ORIGINAL ARTICLE

Online training improves paramedics' knowledge of autonomic dysreflexia management guidelines

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Study design: Single-group pre-/post-test with 3- and 6-month follow-ups.

Objectives: To test the effects of the 'ABCs of AD' educational module on immediate and longer-term changes in paramedics' knowledge and beliefs about using the autonomic dysreflexia clinical practice guidelines (AD-CPGs).

Setting: Canada.

Methods: A total of 119 paramedics completed an AD knowledge test and measures of attitudes, perceived control, self-efficacy, social pressure from patients and health-care professionals, and intentions to use the AD-CPGs before and 1 week, 3 months and 6 months after viewing 'ABCs of AD'.

Results: There were significant improvements in AD knowledge, attitudes and social pressure from patients to use the AD-CPGs from baseline to 1 week, 3 months and 6 months post viewing (all $P < 0.001$). Self-efficacy and intentions increased 1 week post viewing ($P < 0.001$), but returned to baseline levels at 3 and 6 months ($P > 0.05$). There was no change in perceived control or social pressure from health-care professionals. AD knowledge and beliefs explained 50–61% of the variance in intentions to use the AD-CPGs. Attitudes, social pressure from patients and perceived behavioural control were significant unique predictors of intentions at all time points ($P < 0.05$); AD knowledge was a significant predictor at 6 months only ($P = 0.048$). No other predictors were significant.

Conclusion: 'ABCs of AD' has immediate and sustained effects on paramedics' knowledge of attitudes toward and perceived pressure from patients to use the AD-CPGs. Updates to paramedic patient care guidelines and standards are needed to increase paramedics' perceived control and self-efficacy to implement the guidelines, and their intentions to use the AD-CPGs.

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INTRODUCTION

Autonomic dysreflexia (AD) is an acute, life-threatening condition that can occur daily in individuals with a spinal cord injury (SCI) above the sixth thoracic segment (i.e., T6 or higher).^{1–3} Episodes of AD are often unpredictable and characterised by a 20–40 mmHg increase in systolic blood pressure above the individual's baseline, pounding headache, flushing of the skin and profuse sweating above the level of injury, goose bumps above or below the level of injury and cold pale skin below the level of injury.^{4,5} If recognition and management of episodes are delayed, AD can lead to myocardial infarction,⁶ intracranial haemorrhage⁷ and even death.^{8,9} However, early recognition and prompt management of this life-threatening, but easily treatable condition, can mitigate the occurrence of negative outcomes.^{4,8}

Studies of AD knowledge among emergency room nurses and physicians in Australia¹⁰ and Canada¹¹ have revealed limited knowledge of AD, which would impede the ability to initiate treatment according to the AD Clinical Practice Guidelines (AD-CPGs).¹² Given that paramedics are often the first medical professionals to respond to a person experiencing AD, paramedics have a vital role to play in ensuring that AD is properly identified and appropriate treatment is

initiated promptly. However, targeted educational interventions are needed to ensure that paramedics have the knowledge to fulfil this role.

The 'ABCs of AD' is an educational module that was developed to educate emergency health-care professionals about the diagnosis and management of AD (as per the AD-CPGs¹²) and has been shown to influence changes in health-care professionals' perceived and actual AD knowledge.¹¹ Yet, although improving paramedics' knowledge of the AD-CPGs is an important first step in improving AD management, strategies may also be needed to alter paramedics' beliefs about, and intentions to use, the AD-CPGs. Social cognitive beliefs such as one's attitude toward using a CPG, perceived social pressure and perceived control to use a CPG may have a stronger influence on health-care professionals' intentions to use a CPG than simply their knowledge of it.^{13–15}

We recently conducted a pilot test of the short-term training effects of an online version of the 'ABCs of AD' designed specifically for paramedics (freely available at <http://wp-dev.jibc.ca/abcofad/>). The pilot study was conducted among student paramedics.¹⁶ Post training, students had significant improvements in their knowledge, but no change in beliefs about, or intentions to use, the AD-CPGs. In

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hindsight, the null effects likely reflected students having little or no experience with SCI, implementing CPGs, treating patients or working in the field. Past experiences are fundamental to the formulation of the attitudinal, social normative and control beliefs that influence intentions to perform a particular behaviour (cf., Theory of Planned Behaviour (TPB)¹⁷). Without experience, it would have been difficult for students to meaningfully respond to measures of their beliefs or intentions. Indeed, there was some evidence of ceiling effects in the pilot study. Furthermore, the module was designed for experienced paramedics. Given the differences in how emergency medical professionals versus trainees cognitively process new patient information,¹⁸ trainees may not have been able to make sense of or use some of the module content that might otherwise be expected to affect their beliefs (e.g., video interviews of patients recounting experiences with AD). Another limitation of the pilot study was the absence of a follow-up to determine whether increases in AD knowledge were sustained.

Given these limitations, the purpose of the present study was to test the effects of the 'ABCs of AD' module on shorter- and longer-term changes in experienced paramedics' knowledge of, beliefs about and intentions to use the AD-CPGs. We predicted that paramedics would demonstrate significant improvements on these outcomes, 1 week after completing the module. Given their ongoing access to

the module, it was predicted that these changes would be sustained at 3- and 6-month follow-ups. Finally, drawing on theory^{17,19} as well as on research demonstrating the role that attitudinal, control and normative beliefs have in medical professionals' intentions to use CPGs,^{13,20} we predicted that measures of these beliefs would explain significant variance in paramedics' intentions to use the AD-CPGs.

MATERIALS AND METHODS

Design

The study used a single-group pretest, post-test study design. Data were collected before completing the ABCs of AD module, and 1 week, 3 months and 6 months after completing the module.

Sample size

The pilot study yielded an effect size of $d=0.84$ for the primary outcome measure of change in AD knowledge.¹⁶ A sample size calculation conducted using G*Power 3.1²¹ indicated that 82 participants were needed to have 90% power to detect $d=0.84$ with $\alpha=0.05$, in a single-group analysis of variance with four measurement points. In the pilot study, attrition was 60% from pre- to post-testing. Preparing for a similar dropout rate, we aimed to recruit 132 paramedics into the present study.

Participants

Experienced paramedics in the provinces of British Columbia (BC), Manitoba (MB) and Ontario (ON) were invited to participate in the study. Potential participants were recruited using electronic message board forums (BC) and email contact lists provided by the research centre (MB) or a paramedic education centre (MB and ON). A total of 140 paramedics enrolled in the study and completed the pretest measures. Their baseline characteristics are presented in Table 1.

All participants who completed the pre- and post-tests were sent a US\$25 e-gift card. An additional US\$25 e-gift card was sent upon completion of each follow-up. Participants in BC were also given five Continuing Medical Education credits (i.e., 25% of their required yearly credits) and participants in ON who completed the 3- and 6-month surveys were also given 1.5 Continuing Medical Education credits (i.e., 30% of yearly required credits).

ABCs of AD module

The ABCs of AD module is designed to be completed in 60–90 min, with interactive content distributed across six sections. The first section, an introduction by a clinician-scientist, outlines the module's objectives, target audience and user requirements (e.g., Internet browser requirements). The second section, 'Getting Started', provides recommendations for working through the module content and how to navigate between the remaining sections. The third section defines AD, the fourth discusses recognising and diagnosing AD and the fifth section discusses the signs, symptoms, pathophysiology and aetiology of AD. The final section discusses the prevention and management of AD, including a discussion of the treatment guidelines for recognising and managing AD (i.e., AD-CPGs). Interactive module content in Sections 3–6 includes optional review questions at the end of each section and case study videos in Sections 4–6 that feature patients with SCI discussing their AD symptoms with a health-care professional. A separate tab in the ABCs of AD module provides links to more comprehensive video testimonials of five patients with SCI discussing their experiences with AD and, for some, how emergency personnel managed their symptoms. Finally, the 'Resource' tab provides links to references used in the module, helpful websites and the option to download the AD-CPGs.

Protocol

Research ethics board approval was granted at each research site. Paramedics who were interested in participating contacted the provincial research coordinator via email. The coordinator responded with an email that included a link and a unique identification code for access to the online study materials. This code allowed participants to remain anonymous throughout the study.

Table 1 Demographic characteristics of paramedics from each recruitment site who completed the pretest measures

Characteristic	Manitoba, n = 7	BC, n = 45	Ontario, n = 88
Age (M $\pm$ s.d. in years)	40.43 $\pm$ 8.22	42.58 $\pm$ 9.80	36.50 $\pm$ 8.68
Gender			
Male	3 (42.9)	33 (73.3)	47 (53.4)
Female	4 (57.1)	12 (26.7)	41 (46.6)
Ethnicity			
Caucasian	6 (85.7)	37 (82.2)	80 (90.9)
Other	1 (14.3)	8 (17.8)	8 (9.1)
Years in practice			
1–5	0 (0)	6 (13.3)	22 (25.0)
6–10	1 (14.3)	10 (22.2)	20 (22.7)
11–15	2 (28.6)	8 (17.8)	18 (20.5)
> 15	4 (57.1)	21 (46.7)	28 (31.8)
Location of practice ^a			
Urban > 500 000	7 (100)	19 (42.2)	38 (43.2)
Urban < 500 000	0 (0)	20 (44.4)	47 (53.4)
Rural	0 (0)	18 (40.0)	31 (35.2)
Have you heard of AD?			
Yes	5 (71.4)	45 (100.0)	54 (61.4)
No	2 (28.6)	0 (0)	34 (38.6)
Current knowledge of AD			
None	1 (14.3)	8 (17.8)	25 (28.4)
Poor	4 (57.1)	24 (53.3)	46 (52.3)
Fair	2 (28.6)	11 (24.4)	15 (17)
Good	0 (0)	2 (4.4)	2 (2.3)
Excellent	0 (0)	0 (0)	0 (0)

Abbreviations: AD, autonomic dysreflexia; BC, British Columbia; SCI, spinal cord injury.

^aParticipants were asked to check all that apply, therefore values can sum to > 100%.

Note: All values are n (%), unless otherwise indicated.

Table 2 Items assessing paramedics' social cognitions for using the autonomic dysreflexia clinical practice guidelines

Items used to measure Theory of Planned Behaviour constructs	Response scale	Internal reliability score (α) or correlation (r)
Attitudes (6 items)		$\alpha_s \geq 0.88$
1. Using the AD-CPGs would help me treat patients with SCI.	1 = Strongly disagree,	
2. 'I think that following the AD-CPGs would be _____.'	7 = Strongly agree	
a. Unsatisfying/satisfying	Anchors represent extremes (1/7)	
b. Inappropriate/appropriate	on 7-point scale	
c. Unhelpful/helpful		
d. Irresponsible/responsible		
e. Bad/good		
Subjective Norm/Social Pressure Health-Care Professionals (2 items)	1 = Strongly disagree,	$r_s \geq 0.49$
'_____ want me to follow the AD-CPGs.'	7 = Strongly agree	
1. Other health-care professionals...		
2. The people I work with		
Subjective Norm/Social Pressure Patients (1 item)	1 = Strongly disagree,	
1. Patients with SCI want me to follow the AD-CPGs.	7 = Strongly agree	
Perceived Control (2 items)	1 = Strongly disagree,	$r_s \geq 0.71$
1. The decision to use the AD-CPGs is in my personal control.	7 = Strongly agree	
2. Whether I follow the AD-CPGs is entirely up to me.		
Self-Efficacy (1 item)	1 = Strongly disagree,	
1. I am confident that I can follow the AD-CPGs when treating patients with SCI.	7 = Strongly agree	
Intention (2 items)	1 = Strongly disagree,	$r_s \geq 0.67$
1. I intend to follow the AD-CPGs when treating patients with SCI.	7 = Strongly agree	
2. I will try to use the AD-CPGs when treating patients with SCI.		

Abbreviations: AD, autonomic dysreflexia; CPGs, clinical practice guidelines; SCI, spinal cord injury.

Informed consent and the study measures were administered through an online survey system (Fluid Surveys). After providing informed consent, participants completed a demographics questionnaire, measures of beliefs about using the AD-CPGs and an AD knowledge test. They were then automatically directed to the 'ABCs of AD' page, and emailed a link to the module, with a note to encourage viewing, at their convenience, in the next few days. Approximately 1 week later, participants were emailed a link to the post-test measures (AD knowledge test, social cognition measures). Participants who completed the post-test were emailed a link to the follow-up survey, 3 and 6 months from the date of post-test completion (only participants who responded at 3 months were sent a link at 6 months). The AD knowledge and belief measures were readministered; participants indicated if they had reviewed the module (yes/no) and provided consent before completing the measures.

Measures

Demographic information. Participants reported their age, gender, ethnicity, profession, years in practice and location of practice. Participants were also asked whether they had heard of the term AD (yes or no) and to rate their current knowledge of AD as 'Excellent', 'Good', 'Fair', 'Poor' or 'None'.

AD knowledge test. The original AD knowledge test was written by a group of physiatrists and other health-care professionals who had expertise in SCI and/or AD.¹¹ For the purpose of this study, items not relevant to paramedics were removed (e.g., questions regarding the administration of medication or protocols once the patient is admitted to hospital), leaving seven questions in different formats (e.g., multiple choice, case studies, matching; see Supplementary Material 1 for AD knowledge test) that assessed participants' current knowledge about recognising and managing a patient with AD. Responses were scored with a possible maximum score of 16.

Beliefs about using the AD-CPGs. Belief-based constructs captured by Ajzen's (1991) TPB¹⁷ were measured. The TPB is a theory of human-motivated behaviour that has been used extensively to predict and understand a wide range of actions including health-care professionals' clinical behaviours.^{22–25} According to the TPB, one's intention/motivation to perform a behaviour is the

most proximal predictor of that behaviour. Intention is predicted by one's attitude toward the behaviour, subjective norms/perceived social pressure to perform the behaviour and perceived control over one's ability to perform the behaviour. This latter construct (i.e., perceived behavioural control) also has a direct influence on the behaviour.

We measured these constructs with the same items used in the pilot study,¹⁶ which were written in accord with established guidelines^{22,26,27} for measuring the TPB constructs. All items were rated on 7-point scales. For constructs measured with two or more items, an average item score was calculated.

Internal consistency reliability was calculated using Cronbach's α for constructs with ≥ 3 items and was acceptable at all time points for the attitude items (i.e., $\alpha > 0.70$ ²⁸) but unacceptable for the measures of social pressure ($\alpha < 0.70$ at all time points) and perceived control ($\alpha < 0.70$ at three time points). Further psychometric analysis revealed that the item assessing social pressure from patients yielded higher ratings and was poorly correlated with the items assessing social pressure from health-care professionals. Thus, separate scores were subsequently calculated and analysed for *social pressure (patients)* and *social pressure (health-care professionals)*. Similarly, analysis of the perceived control items revealed that the item assessing confidence was poorly correlated with the items assessing control; thus, the self-efficacy (i.e., confidence) and control items were analysed separately.²⁹ Table 2 presents the items used to measure each construct.

Data analysis

The data were screened for outliers and violations of normality. Descriptive statistics were calculated for all study measures. Because of the large differences in sample sizes across study sites, it was not possible to treat site as an independent variable; thus, the data were collapsed for analysis.

The level of significance was set at $P < 0.05$ for all analyses. A General Linear Model repeated-measures analysis of variance was conducted on each study variable. When the assumption of sphericity was violated, the degrees of freedom for the multivariate test were adjusted using the Greenhouse–Geiser estimate.³⁰ When the multivariate test was significant, planned contrasts were computed using the pretest score as the comparator, to identify values that

differed significantly from baseline. Partial η^2 and Cohen's d effect sizes (adjusted for within-subjects comparisons)³¹ were calculated for the multivariate effect and contrasts, respectively.

Hierarchical multiple regression models were computed to predict intentions to use the AD-CPGs. Separate models were computed for post-test, 3 and 6 months. The AD test score was entered on the first step of the model, and belief measures were entered on the second step. Unique variance explained at each step was calculated (ΔR^2_{adj}), along with the unique relationship between intentions and each variable in the final model (standardized β).

RESULTS

Preliminary analyses

The analyses were first conducted using data only from participants who completed the pre-, post-, 3-month and 6-month assessments ($n=97$; 69% of the sample). Preliminary analyses indicated that changes in the outcome measures did not differ as a function of years of practice as a paramedic or for those who reviewed/did not review the module before the 3- and 6-month assessments. Thus, these factors were not included in subsequent analyses. Sample means were then used to replace missing values for participants who completed the post-test ($n=119$) but did not complete the 3- ($n=9$) or 6-month ($n=24$) assessments. The analyses were repeated. There was no difference in the two sets of results. As the second set of analyses allowed us to use all data collected from participants who completed the post-test ($n=119$; 85% of the original sample), those results are presented next.

Changes in AD knowledge and beliefs about using the AD-CPGs

Table 3 shows the descriptive statistics for each study measure at each time point.

Regarding *changes in AD knowledge*, there was a significant multivariate effect for time, $F(3, 2.63)=68.41$, $P<0.001$, $\eta^2=0.37$. Compared with pretest, AD test scores were significantly higher at the post-test ($d=1.04$), 3-month ($d=0.77$) and 6-month ($d=1.04$) follow-ups (all $P<0.001$).

With regard to the belief measures, there were significant multivariate effects over time for *attitudes*, $F(3, 2.63)=26.19$, $P<0.001$, $\eta^2=0.18$, *social pressure (patients)*, $F(3, 2.81)=40.34$, $P<0.001$, $\eta^2=0.26$, *self-efficacy*, $F(3, 2.97)=9.33$, $P<0.001$, $\eta^2=0.07$ and *intentions*, $F(3, 2.76)=9.31$, $P<0.001$, $\eta^2=0.07$. Planned contrasts revealed that, compared with baseline, attitudes toward using the guidelines were more positive, and perceived social pressure from patients to use the guidelines was stronger, at post-test ($d=0.64$ (attitudes), $d=0.89$ (pressure)) 3 months ($d=0.59$ (attitudes), $d=0.64$ (pressure)) and 6 months ($d=0.55$ (attitudes), $d=0.61$ (pressure)), all $P<0.001$. Self-efficacy and intentions to use the

guidelines increased from baseline to post-test ($d=0.45$ (efficacy), $d=0.51$ (intentions)), $P<0.001$, but returned to baseline levels at the 3-month ($d=0.13$ (efficacy), $d=0.17$ (intentions)) and 6-month follow-ups ($d=0.11$ (efficacy), $d=0.16$ (intentions)), $P>0.05$. There were no significant changes over time for perceived control, $F(3, 2.78)=2.62$, $P=0.055$, $\eta^2=0.02$, or social pressure (health-care professionals), $F(3, 2.78)=2.54$, $P=0.12$, $\eta^2=0.02$.

Predicting intentions to use the AD-CPGs

Table 4 shows the results of the regression analyses. Overall, the models explained 49.5%, 60.6% and 57% of the variance in intentions to use the AD-CPGs at post-test, 3 months and 6 months, respectively. AD knowledge explained significant unique variance in intentions to use the guidelines at 3 months ($R^2_{adj}=0.081$, $P=0.001$) and 6 months ($R^2_{adj}=0.064$, $P=0.003$). Once all variables were entered into the model, attitudes, social pressure from patients and perceived control were significant predictors of intentions at all three time points ($P<0.05$). At the 6-month follow-up, AD knowledge was also a significant predictor ($P=0.048$). No other predictors were significant at any time point.

DISCUSSION

Paramedics can have a vital role in the emergency treatment of patients experiencing AD. This study demonstrated that a relatively brief online training module improved paramedics' knowledge of how to recognise and manage AD. Moreover, viewing the module led to significant, sustained improvements in paramedics' attitudes, and greater perceived pressure from SCI patients, regarding the use of the AD-CPGs. These beliefs, along with perceived control, were significant, unique predictors of paramedics' intentions to use the guidelines. Each of these findings will be discussed in turn.

First, consistent with findings observed in paramedic trainees¹⁶ and emergency health-care professionals,¹¹ the module proved effective for increasing professional paramedics' knowledge of how to recognise and manage AD, as reflected in significant improvements in AD test scores at all time points relative to baseline. It is encouraging to see that the effects were maintained at 6 months. However, additional reminder tools such as pocket cards or mobile phone applications that describe the AD-CPGs may be needed to reinforce the knowledge over longer periods.^{32,33}

Second, the module improved attitudes and increased perceived pressure from patients to use the AD-CPGs. These changes were sustained over 6 months and could be a consequence of the patient testimonials in the module. Hearing patients speak, in their own words, about their personal experiences of being treated and

Table 3 Descriptive statistics and results of the analyses comparing the study measures over time

Measure	Descriptive statistics (<i>M</i> and <i>s.d.</i>)				Effect for time		
	Pre-test	Post-test	3 months	6 months	<i>F</i>	<i>P</i> -value	η^2
AD knowledge	8.97 (2.96)	12.59 (2.74) ^a	11.15 (2.69) ^a	11.47 (2.05) ^a	68.41	<0.001	0.367
Attitudes	4.80 (1.02)	5.59 (1.02) ^a	5.50 (0.94) ^a	5.48 (0.91) ^a	26.19	<0.001	0.182
Social pressure—health-care professionals	3.97 (0.96)	4.21 (1.19)	3.99 (1.21)	4.07 (0.96)	2.03	0.120	0.017
Social pressure—patients	4.71 (1.36)	6.03 (1.24) ^a	5.68 (1.36) ^a	5.61 (1.25) ^a	40.34	<0.001	0.255
Perceived control	3.55 (1.80)	3.76 (1.77)	3.37 (1.65)	3.39 (1.69)	2.62	0.055	0.022
Self-efficacy	4.76 (1.37)	5.47 (1.34) ^a	4.97 (1.39)	4.93 (1.27)	9.33	<0.001	0.073
Intentions	4.85 (1.15)	5.46 (1.26) ^a	5.10 (1.37)	5.04 (1.21)	9.31	<0.001	0.073

Abbreviation: AD, autonomic dysreflexia.

^aSignificantly different from pre-test, $P<0.05$.

Table 4 Final results of the regression analyses predicting paramedics' intentions to use the AD guidelines at post-test and 3-month and 6-month follow-ups

	Post, β	3 months, β	6 months, β
<i>Step 1</i>			
AD test score	0.03 change $R^2_{adj} = 0.018$	0.00 change $R^2_{adj} = 0.089^{**}$	0.13* change $R^2_{adj} = 0.072^*$
<i>Step 2</i>			
Attitudes	0.22*	0.34**	0.37**
Social pressure—patients	0.21*	0.18*	0.03
Social pressure—HCPs	0.12	0.06	0.23*
Perceived control	0.38**	0.47**	0.37**
Efficacy	0.12 change $R^2_{adj} = 0.503^{**}$	0.06 change $R^2_{adj} = 0.537^{**}$	−0.02 change $R^2_{adj} = 0.524^{**}$
Total $R^2_{adj} =$	0.50**	0.61**	0.57**

Abbreviations: AD, autonomic dysreflexia; HCP, health-care professional.
* $P < 0.05$; ** $P < 0.001$.

mistreated for AD may have bolstered paramedics' perceptions of the value and benefits of using the AD-CPGs (i.e., attitudes) and created patient social pressure to use the guidelines. This interpretation aligns with research showing that story-telling and patient vignettes can be effective for conveying evidence-based information about SCI to health-care professionals³⁴ and can influence social cognitive determinants of behaviour change (for a review, see Perrier and Martin Ginis³⁵).

There was, however, no sustained change in perceived social pressure from health-care professionals, perceived control, self-efficacy or intentions to use the guidelines. These results likely reflect an absence of provincial directives/policies on how paramedics should manage AD.^{36–38} If paramedics are not provided with patient care standards and guidelines on how to manage AD, then it is understandable that they will not feel empowered or expected to implement the AD-CPGs. Thus, an important next step is to work with paramedic and medical leaders to incorporate the AD-CPGs into provincial patient care standards and guidelines.

The third key finding was that AD knowledge explained unique variance in intentions at 3 and 6 months, whereas the belief measures explained unique variance in intentions at all three time points. However, when all variables were entered into the model, only attitudes, social pressure from patients and perceived control were unique predictors of intentions to use the AD-CPGs. These findings align with previous research, indicating that knowledge alone is insufficient for clinical behaviour change^{14,15} (whereas attitudes, subjective norms/social pressure and perceived control typically account for >50% of the variance in health-care professionals' intentions to comply with guidelines²⁵). Taken together, these results attest to the importance of incorporating information and strategies to alter beliefs about the targeted behaviour (e.g., using a new CPG) when developing educational interventions for paramedics.^{16,39} In addition to patient testimonials, such strategies may include testimonials from other health-care professionals about the importance of using the CPGs (to foster positive attitudes and create social pressure), and videos showing paramedics implementing the CPGs in real-world situations (to enhance self-efficacy and perceived control).

Implications for knowledge translation

Our study raises several issues with implications for knowledge translation. In terms of *what* knowledge needs to be conveyed, the

low baseline scores on the AD test indicate that paramedics need training on identifying and managing AD. Having demonstrated the effectiveness of the ABCs of AD for improving paramedics' knowledge, we must also work to ensure that paramedics are aware of, and have access to, the online training module.

Ideally, these knowledge translation steps would be achieved by researchers working collaboratively with policy makers, professionals and educators to ensure that the information gets in the hands of the people who can use it. Unfortunately, systematic change across these levels is slow and often asynchronous, for several reasons. First, policy makers, health-care professionals and educators present with different and sometimes competing priorities.⁴⁰ For example, although potentially life threatening for the patient and complicated to manage for emergency health-care providers, AD is a rare condition relative to other acute conditions that paramedics encounter (e.g., myocardial infarction, stroke). As a result, AD is often overlooked by decision makers who formulate policies regarding paramedic training. Second, educational curriculum at health-care professional training institutions is typically updated once every 5 years to be in line with updates to provincial and local standards. A change at the policy level will have an indirect influence on educational content and professional behaviour, but there is a time lag between policy change, curriculum change and subsequent practice change. Overall, impacting professionals' ability to identify and manage AD will require researchers, decision/policy makers, professionals and educators to work together.

To date, members of our research team have made progress addressing the above barriers to knowledge translation by conducting research in the area of AD and providing a strong evidence base regarding the importance of AD clinical management,^{4–6,9} as well as creating and evaluating the 'ABCs of AD' educational module.^{11,16} The senior author has also led the development of the 'International Standards to document remaining Autonomic Function after Spinal Cord Injury' (ISAFSCI)⁴¹, of which AD is a component. Since their release in 2012, the ISAFSCI have been translated into multiple languages and implemented into medical practice around the world, including hospital accreditation requirements in Canada. These first steps have initiated and maintained collaborations with other policy makers, practitioners and researchers in emergency medicine and paramedicine and have generated a number of opinion leaders at several paramedic training institutions in Canada. These opinion leaders have the potential to drive educational change by including SCI

and AD-related content into the next revision of their local curricula, as well as advocate for the uptake of specific continuing education, such as the 'ABCs of AD' module, for practicing professionals. Additional avenues to explore to enhance the uptake of findings include publishing study results and information about accessing the 'ABCs of AD' module in regulatory college newsletters.

Strengths and limitations

There are several strengths of the present study, including an adequately powered design, a sample that consisted of the intended users of the educational module (i.e., experienced paramedics), the use of theory to guide the choice of evaluation outcomes and measures, and a relatively low study attrition rate. One limitation, however, is that the actual implementation of the AD-CPGs was not assessed. Given the relatively low incidence of SCI in Canada (~41–68 per million⁴²), and the low incidence of AD episodes requiring paramedic attention, we would need to track each individual paramedic's practices for several years to accumulate sufficient data on their treatment of patients presenting with AD. This was neither practical nor feasible. Given, however, that intentions account for 15 to 40% of the variance in health-care professional behaviour, intentions can be considered a reasonable proxy measure of behaviour change.²⁰ Another limitation is the lack of a control group. Although it may be argued that the observed changes are a mere measurement effect, the absence of across-the-board changes in all measured constructs suggests that this was not the case. Nevertheless, there may be utility in using alternative study designs (e.g., Solomon four group design, interrupted time series) to rule out this possibility and to help determine whether such improvements are greater than the change expected due to practice effects or other chance variation.⁴³ Along these lines, it will be important to determine whether the magnitude of change in the study variables is sufficient to yield meaningful change in practical settings.

CONCLUSION

In conclusion, the present study has demonstrated the effectiveness of the ABCs of AD module for generating sustained increases in paramedics' knowledge on how to recognise and manage AD. Although paramedics reported sustained improvements in attitudes, and greater perceived patient pressure to use the AD-CPGs, their intentions to use the AD-CPGs were unchanged at the 3- and 6-month follow-ups. To have a lasting impact on paramedics' intentions and actual use of the AD-CPGs, it is recommended that the AD-CPGs be implemented into professional education and provincial or local patient care standards.

DATA ARCHIVING

There were no data to deposit.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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