The “ABCs of AD”: A pilot test of an online educational module to increase use of the autonomic dysreflexia clinical practice guidelines among paramedic and nurse trainees

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Context/Objective: Despite availability of clinical practice guidelines (CPGs), gaps in autonomic dysreflexia (AD) knowledge and practice persist. A free, online educational module, the “ABCs of AD”, was developed to improve knowledge of the AD-CPGs among emergency healthcare personnel. We examine short-term changes in paramedic and nurse trainees’ knowledge of, and social cognitions towards using, the AD-CPGs following module completion.

Design: Pre–post.

Methods: Thirty-four paramedic and nurse trainees from two training programs in Canada completed measures immediately before and after viewing the online “ABCs of AD” module.

Outcome measures: AD knowledge test; Theory of Planned Behavior social cognition questionnaire; module feedback survey.

Results: Paired samples *t*-tests revealed significant increases in participants’ AD knowledge test scores ($M \pm SD_{pre} = 9.00 \pm 2.46$, $M \pm SD_{post} = 12.03 \pm 4.07$, $P < 0.001$; $d = 0.84$). Prior to viewing the module, participants reported positive social cognitions for using the AD-CPGs (all $M_s \geq 4.84$ out of 7). From pre- to post-module, no significant changes were seen in participants’ social cognitions for using the AD-CPGs. Participants’ average module viewing time was 36.73 ± 24.17 minutes (range 8–90 minutes). There was a decline in viewing from the first to the last module sections, with only half of participants viewing all six sections.

Conclusion: Knowledge alone is insufficient for clinical behavior change; as such, social cognitive determinants of behavior should be explicitly targeted in future iterations of the module to increase the likelihood of increased use of the AD-CPGs. To engage viewers across all module sections, the “ABCs of AD” module should include supplementary learning strategies, such as interactive quizzes and peer-to-peer interaction.

Keywords: Autonomic dysreflexia, Clinical practice guideline, Knowledge translation, Psychological theory, Spinal cord injuries

Individuals with spinal cord injury (SCI) frequently experience autonomic dysreflexia (AD), an acute, episodic bout of hypertension characterized by a sudden, exaggerated increase in systolic and diastolic blood pressure above

an individual’s baseline.¹ Episodes of AD are often accompanied by 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.^{1,2} AD occurs frequently in up to 90% of individuals with SCI with injuries above the mid-thoracic spine (i.e. T6).¹ AD events are often

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unpredictable, can occur daily, and depend on a number of factors, including the presence of peripheral pain.^{2,3} Delayed recognition and unmanaged episodes of AD can lead to myocardial infarction,⁴ intracranial hemorrhage,⁵ and even death.⁶ However, such outcomes are avoidable if AD is recognized and managed promptly.^{2,6}

The Consortium for Spinal Cord Medicine has published clinical practice guidelines (CPGs) for recognizing and managing AD.⁷ More recently, a systematic review of research evaluating AD prevention and management strategies has been published.² Despite the availability of these evidence-based resources and guidelines, tremendous gaps in AD knowledge and practice persist among healthcare professionals.⁸ For example, Krassioukov *et al.* (Krassioukov AV, Pak M, Craven BC, Ghotbi MH, Ethans K, Ford M, *et al.* Autonomic dysreflexia: translating knowledge into practice for Canadian emergency room personnel. Unpublished manuscript) evaluated knowledge of AD among 133 emergency healthcare personnel (including paramedics and emergency room physicians and nurses) in three Canadian provinces. Over 80% of respondents rated their AD knowledge as “Poor” or “Fair”, 25% of respondents failed to define AD correctly, and only 50% identified three or more associated signs and symptoms of AD. Given that paramedics and emergency room physicians and nurses are the most likely healthcare professionals to encounter a patient with AD, their lack of knowledge for diagnosing and managing AD is alarming. If AD is misdiagnosed or mismanaged, patients can spend a week or more in the hospital, suffering from unstable blood pressure and associated life-threatening complications. A targeted educational intervention to improve emergency personnel’s recognition and management of AD could have a profound impact on the medical treatment of people with SCI in Canada.

In response to this gap in knowledge, a free online educational module – “ABCs of AD” (available at <http://wp-dev.jibc.ca/abcofad/>) – was developed as part of an integrated knowledge translation (KT) project that brought together clinicians and scientists to assess and improve knowledge and management of AD among emergency healthcare personnel. The “ABCs of AD” module is delivered by an SCI clinician-scientist (Andrei Krassioukov) with supplementary video modules featuring a discussion between clinicians and people with SCI who have experienced AD. The target audience of the module is pre-hospital emergency care workers, including paramedics and emergency room nurses and physicians, with evidence-based content focusing on defining and diagnosing AD, recognizing signs and symptoms of AD, and using the AD-CPGs.

Educational outreach methods that provide knowledge, such as courses, seminars, and e-learning modules, are generally effective at increasing knowledge, but ineffective at changing the practice, of healthcare professionals.^{9–11} For example, knowledge about a CPG alone does not guarantee it will be adopted and implemented; individual-level beliefs and other cognitions about the guideline, as well as environmental and organizational barriers and facilitators, can impact the translation of the knowledge contained in the guideline into healthcare practice.^{12,13} A theory-based process evaluation of the individual-level perceptions that may be associated with intervention effectiveness can be useful for understanding why behavior change does or does not occur following a targeted educational intervention.¹⁴

The Theory of Planned Behavior (TPB) is a psychological theory that has been used widely to predict and understand individual-level behavior,¹⁵ including healthcare professionals’ behavior.^{16–18} The TPB states that an individual’s intention, or motivation, to perform a behavior is the most proximal predictor of that behavior.¹⁹ Intention is predicted by the individual’s attitude (evaluation of behavior and its consequences), subjective norm (perceived sense of pressure from others to perform behavior, and motivation to comply), and perceived behavioral control (PBC; sense of control and confidence for performing behavior). PBC also has a direct influence on behavior. Although the “ABCs of AD” module was designed to be evidence-, but not behavior change theory-, based, the module includes components that may inadvertently target users’ social cognitions for using the AD-CPGs. For example, by providing knowledge about AD and outcomes associated with using the AD-CPGs, the “ABCs of AD” module may target viewers’ *attitudes* towards using the guidelines. Because the module information is provided by practicing clinicians and people with SCI who have experienced AD, viewers may become aware of their professional duty to follow and increase their perceptions of *subjective norms* for using the AD-CPGs. Finally, the module emphasizes the use of the AD-CPGs by discussing how the guidelines are used by other professionals (e.g. vicarious experiences) and encourages the use of the guidelines by all professionals (e.g. social persuasion); together these features of the module may target viewers’ *PBC*. Examining changes in viewers’ social cognitions would allow researchers to hone in on the module components that have the greatest potential for leading to changes in practice behavior.

While it is important to educate healthcare professionals who would use the AD-CPGs in day-to-day

practice, more proximal education of paramedic and nurse trainees would ensure that future healthcare professionals are equipped with the knowledge and resources necessary to implement the guidelines as soon as they enter the workforce. Furthermore, exposure to CPGs during training may result in earlier adoption, and thus use, of the guidelines in practice. As such, the purpose of the current pilot study was to examine short-term changes in paramedic and nurse trainees’ knowledge of, and social cognitions towards using, the AD-CPGs following completion of the “ABCs of AD” module. We hypothesized that trainees would report significant increases in their knowledge of, and TPB social cognitions (e.g. attitudes, subjective norm, PBC, and intentions) towards using, the AD-CPGs immediately following completion of the “ABCs of AD” module.

Methods

Participants and recruitment

Paramedic and nurse trainees enrolled at two different training institutions, one in British Columbia and one in Ontario, were recruited to participate in the current study. Both male and female trainees at any stage of their training (e.g. first year through fourth year) were asked to participate. A member of the research team visited paramedic and nursing classes at the training institutions to provide information about the study to trainees. During recruitment, the researcher made the trainees aware of the existence of AD-CPGs without providing specific information about the content of the guidelines. Note that the regular classroom instructor was not present in the classroom during recruitment and trainees were given the opportunity to have their questions about the study answered before participating. Interested trainees anonymously provided the research team member with their email address, which was used to contact trainees for collecting informed consent and administering online study measures, as well as for providing online access to the “ABCs of AD” module. Each email address was assigned a unique study identification number so that data could be tracked anonymously. These classroom visits were done at the beginning of the school year to avoid the study measures conflicting with trainees’ mid-term and final exams.

Based on a previous report of an educational intervention about the AD-CPGs, a large-sized effect was expected for changes in AD knowledge following the completion of the “ABCs of AD” module (Krassioukov *et al.*). G*Power statistical software indicated a sample of 24 participants was required to have 95% power to detect a large-sized effect at $\alpha < 0.05$.²⁰

The module

The module is designed to take 60–90 minutes for users to complete, with the content distributed among six module sections. The first section is an introduction by a clinician-scientist that outlines the module’s objectives, target audience, and user requirements (e.g. Internet browser requirements). The second section provides recommendations for working through the remaining content, and how to navigate between sections. The definition of AD is discussed in the third section, recognizing and diagnosing AD are discussed in the fourth section, and signs and symptoms, the pathophysiology, and the etiology of AD are discussed in the fifth section. The sixth and final section is dedicated to the prevention and management of AD, including a discussion of the AD-CPGs. Sections 3–6 include optional review questions at the end of the section, and Sections 4–6 include case study videos that feature patients with SCI discussing relevant content about their experience with AD with a healthcare professional. A separate tab in the module provides links to video testimonials about experiencing AD among five patients with SCI. There is also a “Resource” tab that provides links to helpful websites, references used in the module, and the option to download the AD-CPGs.

Protocol

Ethical clearance was provided by all institutional ethics boards. Informed consent and all data were collected using Fluid Surveys. Participants were emailed a link to the letter of information and consent form. Trainees who consented were directed to an online pre-module questionnaire, which included demographic questions, TPB scales assessing participants’ social cognitions for using the AD-CPGs, and an AD knowledge test. Upon the completion of the pre-module questionnaire, participants were automatically directed to the “ABCs of AD” online module. Four days after the completion of the pre-module questionnaire, the research team emailed participants to remind them about the online module and to encourage them to view the module at their convenience. Approximately 1 week later, participants who completed the pre-module questionnaire were emailed a link to the post-module questionnaire, which included the same TPB scales and the same AD knowledge test as the pre-module questionnaire, as well as a brief module feedback survey. Participants who completed both the pre- and post-module questionnaires were sent a \$10 e-gift card to thank them for their time and effort.

Table 1 Questionnaire items assessing trainees’ social cognitions for using the AD CPGs

Theory of Planned Behavior construct (# items) Items included in scale	Response scale	Internal reliability score (α) or correlation (r)
Attitudes (6 items)		
1. Using the AD-CPGs would help me treat patients with SCI	1 = Strongly disagree,	$\alpha_s \geq 0.94$
2. Complete the statement, “I think that following the AD-CPGs would be _____”	7 = Strongly agree	
(a) unsatisfying/satisfying	Anchors represent extremes	
(b) inappropriate/appropriate	(1/7) on	
(c) unhelpful/helpful	7-point Likert scale	
(d) irresponsible/responsible		
(e) bad/good		
Subjective norm (3 items)		
Complete the statement: “_____ want me to follow the AD-CPGs”	1 = Strongly disagree,	$\alpha_s \geq 0.76$
1. Other healthcare professionals...	7 = Strongly agree	
2. Patients with SCI...		
3. The people I work with...		
Perceived behavioral control (3 items)		$\alpha_s \geq 0.73$
1. I am confident that I can follow the AD-CPGs when treating patients with SCI	1 = Strongly disagree,	$\alpha_s \geq 0.73$
2. The decision to use the AD-CPGs is in my personal control	7 = Strongly agree	
3. Whether I follow the AD-CPGs is entirely up to me		
Intention (2 items)		
1. I intend to follow the AD-CPGs when treating patients with SCI	1 = Strongly disagree,	$r_s \geq 0.64$
2. I will try to use the AD-CPGs when treating patients with SCI	7 = Strongly agree	

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

The column indicating scale internal reliability (Cronbach’s α) scores for the items on the scale and Pearson correlations between the items on the scale represent the lowest value across the two timepoints (pre- and post-module). All internal reliability scores were acceptable.

Measures

Demographic information

Participants were asked to report their age, sex, ethnicity, province, program, and year of study, and whether they had any previous experience with a patient with SCI. Participants were also asked to rate their current knowledge of AD as “None”, “Poor”, “Fair”, “Good”, or “Excellent”.

AD knowledge test

The AD knowledge test was written and previously used by a group of SCI physiatrists and experts in AD-CPGs (Krassioukov *et al.*). The AD knowledge test consisted of 11 questions of varying question types (e.g. case studies, multiple choice, matching; see Supplementary Material 1 for AD knowledge test available at www.maneyonline.com/doi/suppl/10.1179/2045772314Y.0000000253) that assessed participants’ current knowledge of recognizing and managing a patient with AD. Responses were scored according to the previous study that used the survey (Krassioukov *et al.*) with a possible maximum score of 22.

TPB cognitions for using the AD-CPGs

Participants’ attitudes, subjective norms, and PBC were assessed with items adapted from Ajzen’s,²¹ Conner and Sparks’,²² and Francis *et al.*s²³ recommendations for

developing a TPB questionnaire. All items were rated on a 7-point Likert-type scale. For TPB construct scales with more than two items, item scores were averaged to give an overall construct score. Table 1 lists the items, response scale, and the internal reliability or correlation of the items for each scale included in the TPB questionnaire.

Module feedback survey

Participants were asked to report the number of minutes they spent working through the module, and indicate which module sections they viewed. Six items that assessed whether the participants felt the module information was novel, interesting, easy to understand, credible, personally important to them, and whether participants would recommend the module to a colleague, were rated on a 7-point Likert-type scale (1 = *strongly disagree*, 7 = *strongly agree*). Participants were also asked open-ended questions regarding what they found effective about the module, and additional strategies that would enhance the “ABCs of AD” module in the future.

Data analysis

All data were screened for outliers and normality using established guidelines.²⁴ Descriptive statistics were calculated for each study measure. Paired samples *t*-tests

were computed to identify significant changes in the TPB variables and AD knowledge test scores between pre- and post-module. Cohen’s *d* was calculated as an index of effect size.

Results

Participants

Of the 196 trainees who provided their email addresses, 86 completed the pre-module questionnaire and 34 completed the post-module questionnaire. The majority of participants who completed the pre-module questionnaire were female (72.1%), Caucasian (89.5%), and from Ontario (77.9%), with an average age of 24.33 years (*SD* = 6.20). Participants were enrolled in either a nursing (53.5%) or paramedic (46.5%) program, and the majority of participants were in their second year of their program (67.4%). Less than 20% of trainees had previous experience with a patient with SCI, and most participants rated their knowledge of AD as “Poor” (43.7%) or “None” (39.1%). There were no significant differences in demographics between participants who completed only the pre- vs. both the pre- and post-module questionnaires. Please see Table 2 for complete participant demographic information.

Knowledge of, and social cognitions towards using, the AD-CPGs

Table 3 contains the descriptive statistics, *t*-test results, and effect sizes for participants’ social cognitions and AD knowledge test scores. From pre- to post-module, significant increases in participants’ AD knowledge test scores were seen ($P < 0.001$; $d = 0.84$). Prior to viewing the “ABCs of AD” module, participants reported positive social cognitions for using the AD-CPGs (all *M*s ≥ 4.84 out of 7). From pre- to post-module, no significant changes were seen in participants’ social cognitions for using the AD-CPGs; however, small effect sizes were seen for increases in participants’ attitudes ($d = 0.22$), subjective norms ($d = 0.27$), and PBC ($d = 0.24$) to use the AD-CPGs.

Module feedback

Participants’ average module viewing time was 36.73 ± 24.17 minutes, with a range of viewing times between 8 and 90 minutes. On average, participants viewed 4.48 ± 1.89 of the six module sections, with a decline in viewing from the first to the last module sections. Of the 34 participants who completed the post-module questionnaire, the percentage of participants who self-

Table 2 Demographic characteristics of participants who completed the pre- and post-module questionnaires

Characteristic	Pre-module <i>n</i> = 86	Post-module <i>n</i> = 34
Age (<i>M</i> $\pm$ <i>SD</i> in years)	24.33 $\pm$ 6.20	24.68 $\pm$ 7.58
Sex		
Male	24 (27.9)	5 (14.7)
Female	62 (72.1)	29 (85.3)
Ethnicity		
Caucasian	77 (89.5)	32 (94.1)
Other	9 (10.5)	2 (5.9)
Province		
Ontario	67 (77.9)	27 (79.4)
British Columbia	19 (22.1)	7 (20.6)
Program		
Primary care paramedic	31 (36.0)	9 (26.5)
Advanced care paramedic	9 (10.5)	2 (5.9)
Practical nursing	11 (12.8)	7 (20.6)
BSc nursing	35 (40.7)	16 (47.1)
Year in program		
First	27 (31.4)	9 (26.5)
Second	58 (67.4)	25 (73.5)
Third	1 (1.2)	
Previous experience with patient with SCI		
Yes	16 (18.6)	4 (11.8)
No	70 (81.4)	30 (88.2)
Current knowledge of AD		
None	34 (39.1)	15 (44.1)
Poor	38 (43.7)	16 (47.1)
Fair	6 (6.9)	2 (5.9)
Good	2 (2.3)	0 (0)
Excellent	0 (0)	0 (0)

AD, autonomic dysreflexia; BSc, Bachelor of Science; SCI, spinal cord injury.
All values are *n* (%) unless otherwise indicated.

Table 3 Summary of changes in social cognitions to use AD-CPGs and AD knowledge test scores between pre- and post-module participation (*n* = 34)

Construct	Module		Paired samples <i>t</i> -test		Effect size <i>d</i>
	Pre	Post	<i>t</i> -value	P-value	
Attitude	5.43 ± 1.41	5.76 ± 1.14	−1.23	0.23	0.22
SN	4.84 ± 1.09	5.18 ± 1.17	−1.51	0.14	0.27
PBC	4.79 ± 1.34	5.13 ± 1.15	−1.23	0.19	0.24
Intention	5.36 ± 1.38	5.55 ± 1.34	−0.78	0.44	0.14
AD knowledge (out of 22)	9.00 ± 2.46	12.03 ± 4.07	−4.20	<0.001	0.84

AD, autonomic dysreflexia; CPGs, clinical practice guidelines; PBC, perceived behavioral control; SN, subjective norms.

All mean construct scores are reported as *M* ± *SD* and are out of 7, except AD knowledge test scores which are out of 22 (as noted).

reported completing each module section are as follows: Introduction (88.2%), Getting Started (82.4%), Defining AD (76.5%), Diagnosis of AD (67.7%), Signs and Symptoms of AD (64.7%), and Management of AD (55.9%). (Given the variability in participants' module viewing time and the number of module sections completed, repeated measures ANCOVAs controlling for these two variables on pre- to post-changes in AD knowledge test scores and TPB social cognitions would have been an appropriate analytic approach; however, the covariates violated the assumption of homogeneity of regression variance thus precluding this analytic strategy.) Participants had positive perceptions of the module – the average ranking of each of the six feedback items was >5.67 out of 7 (see Table 4 for complete module feedback items and scores). The only exception was the item asking about the module's personal importance to participants, which had an average ranking of 4.67 out of 7.

When asked what they found particularly effective about the “ABCs of AD” module, participants listed the following: (1) valuable information (*n* = 8), (2) personal touch of stories of real people who have been affected by AD (*n* = 7), (3) clear concise information with relevant images and diagrams (*n* = 7), (4) organization/set up of the module (e.g. easy to navigate and follow different sections; *n* = 5), and (5) ability to work through the module at own pace (*n* = 3). Participants listed the following strategies as useful ways to enhance the “ABCs of AD” module: (1) the inclusion

of online quizzes to engage the viewer (*n* = 1), (2) more detail about the definition and etiology of AD at the front end of the module (*n* = 1), and (3) more specific information to engage paramedic and nursing students (*n* = 1).

Discussion

Following completion of the “ABCs of AD” online module, paramedic and nurse trainees achieved statistically significant improvements in their AD knowledge test scores. Despite these increases in knowledge, no statistically significant changes were seen in trainees' TPB social cognitions to use AD-CPGs. Participants' feedback about the module was positive, and several participants provided suggestions for future improvements to the module to more fully engage healthcare professional trainees.

Our first hypothesis – that participants' AD knowledge would increase following exposure to the “ABCs of AD” module – was supported. Educational outreach interventions, such as the “ABCs of AD” module, have been shown to be effective at imparting new knowledge to attendees^{9–11}; thus, these results are not surprising. Despite these significant increases in AD knowledge test scores, trainees' post-module AD knowledge test scores were still relatively low (mean of 12 out of 22). A possible explanation for these low knowledge scores may reflect participants' lack of knowledge and experience with patients at their current stage of their career. Compared to practicing healthcare professionals,

Table 4 Participants' feedback about “ABCs of AD” module

Module feedback items	Mean ± SD
I learned a lot of new information in the module	5.87 ± 1.85
The information in the module was interesting	6.00 ± 1.29
The information in the module was easy to understand	6.17 ± 1.58
The information in the module was credible	6.33 ± 1.49
The module was personally important to me	4.67 ± 2.02
I would recommend this module to a colleague	5.67 ± 1.54

Scores are out of 7 (1 = strongly disagree, 7 = strongly agree).

trainees likely have less prior theoretical and practical knowledge of SCI and pathophysiology, as well as how to manage patients and apply CPGs in general. As such, it may have been challenging for trainees to understand the relevance of the module content, as well as to integrate and apply the content when completing the post-module AD knowledge test. Trainees’ feedback supports this explanation; compared to the other feedback items, trainees had lower perceptions of the module’s personal importance, and they suggested that the “ABCs of AD” module could be enhanced by including more information that specifically engages trainees. These results suggest that the module content may not have been salient to trainees at this stage in their career; that is, trainees may not recognize the personal relevance of “ABCs of AD” module when they do not yet have experience with patients with SCI or are not currently working in a capacity where they can put their new knowledge into practice. This perception of personal importance may have negatively impacted participants’ desire to view all six module sections, as well as their module viewing time.

Another explanation for the low AD knowledge test scores is the lack of exposure and engagement the participants had with the module content. Given that most participants did not have previous experience with a patient with SCI, and the majority of participants rated their pre-module AD knowledge as “Poor” or “None”, the module likely presented trainees with new information. With an average module viewing time of ~37 minutes, it is unlikely that the trainees had adequate time to process and apply the new information. Moreover, given that participants only viewed 4.5 of 6 module sections, with just over half of participants viewing the last module section about AD management highlighting the use of the AD-CPGs, participants may not have been exposed to all the content that is evaluated on the AD knowledge test. In order to more fully engage viewers, additional learning strategies to enhance knowledge retention and application should be included in future iterations of the module. For example, enhanced interaction between the user and the module, such as through quizzes, may help to engage viewers in the content.²⁵ Also, peer-to-peer interaction (i.e. medical roundtables, discussion of case studies) is commonly used in healthcare professional practice to facilitate learning; this concept could be applied virtually in the module by including an online discussion board or real-time webinar discussion to give users the opportunity to ask each other questions and share practical experiences.²⁵ Including module end users during the development and/or refinement

of the intervention may help ensure that the strategies included are feasible for enhancing interaction with the module content.

Despite the significant increases in AD knowledge test scores, our second hypothesis was not supported. There were no significant changes in participants’ TPB social cognitions for using the AD-CPGs between pre- and post-module. There are two possible reasons for this lack of change. First, participants’ pre-module social cognitions were already quite positive (scores were >4.79 out of 7 on the TPB measure). These initially high scores may have left little room for improvement, especially considering that the use of the guidelines is not imminent in their career; that is, most participants were at least 1 year from practicing in the field and applying the guidelines with real-life patients. Second, the “ABCs of AD” module was designed to translate evidence-based knowledge of AD and the AD-CPGs without overtly targeting viewers’ social cognitions for enacting the guidelines. Previous research suggests that providing knowledge alone is necessary, but insufficient, for behavior change,^{26,27} and that determinants of behavior should be explicitly targeted in interventions in order to increase individuals’ motivation for changing their behavior.^{10,28} While the “ABCs of AD” module may have inadvertently targeted the TPB social cognitions, the overt inclusion of behavioral techniques that target these cognitions should be considered for future iterations of the module. For example, demonstrating to module viewers that social support processes are in place for the use of AD-CPGs in practice may be effective in changing social cognitive domains that could influence viewers’ perceptions of attitudes, subjective norms, and PBC.²⁹ Third, examining individual-level perceptions of a guideline provides an incomplete picture of why guideline use does or does not occur.^{12,13} Environmental and organizational barriers and facilitators that influence the translation of the knowledge contained in the guideline into healthcare practice should be examined, as these factors can impact individual-level perceptions.^{12,13,30} For example, the incorporation of the AD-CPG recommendations and algorithms into organizational and professional standards and policies (i.e. both the Basic and Advanced Life Support Patient Care Standards used as the standard of practice for paramedics in Ontario)^{31,32} would likely enhance individuals’ attitudes, subjective norms, PBC, and intentions to use the guidelines, as well as increase the reach, adoption, and implementation of the guidelines.

While this study represents a pilot test of the “ABCs of AD” module among trainees, it is nevertheless

important to expose healthcare professionals to guidelines early in their training to help generate a sense of norms about using guidelines throughout their career. There is an increasing demand for evidence-based practice in healthcare,³³ and healthcare professionals are inundated with ever-changing CPGs that they are expected to adopt and routinely use.¹² Early exposure to guidelines, such as through educational outreach like the “ABCs of AD” module, may help create a normative culture of guideline use among trainees so that they are more open to adopting new guidelines throughout their practice (c.f. Rogers’ Diffusion of Innovations³⁴).

Strengths and limitations

A strength of this study is the inclusion of a theory-based process evaluation for determining intervention effectiveness. Few evaluations of implementation interventions, such as educational outreach, test hypotheses based on theory.³⁵ Theory-driven evaluations can help decipher the behavioral determinants of change when an intervention is hypothesized to be mediated by the theory’s constructs.^{14,28} The current study’s evaluation protocol can now be used to determine the impact of the “ABCs of AD” module on practicing healthcare professionals’ knowledge of, and social cognitions for using, the AD-CPGs.

Despite this strength, a number of limitations should be noted. First, the module was designed to target emergency healthcare professionals, rather than trainees who were the participants in the current study. Compared to professionals, trainees may have a different perspective with respect to adopting and implementing a specific CPG when they are several years from professional practice and unfamiliar with CPGs in general. This perspective may be reflected in the strength of their social cognitive determinants for using the AD-CPGs; thus, it is unclear whether professionals would also report a lack of significant changes TPB social cognitions following completion of the module. However, a caveat is that without designing the module to include a foundation in behavior change theory, it is unlikely that professionals’ social cognitions for using CPGs will change once the module is viewed. Nevertheless, as noted above, increasing awareness of the CPGs among trainees may be important for facilitating a normative culture of guideline use; therefore, future iterations of the “ABCs of AD” module should include an additional component targeting trainees that provides general information about the importance of adopting and using CPGs prior to trainees being asked to complete

the AD-specific content. Second, the study is limited by the low response rate at follow-up; only 40% of trainees who completed the pre-module questionnaire also completed the post-module questionnaire. This response rate may have improved if we had used personalized contacts when administering links to the questionnaires and modules (e.g. using the individual’s name in a reminder email)³⁶; however, trainee anonymity was a key ethical concern of the training institutions, so personalization of emails beyond the participants’ unique study ID was not possible. A third limitation is the lack of a control group that did not receive the “ABCs of AD” module. While the control group would likely not report changes in AD knowledge test scores, simply being in a study that asks about social cognitions for adopting CPGs might prompt changes in participants’ social cognitions for using the AD-CPGs, a phenomenon referred to as the mere measurement effect.³⁷ The use of a control group is a consideration for future research evaluating the impact of the “ABCs of AD” module on changes in social cognitions for changing behavior.

Conclusion/future directions

The “ABCs of AD” online educational module appears to be effective at increasing healthcare professional trainees’ knowledge of, but not social cognitions for using, the AD-CPGs. The results of the current study suggest that the impact of the “ABCs of AD” module has the potential to be maximized by ensuring the module has a foundation in behavior change theory and by incorporating additional learning strategies throughout the module. Explicit use of theory in the design of the module would better target the social cognitions that are more likely to lead to behavior change among users (e.g. use of the AD-CPGs by healthcare professionals and trainees). The inclusion of supplementary adult learning strategies, such as interactive quizzes and peer-to-peer interaction, and tailoring of module content to the intended audience would help to ensure that users are engaged across all module sections and processing module content. Furthermore, the module would benefit from including separate components that target trainees and professionals, with the appropriate end users being included in the intervention development process so to ensure the content is salient and acceptable to each target audience group. These suggestions are currently being considered by module developers, and would likely be facilitated by including behavior change and KT researchers in the module development process.

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Disclaimer statements

Contributors KAMG and AK conceived of/designed the study and obtained funding. JRT, KAMG, WP and AK obtained ethics approval at their respective institutions. JRT and WP collected the data. JRT and KAMG analyzed and interpreted the data. JRT wrote the article in whole. KAMG, WP, and AK revised the article and approved of the final version before submission.

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