options for smoking cessation interventions preferred by persons with SCI. Our findings suggest that conventional smoking cessation interventions may need to be optimised to address the unique circumstances encountered by persons with SCI when stopping smoking. Continued efforts are needed to ensure these findings are translated in partnership with SCI organizations and contribute to improvements in health among persons with SCI.

DATA AVAILABILITY

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AUTHOR CONTRIBUTIONS

KRW, CBM, and HLG were responsible for co-developing the research question, selecting the methodology, co-developing all recruitment materials, and co-developing the interview guide. KRW conducted all interviews. KRW and JDB extracted and deductively coded all transcripts. HLG provided coding oversight. KRW inductively coded all transcripts. FH and HLG acted as critical friends and provided feedback on the thematic analysis. CBM provided partner oversight. HLG supervised the research. KRW wrote the manuscript. All authors contributed to the critical revision of the manuscript.

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The authors declare no competing interests.

ETHICAL APPROVAL

We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research. Ethics approval for this study was obtained from the University of British Columbia Okanagan Behavioural Research Ethics Board (#H19–01020).

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