Treatment of Adolescent Alcohol Misuse and Clinician Acceptance of Technology-facilitated Care in the Emergency Department

by

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Abstract

Screening, brief intervention, and referral to treatment (SBIRT) is the recommended approach for clinicians to use with adolescent patients with suspected alcohol-related problems. Although the emergency department (ED) is an opportune setting for early identification of alcohol misuse, SBIRT is underused. Use of technology to facilitate the delivery of SBIRT is regarded as a promising strategy to standardize, expedite, and support delivery of care. However, little is known about its implementation in real-world clinical practice. The aim of this research was to explore the acceptance of technology-facilitated care in the ED, particularly, for the treatment of adolescent patients with problematic alcohol use. This thesis includes a scoping review (Study 1) and survey (Study 2). Study 1 was guided by the Arksey and O'Malley scoping review framework and examined emergency clinicians' acceptance of cognitive support technology used at the point-of-care (POC) in the ED. This review demonstrated that while health care providers are receptive to technology-facilitated care in the ED, gaps remain between provider intentions and practice. Study 2 was a cross-sectional survey of pediatric emergency physicians from across Canada. A 35-item questionnaire was developed to examine physicians' perceptions of adolescent alcohol drinking and treatment for alcohol misuse, current SBIRT practices, and acceptance of technology-based SBIRT. Survey findings revealed that physicians recognize the need and responsibility to address adolescent alcohol misuse. However, confidence in knowledge and abilities for SBIRT execution was low. While physicians were receptive to using technology to deliver SBIRT, they were unsure about its impact on patient care. Taken together, findings from both studies suggest that to promote integrated technology-facilitated patient care, strategies to support and orient clinicians when using technology are needed.

Preface

This thesis is an original work by Shelly Jun. The survey, which forms a part of this thesis, received ethics approval from the University of Alberta Research Ethics Board 2, on June 27, 2016, under the study title "Screening, brief intervention and referral to treatment (SBIRT) for adolescent alcohol use in the emergency department – a national survey of pediatric emergency physicians' practices and acceptance of technology models", Pro00065691. The Pediatric Emergency Research Canada (PERC) Executive granted permission to access the PERC clinician contact database on September 19, 2016. Ethics approval was renewed on June 2, 2017.

Chapter 3 of this thesis is under peer review as S. Jun, A.C. Plint, S.M. Campbell, S. Curtis, K. Sabir, and A.S. Newton, "Point-of-care cognitive support technology in emergency departments: a scoping review of technology acceptance by clinicians". Under the supervision of A.S. Newton, I was responsible for *(i)* designing the study, *(ii)* analyzing the data, and *(iii)* composing the first draft of the manuscript. Working alongside the co-authors, I contributed to *(iv)* developing the search strategy, and *(v)* collecting the data.

Chapter 4 of this thesis is under peer review as S. Jun, A.C. Plint, S. Curtis, and A.S. Newton on behalf of Pediatric Emergency Research Canada, "Screening, brief intervention, and referral to treatment (SBIRT) for adolescent alcohol use in Canadian pediatric emergency departments: a national survey of pediatric emergency physicians". Under the supervision of A.S. Newton, I was responsible for *(i)* designing and coordinating the study, *(ii)* collecting and analyzing the data, and *(iii)* composing the first draft of the manuscript. All co-authors contributed intellectual content and critical review.

Chapter 5 of this thesis is under peer review as S. Jun, A.C. Plint, S. Curtis, and A.S. Newton on behalf of Pediatric Emergency Research Canada, "Technology-based screening, brief intervention and referral to treatment (SBIRT) to identify and treat problematic alcohol use among adolescents during emergency department visits". Under the supervision of A.S. Newton, I was responsible for *(i)* designing and coordinating the study, *(ii)* collecting and analyzing the data, and *(iii)* composing the first draft of the manuscript. All co-authors contributed intellectual content and critical review.

Dedication

"Call it a clan, call it a network, call it a tribe, call it a family. Whatever you call it, whoever you are, you need one."

-- Jane Howard

I dedicate this thesis to my selfless parents, loving sisters, and dear friends. In my downcast moments, it was them—my greatest cheerleaders of all time—who kept me going to the end ☺

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Study 1: Scoping Review

List of Abbreviations

AAP	American Academy of Pediatrics
ACEP	American College of Emergency Physicians
AUDIT	Alcohol Use Disorders Identification Test
BAC	Blood alcohol concentration
CAEP	Canadian Association of Emergency Physicians
CPS	Canadian Pediatric Society
CAGE	Cut down, Annoyed, Guilty, and Eye-opener
CHERRIES	Checklist for Reporting Results of Internet E-Surveys
CME	Continuing Medical Education
ED	Emergency department
MMAT	Mixed Methods Appraisal Tool
PERC	Pediatric Emergency Research Canada
PICO	Population, Intervention, Comparison, Outcome
POC	Point-of-care
PRISMA	Preferred Reporting Items for Systematic Reviews
RAFFT	Relax, Alone, Friends, Family, Trouble
REDCap	Research Electronic Data Capture
SBIRT	Screening, Brief Intervention, and Referral to Treatment
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TAM2	Technology Acceptance Model 2

Chapter 1:

Introduction

For my graduate research, I conducted two studies that explored the potential for technology-facilitated health care in the emergency department (ED). In Study 1, I conducted a scoping review of current acceptance for all types of point-of-care (POC) cognitive support technology among clinicians working in the ED. Findings from Study 1 were intended to inform the design and interpretation of Study 2, a survey of pediatric ED physicians from across Canada. This study focused on current physician practices during adolescent alcohol-related emergency visits, and acceptance of a POC technology to facilitate alcohol intervention and treatment during these presentations.

In this paper-based thesis, Study 1 is detailed in one manuscript (Chapter 3). Study 2 has been reported in two manuscripts (Chapter 4 and 5), which focus on conceptually distinct pieces of the survey project. This chapter is an introduction to my thesis. It includes the background literature, research objectives, and an outline of each chapter's contribution to my thesis.

1.1. Background

Adolescent Alcohol Misuse

Alcohol is one of the most commonly used and misused substances among adolescents across North America (Kann et al., 2014; Thomas, 2012). Problematic alcohol consumption escalates in adolescence (Maio et al., 2005), and reaches a peak in young adulthood (Porter, 2000). This type of alcohol misuse in adolescence can be hazardous, potentially leading to the development of substance dependence and abuse in adulthood (Bonomo et al., 2004; D'Amico et al., 2005). In Canada, up to 47% of students have engaged in binge drinking, defined as five or more drinks in one occasion, by grade 12 (Health Canada, 2016). This type of alcohol drinking is

a public health concern because of its strong association with health consequences including, but not limited to, trauma (Black et al., 2009), psychiatric disorders (Maio et al., 2000; Newton et al., 2009), victimization (Swahn et al., 2008), and premature death (Thomas, 2012).

Adolescents may not recognize their alcohol use as being problematic (D'Amico, 2005), not know where to seek assistance (Klein et al., 1998), or be embarrassed to ask for help (Cunningham et al., 1993). Consequently, identification of problematic alcohol use may be achieved when adolescents present to the ED for associated morbidities. A significant proportion of ED visits by adolescents—up to 41% (Ali et al., 2012)—have been attributed to health consequences due to problematic alcohol drinking. The ED visit may be a valuable opportunity to identify problematic alcohol use, and provide early intervention (Academic ED SBIRT Research Collaborative, 2007; Burke et al., 2005). ED-based alcohol intervention can also fill a health care services gap for adolescents who may not access primary health care, where such interventions are traditionally offered (Levy & Kokotailo, 2011).

Intervention in the Emergency Department

In the ED, Screening, Brief Intervention, and Referral to Treatment (SBIRT) is the recommended approach for pediatricians to use when treating adolescent patients suspected with alcohol-related concerns (American College of Emergency Physicians, 2017; Higgins-Biddle et al., 2009). Alcohol SBIRT is designed to: *(i)* identify hazardous and harmful alcohol consumption (screening), *(ii)* provide brief counseling intended to increase awareness and elicit change (brief intervention), and *(iii)* connect individuals with specialty treatment services (referral to treatment). It is a three-phase sequential procedure (Bernstein et al., 2009; Newton et al., 2013).

During screening, adolescents who engage in unsafe alcohol practices are identified. Available screening instruments differ in their ability to detect different groups of patients engaging in risky alcohol practices (Maio et al., 2000). To date, there is no universally established approach to screening for problematic alcohol use (Kelleher et al., 2013). While screening blood alcohol concentration (BAC) is currently standard practice for detecting problematic alcohol use in EDs (Cunningham et al., 2009), instruments that go beyond biological markers to assess associated problematic attitudes and behaviours are critical to informing brief alcohol intervention (Pilowsky & Wu, 2013). The CRAFFT, RAFFT, AUDIT and CAGE are commonly used instruments used to screen for problematic alcohol use among adolescents (Newton et al., 2017; Pilowsky & Wu, 2013; Yuma-Guerrero et al., 2012). Instrument scores are determined from questionnaire answers, and assessed as positive for problematic use if falling above the designated adolescent adjusted cutoff scores: 2, 2, 4 and 1, respectively (Bastiaens et al., 2002; Chung et al., 2000; Knight et al., 2002).

Adolescents who have been identified as problematic alcohol users during screening in the ED should subsequently receive brief intervention. The short and focused session is designed to increase knowledge about normative behaviour, relative to others of the same age and gender, and consequences associated with alcohol misuse (Cunningham et al., 2015). It is also intended to promote intention to change (Bernstein et al., 2010; Gregor et al., 2003; Murphy et al., 2013), and ultimately reduce alcohol consumption and associated harmful and hazardous behaviour (Academic ED SBIRT Collaborative, 2007). Brief intervention may also involve skills development, such as fostering the ability to avoid and refuse engaging in alcohol-related hazardous behaviour (Maio et al., 2005). At present, face-to-face brief intervention on a one-on-one contact basis between the adolescent and deliverer, is the primary method of delivery.

However, there is great flexibility for who delivers the intervention (i.e., specialized therapist, clinician, peer educator, research assistant) and its mode of delivery (i.e., computerized prompts for therapist to follow, stand-alone computer programs) (Newton et al., 2013).

The final phase of SBIRT, referral to treatment, is intended for adolescents who screen alcohol dependent (Yuma-Guerrero et al., 2012). Following the brief intervention, these patients may require further assessment and elaborate treatment services (Desy et al., 2010). Appropriate with risk level, a list of resources is provided and patients are offered assistance in creating appointments, facilitating access to follow-up services post-discharge.

Many reviews have assessed the efficacy of SBIRT for treating adolescent ED patients (Merz et al., 2015; Forsythe & Lee, 2012; Yuma-Guerrero et al., 2012; Newton et al., 2013; D'Onofrio & Degutis, 2004). Some studies included in these reviews showed significant intervention effects of efforts to change behaviour (Johnston et al., 2002; Bernstein et al., 2010), decreased alcohol-related consequences (Walton et al., 2010), and reduced alcohol intake (Spirito et al., 2004). Other studies reported statistically insignificant and short-lived reductions in alcohol drinking patterns that returned to baseline at long-term follow up (Bernstein et al., 2010; Maio et al., 2005; Sommers et al., 2011). Reports of undifferentiated outcomes between SBIRT intervention and control groups suggest that ED visits and triage screening in itself may have protective effects, diminishing the magnitude of SBIRT effect (Yuma-Guerrero et al., 2012). Nevertheless, SBIRT has great potential in the ED to address problematic alcohol use among adolescent patients (Merz et al., 2015).

Health Technology Acceptance

Despite recommendations for the routine use of SBIRT by pediatricians (Levy & Williams, 2016; ACEP 2017; Higgin-Biddle et al., 2009), it is underused in the ED. Lack of

time, staff expertise and training, and resources are commonly reported barriers that undermine SBIRT implementation in this clinical setting (D'Onofrio & Degutis, 2004; Weiland et al., 2008). Using technology to facilitate SBIRT delivery is regarded as a promising strategy to address the limitations of standard SBIRT in the ED.

Broadly, in recent years, health technology systems that guide and support clinical decisions in medication prescribing, risk assessment, and treatment are emerging in the health care system (Harris & Knight, 2014; Goodnough & Shah, 2014; Cresswell et al., 2012). Preliminary evidence demonstrates that these tools have the potential to reduce medication errors, increase providers' adherence to clinical guidelines and improve efficiency (Sedlmayr et al., 2013; Rosenbloom et al., 2004). Specific to SBIRT technologies, recent trials of ED-based SBIRT have demonstrated that SBIRT delivered using a computer is more efficacious than routine ED care in reducing alcohol consumption and alcohol-related consequences among adolescent patients (Cunningham et al., 2015; Walton et al., 2010). Moreover, this tool may facilitate expedited and standardized delivery of alcohol-related care, reduce the need for individual staff expertise, and lower health care costs (Bewick et al., 2008; Portnoy et al., 2008; Donoghue et al., 2014; Nilsen et al., 2009; Choo et al., 2012). Considering these enabling attributes, technology-based SBIRT is regarded as a promising sustainable, long-term option for ensuring SBIRT is provided when needed during ED care (Harris & Knight, 2014).

When considering the implementation of SBIRT technology in the ED, it is important to consider end-user acceptance as it is critical to successful integration and use in the ED. In general, health care providers may be resistant to accept changes to their routine clinical practices (Bhattacherjee & Hikmet, 2007). To date, little is known on the acceptability of technology-based, alcohol SBIRT among physicians in the ED. To explore technology

acceptance, this thesis was informed by the adapted Technology Acceptance Model 2 (TAM2) (Venkatesh & Davis, 2000; Sedlmayr et al., 2013). Under a pluralistic perspective, the TAM2 proposes that technology acceptance is based on constructs derived from several social psychology theories. Components of the Motivational Model (Vallerand, 1997) and Cognitive Evaluation Theory (Deci & Ryan, 1985) are used to explain behavioural acceptance as a result of intrinsic and extrinsic motivators. The Theory of Reasoned Action (Fishbein & Ajzen, 1975) and Theory of Planned Behaviour (Ajzen & Fishbein, 1980) are used to suggest that perceptions predict behavioural intentions. In sum, based on these theories, the TAM2 suggests that acceptance, which is an individual's behavioural intention to use, is affected by motivation, attitudes, and beliefs, and predicts actual use of a technological system. The original model, TAM, was designed to measure acceptance for information technology among a general, working population. However, the ED is a unique setting with clinicians as the specific technology user population. Thus, the TAM2 is the more appropriate acceptance model to use to study technology acceptance among ED clinicians because its variables are the most relevant to the medical setting and health technology. (Venkatesh & Davis, 2000; Holden & Karsh, 2010). I used the adapted version of the TAM2 because it includes two additional constructs, compatibility with workflow and resistance to change, constructs that I felt were important to understanding technology acceptance by ED clinicians. These additional determinants of acceptance are based on literature suggestions, the authors' field observations, and statistical analyses of correlation (Sedlmayr et al., 2013).

1.2. Personal Interest

As the saying goes: "It is easier to build strong children than to repair broken men" (Frederick Douglass). Early intervention for adolescents who engage in harmful and hazardous

practices is critical. Underage drinking is not a new phenomenon; however, modern healthcare and the resources that are becoming available now lend greater opportunities to address this problem. I was really excited to develop and conduct a project that would use these opportunities to promote healthier alcohol use among adolescents.

1.3. Research Objectives

The objective of my thesis was to study the acceptance of technology-facilitated care in the ED. To fill the knowledge gap on emergency clinicians' technology acceptance, I conducted a scoping review and cross-sectional, national survey of pediatric emergency physicians.

The objective of my scoping review (Study 1) was to synthesize evidence on the acceptance of POC cognitive support technology among ED clinicians. Scoping reviews are preliminary investigative processes that illuminate the breadth of existing evidence in emerging topics, such as POC cognitive support technology, and its patterns and themes (Colquhoun et al., 2014). This approach is particularly useful for mapping the nature of POC technology research that has been conducted and directing future research that is still needed.

The objective of my survey (Study 2) was to explore pediatric emergency physicians' perceptions about problematic adolescent alcohol use, current intervention practices, and their acceptance of using a technology-based, alcohol SBIRT system during ED care. Based on one pediatric (Chun et al., 2011) and two adult studies (Indig et al., 2009; O'Rourke et al., 2006), I hypothesized that physician-specific characteristics (i.e., training, attitudes, beliefs) would be associated with SBIRT practices. Little is known about pediatric emergency physicians' preferences for technology-based health interventions, this aspect is novel in my study. Thus, no hypotheses were made regarding acceptance of technology-based SBIRT.

1.4. Thesis Outline

This paper-based thesis reports on two studies. Chapter 2 is an overview of the methods for each study, detailing the research development and execution processes. Chapter 3 is a scoping review (Study 1) of the literature on emergency clinicians' acceptance of POC cognitive support technology. This review informed my survey of pediatric emergency physicians across Canada (Study 2), which is presented in Chapters 4 and 5. Underlying physician perceptions of adolescent alcohol use and their current intervention practices are reported in Chapter 4. Potential barriers to SBIRT use are also explored in this chapter. Chapter 5 presents a brief report on the acceptance of technology-based, alcohol SBIRT as a means to enhance SBIRT delivery and uptake. The final chapter, Chapter 6, is a concluding summary and discussion of study findings, limitations and strengths to my thesis, and recommendations for policy and future research in this field. Supplementary documents involved in the study design, recruitment process, and data collection and analyses are available in the Appendix, and appear in the order they have been addressed in the thesis.

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Chapter 2:

Overview of Methods

This chapter provides an overview of the research methods used in Studies 1 and 2. The steps involved in the development and execution of each study are detailed.

2.1. Study 1

Methodological Approach

To create a foundational knowledge base from which to develop my cross-sectional, national survey, I conducted a review of the literature. To determine what review would be the most appropriate for this topic, I compared potential eligible types of reviews (Grant & Booth, 2009; Rumrill et al., 2010). I examined the purpose and type of evidence that would be generated for a literature (both empirical and narrative), meta-analytical, systematic, and scoping review. Following this comparative evaluation, I concluded that an exploratory, scoping approach would be the most appropriate way to synthesize evidence on the acceptance of health technology in the ED. Due to the novelty of this study topic, a method to aggregate existing literature from a range of databases, identify research patterns and highlight reoccurring themes without the exhaustive methodology for a systematic review was needed. I determined that the scoping review approach would fulfil all these needs and also direct future work that is needed in this field.

In order to conduct a rigorous and systematic scoping review, I followed the 5-stage Arksey and O'Malley framework (Arksey & O'Malley, 2005), which is the most frequently used approach for scoping reviews (Pham et al., 2014). Enhancements to the framework—assessing the methodological quality of the studies reviewed—was also incorporated in the review (Levac et al., 2010). This addition aimed to address the critique that scoping reviews do not account for the quality of evidence in the literature.

Developing the Search Strategy

To identify key words to describe the topic, I informally completed a literature review of health technology in the ED and technology acceptance. I then consulted a research librarian experienced in conducting literature searches relevant to medicine. We collaborated on the appropriate time frame to include, pertinent databases, and keywords that would describe the concepts of "emergency department", "computer technologies", "point-of-care", and "technology acceptance". First, we performed a preliminary orienting search (Landa et al., 2011) on Ovid MEDLINE to expand our search query for keywords. Once we developed a search strategy, we tested it for sensitivity to determine whether it would successfully filter in four relevant studies (Malo et al., 2012; O'Sullivan et al., 2011; Sedlmayr et al., 2013; Sheehan et al., 2013) that had been manually selected to be included in the review. The strategy was iteratively adapted to ensure that it would identify all potentially eligible studies. The full search strategy is provided in Appendix A.

Developing the Eligibility Criteria and Screening

The eligibility criteria were structured on select components of the PICO (Population, Intervention, Comparison, and Outcome) framework, normally used for systematic reviews. My population of interest was emergency clinicians, the intervention of interest was point-of-care (POC) cognitive support systems, and the outcome of interest was user acceptance. POC cognitive support systems could not have any comparison so this component was not used for screening. I implemented a team approach to eligibility screening as recommended by Levac et al. (2010). This approach involved two reviewers screening article titles and abstracts (Level I screening) and full-text review (Level II screening). Each reviewer independently conducted Levels I and II screening, and reconvened after every 50 citations to determine reviewer

agreement. A screening form was used and refined during this process to be more explicit in its criterion and ensure reviewer agreement exceeded a kappa statistic of 0.80 (Landis & Koch, 1977). Appendix B presents the final version of the screening form.

During Level I screening, studies that met the "yes" criteria for every component (i.e., population, intervention, and outcome) were marked as 'relevant'. Studies that did not meet the "yes" criteria for any components were marked as 'irrelevant'. When the title and abstract were ambiguous and a decision could not be made, the study was flagged as being 'unclear' in eligibility. All studies marked as 'relevant' and 'unclear', from either reviewer's screening form, proceeded to Level II screening. At this stage, the full-text of each study was closely examined and marked as 'relevant' or 'irrelevant' based on the same criteria as Level I. When disagreements could not be resolved between the two reviewers, a third reviewer was consulted.

Extracting and Analyzing the Data

Using the four studies (Malo et al., 2012; O'Sullivan et al., 2011; Sedlmayr et al., 2013; Sheehan et al., 2013) manually selected and determined to be relevant, I created an extraction form on Microsoft Excel. The form was designed to capture information on: *i)* study characteristics (i.e., author, year of publication, country of study setting, design, ED setting), *ii)* population (i.e., type of clinicians, sample size, gender, age, professional experience, targeted patient population), *iii)* type of technology (i.e., platform, function, system name), *iv)* outcomes (i.e., satisfaction, usage, acceptance), and *v)* methodological quality. For my analysis, I collated descriptive data for study, population and technology characteristics. Subsequently, I organized technology acceptance data by TAM2 components, and by my predetermined four outcomes of interest—clinician, patient, organizational, and technical factors that influence acceptance.

2.2. Study 2

Developing the Survey Tool

To develop the questionnaire to be used in the survey, I began with conceptual mapping, to ensure that all questionnaire items would be relevant to the four domains I intended to investigate: clinician background, attitudes and beliefs regarding alcohol use and treatability in the ED, SBIRT practices, and technology acceptance. Subsequently, I studied existing questionnaires that were relevant to my topic and used to: *i)* examine the effect of a SBIRT training curriculum on emergency residents' practices (D'Onofrio et al., 2002) and, *ii)* predict alcohol counseling practices by clinician characteristics (Chun et al., 2011). Informed by the limitations of these prior questionnaires, I adapted select items that I intended to include in my questionnaire. Additional published literature on clinician perceptions and practices (Mabood et al., 2012; Rosenbloom et al., 2004; Nordqvist et al., 2005; O'Rourke et al., 2006; D'Onofrio & Degutis, 2004/2005; Indig et al., 2009; Langhan et al., 2015; Vadlamudi et al., 2008; Venkatesh & Bala, 2008; Venkatesh et al., 2003; Compeau & Higgins, 1995; Davis, 1989), the Substance Abuse and Attitude Scale (Chappel et al., 1985), and the Adapted Technology Acceptance Model 2 (Venkatesh & Davis, 2000; Sedlmayr et al., 2013) were also integral to item development. Scaling and filtering of items was then guided by my reading of "Health Measurement Scales" (Streiner & Norman, 1995). The original 47-item questionnaire development chart is provided in Appendix C. During pilot testing of the questionnaire, I removed 21 redundant, potentially sensitive, or leading items; reworded 15 ambiguous items; and added 9 items to capture information that would complement or improve the clarity of existing items. The final questionnaire was composed of 35 items. To account for French language preferences among

some of the potential research participants, I collaborated with language translation services to create a French survey version of the questionnaire.

The final stage of questionnaire development involved formatting the questionnaire for a web-based browser and ensuring a user-friendly interface. Based on recommendations from my peers, and because of the availability of institutional resources to support its use, I decided to house the questionnaire on the Research Electronic Data Capture platform (REDCap, University of Alberta, Edmonton, AB) (Harris et al., 2009), a secure web-based survey software.

Recruiting Participants

I submitted an application to Pediatric Emergency Research Canada (PERC) to access their ED clinician database. This database houses contact information from ED clinicians from across Canada that have granted permission to be contacted for PERC-endorsed surveys. Once permission was granted by PERC to conduct my survey, I recruited participants through e-mails and paper-based letters. To maximize my response rate, I contacted potential participants using the Dillman four-contact approach (Dillman et al., 2009). All e-mails and letters of communication with potential participants are included in Appendix D. In total, 245 potential participants from the PERC database were contacted. I was able to track non-respondents for follow-up contact while ensuring that all participant responses were anonymized through features offered on REDCap. To avoid inappropriate coercion to consent or undermine free participation, reimbursement only took form as a prize draw, without additional individual incentives (Canadian Institute of Health Research: Ethical Conduct, 2014). Participants who wished to enter the prize draw (a chance to win a 16GB iPad Mini 4, value $439, or $50 Amazon gift card) were required to answer a skill-testing question, (11 + 19) / 10, to be entered into the

draw. E-mail contact information provided for the draw was not linked to questionnaire responses.

Collecting and Analyzing the Data

I collected and managed study data using REDCap. For analysis, I exported the final dataset to STATA (version 14.0; StataCorp, College Station, Texas). Paper-based submissions were manually entered into STATA, and verified for completeness two weeks after the first entry. For each questionnaire item, STATA produced a variable name and converted responses into numerical codes. Subsequently, I cleaned the entries to ensure consistency in coding across variables, generated new variables to re-categorize select items, and developed a data dictionary (Appendix E) to document these changes.

I conducted descriptive and inferential statistics to address all three research objectives for Study 2 (outlined in Chapters 4 and 5). I consulted with several biostatisticians when determining which inferential statistic would be most appropriate. I chose the Jonckreere-Terpstra trend test because it runs data for two ordinal variables and indicates the direction of their relationship. This function was ideal for my analysis of association between our ordinal variables for physician attitudes, beliefs, and practices.

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Chapter 3:

Study 1 – A Scoping Review

Title: Point-of-care cognitive support technology in emergency departments: A scoping review of technology acceptance by clinicians

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3.1. Abstract

Objective: Cognitive support technologies that support clinical decisions and practices in the emergency department (ED) have the potential to optimize patient care. However, limited uptake by clinicians can prevent successful implementation. A better understanding of acceptance of these technologies from the clinician perspective is needed. We conducted a scoping review to synthesize diverse, emerging evidence on clinicians' acceptance of point-of-care (POC) cognitive support technology in the ED.

Method: We systematically searched 10 electronic databases and grey literature published from January 2006 to December 2016. Studies of any design assessing an ED-based POC cognitive support technology were considered eligible for inclusion. Studies were required to report outcome data for technology acceptance. Two reviewers independently screened studies for relevance and quality. Study quality was assessed using the Mixed Methods Appraisal Tool. A descriptive analysis of the features of POC cognitive support technology for each study is presented, illustrating trends in technology development and evaluation. A thematic analysis of clinician, technical, patient, and organizational factors associated with technology acceptance is also presented.

Results: Of the 1,563 references screened for eligibility, 24 met the inclusion criteria and were included in the review. Most studies were published from 2011 onwards (88%), scored high for methodological quality (79%) and examined POC technologies that were novel and newly introduced into the study setting (63%). Physician use of POC technology was the most commonly studied (67%). Technology acceptance was frequently conceptualized and measured by factors related to clinician attitudes and beliefs. Experience with the technology, intention to use, and actual use were also more common outcome measures of technology acceptance. Across

studies, perceived usefulness was the most noteworthy factor impacting technology acceptance, and clinicians generally had positive perceptions of the use of POC cognitive support technology in the ED. However, the actual use of POC cognitive support technology reported by clinicians was low—use, by proportion of patient cases, ranged from 30% to 59%. Of the 24 studies, only 2 studies investigated acceptance of POC cognitive support technology currently implemented in the ED, offering 'real world' clinical practice data. All other studies focused on acceptance of novel technologies. Technical aspects such as an unfriendly user interface, presentation of redundant or ambiguous information, and required user effort had a negative impact on acceptance. Patient expectations were also found to have a negative impact, while patient safety implications had a positive impact. Institutional support was also reported to impact technology acceptance.

Conclusions: Findings from this scoping review suggest that while ED clinicians acknowledge the utility and value of using POC cognitive support technology, actual use of such technology can be low. Further, few studies have evaluated the acceptance and use of POC technologies in routine care. Prospective studies that evaluate how ED clinicians appraise and consider POC technology use in clinical practice are now needed with diverse clinician samples. While this review identified multiple factors contributing to technology acceptance, determining how clinician, technical, patient, and organizational factors mediate or moderate acceptance should also be a priority.

3.2. Introduction

Point-of-care (POC) health technologies are systems that apply organized knowledge or skills at the place and time of patient care (World Health Organization, 2016). Among the range of POC systems, cognitive support technologies—tools designed to guide clinician practice—are emerging as a means to optimize patient care and address inefficiencies (Cresswell et al., 2012). Offering real-time, tailored, clinical information, cognitive support technology can be used across a spectrum of clinical processes including screening and risk assessment, intervention, order entry, and medication prescribing (Cresswell et al., 2012; Goodnough & Shah, 2014). Within the emergency department (ED), these technologies are proposed to mitigate clinical challenges associated with crowding, limited patient background information, and urgency to treat (Cummings, 1990). Preliminary evidence demonstrates that computerized POC cognitive support technologies in the ED are feasible (Dean et al., 2015), and have enhanced adherence to guidelines (Cresswell et al., 2012; Demonchy et al., 2014), improved the timeliness of diagnoses and treatment decisions (Nam et al., 2007; Singer et al., 2015), and reduced medication errors (Radley et al., 2013).

ED clinicians, the intended POC system end-users, make the ultimate decision to use such technologies into their day-to-day practices. Regardless of the promising features proposed for cognitive support technologies, the extent of a clinician's 'technology acceptance' can facilitate or prevent use. A number of theories, models and studies have proposed that technology acceptance may be determined by end-user motivation, perception, and experiences (Vallerand, 1997; Deci & Ryan, 1985; Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), and is underpinned by a range of behavioral and cognitive processes (Khan et al., 2016; Vandenberg et al., 2017; O'Sullivan et al., 2011). At this time, technology acceptance with respect to POC

cognitive support technologies among ED clinicians is not well understood, but could help ED administrators and technology developers anticipate barriers to use, address clinician concerns regarding use, and better integrate technology into emergency care systems.

We conducted a scoping review of the literature to identify the evidence base for the acceptance among ED clinicians towards POC cognitive support technologies. A scoping approach is particularly useful for aggregating evidence and revealing themes in high volumes of diverse literature on developing fields of research (Arksey & O'Malley, 2005; Levac et al., 2010). We also sought to identify in the literature, specific clinician, patient, organizational, and technical factors that have been shown to influence technology acceptance among ED clinicians. We concluded the review by identifying gaps in the evidence base on technology acceptance for which research might add value to emergency care.

3.3. Methods

Study Design

This was a scoping review guided by the Arksey and O'Malley framework (Arksey & O'Malley, 2005), with enhancements as recommended by Levac et al. (2010). Reporting of the review adheres to the PRISMA statement checklist (PRISMA, 2015).

Search Strategy

We developed and executed the search strategy in collaboration with a medical librarian (author: SMC) experienced in literature searches relevant to emergency medicine. The search strategy was tested for sensitivity, determined by whether the search successfully filtered in four studies (O'Sullivan et al., 2011; Malo et al., 2012; Sedlmayr et al., 2013; Sheehan et al., 2013) manually selected a priori for inclusion. Ten databases: Ovid MEDLINE, Ovid EMBASE, Ovid PsycINFO, SCOPUS, EBSCO CINAHL, CBCA, INSPEC (Engineering Village), ProQuest

Dissertations and Theses Global, EBM Reviews (Cochrane Database of Systematic Reviews, ACP Journal Club, Database of Abstracts of Reviews of Effects, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, Health Technology Assessment, NHS Economic Evaluation Database), and PROSPERO were searched. The databases were initially searched on April 19, 2016 and the search was updated on December 12, 2016. Databases were searched using both controlled vocabulary (e.g., MESH and EMTREE) and text-words describing the concepts of "emergency department" and "computer technologies", and "acceptance". Articles related to "prehospital care" were removed. The searches included both published and unpublished studies from January 2006 to December 2016. The search strategy was not limited by study design or language. Appendix A provides the search terms developed for the MEDLINE database. We also hand-searched two online archives of conference abstracts: the Society for Academic Emergency Medicine (2006 to 2016) and the American College of Emergency Physicians (2008 to 2016). The reference lists of included studies were also reviewed to identify additional relevant studies.

Inclusion Criteria

We included studies of any design that assessed a cognitive support system implemented in the ED that was: 1) delivered via technology (e.g., computer, smartphone), 2) used at the point-of-care by ED clinicians, and 3) assessed for user acceptance. Studies of stand-alone electronic medical/health records, without integrated cognitive support decision support systems, were excluded. We defined ED clinicians as medical residents, fellows, attending physicians, physician assistants and nurses employed in the ED. We defined an assessment of user acceptance as an assessment of cognitive (i.e., beliefs, attitudes and intention) and/or behavioral (i.e., uptake and adherence) factors related to technology use.

Screening for Eligibility

Articles were organized and screened using RefWorks bibliographic management software. Two reviewers (authors: SJ and KS) independently screened the title and abstract of articles in the RefWorks library, classifying each as 'relevant', 'irrelevant', or 'unclear' using pre-determined inclusion and exclusion criteria. The same reviewers independently reviewed the full-text of studies that were identified as 'relevant' or 'unclear', and subsequently calculated inter-rater agreement with the kappa statistic (Altman, 1991). The reviewers contacted primary authors of studies when reports were vague or were missing information, and a decision on eligibility could not be made. Furthermore, the reviewers contacted primary authors of relevant unpublished studies for updated published work, if available. Discrepancies in screening decisions were resolved by discussion and consensus between the reviewers, or through third party (authors: ASN, AP and SC) consultation as necessary.

Data Extraction

A standardized data extraction form was developed based on four cycles of pilot test extractions (O'Sullivan et al., 2011; Malo et al., 2012; Sedlmayr et al., 2013; Sheehan et al., 2013). The extraction form captured characteristics about the study (e.g., country, design), setting, clinician sample, patient population, and technology (e.g., type, function). Study findings pertaining to technology acceptance and its measures were also extracted. The data were independently extracted by two reviewers (authors: SJ and KS), and reviewed by one reviewer (author: SJ) for completeness and accuracy. Discrepancies were resolved by consensus or by contacting corresponding authors of included studies.

We organized technology acceptance results in two separate, but complimentary ways. To begin with, results were organized using domains from the Technology Acceptance Model 2

(TAM2), which identifies many end-user cognitive processes involved with technology acceptance (Sedlmayr et al., 2013; Venkatesh & Davis, 2000). This model proposes 11 measurable determinants of acceptance: perceived ease of use, perceived usefulness, subjective norms (i.e., perception of the degree to which use is advocated by others), image (e.g., perception that use will enhance status), job relevance, output quality (e.g., technology performance), result demonstrability (e.g., how tangible the outputs are), personal experience with the technology, voluntariness of use, compatibility with work flow, and resistance to change (i.e., maintaining status quo) (Venkatesh & Davis, 2000; Bhattacherjee & Hikmet, 2007; Moore & Benbasat, 1991; Davis, 1989; Venkatesh et al., 2003). We also grouped findings under four domains: attitudes and beliefs, experience, intention to use, and actual use. This grouping was done to stratify the evidence for technology acceptance by different domains of acceptance and illuminate discrepancies in acceptance across the domains.

Quality Assessment

The quality of studies was assessed using the Mixed Methods Appraisal Tool (MMAT), which offered a consistent scoring system across heterogeneous study designs in this review (Pluye et al., 2011). The MMAT consists of two screening questions applicable to all study designs, and three to four questions applicable to specific designs. Questions relevant to each study design were scored by summing the final count of 'yes' answers, dividing it by the total number of questions, and multiplying by 100 to give a MMAT percentage score. Higher scores indicate higher methodological quality. Qualitative studies were appraised for the relevance of data sources, processes used for data analysis, consideration of study context, and the researchers' potential to bias the results. A randomized controlled trial was appraised for sequence generation, allocation concealment, the completeness of outcome data, and study

attrition. All other quantitative studies were appraised for recruitment strategies and/or sample representativeness, outcome measurement, the completeness of outcome data and/or study response rate, and when applicable, the comparability of comparison groups. Mixed methods studies were assessed for the relevance of the design, integration of methods, and limitations to integration. Two reviewers (authors: SJ and KS) independently assessed the methodological quality of studies. Disagreements were resolved by consensus, or by involving a third reviewer (author: ASN) as required.

Data Analysis

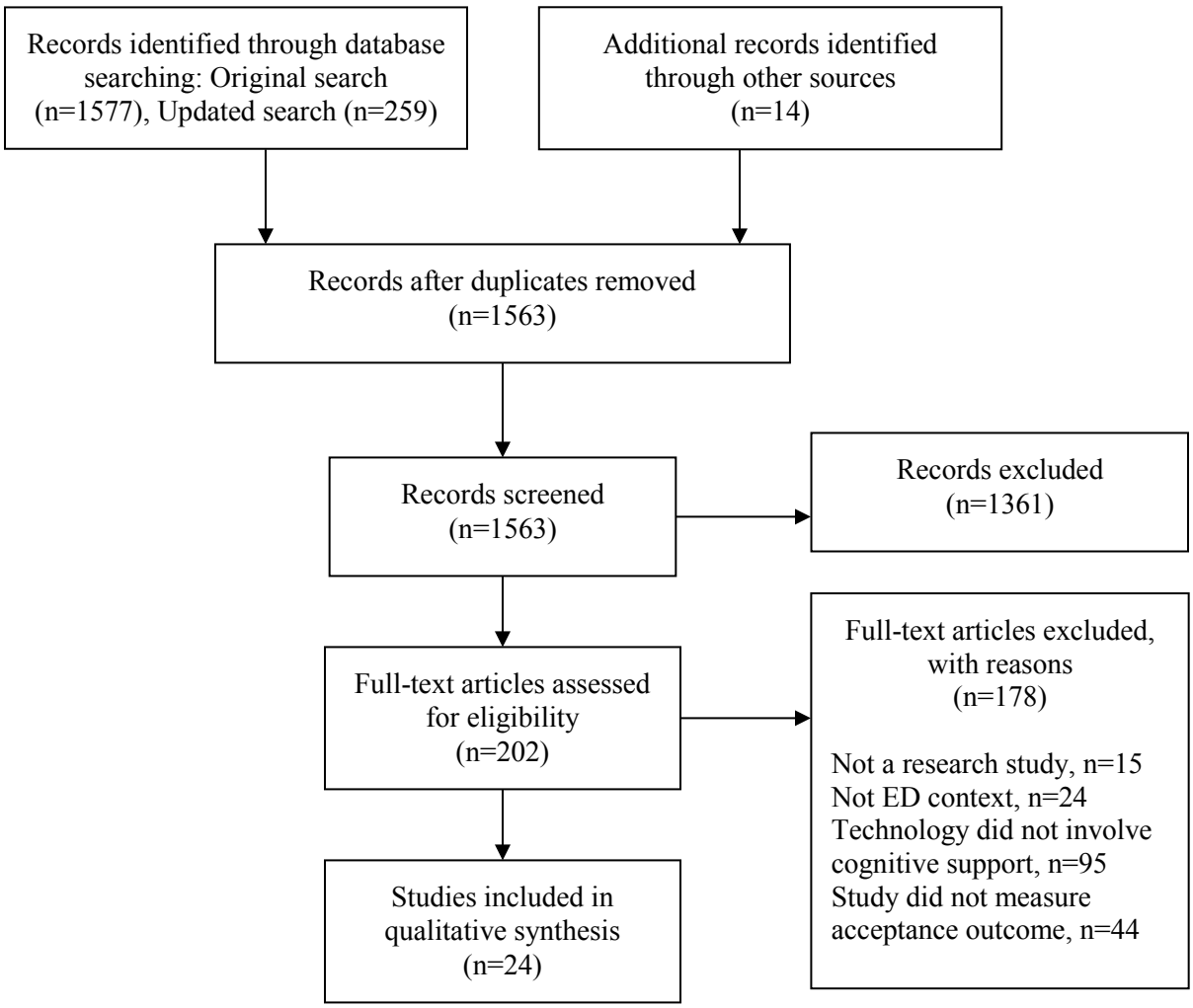
Evidence tables were developed to systematically aggregate findings into descriptive and thematic summaries (Arksey & O'Malley, 2005). Descriptive summaries included information on study design, methodological quality, study population and setting, and sample size. Summary statistics were calculated using STATA (version 14.0; StataCorp, College Station, Tex). To give a practical context to the acceptance findings, the POC cognitive support tools were identified and grouped as: 1) hypothetical or in development (i.e., not yet introduced into ED care), 2) novel (i.e., newly introduced to ED care), or 3) existing (i.e., already used for ED care). We summarized acceptance findings by clinician, patient, organizational, and technical factors shown to influence technology acceptance among ED clinicians. For each factor, we extracted specific variables related to acceptance and calculated the frequency of studies examining each variable. Stratification of outcome data by frequency of studies lends to an understanding of broader trends in research on technology acceptance.

3.4. Results

Literature Search and Selection

The search strategy identified 1,563 unique citations. Of these citations, 202 were considered potentially relevant based on their title and abstract (Figure 3.4.1).

Figure 3.4.1. Selection of studies



After full-text review, 24 articles met inclusion criteria and were included in the review (Demonchy et al., 2014; Khan et al., 2016; Vandenberg et al., 2017; O'Sullivan et al., 2011; Malo et al., 2012; Sedlmayr et al., 2013; Sheehan et al., 2013; Ballard et al., 2013; Boudreaux et al., 2012; Boudreaux et al., 2009; Carman et al., 2011; Drescher et al., 2011; Fowler et al., 2014; Goergen et al., 2006; Griffey et al., 2014; Kline et al., 2014; Kunisch, 2012; Lee et al., 2013; O'Sullivan et al., 2014; Patapovas et al., 2013; Sard et al., 2008; Venkat et al., 2012; Yadav et al., 2015; Zafar, 2012). Reviewer agreement on identifying studies for inclusion was excellent (kappa=0.901). Any discrepancies were resolved to achieve 100% consensus on study inclusion.

Description of Included Studies

Characteristics of included studies that have evaluated acceptance of POC cognitive support technologies are presented in Table 3.4.1. The majority of studies were conducted in EDs in the United States (67%), and the same proportion was conducted at single sites (67%).

Study Quality

Details on the quality of studies are provided in Appendix F. The majority of studies (79%) received a MMAT score above 75 (2 of 3, or 3 of 4 criteria met), while two studies (8%) (Carman et al., 2011; Fowler et al., 2014) had a score below 50 (half to less than half of criteria met).

Table 3.4.1. Overview of study characteristics, stratified by the stage of the POC technology

Study (Year, Country)	ED setting (Annual patient volume)	POC cognitive support technology	Purpose
Hypothetical or in development technology			
Ballard et al. (2013, US)	20 community EDs[‖] (913,466 combined)	CDSS on EMR system	Assessment of TBI in adherence to PECARN clinical prediction rules
Sheehan et al. (2013, US)	3 pediatric, 2 tertiary care, and 6 community EDs (NR)		
Khan et al. (2016, US)	2 EDs in same tertiary academic centre (183,700)		Estimate PE pretest probability
Griffey et al. (2014, US)	Private, contract and hospital-owned groups; 1 academic, 1 pediatric ED (‡)	CDSS on unspecified platform	Decisions for CT ordering
Malo et al. (2012, Canada)	1 tertiary care ED (NR)	ReaScribe+ on EMR system	Clinical decision support, facilitate charting of clinical information
Lee et al. (2013, Australia)	1 general ED (60,000)	Algorithm-based CDSS on unspecified platform	Real-time trauma resuscitation management
Novel technology			
Kline et al. (2014, US)	1 community, 3 academic EDs (NR)	CDSS aid on an internet-based program, "webtool"	Differentially assess symptoms suggesting ACS and PE
Demonchy et al. (2014, France)	3 academic EDs (NR)	CDSS triggered by UTI diagnosis, on EMR system	Patient-tailored treatment and follow-up recommendations
Venkat et al. (2012, US)	1 Level I, academic ED (NR)	CDSS on EMR system	Screening for seasonal influenza vaccination
Boudreaux et al. (2009, US)	1 Level I academic ED (47,000)	DARSSA on web-based program on laptop	Assessment, intervention and referral for substance abuse
Georgen et al. (2006, Australia)	1 tertiary care, adult ED (NR)	MedWeb on computer dedicated to study	Management of cervical spine trauma patients
Vandenberg et al. (2016, US)	2 Veterans Affairs Medical Centres (NR)	eCDSS on unspecified platform	Geriatric prescribing
O'Sullivan et al. (2014, Canada)	1 pediatric, academic ED (NR)	MET3-AE on mobile device, motion computing C5 tablet	Predict asthma exacerbation severity and provide appropriate management support
O'Sullivan et al. (2011, Canada)			
Patapovas et al. (2013, Germany)	1 Level III ED (40,000)	OntoDrug on electronic case sheet on mobile workstation	Provide drug interaction and contraindication alerts
Kunisch (2012, US)	1 Level I pediatric ED (NR)	CDSS, ESI algorithm, on Epic system	Classify patients at triage
Boudreaux et al. (2012, US)	1 Level I academic ED (47,000)	CABIT on web-based program on laptop	Assessment, intervention and referral for tobacco use

Yadav et al. (2015, US)	1 Level I ED (87,000)	eCDS on EMR system on computer/ mobile device	Assessment of TBI and decision to order head CT in adherence to PECARN clinical prediction rules
Drescher et al. (2011, US)	1 community ED (NR)	CDSS (algorithm of Wells score) on CPOE on EMR system	Recommendation for diagnosis of PE
Fowler et al. (2014, US)	1 academic ED (NR)	DDST and Knowledge Page (Isabel) on EMR system	Provide possible context-specific diagnoses and treatment plans
Carman et al. (2011, US)	1 Level 1, 1 community, 2 freestanding EDs (200,000 combined)	CDSS using HMED 6.3 features, on EMR system	Medical examination, follow-up and discharge
Existing technology			
Sedlmayr et al. (2013, Germany)	1 Level III ED (45,000)	Infobutton and Medi-check on EMR system	Provide medication safety prompts and information
Zafar (2012, US)	1 academic ED (NR)	CDSS on EMR system	Provide general clinical management support
Sard et al. (2008, US)	1 Level I academic ED (30,000)	Drug dosing support, 'Quicklist', on IBEX	Provide pediatric, weight-based drug dosing, allergy, interactions information

[J] 8 of the EDs had affiliations with academic centres; [‡] Multisite annual ED census: percentage of participants working in ED with specified annual census range (< 35,000 = 17.4%; 35,000-54,999 = 27.1%; 55,000-74,999 = 9.0%; < 75,000 = 46.5%)

ACS – acute coronary syndrome; CABIT – Computer-assisted Brief Intervention for Tobacco; CDSS – clinical/computerized decision support system; CPOE – computerized provider order entry; CT – computed tomography; DARSSA – Dynamic Assessment and Referral System for Substance Abuse; DDST – Diagnostic Decision Support Tool; eCDS – electronic clinical decision support; EMR – electronic medical record; ESI – Emergency Severity Index; MET3-AE – Mobile Emergency Triage-Asthma Exacerbation; NR – not reported; PE – pulmonary embolism; PECARN – pediatric emergency care applied research network; TBI – traumatic brain injury; US – United States; UTI – urinary tract infection

Table 3.4.2. Technology acceptance across the various POC cognitive support technologies, stratified by the stage of technology

Study	Participants (n)	POC cognitive support technology			General Findings
		Purpose	Patient population (n)	Implementation time frame*	
Hypothetical or in development technology					
Ballard et al., 2013	Physicians (339)	To support assessment of TBI in adherence to PECARN clinical prediction rules	Hypothetical scenario of minor head trauma in pediatric patients (NA)	NA	Majority acknowledged its value, 26% had completely positive opinions of tool characteristics
Sheehan et al., 2013	Physicians and physician assistants (56), nurses and nurse managers (61)			NA	Generally positive attitudes, better received if technical and situational barriers were addressed
Khan et al., 2016	Physicians and medical residents (10)	To estimate PE pretest probability	Adult (NA)	NA	Positive consensus on usefulness, low intention to use
Griffey et al., 2014	Physicians and medical residents (235)	To support decisions for CT ordering	Adult and pediatric patients (NA)	NA	Preference for decision support Mean=2.05, SD=0.74 [1 strongly agree, 5 strongly disagree]
Malo et al., 2012	Nurses (74)	To provide clinical decision support and facilitate charting of clinical information	Adult and pediatric trauma patients (NA)	NA	High intention to use tool Mean=6.35, SD=1.06 [out of 7]
Lee et al., 2013	Nurses and medical staff (33)	To provide real-time trauma resuscitation management support	Adult and pediatric trauma patients (NA)	NA	Generally negative attitudes and concerns of its impact on care
Novel technology					
Kline et al., 2014	Physicians (270)	To differentially assess symptoms suggesting ACS and PE	Adult patients with chest pain and difficulty breathing (541)	11 months	Intent to use recommendations: ACS: 73% replied "yes" or "maybe" PE: 76% replied "yes" or "maybe"
Demonchy et al., 2014	Physicians (NR†)	To provide patient tailored hospitalization treatment and follow-up recommendations	Adult - 15+, diagnosed with community-acquired UTI; n=912	10 weeks	Used with 59% of patients, positive feedback on time to use and usability
Venkat et al., 2012	Nurses (58)	To facilitate screening for seasonal influenza vaccination	General ED patients aged 6 months+ who were eligible for vaccination screening (2,884)	1 month	54% of nurses felt the ED was inappropriate for public health interventions or desired process modifications
Boudreaux et al., 2009	Physicians (19), nurses (15)	To facilitate assessment, intervention and referral for	Adult - risky use of 1 or more substances, stable,	NR	Satisfaction (useful, understandable, length,

		substance abuse	literate; n=85		appropriate) Mean=4.63, SD=0.46 [1 very poor, 5 excellent]
Georgen et al., 2006	Physicians (NR)	To support management of cervical spine trauma patients	Adult patients aged 16+ years with acute cervical spine trauma (353)	11 months	Used with 40% of patients, negative feedback on time to use and relevance
Vandenberg et al., 2017	Physicians, physician assistants, nurses (20)	To support and enhance geriatric prescribing	Adult patients aged 65+ years (NR)	31 months	40% adopting users (use tool ≥1 per shift)
O'Sullivan et al., 2014	Physicians (19)	To predict asthma exacerbation severity and provide appropriate management support	Pediatric patients with asthma (NR)	12 months	Usability=0.74 [scale of 0 to 1], physicians reported it effective, efficient and satisfactory
O'Sullivan et al., 2011	Physicians and medical residents (36)				Perceived value/usefulness: Mean=5.22, SD=1.34 [out of 7] Interest/enjoyment: Mean=5.58, SD=1.13 [out of 7]
Patapovas et al., 2013	Physicians (9)	To facilitate drug therapy by providing drug interaction and contraindication alerts	Adult patients (NR)	32 weeks (7-8 months)	Overall higher positive ratings for computer support (vs. paper-based)
Kunisch, 2012	Nurses (32)	To assist classifying patients at triage	Pediatric patients with ESI levels of 3/4/5 (retrospective study: 53,041; prospective study: 23,711)	6 months	Low uptake, 54.8% never used it
Boudreaux et al., 2012	Physicians and nurses (NR)	To facilitate assessment, intervention and referral for tobacco use	Adult patients who were tobacco users, literate in English/computer, and medically stable (67)	7 months	Satisfaction (useful, understandable, length, format): mean=4.31 [1 very poor, 5 excellent]
Yadav et al., 2015	PEM physicians (45)	To support assessment of TBI and decision to order head CT in adherence to PECARN clinical prediction rules	Pediatric patients with a TBI patients (NR)	1 month	Usability=84% reported the eCDS incorporated CPOE was "better" than existing CPOE
Drescher et al., 2011	Physicians (19)	To provide recommendation for diagnosis of PE	Adult patients undergoing CT angiography or D-dimer (404)	4 months	26.7% of patient cases did not adhere to tool, physicians requested removal of decision support tool from CPOE
Fowler et al., 2014	Attending physicians and fellows (7)	To provide possible context-specific diagnoses and treatment plans	Pediatric patients (125)	7 months	Negative response to the DDST, interest/excitement for 'Knowledge Page'
Carman et al., 2011	Physicians, mid-level providers, n=20	To facilitate medical examination, follow-up and discharge	Adult and pediatric patients with a chief complaint of abscess	12 weeks	Overall reaction at week: mean=7.33; SD=1.51 [1 frustrating, 9 satisfying]

			who had no animal bites or oral infections (873)		
Existing technology					
Sedlmayr et al., 2013	Physicians (9)	To provide medication safety prompts and information	Adult patients (NR)	Implemented prior to study (conducted the following year)	Useful and relevant to job, but time and effort are downfalls
Zafar, 2012	Attending physicians, fellows, medical residents, interns (25)	To provide general clinical management support	General ED patients (NR)	Implemented 2 months prior to study	Overall reaction: mean=4.50; SD=1.70 [out of 6] Trainees used more than attending
Sard et al., 2008	Physicians: attending (7), PEM fellow (4), medical resident (59)	To provide pediatric, weight-based drug dosing, allergy, interactions information	Pediatric patients seen by physician (840)	10 months	Used for 30% of orders attending/fellows used more than residents

[J] Excluded if ECG pos., cocaine use, prisoner, pregnant, barrier to F/U, known AMI/PE, SBP <100 mmHg, prior plan for treatment; [*] Only applicable to evaluations of novel and existing technologies.

ACS – acute coronary syndrome; CPOE – computerized provider order entry; CT – computed tomography; DDST – Diagnostic Decision Support Tool; ESI – Emergency Severity Index; NA – not applicable; PE – pulmonary embolism; PECARN – pediatric emergency care applied research network; SD – standard deviation; TBI – traumatic brain injury; UTI – urinary tract infection

Acceptance of Point-of-care Cognitive Support Technology

Table 3.4.2 details general findings across the various POC cognitive support technologies, stratified by the developmental stage of the POC technology under examination. More than half the studies (63%) examined acceptance of novel technologies, which were newly introduced to the study setting for research purposes. Attitudes and beliefs were the most common outcomes for measuring technology acceptance among physicians (10 studies), nurses (3 studies) and a mixed ED clinician group (3 studies). Personal experience with a POC cognitive support technology was measured among physicians (6 studies) and a mixed ED clinician group (3 studies). Intention to use POC cognitive support technology and actual use of POC cognitive support technology was primarily studied among physicians (intention: 3 studies; actual use: 5 studies). Acceptance measures of satisfaction and usability among nurses was not studied. Outcomes used to define and measure technology acceptance are summarized in Appendix G.

Factors Associated with Technology Acceptance

Table 3.4.3 presents clinician, technical, patient, and organizational factors related to POC cognitive support technology acceptance. Figure 3.4.2 illustrates trends in measures of technology acceptance through a comparison of the frequency with which each factor was studied.

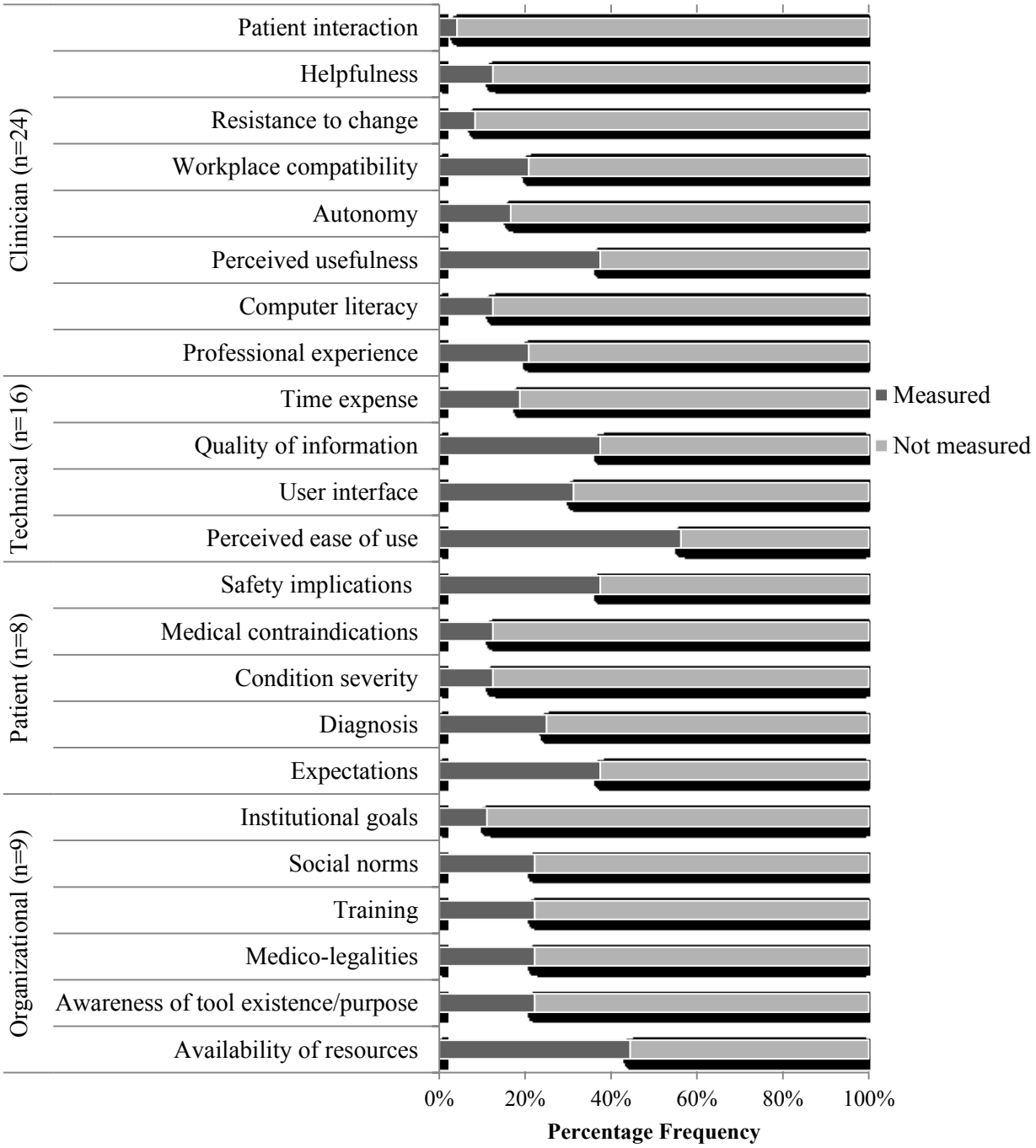
Clinician factors are specific perceptions and demographic characteristics which may impact technology acceptance. Among clinician-related factors, perceived usefulness of POC cognitive support technology acceptance was the most widely studied (Vandenberg et al., 2017; Sedlmayr et al., 2013; Sheehan et al., 2013; Ballard et al., 2013; Boudreaux et al., 2012; Boudreaux et al., 2009; Goergen et al., 2006; Griffey et al., 2014; Patapovas et al., 2013). In two

Table 3.4.3. Impact of factors related to technology acceptance

Clinician-related factors (24 studies)								
	Professional experience	**Computer literacy**	**Perceived usefulness**	**Autonomy**	**Workplace compatibility**	**Resistance to change**	**Helpfulness**	**Patient interaction**
Positive	Seniors	Competent	Useful	Voluntary	Compatible			
Negative				Undermining	Inappropriate	Resistant	Unhelpful	Interference
No Impact	Senior/Junior							
Technical factors (16 studies)								
	Perceived ease of use			**User interface**	**Quality of information**		**Time expense**	
Positive				Simple/Flexible	Relevant/Comprehensive			
Negative	Effortful			Unfriendly	Redundant/Ambiguous		Too much time	
Patient-related factors (8 studies)								
	Expectations		**Diagnosis**	**Condition severity**	**Medical contraindications**		**Safety implications**	
Positive			Type of infection	Less severe	Polypharmacy		Risk reduction	
Negative	Expectant/Preferences							
No Impact			Potential ACS/PE					
Organizational factors (9 studies)								
	Availability of resources		**Awareness of tool existence/purpose**	**Medico-legalities**	**Training**	**Social norms**		**Institutional goals**
Positive	Sufficient			Immunity		Used by colleagues		Positively aligns
Negative	Limited/Unavailable		Unaware	Liability	Insufficient			

ACS – acute coronary syndrome; PE – pulmonary embolism

Figure 3.4.2. Frequency of studies examining factors related to technology acceptance, by category



studies, perceived usefulness was related to physicians' overall perception of POC cognitive support tools, and positively correlated with intention to use (Patapovas et al., 2013; Sedlmayr et al., 2013). Perceptions of tool compatibility with workflow was found to positively impact acceptance in three studies (Khan et al., 2016; Sedlmayr et al., 2013; Patapovas et al., 2013). Clinician beliefs that were barriers to technology acceptance included: the belief that the ED is an inappropriate setting for POC cognitive support technology (Lee et al., 2013; Venkat et al., 2012), and the belief that cognitive support technology undermines judgments based on expertise and an intuitive approach to patient care (Carman et al., 2011; Drescher et al., 2011; Vandenberg et al., 2017). Some studies found higher acceptance among senior physicians (Sard et al., 2008; Zafar, 2012), while other studies reported little to no difference in level of acceptance between senior and junior physicians (Demonchy et al., 2014; Malo et al., 2012; Griffey et al., 2014).

Among the range of technical elements affecting clinician acceptance of POC cognitive support technology, perceived ease of use and perceived ease of effort, were the most commonly cited barriers to technology acceptance (Khan et al., 2016; O'Sullivan et al., 2011; Sedlmayr et al., 2013; Sheehan et al., 2013; Carman et al., 2011; Goergen et al., 2006; O'Sullivan et al., 2014; Patapovas et al., 2013; Zafar, 2012). Studies also demonstrated potential mediating effects of perceived value (O'Sullivan et al., 2011) and helpfulness (Carman et al., 2011) of the technology on perceived ease of use and intention to use. Regarding user interface, tool simplicity and flexibility had positive impacts on acceptance (Sheehan et al., 2013; Boudreaux et al., 2012; Zafar, 2012). Several studies reported that redundant and ambiguous information, which was difficult to apply to unique or specific patient cases, hindered uptake (Sheehan et al., 2013; Fowler et al., 2014; Zafar, 2012). In one study, high specificity and sensitivity of

information and feedback was found to increase clinicians' intention to use POC technology (Ballard et al., 2013).

Studies of caregiver and patient preferences for procedures found that preferences had the potential to impact test ordering and treatment plan decisions, which may deviate from the recommended treatment guidelines (Sheehan et al., 2013; Griffey et al., 2014; Yadav et al., 2015). The willingness to use POC cognitive support technology among clinicians was higher when treating patients with less severe complaints (Sheehan et al., 2013), and for polypharmacy patient cases (Sedlmayr et al., 2013). Evidence on the impact of patient diagnosis on technology acceptance was inconsistent across two studies. One study showed differences in the frequency of technology use by the type of infection that patients were diagnosed with (Demonchy et al., 2014). In another study, clinician-reported intention to use recommendations offered on the technology were similar for diagnoses of both pulmonary embolism and acute coronary syndrome (Kline et al., 2014).

Technology acceptance was also affected by institutional capacity, namely whether platforms to host the technology and personnel to support and sustain the system were available (Sedlmayr et al., 2013; Boudreaux et al., 2012). Barriers to use, including the failure to increase the awareness of the existence and purpose of the technology (Demonchy et al., 2014; Sedlmayr et al., 2013; Kunisch, 2012), as well as insufficient training (O'Sullivan et al., 2011; Boudreaux et al., 2012) among physicians and nurses, were other organizational level factors that affected acceptance. Technology acceptance was also influenced by medico-legal concerns. Conflicting opinions were expressed—some physicians indicated that cognitive support technology offered some immunity and legal protection (Ballard et al., 2013), whereas others viewed these tools as a legal liability (Yadav et al., 2015). A higher intention to use POC technology was found when

positive uptake was demonstrated by colleagues (Malo et al., 2012; Ballard et al., 2013), and tool integration was aligned with the evidence-based care guidelines advocated by the institution (Sheehan et al., 2013).

Use of Cognitive Support Technologies

Overall, studies of technology acceptance demonstrated that while there was general agreement on the potential benefits of POC cognitive support technology, actual use by clinicians in the ED was low. When measured by the proportion of patient cases for which the tool was used, actual use ranged from 30% to 59% (Demonchy et al., 2014; Goergen et al., 2006; Sard et al., 2008). Among these, the lowest reported use was 30% (Sard et al., 2008). Across studies measuring 'uptake' as frequency of use, use ranged from 40% to 45% (Vandenberg et al., 2017; Kunisch, 2012). In one study, uptake was measured in reverse, as the prevalence of incomplete adherence to tool recommendations, which was 27% (Drescher et al., 2011).

3.5. Discussion

The examination of POC cognitive support technologies in the ED is an emerging field of study. Preliminary evidence demonstrates the enabling features of cognitive support technology during acute patient care (Cresswell et al., 2012; Cummings, 1990; Demonchy et al., 2014; Nam et al., 2007; Singer et al., 2015; Radley et al., 2013), and suggests it to be a promising asset to the health care system. To ensure the sustainable integration of these valuable tools in the ED, it is necessary to identify the factors that impact end-user acceptance. This evaluation is foundational to subsequent efforts to address barriers to technology use, to manage inefficiencies, and to promote technology acceptance among ED clinicians. Using a scoping review, we synthesized diverse, emerging evidence on the factors related to the acceptance of ED-based POC cognitive support technology among clinicians. This review revealed three key aspects of technology

acceptance by ED clinicians: 1) while perceptions of use can be high, actual use can be low; 2) 'real world' clinical practice is understudied; and 3) technology acceptance is affected by a number of clinician, patient, technical, and organizational factors.

An important highlight of this review, and the first key finding, is that although ED clinicians acknowledge the value and usefulness of features offered by POC cognitive support technology in the ED, actual use of the technology can be low. While the acceptance of POC cognitive support technology in concept was generally high across all studies, studies of existing POC technologies in the ED reported lower clinician use compared to studies of novel technologies (Demonchy et al., 2014; Vandenberg et al., 2017; Goergen et al., 2006; Kunisch, 2012; Sard et al., 2008). It may be that while an ED clinician's attitudes and beliefs can predict behavioral intention and use of a technology (Venkatesh & Davis, 2000), the clinical context within which a clinician works (e.g., time pressures, patient acuity and preferences, staffing) (Demonchy et al., 2014; Vandenberg et al., 2017; O'Sullivan et al., 2011; Sedlmayr et al., 2013; Sheehan et al., 2013; Griffey et al., 2014; Patapovas et al., 2013; Yadav et al., 2015) and the stage of technology implementation (e.g., novel technology not yet used in routine care, existing technology already widely used) are important considerations when it comes to understanding and facilitating clinician use of technology during routine ED care. End-user appraisal, once a technology is in use, is considered a core determinant of adoption (Pope et al., 2013; Jones et al., 2016). Nine studies in this review explored the role of clinical context on technology use (O'Sullivan et al., 2011; Malo et al., 2012; Sedlmayr et al., 2013; Sheehan et al., 2013; Ballard et al., 2013; Boudreaux et al., 2012; Kunisch, 2012, Venkat et al., 2012; Yadav et al., 2015). These studies found that compatibility with the ED workflow, implications on patient safety and their expectations for treatment, and understaffing or staff turnover affected technology acceptance.

That POC cognitive support technologies have the added complexity of an active cognitive application to a technology platform may also explain the discrepancy between high acceptance and low use. Clinicians may need time to become familiar with and use the cognitive support aspect of the technology to determine whether it improves the delivery of patient care. In this regard, the evaluation and adoption of POC cognitive support technology extends beyond establishing its value (Murray et al., 2010), to establishing how it is used or experienced over time.

The second key finding from this review is that there is an insufficient evidence base about technology acceptance of POC cognitive support technologies during 'real world' clinical practice. In this review, the number of studies that examined existing technology was disproportionately small in comparison to those that studied a novel or developing technology that had yet to be introduced into clinical care. As such, 'actual use' as an indicator of technology acceptance is considerably understudied compared to study of perceptions of and experiences with a technology, based on usability testing and short-term pilot studies. Technology acceptance, however, is not static. Familiarity can promote higher acceptance as the tension associated with use diminishes over time (Carman et al., 2011). To better understand and predict how technology acceptance fluctuates over time and during routine ED use, studies investigating clinician use of, and adherence to, POC cognitive support technology that are used in day-to-day care are needed. Evaluations should be prospective and over long-term implementation periods. Such studies would capture changes in user perception and use over time, and would allow for a more robust evaluation of technology acceptance. Longitudinal prospective evaluations of technology acceptance and use would provide findings with direct applicability to ED administrators. Studies should also examine technology acceptance among

ED health professional groups other than physicians. Most of the studies in this review examined acceptance among ED physicians. Yet, a key feature of the ED is transitory patient care, which involves a dynamic and interactive group of health care professionals. A practical evaluation of technology acceptance and adoption requires an assessment of how users collectively engage with the technology (Jones et al., 2016; Murray et al., 2010).

The third key finding from this review is that technology acceptance is affected by a number of clinician, technical, patient, and organizational factors. The TAM2 framework (Sedlmayr et al., 2013; Venkatesh & Davis, 2000), the most pertinent and widely used model of technology acceptance in the medical context (Holden & Karsh, 2010), suggests an interplay of social and cognitive processes that affect acceptance and usage behavior. In this review, however, only two studies considered all the variables in the TAM2 framework (Sedlmayr et al., 2013; Patapovas et al., 2013). The remaining 22 studies examined select portions of the model. The discord between perception of use and actual use in studies that was identified by this review may, in part, reflect the fragmented application of technology acceptance theory to study POC cognitive technology use. Moving this review's findings forward, studies of POC cognitive support technology should now examine technology acceptance and usage from a comprehensive clinician, technical, patient and organizational perspective, extending beyond the TAM2. Specifically, future studies should examine actual use in the ED, and explore discrepancies between 'intended use' and 'actual use' using a more complete perspective of technology acceptance. Researchers may also wish to further examine inter-domain relationships that have been explored in this review to impact technology acceptance:

1) Opportunities for training, feedback, and discussion on tool use (organizational factors) to promote clinicians' knowledge and confidence to use POC cognitive support tools

(clinician factors) (O'Sullivan et al., 2011; Boudreaux et al., 2012). These opportunities may, in turn, address current findings that ED clinicians are concerned that POC cognitive support technologies will override clinical judgment (Vandenberg et al., 2017; Carman et al., 2011; Drescher et al., 2011) or introduce legal liability (Ballard et al., 2013; Yadav et al., 2015).

2) Tool revision (technical factors) to better support patient care in the ED. This would address study findings that POC cognitive support technology can be inflexible or difficult to use for unique or complex patient cases (patient factors) (Sheehan et al., 2013; Ballard et al., 2013; Fowler et al., 2014; Zafar, 2012).

3.6. Limitations

This review has several limitations. First, the parameters defining POC cognitive support technology in the ED lacked clarity prior to the literature search. Due to the novelty of this area of study, these parameters were ambiguous in the literature, and our criteria was subject to revision during the search execution. Initially, five studies were manually pre-selected for inclusion, and incorporated into the search strategy. Upon full engagement with the breadth of literature during the screening phase, one of the five studies were deemed to be inconsistent with the revised criteria for 'cognitive support technology', and removed post-hoc. Appendix B presents the final inclusion and exclusion criteria, based on five iterations of revision, and has been provided for consideration in future research on ED-based POC cognitive support technology. Second, given that health technology is an emerging science, there may have been grey literature not included in this review and review findings may not fully reflect technology acceptance.

3.7. Conclusions

POC cognitive support technologies are emerging evidence-based tools that have the potential to enhance the quality and safety of patient care. In this review, we found that despite clinicians' acknowledgement of the utility and value of POC cognitive support technology use in the ED, the actual reported level of use was low. Implementation research with large and diverse clinician samples, over extended timeframes, and using a uniform approach to explore the relationships and impact of clinician, technical, patient, and organizational factors on technology acceptance are needed. We recommend product manufacturers address the technical barriers to acceptance, by developing user-friendly interfaces. Further, health administrators need to consider institutional barriers to POC cognitive support technology, particularly when uptake among clinicians is low. We also recommend that health administrators provide environments conducive to the adoption of new technologies, including adequate training, user support, and advocacy.

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Chapter 4:

Study 2 – Alcohol Intervention Perceptions and Practices

Title: Screening, brief intervention, and referral to treatment (SBIRT) for adolescent alcohol use in Canadian pediatric emergency departments: A national survey of pediatric emergency physicians

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4.1. Abstract

Background: Problematic alcohol use is associated with detrimental cognitive, physiological and social consequences. In the emergency department (ED), Screening, Brief Intervention, and Referral to Treatment (SBIRT) is the recommended approach to identify and treat adolescent alcohol-related concerns, but is underused by physicians.

Objective: This study examined pediatric emergency physicians' perceptions of adolescent drinking and treatment, and their current self-reported SBIRT practices.

Method: Physicians in the Pediatric Emergency Research Canada database (n=245) received a 35-item questionnaire that was administered through a web-based platform and paper-based mail-outs. Recruitment followed a modified Dillman four-contact approach.

Results: From October 2016 to January 2017, 166 pediatric emergency physicians (46.4% males; mean age=43.6 years) completed the questionnaire. The response rate was 67.8%. Physicians recognized the need (65%) and responsibility (86%) to address adolescent alcohol problems. However, confidence in knowledge and abilities for SBIRT execution was low. Twenty-five percent of physicians reported never having practiced all, or part of, SBIRT while 1.3% reported consistent SBIRT delivery for adolescents with alcohol-related visits. More alcohol education and counseling experience was associated with higher SBIRT use; however, physicians generally reported to have received minimal alcohol training. SBIRT practices were also associated with physician perceptions of problematic alcohol use and its treatability.

Conclusions: Pediatric emergency physicians acknowledge the need to address problematic adolescent alcohol use, but routine SBIRT use is lacking. Strategies to educate physicians about SBIRT and its efficacy, and increase counseling experience may improve SBIRT use. Clinical guidelines to support SBIRT implementation in the ED are also needed.

4.2. Introduction

Problematic alcohol use initiates and escalates in adolescence, and is common in Canada (Thomas, 2012). A 2015 Health Canada survey of Canadian students indicated that by grade 12, 47% of students engaged in alcohol binge drinking (five or more drinks on one occasion) within the past year (Health Canada, 2016). This type of problematic drinking is harmful—impairments to attention, memory, and decision-making (Peeters et al., 2014), and elevated suicidality (Epstein & Spirito, 2009), trauma (Black et al., 2009), and premature death (Thomas, 2012) are associated health concerns. Social consequences include diminished academic performance, poorer job prospects (Jeynes, 2002; Renna, 2007), and victimization (Swahn et al., 2008). Problematic alcohol use can also be hazardous—early onset is a predictor of dependence, abuse, and persistent dysfunction in later adulthood (Bonomo et al., 2004; D'Amico et al., 2005).

Treatment for morbidities associated with problematic alcohol use can be sought by adolescents in emergency departments (EDs). In Canadian EDs, these alcohol-related visits have been increasing in recent years, particularly for trauma (Black et al., 2009) and mental health care (Newton et al., 2009). As many adolescents may not recognize their alcohol use as being problematic (D'Amico, 2005), the ED visit may offer a pivotal opportunity, or 'teaching moment' (Burke et al., 2005; Bernstein et al., 2009; D'Onofrio & Degutis, 2004/2005), to intervene at a time directly coupled to the consequences of problematic alcohol drinking (Desy et al., 2010). In the United States (US), the American Academy of Pediatrics (AAP) endorses screening, brief intervention and referral to treatment (SBIRT) for pediatrician use with adolescent patients (Levy & Williams, 2016). The American College of Emergency Physicians (ACEP) also endorses SBIRT use in EDs with patients of all ages, and practical guides exist to support SBIRT implementation (ACEP, 2017; Higgin-Biddle et al., 2009). No comparable

recommendations or guides are provided for Canadian physicians. The SBIRT approach is designed to identify hazardous and harmful alcohol (i.e., problematic) alcohol consumption, increase awareness of the problem, elicit behavioral change, and connect patients with treatment services (Bernstein et al., 2009; Newton et al., 2013). Despite the potential benefits of ED-based SBIRT for adolescent patients (Bernstein et al., 2010; Spirito et al., 2004; Cunningham et al., 2015; Walton et al., 2010), barriers to use limit routine provision of SBIRT by ED physicians. These barriers include minimal training and support, and ED physician beliefs that alcohol-related visits require more time and resources than can be offered, or is available, during beside care (D'Onofrio & Degutis, 2004/2005; Mabood et al., 2012; Chun et al., 2011).

To date, there are no available reports of Canadian pediatric emergency physicians' alcohol intervention practices, including whether practices reflect SBIRT, and attitudes and beliefs towards SBIRT use in the ED. Such reports can inform recommendations and strategies for SBIRT training and implementation in Canadian EDs. We surveyed a group of pediatric emergency physicians from across Canada to: 1) examine self-reported SBIRT practices, attitudes and beliefs regarding ED-based treatment of adolescent alcohol-related concerns, and 2) explore the association between physician-specific characteristics (i.e., demographics, training, attitudes, and beliefs) and SBIRT practices.

4.3. Methods

Study Design

We surveyed pediatric emergency physicians working in 15 children's hospitals across Canada. The University of Alberta Research Ethics Board approved this study. Reporting of results was informed by the STROBE statement (von Elm et al., 2008) and CHERRIES guideline (Eysenbach, 2004).

Study Setting and Population

All physicians listed in the Pediatric Emergency Research Canada (PERC) database were surveyed (n=245). Using published guidelines for survey sample size, we determined that 81 study participants were needed to estimate aggregated survey responses with 95% confidence (±3% sampling error) (Krejcie & Morgan, 1970; Bartlett et al., 2001; Cochran, 1977).

Survey Development

We developed a novel, 47- item questionnaire with 4 domains: demographics and training (13 items), attitudes and beliefs (14 items), SBIRT practices (3 items), and technology acceptance (17 items). To ensure content validity, items were informed by published literature (Mabood et al., 2012; Indig et al., 2009; Vadlamudi et al., 2008; O'Rourke et al., 2006), previously conducted surveys (Chun et al., 2011; D'Onofrio et al., 2002), the Substance Abuse and Attitude Scale (Chappel et al., 1985), and the Adapted Technology Acceptance Model 2 (Venkatesh & Davis, 2000; Sedlmayr et al., 2013). To address face validity and instrumentation issues, the survey was pilot tested with convenience sample of 4 pediatric emergency physicians, two members of the research team, and one external scientific reviewer. Two of the 4 physicians were also allowed to participate in the study. Pilot testing resulted in the removal of 21 redundant, potentially sensitive, or leading items; the rewording of 15 items to improve clarity; and the addition of 9 items to capture additional information complementary to existing items. The final questionnaire (see Appendix H) was composed of 35 items: demographics (7 items), training (3 items), current SBIRT practices (7 items), attitudes and beliefs about adolescent drinking and treatment (7 items), and technology acceptance (11 items). Items and results detailing technology acceptance are reported separately. The questionnaire was created in English and translated into French.

Survey Administration

From October 2016 to January 2017, PERC physicians were invited to participate in a voluntary survey. We recruited participants using a modified Dillman four-contact approach (Dillman et al., 2009). Potential participants received a pre-notice e-mail and a cover letter detailing the survey purpose, duration, potential risks and benefits, data storage, and confidentiality. A secondary e-mail invitation to the online survey, with unique participant hyperlinks to prevent multiple entries from the same user ID, was distributed the following week. Subsequently, two follow-up e-mails and a final paper-based invitation were distributed to non-respondents and those who partially completed the questionnaire. Respondents were unable to review or change their responses once they had been submitted. For online surveys, selection of a response was enforced, and only completed questionnaires could be submitted.

Data were collected and managed using Research Electronic Data Capture (REDCap, University of Alberta, Edmonton, AB), a secure web-based survey software. All participant responses were anonymized and no identifying information was recorded. Participants were informed that consent to participate and permit dissemination of survey data was indicated by survey completion and submission. Respondents were given the option to be entered into a prize draw upon submission of their questionnaire.

Statistical Analysis

The survey response rate was calculated as the number of submitted surveys divided by the number of surveys sent to physicians in the PERC database. For online submissions, incomplete questionnaires (n=6) were excluded from the response rate calculation and analysis. We used frequencies and proportions with 95% confidence intervals (CIs) to summarize participant characteristics and survey responses. Missing data for questionnaire items, which was

only applicable for paper-based submissions, were coded as 'unknown'. We used the Chi-square test to explore the association between physician-specific factors (i.e., demographics, training, attitudes and beliefs) and self-reported SBIRT practices. We used the non-parametric Jonckheere-Terpstra trend test to explore the directionality of associations. All tests were two-sided, and *p* values less than 0.05 were considered statistically significant. Analyses were performed using STATA (version 14.0; StataCorp, College Station, Texas).

4.4. Results

Respondent Characteristics

One hundred and sixty-six physicians of the 245 contacted completed the questionnaire (68% response rate). Table 4.4.1 summarizes respondent demographics, training, and experiences, both personal and professional, with alcohol-related problems. Among respondents who indicated personal experience with someone with an alcohol problem (i.e., other than a patient), almost half, 42.8%, specified a family relation (immediate=5.7%; extended=27.1%).

Physician Attitudes and Beliefs

Most physicians reported feeling comfortable in addressing alcohol drinking behaviours with adolescents; however, ratings for confidence in their knowledge of, and ability to conduct, SBIRT were low (Table 4.4.2). The majority of physicians agreed that adolescent alcohol use should be addressed during an ED visit and that was their responsibility to do so. However, perceptions of the treatability of problematic drinking in the ED varied (Tables 4.4.2 and 4.4.3). Our analysis also indicated that personally knowing someone with alcohol problems was associated with the belief that adolescent alcohol use was a problem that should be addressed in the ED ($p<0.05$). Twenty-four physicians (14.5%) reported not feeling responsible for addressing adolescent alcohol problems in the ED. These physicians most commonly identified primary

Table 4.4.1. Characteristics of study participants (n=166)

Characteristic	n (%)
Gender	
Male	77 (46.4)
Female	89 (53.6)
Age, years	
≤30	5 (3.0)
31-40	62 (37.3)
41-50	65 (39.2)
>50	33 (19.9)
Unknown	1 (0.6)
Years in clinical practice	
<5	27 (16.3)
5-12	58 (34.9)
13-20	51 (30.7)
>20	30 (18.1)
Primary clinical appointment	
Pediatric Emergency Medicine (PEM) department	137 (82.5)
Other	28 (16.9)
Unknown	1 (0.6)
PEM fellowship training	
Yes	107 (64.5)
No	59 (35.5)
Hours devoted to alcohol problems in medical school, residency, fellowship	
None	10 (6.0)
1-10	128 (77.1)
11-25	19 (11.5)
>25	9 (5.4)
Continuing Medical Education (CME) hours devoted to alcohol training	
None	79 (47.6)
1-2	40 (24.1)
3-5	23 (13.8)
>5	24 (14.5)
Clinical experience counseling adolescents about alcohol use	
Little or none	30 (18.1)
Small	81 (48.8)
Moderate	48 (28.9)
Large/Extensive	7 (4.2)
Personally know someone with alcohol problems	
Yes	104 (62.7)
No	55 (33.1)
Decline to answer	7 (4.2)

Table 4.4.2. Self-reported competency to address adolescent alcohol-related concerns and outlook on treating alcohol concerns in the ED

	Proportion, % [95% confidence interval]					
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
Comfort addressing alcohol drinking behaviours	2.4 [0.9, 6.3]	12.7 [8.4, 18.7]	12.0 [7.9, 18.0]	34.9 [28.0, 42.6]	24.7 [18.7, 31.9]	13.3 [8.8, 19.4]
Confidence in knowledge of SBIRT protocol	28.3 [21.9, 35.7]	27.1 [20.8, 34.4]	19.9 [14.4, 26.7]	17.5 [12.4, 24.1]	5.4 [2.8, 10.2]	1.8 [0.6, 5.5]
Confidence in ability to conduct SBIRT	22.9 [17.1, 30.0]	21.7 [16.0, 28.7]	17.5 [12.4, 24.1]	22.9 [17.1, 30.0]	10.2 [6.4, 15.9]	4.8 [2.4, 9.4]
Harmful and hazardous drinking is treatable in the ED	13.2 [8.8, 19.4]	22.9 [17.1, 30.0]	16.9 [11.9, 23.4]	28.9 [22.5, 36.3]	13.9 [9.3, 20.1]	4.2 [2.0, 8.6]

Table 4.4.3. Perceptions on the appropriateness of treatment for problematic adolescent alcohol use in the ED

	Proportion, % [95% confidence interval]						
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Undecided/ Neutral	Slightly Agree	Moderately Agree	Strongly Agree
Adolescent alcohol use is a problem to be addressed in the ED	3.6 [1.6, 7.9]	9.6 [6.0, 15.2]	7.8 [4.6, 13.1]	13.9 [9.3, 20.1]	20.5 [15.0, 27.4]	26.5 [20.3, 33.8]	18.1 [12.9, 24.8]
Responsible for addressing adolescent alcohol problems when clinically indicated	0.6 [0.1, 4.2]	1.8 [0.6, 5.5]	4.2 [2.0, 8.6]	7.8 [4.6, 13.1]	17.5 [12.4, 24.1]	43.4 [36.0, 51.1]	24.7 [18.7, 31.9]

health care providers and family members as the individuals responsible for addressing alcohol-related concerns (Table 4.4.3).

Physician SBIRT Practices

One quarter of physicians (24.7%) reported that they never conduct alcohol SBIRT for adolescents presenting to the ED with an alcohol-related concern. A lack of time and resources were the most commonly reported reasons for lack of conduct. Only 1.2% of physicians reported that they consistently conducted all, or part, of alcohol SBIRT with adolescents when clinically indicated. Among physicians who reported conducting SBIRT ('rarely', 'sometimes', 'usually', or 'always'; n=125), 59.6% perform screening, 57.8% provide a brief intervention, and 51.2% make referrals to treatment. Less than half of the physicians who conducted alcohol screening reported using a validated tool (40.4%). Of the physicians who reported use of a validated screening tool, the CAGE questionnaire (Ewing, 1984) was most frequently used tool.

Factors Associated with Physician SBIRT Practices

Table 4.4.4 presents the associations of physician-specific characteristics with self-reported current SBIRT practices. Physician demographics were not associated with conduct of SBIRT. A greater number of hours of alcohol education during professional training (i.e., during medical school, residency and fellowship) was associated with increased conduct of all, or part of, SBIRT with patients. There was no association between alcohol education received as continuing medical education (CME) and SBIRT practices (p=0.68). The amount of alcohol counselling experience that physicians had was also associated with SBIRT practices, where more experience related to greater SBIRT use. More positive responses for comfort in addressing adolescent alcohol use, confidence in knowledge of the SBIRT protocol and confidence in ability to conduct SBIRT were associated with higher self-reported SBIRT practice. Beliefs that the ED

Table 4.4.4. Relationship between current SBIRT practices and physician-specific factors

		Conduct of alcohol SBIRT, n (%)			Pearson χ^2	Jonckheere-Terpstra*
		Never / Rarely	Sometimes	Usually / Always		
Demographics						
Sex	Male	44 (50.0)	23 (51.1)	10 (30.3)	4.30, p=0.12	1.49, p=0.14
	Female	44 (50.0)	22 (48.9)	23 (69.7)		
Age (years)	≤30	3 (3.4)	0	2 (6.1)	8.63, p=0.38	0.15, p=0.88
	31-40	35 (39.8)	15 (33.3)	12 (36.3)		
	41-50	33 (37.5)	16 (35.6)	16 (48.5)		
	51-60	12 (13.6)	11 (24.4)	2 (6.1)		
	61-70	5 (5.7)	3 (6.7)	1 (3.0)		
Experience (years)	<5	14 (15.9)	8 (17.8)	5 (15.1)	4.20, p=0.65	-0.60, p=0.55
	5-12	30 (34.1)	13 (28.9)	15 (45.5)		
	13-20	28 (31.8)	13 (28.9)	10 (30.3)		
	>20	16 (18.2)	11 (24.4)	3 (9.1)		
Primary clinical work in PED	Yes	77 (87.5)	34 (75.6)	26 (81.3)	3.10, p=0.21	1.64, p=0.10
	No	11 (12.5)	11 (24.4)	6 (18.7)		
Personally know someone with alcohol problems	Yes	55 (62.5)	25 (55.5)	24 (72.7)	3.65, p=0.16	-1.13, p=0.26
	No	32 (36.4)	17 (37.8)	6 (18.2)		
	Decline to answer	1 (1.1)	3 (6.7)	3 (9.1)		
Training						
PEM fellowship training	Yes	58 (65.9)	27 (60.0)	22 (66.7)	0.54, p=0.76	0.21, p=0.83
	No	30 (34.1)	18 (40.0)	11 (33.3)		
Alcohol education during professional training (hours)	None	6 (6.8)	4 (8.9)	0	23.37, ***p*=0.00**	3.25, ***p*=0.0012**
	1-10	74 (84.1)	34 (75.5)	20 (60.6)		
	11-25	5 (5.7)	3 (6.7)	11 (33.3)		
	>25	3 (3.4)	4 (8.9)	2 (6.1)		
CME hours in alcohol education	None	48 (54.5)	19 (42.2)	12 (36.4)	4.01, p=0.68	1.78, p=0.08
	1-2	18 (20.5)	12 (26.7)	10 (30.3)		
	3-5	11 (12.5)	7 (15.5)	5 (15.1)		
	>5	11 (12.5)	7 (15.5)	6 (18.2)		

Amount of clinical experience counselling adolescents about alcohol use	None/Little	26 (29.5)	3 (6.7)	1 (3.0)	40.06, ***p*=0.00**	5.82, ***p*=0.00**
	Small	48 (54.6)	21 (46.7)	12 (36.4)		
	Moderate	13 (14.8)	19 (42.2)	16 (48.5)		
	Large	1 (1.1)	0	3 (9.1)		
	Extensive	0	2 (4.4)	1 (3.0)		
Attitudes and beliefs						
Comfort addressing alcohol drinking behaviors	Strongly disagree	4 (4.6)	0	0	23.29, ***p*=0.01**	4.14, ***p*=0.00**
	Moderately disagree	16 (18.2)	3 (6.7)	2 (6.1)		
	Slightly disagree	13 (14.8)	6 (13.3)	1 (3.0)		
	Slightly agree	30 (34.1)	20 (44.4)	8 (24.2)		
	Moderately agree	17 (19.3)	11 (24.4)	13 (39.4)		
	Strongly agree	8 (9.1)	5 (11.1)	9 (27.3)		
Confidence in knowledge of SBIRT protocol	Strongly disagree	40 (45.5)	3 (6.7)	4 (12.1)	49.51, ***p*=0.00**	6.42, ***p*=0.00**
	Moderately disagree	26 (29.5)	16 (35.6)	3 (9.1)		
	Slightly disagree	13 (14.8)	10 (22.2)	10 (30.3)		
	Slightly agree	9 (10.2)	10 (22.2)	10 (30.3)		
	Moderately agree	0	5 (11.1)	4 (12.1)		
	Strongly agree	0	1 (2.2)	2 (6.1)		
Confidence in ability to conduct SBIRT	Strongly disagree	34 (38.6)	1 (2.2)	3 (9.1)	44.76, ***p*=0.00**	5.72, ***p*=0.00**
	Moderately disagree	23 (26.1)	11 (24.4)	2 (6.1)		
	Slightly disagree	10 (11.4)	12 (26.7)	7 (21.2)		
	Slightly agree	14 (15.9)	11 (24.4)	13 (39.4)		
	Moderately agree	5 (5.7)	8 (17.8)	4 (12.1)		
	Strongly agree	2 (2.3)	2 (4.4)	4 (12.1)		
Harmful and hazardous drinking is treatable in the ED	Strongly disagree	15 (17.0)	2 (4.4)	5 (15.2)	18.96, ***p*=0.04**	2.84, ***p*=0.0045**
	Moderately disagree	24 (27.3)	11 (24.4)	3 (9.1)		
	Slightly disagree	13 (14.8)	10 (22.2)	5 (15.2)		
	Slightly agree	27 (30.7)	13 (28.9)	8 (24.2)		
	Moderately agree	7 (7.9)	6 (13.3)	10 (30.3)		

	Strongly agree	2 (2.3)	3 (6.7)	2 (6.1)		
Adolescent alcohol use is a problem to be addressed in ED	Strongly disagree	6 (6.8)	0	0	42.18, ***p*=0.00**	4.80, ***p*=0.00**
	Moderately disagree	12 (13.6)	1 (2.2)	3 (9.1)		
	Slightly disagree	12 (13.6)	1 (2.2)	0		
	Neutral	12 (13.6)	10 (22.2)	1 (3.0)		
	Slightly agree	16 (18.2)	11 (24.4)	7 (21.2)		
	Moderately agree	22 (25.0)	15 (33.3)	7 (21.2)		
	Strongly agree	8 (9.1)	7 (15.6)	15 (45.5)		
Responsibility for addressing adolescent alcohol related problems when clinically indicated	Strongly disagree	1 (1.1)	0	0	21.98, ***p*=0.04**	3.69, ***p*=0.0002**
	Moderately disagree	3 (3.4)	0	0		
	Slightly disagree	6 (6.8)	0	1 (3.0)		
	Neutral	9 (10.2)	4 (8.9)	0		
	Slightly agree	17 (19.3)	8 (17.8)	4 (12.1)		
	Moderately agree	36 (40.9)	24 (53.3)	12 (36.4)		
	Strongly agree	16 (18.2)	9 (20.0)	16 (48.5)		

Bolded *p* values are considered statistically significant with $p<0.05$

* Standardized Jonckhreere-Terpstra test statistic

is an appropriate setting to address adolescent alcohol use, treatability of problematic alcohol use, and clinical responsibility to intervene were also associated with SBIRT use.

4.5. Discussion

To our knowledge, this is the first study to describe the perceptions and practices of Canadian pediatric emergency physicians regarding adolescent alcohol-related ED presentations. In this study physicians recognized the importance of and their responsibility to address problematic adolescent alcohol use, but lacked confidence in their knowledge of and ability to conduct SBIRT in clinical practice. SBIRT practices were also lacking—a quarter of respondents reported to never conduct all, or even part of, SBIRT for alcohol-related adolescent ED presentations.

Findings from a 10-year comparison study of emergency physicians' SBIRT utilization in the United States suggested that the underutilisation of SBIRT practices among emergency physicians has been prevalent in the past and remains unchanged (Broderick et al., 2015). In this study, believing that SBIRT would not impact patient outcomes was the most commonly cited reason for not practicing SBIRT in both 1999 and 2010. In our study, physicians who did not view problematic alcohol use as treatable in the ED reported less SBIRT conduct. In this regard, the evidence base for SBIRT efficacy and effectiveness may be a critical factor in influencing clinical practices among emergency physicians. Both statistically significant and insignificant treatment effects have been reported across randomized controlled trials comparing SBIRT to routine ED care (Newton et al., 2013; Harris & Knight, 2014; Yuma-Guerrero et al., 2012). There is a trend of efficacy when SBIRT is provided to adolescent patients who screen positive for harmful and hazardous alcohol use using a validated instrument (Cunningham et al., 2015; Walton et al., 2010; Yuma-Guerrero et al., 2012). While treatment effects are considered small

(Cunningham et al., 2015; Walton et al., 2010), such effects are expected for a brief intervention. However, whether these reductions are clinically significant is a current limitation in the SBIRT field as a minimal clinically important difference has not yet been established.

In this study, among those physicians who reported conducting SBIRT, approaches to SBIRT varied and did not necessarily follow what is currently recommended in the U.S. for pediatricians and ED physicians (ACEP, 2017; AAP Committee on Substance Use and Prevention, 2016). This finding may reflect the absence of clinical practice guidance from the Canadian Association of Emergency Physicians and the Canadian Paediatric Society; however, we did not set out to examine this relationship. Moving forward, if Canadian associations and societies publish position statements on alcohol SBIRT for adolescents, it would be worthwhile to study practice variation after publication to see if the statements have a direct impact on the clinical care provided by physicians. This includes examining whether statements impact SBIRT fidelity such as whether physicians are using validated tools for screening, and providing brief interventions as recommended.

We found that confidence in knowing the SBIRT protocol and one's ability to conduct SBIRT were associated with SBIRT conduct. While SBIRT practice was associated with differences in the amount of alcohol education received during professional training, it was not associated with education received in the post-training period. The amount of clinical experience in counselling was also associated with SBIRT conduct. Bernstein *et al.* reported that SBIRT education among ED staff improved SBIRT utilization short-term, but improvements were not sustained over time (Bernstein et al., 2007). It may be that those physicians who receive alcohol education during professional training use SBIRT, including counselling approaches, more often beginning at career inception. Translating our study findings to a practical recommendation for

training Canadian physicians, offering an SBIRT curriculum to physicians early in their professional learning may be of value. This educational initiative has been shown to be feasible, is well received by trainees (Tetrault et al., 2012), and results in skill development, perceived self-competency, and enhanced confidence to treat alcohol problems (Chun et al., 2011; D'Onofrio et al., 2002).

A study by D'Onofrio *et al.* examined the effect of a SBIRT curriculum on medical residents' knowledge and practice of alcohol screening and intervention (D'Onofrio et al., 2002). In this controlled trial, physician demographic information was collected to ensure the comparability of the intervention and control group. In our study, we sought to determine whether physician demographics played a role in the conduct of SBIRT. Only one demographic variable, personally knowing someone with alcohol problems, was associated with physician agreement that adolescent alcohol use was a problem that needed to be addressed in the ED, and physician SBIRT practices. This finding warrants further investigation of underlying physician factors that impact SBIRT attitudes and beliefs. This finding also suggests that alcohol-related care is influenced by physicians' personal experiences and perceptions.

This study has several limitations. First, the representativeness of our sample is unclear. Although statistically, our sample size was sufficient for appropriate estimates, our response rate was below the desirable value of ≥80% (Dillman, 1978). To protect participant anonymity, we did not collect demographic data from non-respondents, and could not determine whether survey responses were representative of all physicians in the PERC database. Even within the PERC database, the proportion of physicians across the 15 ED sites represented in this database is about 53%. Moreover, study findings do not reflect of other ED-based health care providers. For example, nurses often have the first contact with patients and can play an important role in

alcohol screening and brief intervention. To fully understand SBIRT use in the ED with adolescents, it is necessary to know of the attitudes, beliefs, knowledge, and skills of nurses and other key ED team members such as mental health care providers. Finally, findings from this study may have been affected by social desirability bias, which is particularly known to effect survey data measuring behavior, attitude, and beliefs, which were the fundamental domains of our survey (Gittelman et al., 2015). As physicians were not blinded to the objective of this study, they may have responded in perceived favorable directions.

4.6. Conclusions

Although alcohol SBIRT is recommended for use in the ED with adolescent patients, pediatric emergency physicians in this study reported that they do not routinely practice SBIRT when clinically appropriate (i.e., during alcohol-related ED visits). Even among those physicians who did practice SBIRT occasionally, there was a variation in practices. Strategies to increase learning opportunities and clinical exposure to alcohol treatment among physician trainees is important. Further, the development of ED-based SBIRT clinical guidelines is also needed.

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Chapter 5:

Study 2 – Technology Acceptance

Title: A brief report of a national survey of pediatric emergency physicians: acceptance of technology-based screening, brief intervention and referral to treatment (SBIRT)

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5.1. Abstract

Objective: Screening, brief intervention, and referral to treatment (SBIRT) is the recommended clinical approach for adolescent patients with alcohol-related concerns. Yet, the routine use of SBIRT is lacking in emergency departments (EDs) due to limited time, resources, training and support to use. Clinician use of technology to conduct SBIRT is regarded as a promising strategy to address these barriers. In this study, we examined pediatric emergency physicians' acceptance of technology-based, alcohol SBIRT by examining their perceptions, readiness to change SBIRT practices, and intentions to use SBIRT technology.

Method: Pediatric emergency physicians listed in the Pediatric Emergency Research Canada (PERC) database received a 35-item electronic and paper-based questionnaire between October 2016 and January 2017. Questionnaire items related to technology acceptance were based on the Technology Acceptance Model 2 (TAM2): perceived usefulness (e.g., improve care, make job easier, enable higher efficiency), perceived ease of use (e.g., easy to become skillful using tool), subjective norm (e.g., use by colleagues), image (e.g., innovate care), job relevance (e.g., applicable to job), and external control (e.g., availability of ED resources). Items were measured on 7-point Likert scales from extremely unlikely to extremely likely, and strongly disagree to strongly agree, with higher ratings indicating higher regard of a technology-based, alcohol SBIRT system. Frequencies and proportions with 95% confidence intervals (CIs) were used to summarize participant characteristics and questionnaire responses. Chi-square and Jonckheere-Terpstra tests were used to identify associations and trends between physicians' readiness to change practice and intention to use technology-based, alcohol SBIRT.

Results: Of the 245 physicians surveyed, 166 physicians (68%) responded (46.4% males; mean age=43.6 years, SD=8.8 years). All technology acceptance factors, except external control, were

rated positively (scale responses of likely and agree). Most physicians indicated that it would be easy for them to become skillful at using (78.3%) and intended to use (83.0%) SBIRT technology. Some physicians were uncertain of whether it would improve (34.3%) and innovate (26.5%) care, and the sustainability of its integration in the ED (34.9%). Higher ratings on all 6 acceptance factors were significantly associated ($p<0.05$) with a higher reported intention to use and willingness to incorporate SBIRT when treating adolescent patients for alcohol-related ED visits. Baseline comfort with technology for general patient care in the ED was associated with intention to use a technology-based, alcohol SBIRT ($p=0.02$), but not readiness to change SBIRT practices ($p=0.10$)

Conclusions: Emergency physicians have positive perceptions about, and are willing to use, ED-based SBIRT technology for treating alcohol problems among adolescent patients. Strategies to support sustainable implementation in the ED are needed.

5.2. Introduction

The emergency department (ED) is an opportunistic setting for early alcohol intervention (Bernstein et al., 2009). Use of alcohol SBIRT (Screening, Brief Intervention, Referral to Treatment), the approach recommended by the American College of Emergency Physicians (ACEP, 2017), however, is limited by lack of clinician time, resources, support, and training (Chun et al., 2011). Using technology to provide SBIRT may address these barriers as SBIRT content is built into the technology, thereby guiding clinical efforts (Harris & Knight, 2014).

Recent clinical trials have demonstrated that SBIRT delivery via technology is more efficacious than routine ED care in reducing alcohol consumption and alcohol-related consequences among adolescent patients (Cunningham et al., 2015; Walton et al., 2010). ED physician acceptance of this approach to alcohol care is critical for understanding whether these trial findings can translate into real-world implementation. The objective of this study was to determine pediatric emergency physicians' acceptance of alcohol SBIRT technology by examining their perceptions, readiness to change SBIRT practices, and intentions to use SBIRT technology.

5.3. Methods

Study Design and Population

We surveyed 245 emergency physicians listed in the Pediatric Emergency Research Canada (PERC) database. The database includes approximately 53% of the physicians working in 15 pediatric EDs across Canada. We required 81 physicians to participate in order to estimate aggregated survey responses with 95% confidence (±3% sampling error) (Bartlett et al., 2001). This study was approved by a University of Alberta research ethics board.

Survey Development

We developed a 35-item questionnaire to examine physician demographics, training in alcohol problems, perceptions of adolescent drinking and treatment, alcohol SBIRT practices, and acceptance of technology-based, alcohol SBIRT. Technology acceptance findings are reported in this paper; additional results are reported elsewhere. We measured 6 determinants of technology acceptance—perceived usefulness, perceived ease of use, subjective norm, image, job relevance, and external control—derived from the Technology Acceptance Model (TAM2) (Venkatesh & Davis, 2000), one of the most widely used frameworks to understand technology acceptance in the medical context. Items were measured on 7-point Likert scales from extremely unlikely to extremely likely, and strongly disagree to strongly agree, with higher ratings indicating higher regard of a technology-based, alcohol SBIRT system.

Recruitment

Physicians were recruited from October 2016 to January 2017 following the Dillman four-contact approach. Physicians received pre-notice e-mail invitations to participate in the survey. Three e-mails, with unique participant hyperlinks, and final paper-based mail outs were then distributed in succession over the recruitment period.

Data Analysis

We used frequencies and proportions with 95% confidence intervals (CIs) to summarize participant characteristics and survey responses. We used the Chi-square test and Jonckheere-Terpstra trend test to explore associations between TAM2 variables and physicians' readiness to change practice and intention to use technology-based, alcohol SBIRT (two-tailed $p<0.05$ established statistical significance). All analyses were performed using the STATA statistical package (version 14.0; StataCorp, College Station, Texas).

5.4. Results

The survey response rate was 68% (166/245 physicians; 46.4% male). On average, physicians were 43.6 years old (SD=8.8) with 13.5 years of professional experience (SD=9.1). The majority of physicians indicated that their clinical work was primarily in a pediatric ED (83.0%); 64.5% reported to have pediatric emergency fellowship training.

Physicians were generally accepting of using technology to provide alcohol SBIRT to patients (Table 5.4.1). The majority of respondents (76.5%) indicated that a technology-based SBIRT tool would increase current SBIRT practices with adolescent patients, and intention to use technology was favorable, with only 16.9% of respondents reporting that it was 'unlikely' for them to use technology for SBIRT. Most physicians (80.1%) reported feeling comfortable using technology during patient care in the ED, and perceived SBIRT technology as potentially useful in increasing efficiency of patient care (58.2%). Physicians were divided, however, as to whether the ED had the resources to support and sustain a technology-based SBIRT system. Many respondents were 'not sure' of how a technology-based, alcohol SBIRT system would impact care (34.3%), be used by colleagues (39.8%), and be sustained in the ED (34.9%).

All 6 determinants of technology acceptance were statistically associated ($p<0.05$) with physician readiness to change SBIRT practice and intention to use technology-based, alcohol SBIRT. A trend was demonstrated, where positive attitudes and beliefs regarding technology-based, alcohol SBIRT were linked with a greater readiness to change and higher intention to use ($p<0.05$). Baseline comfort using technology during patient care in the ED was associated with intention to use the technology ($p=0.02$), but not with readiness to change SBIRT practices ($p=0.10$). Higher baseline comfort with technology in the ED during patient care was related to

Table 5.4.1. Attitudes and beliefs on technology-based, alcohol SBIRT in the ED

TAM2 factors	Questionnaire items	Proportion, % [95% confidence interval]			Jonckheere-Terpstra*	
					Readiness to change[∫]	Intention to use[‡]
		Unlikely	**Not sure**	**Likely**		
Perceived usefulness	Improve care	10.2 [6.43, 15.9]	34.3 [27.4, 42.0]	55.4 [47.7, 62.9]	6.70, ***p*=0.00**	6.63, ***p*=0.00**
	Make job easier	15.2 [10.4, 21.5]	27.3 [21.0, 34.6]	57.6 [49.8, 65.0]	5.93, ***p*=0.00**	7.48, ***p*=0.00**
	Enable higher efficiency during patient care	13.3 [8.90, 19.5]	28.5 [22.1, 35.9]	58.2 [50.4, 65.5]	6.33, ***p*=0.00**	7.19, ***p*=0.00**
Perceived ease of use	Will be easy becoming skillful at using the tool	5.4 [2.83, 10.2]	16.3 [11.4, 22.8]	78.3 [71.3, 84.0]	3.87, ***p*=0.0001**	4.72, ***p*=0.00**
Subjective norm	Colleagues would advocate use	12.0 [7.87, 18.0]	39.8 [32.5, 47.5]	48.2 [40.6, 55.9]	5.05, ***p*=0.00**	6.65, ***p*=0.00**
Image	Innovate care provided	7.2 [4.13, 12.4]	26.5 [20.3, 33.8]	66.3 [58.7, 73.1]	6.11, ***p*=0.00**	7.54. ***p*=0.00**
		Disagree	**Not sure**	**Agree**		
Job relevance	Applicable to job	11.4 [7.39, 17.3]	24.1 [18.1, 31.3]	64.5 [56.8, 71.4]	5.74, ***p*=0.00**	7.33, ***p*=0.00**
External control	ED has resources to support/sustain	38.6 [31.4, 46.2]	34.9 [28.0, 42.6]	26.5 [20.3, 33.8]	3.51, ***p*=0.0005**	5.28. ***p*=0.00**

Bolded *p* values are considered statistically significant with $p<0.05$

*Standardized Jonckheere-Terpstra test statistic

[∫]5-point scale (significantly/moderately decrease, slightly decrease, no effect, slightly increase, significantly/moderately increase)

[‡]6-point scale (extremely unlikely, quite unlikely, slightly unlikely, slightly likely, quite likely, extremely likely)

physicians indicating a greater intention to use a technology-based, alcohol SBIRT system if it were available (p=0.04).

5.5. Discussion

Although a technology-based, alcohol SBIRT system may be a promising clinical treatment approach in the ED (Cunningham et al., 2015; Walton et al., 2010), how emergency physicians perceive the technology is important for successful integration into clinical practice. In this study, although pediatric emergency physicians were receptive to using technology if it was made available, they were uncertain of how an alcohol SBIRT technology would impact clinical care and adolescent outcomes. This uncertainty suggests that the current evidence base for alcohol SBIRT technology needs to move beyond efficacy to study implementation in day-to-day clinical practice in EDs and determine intervention effectiveness. Trials to date have delivered SBIRT technology to highly select groups of adolescents using trained, non-ED personnel (Cunningham et al., 2015; Walton et al., 2010). Implementation research that involves ED staff engagement with technology to deliver alcohol SBIRT to patients where the intervention is clinically indicated, and without the use of strict inclusion/exclusion criteria is needed, and would provide an understanding of how the treatment approach works under more generalizable conditions.

Findings from this study showed that physicians had positive attitudes and beliefs towards technology-based, alcohol SBIRT. Perceived usefulness, the most well-known factor to impact the acceptance of technology-based clinical support systems among ED clinicians (Jun et al., under review), was rated favorably on all measures (improve care, make job easier, enhance job efficiency). Additionally, physicians who recognized that alcohol SBIRT technology had potential were more willing to use it to treat adolescents for alcohol-related concerns in the ED.

In this regard, opportunities for physicians to directly use and experience SBIRT technology may be critical to helping physicians resolve uncertainties of technology impact, and enhance the uptake of any SBIRT technology that is implemented (Jun et al., under review). Local ED initiatives to make effective SBIRT technologies available to physicians will be necessary in the future, provided that quality improvement measures to evaluate workflow and economical balances are incorporated.

Multiple factors external to perceptions of utility contribute to technology acceptance (Jun et al., under review). In this study, physicians' willingness to use a technology-based, alcohol SBIRT system and change their current standards of practice were affected by perceived ease of use. Departmental strategies to ensure adequate training and technological support personnel may ease physicians into using a new tool and may be critical to the sustained use of alcohol SBIRT technology. Further, in this study, physicians were affected by whether they believed their colleagues would use technology-based, alcohol SBIRT. This subjective norm suggests that technology acceptance is not an independent decision, but can be influenced by the opinions and behaviors of the healthcare team. To encourage higher receptivity to alcohol SBIRT technology among emergency physicians, there may be value in establishing clinical 'champions' in the ED. The presence of these individuals have been shown to facilitate implementation of innovative healthcare technology and positively impact usage behavior among peers (Shea & Belden, 2016).

5.6. Conclusions

Pediatric emergency physicians are receptive to the use of technology-based, alcohol SBIRT when treating adolescents for alcohol-related visits to the ED. Research efforts to

establish the effectiveness of SBIRT technology, and departmental strategies to ensure the availability of resources and clinical ‘champions’ are important to physician uptake.

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Chapter 6:

Conclusions

This thesis presents findings from two studies that examined the acceptance of technology-facilitated care in the ED. Specifically, in these studies I aimed to: *i)* explore and identify gaps in the evidence base for the acceptance of POC cognitive support technology among emergency clinicians, *ii)* describe current alcohol SBIRT practices and perceptions of problematic alcohol use and treatment for adolescents among pediatric emergency physicians, and *iii)* explore pediatric emergency physicians' acceptance of a technology-based tool to support alcohol treatment delivery to adolescents in the ED.

6.1. Summary of Findings

Study 1, a scoping review of the literature, revealed the extent and nature of the evidence for POC cognitive support technology acceptance among emergency clinicians between January 2006 and December 2016. In this study, I found that while clinicians positively perceived the features associated with POC cognitive support technology, actual use was low in the ED. Aside from clinicians' perceptions of POC technology, factors related to the technical aspects of the tool, patient expectations, impact on care, and institutional resources were found to impact technology acceptance. The importance of how a clinician experiences the technology over time, and during 'real world' clinical practice was revealed.

Study 2, a survey of pediatric emergency clinicians across Canada, proceeded to illuminate physician concerns about conducting alcohol SBIRT; yet, their willingness to use a technology-based, alcohol SBIRT tool in the pediatric ED. In the first part of this survey, which examined physician perceptions of alcohol use among adolescents and their SBIRT practices, I discovered that self-reported SBIRT practices were inconsistent and lacking in Canada. Trends

in SBIRT conduct was found to be associated with physicians' perceptions of self-efficacy in performing SBIRT, amount of alcohol-related education received as trainees, and clinical experience providing alcohol counselling. Technology-based, alcohol SBIRT is proposed to facilitate alcohol SBIRT delivery, as it provides POC clinical support to physicians in adherence to SBIRT guidelines. (Harris & Knight, 2014) In the second part of our survey, which examined the acceptance of technology-based, alcohol SBIRT, physicians acknowledged the potential of SBIRT technology and many were receptive to use it in clinical practice. Supplementary data analysis that examined the relationship between physician characteristics (i.e., demographics, training, beliefs, attitudes, and SBIRT practices) and technology acceptance, that has not been included in the brief report manuscript presented in Chapter 5, is reported in Appendix I.

Taken together, my two studies provide an understanding of ED clinician perspectives regarding technology designed to support clinical care in the ED, and the potential to use these tools during the care of adolescent patients presenting with alcohol-related concerns.

6.2. Limitations and Strengths

Limitations

Whilst beginning with a review of the literature was an asset in informing the main thesis project, Study 2, my lack of understanding of POC cognitive support technology early in the study conception and design stage was a limitation for me. Considering this topic is also a novel and emerging science, I needed to iteratively redefine and clarify the parameters entailing POC cognitive support technology. This oversight required me to make post-hoc adjustments to my review protocol, such as removing one of my initial five manually selected studies intended to be included in the review. The removal of this study left me with only four studies to run my pilot test extractions, which was not expected.

The greatest limitation of Study 2 was my use of a single methodological approach to assess physician perceptions. A survey is limited in that it relies on self-reported data and participation is based on voluntary interest. These factors give way to measurement and selection bias, respectively. Due to the subjective nature of my questionnaire items, where self-assessment was required to answer items, true prevalence, associations and predictors may not have been detected. Further, physicians who responded to the survey may have been systematically different in their attitudes, beliefs and practices than non-respondents. A multi-method approach, such as the inclusion of a chart review of clinical practices in the ED or direct observation of ED care, could have augmented my understanding of survey findings. However, time constraints and financial resources available during my Master's thesis made these approaches unfeasible. Another limitation of my survey was that questionnaire items limit respondents in the type and amount of information that they could provide. For the majority of my survey items, participants were required to select a response from a pre-specified categorization of possible responses displayed. While this approach was important for data aggregation, it restricted my ability to unearth novel themes and ideas. At the expense of elongating the survey run time, several items that were designed to gauges physician attitudes and beliefs could have been framed as open-ended questions, rather than pre-specified, categorical response scales. These open fields could have better catered to the range of physician attitudes and beliefs physicians, and detected reoccurring themes that I may not have expected prior to conducting the survey.

Strengths

Despite the limitations in my initial understanding of POC cognitive support technology, my scoping review was guided by an established framework and grounded on theories that were appropriate and applicable to this topic. Moreover, my methods were systematic and robust. By

collaborating with a medical librarian to develop the search strategy, I am confident that the search was inclusive of all the concepts and databases that were relevant. Screening and data extraction involved the duplicated, but independent efforts of two reviewers with different academic backgrounds. The dual and mandatory collaborative efforts of two different reviewers ensured that my study: *i)* had clear and well-defined eligibility criteria, *ii)* is replicable, and *iii)* provides complete and unbiased data.

My survey response rate, 68%, is within the average range when compared to prior PERC endorsed surveys. Between 2006 and 2015, the response rate of other PERC endorsed surveys ranged from 24% to 89%, with a combined average response rate of 63%. Recognizing that alcohol-related ED concerns go generally unaddressed by pediatric emergency physicians during ED care, and that interest in the topic may be low, I preemptively incorporated the four-contact Dillman approach to maximize the study response rate (Dillman et al., 2009). All things considered, the response rate was fairly good. Furthermore, my final survey tool was a product of rigorous and meticulous item generation, scaling, and technical conversion. I was mindful of wordiness, clarity, the supporting literature, contribution to knowledge, and relevance to the research objectives when constructing each questionnaire item. Moreover, careful attention was given to scaling so that the items would generate informative and unbiased responses. Pilot testing ensured that the items had content and face validity. During the conversion of the questionnaire into an online format, I took advantage of all the customizable features available on REDCap to enhance the user interface.

6.3. Future Directions

Technology acceptance is both a cognitive experience and behavioural phenomena. Considering such, qualitative studies that are not restricted by pre-specified themes, and

observational studies that can capture natural behaviour, are valuable in the study of technology acceptance. From my scoping review, it was evident that these types of studies are lacking. A greater range of studies to assess clinician attitudes and beliefs more comprehensively, and report on actual practices, rather than self-reported practices, are needed. Semi-structured interviews and non-disruptive observation of patient-provider interactions at the bedside are potential next steps. In particular, longitudinal studies that are inclusive of ED clinicians beyond solely physicians, to detect changes in perceptions and practices over time and reflect technology acceptance within the entire ED team, are important. Moreover, my scoping review revealed the fragmented conceptualization of technology acceptance in the present study of ED-based POC cognitive support technology. To gain a comprehensive understanding of emergency clinicians' acceptance of POC cognitive support technology, and to address identified barriers to use, future research should consider the interplay of clinician, technical, patient, and organizational factors. Using this approach, future findings may better inform the implementation of POC cognitive support technology, and ensure these efforts are appropriate with the clinical context and well received by emergency clinicians.

My survey highlighted that some physicians doubted the treatability of problematic alcohol use among adolescents in the ED and some had the impression that ED-based SBIRT does not impact adolescent alcohol outcomes. Moreover, these findings were echoed in physician perceptions of a technology-based, alcohol SBIRT system. Some physicians were uncertain as to whether the technology would improve delivery of alcohol-related care. While several studies do demonstrate efficacy of technology-based SBIRT (Cunningham et al., 2015; Walton et al., 2010), more research is needed to establish if SBIRT is an effective intervention when delivered as part of day-to-day clinical care by ED clinicians. Within this research, there is a need to

establish a threshold for clinical significance when studying intervention effects. Statistically significant differences reported in studies may not be clinically significant. To date, minimal clinically important differences have not been defined for primary outcomes in ED-based SBIRT trials. There is also a need in effectiveness studies to identify adolescent patients who benefit most from SBIRT. My survey demonstrated that ED physicians were uncertain as to whether their ED had the resources to support the use of a technology-based, alcohol SBIRT system. Efforts to identify adolescent populations who demonstrate positive changes in alcohol-related outcomes after receiving SBIRT will be foundational to directing available resources where it is most needed.

6.4. Concluding Remarks

This thesis examined end-user acceptance of technology-facilitated care in the ED. The assessment of technology acceptance by health care providers is pivotal to informing implementation strategies to support the integration of all types of promising innovative health technology in pediatric emergency care. While health care providers may be receptive to using technology-facilitated care in the ED, gaps remain between provider intentions and practice. Future research needs to focus on bridging this gap.

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Appendix A

Complete Search Strategy (2006 – Present)

PROSPERO Searched April 26, 2016 (Citations=2)

Emergency (in review title) and (decision or handheld or smart or ipod or ipad or mobile or phone or telephone or decision or system or electronic or support or imaging) (in review title)

Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present> Searched July 21, 2016

1	((cell* or mobile or smart) adj1 (phone* or telephone*)).mp. or exp Cell Phones/ or Smartphones/ or smartphone*.ti,ab. or iPad*.mp. or iPhone*.mp. or Kindle.mp. or wireless.mp. or hand held*.mp. or handheld*.mp. or e-health.mp. or ereader*.mp. or e-reader*.mp. or ehealth.mp. or computerized.mp. or electronic deliver*.mp. or mobile device*.mp. (115643)
2	exp microcomputers/ or computers, handheld/ or minicomputers/ or computer workstation*.mp. (18403)
3	("clinican support system*" or "clinician decision support").mp. or Decision support systems, Clinical/ or Diagnosis, Computer Assisted/ or computeri?ed physician order*.mp. or computer based support*.mp. or "point of care system*".mp. (35338)
4	1 or 2 or 3 (158452)
5	Emergency Treatment/ or Emergency Medicine/ or emergency medical services/ or emergency service, hospital/ or trauma centers/ or triage/ or exp Evidence-Based Emergency Medicine/ or exp Emergency Nursing/ or Emergencies/ or emergicent*.mp. or casualty department*.mp. or ((emergency or ED) adj1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*)).mp. (189914)
6	(("ease of use" or acceptance or resistance or challenge* or perception* or "useful*" or belief* or attitude or intention*) adj7 (computer* or technolog*)).ti,ab. (13452)
7	exp "Attitude of Health Personnel"/ or exp Attitude/ or exp Attitude to Computers/ or attitude*.mp. (378581)
8	(barrier* adj2 ("use" or uptake or accept* or adopt*)).mp. (2652)
9	(facilitat* adj2 ("use*" or uptake or accept* or adopt*)).mp. (10721)
10	6 or 7 or 8 or 9 (402504)
11	4 and 5 and 10 (241)
12	exp *Decision Support Systems, Clinical/ or exp *Diagnosis, Computer-Assisted/ (51033)
13	exp *Emergency Medical Services/ (72431)
14	12 and 13 (240)
15	11 or 14 (468)
16	limit 15 to yr="2006 -Current" (328)
17	remove duplicates from 16 (321)

Embase <1974 to 2016 April 25>

1	((cellular or mobile or smart) adj1 (phone* or telephone*)).ti,ab. or mobile phone/ or smartphone*.ti,ab. or iPad*.mp. or iPhone*.mp. or Kindle.mp. or wireless.mp. or hand held*.mp. or handheld*.mp. or e-health.mp. or ereader*.mp. or e-reader*.mp. or ehealth.mp. or computerized.mp. or electronic deliver*.mp. or mobile device*.mp. (118234)
2	computer/ or computer workstation*.mp. or mincomputer*.mp. or personal digital assistant*.mp. or minicomputer*.mp. or mini computer*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (77515)
3	3 computer assisted diagnosis/ or decision support system/ or decision support system*.mp. or clinican support system*.mp. or clinician decision support*.mp. or computeri?ed physician order*.mp. or computer based support*.mp. or "point of care system*".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (54244)
4	1 or 2 or 3 (235669)
5	emergency treatment/ or emergency medicine/ or exp emergency health service/ or evidence based emergency medicine/ or emergency nursing/ or exp emergency care/ or emergency ward/ or emergency/ or casualty department*.mp. or (emergicent* or ((emergenc* or ED) adj1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*)).mp. or (triage or critical care or (trauma adj1 (cent* or care)))).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (325947)
6	(("ease of use" or acceptance or willing* or unwilling* or resistance or challenge* or perception* or "useful*" or belief* or attitude or intention*) adj7 (computer* or technolog*)).ti,ab. (15641)
7	exp attitude/ (582327)
8	(barrier* adj2 ("use" or uptake or accept* or adopt*)).mp. (2966)
9	(facilitat* adj2 ("use*" or uptake or accept* or adopt*)).mp. (12401)
10	6 or 7 or 8 or 9 (610245)
11	4 and 5 and 10 (538)
12	*computer assisted diagnosis/ or *decision support system/ (29136)
13	exp *emergency health service/ (40678)
14	12 and 13 (140)
15	11 or 14 (665)
16	limit 15 to yr="2006 -Current" (510)
17	remove duplicates from 16 (504)
18	prehospital care.mp. (1784)
19	exp rescue personnel/ or exp ambulance/ or emergency medical technician*.mp. (16941)
20	18 or 19 (18285)
21	17 not 20 (485)

EBM Reviews - Cochrane Database of Systematic Reviews <2005 to April 20, 2016>, EBM Reviews - ACP Journal Club <1991 to April 2016>, EBM Reviews - Database of Abstracts of Reviews of Effects <1st Quarter 2016>, EBM Reviews - Cochrane Central Register of Controlled Trials <March 2016>, EBM Reviews - Cochrane Methodology Register <3rd Quarter 2012>, EBM Reviews - Health Technology Assessment <1st Quarter 2016>, EBM Reviews - NHS Economic Evaluation Database <1st Quarter 2016>

1	(((cell* or mobile or smart) adj1 (phone* or telephone*)) or smartphone* or (iPad* or iPhone* or Kindle or wireless or hand held* or handheld* or e-health or ereader* or e-reader* or ehealth or electronic deliver* or mobile device*)).ti,ab. (2442)
2	compute*.ti,ab. (21302)
3	("clinican support system*" or "clinician decision support" or computeri?ed physician order* or computer based support* or "point of care system*").ti,ab. (55)
4	1 or 2 or 3 (23476)
5	(emergicent* or casualty department* or emergency or (("A and E" or ER or ED) adj1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*))).ti,ab. (9955)
6	(("ease of use" or acceptance or resistance or challenge* or perception* or "useful*" or belief* or attitude or intention*) adj7 (computer* or technolog*)).ti,ab. (578)
7	attitude*.ti,ab. (5814)
8	(barrier* adj2 ("use" or uptake or accept* or adopt*)).ti,ab. (117)
9	(facilitat* adj2 ("use*" or uptake or accept* or adopt*)).ti,ab. (196)
10	6 or 7 or 8 or 9 (6611)
11	4 and 5 and 10 (31)
12	remove duplicates from 11 (30)
13	limit 12 to yr="2006 -Current" [Limit not valid in DARE; records were retained] (20)

PsycINFO <1806 to April Week 3 2016>

1	((cell* or mobile or smart) adj1 (phone* or telephone*)).mp. or exp computers/ or exp computer software/ or smartphone*.ti,ab. or iPad*.mp. or iPhone*.mp. or Kindle.mp. or wireless.mp. or hand held*.mp. or handheld*.mp. or e-health.mp. or ereader*.mp. or e-reader*.mp. or ehealth.mp. or compute*.mp. or electronic deliver*.mp. or mobile device*.mp. (138931)
2	("clinican support system*" or "clinician decision support" or expert systems or computeri?ed physician order* or computer based support* or "point of care system*").mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (4652)
3	1 or 2 (141879)
4	emergency services/ or emergicent*.mp. or casualty department*.mp. or emergency.mp. or ((ER or ED) adj1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*)).mp. (20924)
5	(("ease of use" or avoidance or aversion or avoiding or acceptance or accepting or resistance or challenge* or perception* or "useful*" or belief* or attitude or intention*) adj7 (computer* or technolog*)).ti,ab. (8028)
6	computer attitudes/ or consumer attitudes/ or health personnel attitudes/ or attitude change/ or attitude measurement/ or attitude measures/ or behavioral intention/ (41924)
7	(barrier* adj2 ("use" or uptake or accept* or adopt*)).mp. (812)
8	(facilitat* adj2 ("use*" or uptake or accept* or adopt*)).mp. (3608)
9	5 or 6 or 7 or 8 (53337)
10	3 and 4 and 9 (25)
11	limit 10 to yr="2006 -Current" (21)
12	remove duplicates from 11 (21)

Proquest Dissertations and Theses Global Searched April 25, 2016 (citations=23)

ti("trauma cent*" OR "triage cent*" OR (emergency OR ED) NEAR/3 (room OR doctor* OR medic* OR ward OR wards OR nurse* OR department* OR accident* OR physician* OR clinician* OR accident)) AND all("decision support system*" OR computer* OR "artificial intelligence*" OR "clinical decision tool*" OR "machine learn*" OR computer NEAR/2 diagnos* OR "computerized physician order*") AND all(attitude* OR belief* OR intention* OR avoid* OR phobia OR phobias OR accept* OR resistance OR aversion* OR challenge* OR perception* OR "ease of use" OR "barrier* to use" OR "facilitation of use") NOT all(ambulance* OR prehospital OR emt OR "emergency medical tech*" OR "rescue personnel*")

SCOPUS Searched April 26, 2016 (citations=158)

((TITLE(comput* OR "artificial intelligence" OR "machine learning" OR "medical decision system" OR iphone* OR ipad OR ehealth OR "e-health" OR "e-medicine" OR kindle OR kobo OR wireless OR ereader* OR "e reader")) or ((TITLE(((smart or mobile or cell*) W/2 (device* or phone* or telephone*))) OR TITLE("decision support system*" or minicomputer* or "personal digital assistant" or "point of care system" OR "electronic delivery" or "hand held*" or handheld*)))) and (TITLE(emergency or ED or ER)) and (TITLE-ABS-KEY(willing* OR challenge* OR perception* OR resistance* OR belief* OR attitude* OR unwilling* OR phobia* OR intention* OR avoid* OR aversion* OR barrier* OR facilitat* OR uptake OR adopt* OR accept*))

BSCO CINAHL Searched April 25, 2016

Search History/Alerts

Print Search History | Retrieve Searches | Retrieve Alerts | Save Searches / Alerts

Select / deselect all | Search with AND | Search with OR | Delete Searches

Search ID#	Search Terms	Search Options	Actions
S25	S23 NOT S24	Limiters - Published Date: 20060101-20161231 Search modes - Find all my search terms	View Results (469)
S24	MH "Prehospital Care" or (MH "Emergency Medical Technicians") or (MH "Ambulances") or "prehospital care" or ambulance*	Limiters - Published Date: 20060101-20161231 Search modes - Find all my search terms	View Results (12,147)
S23	S17 AND S21	Limiters - Published Date: 20060101-20161231 Search modes - Find all my search terms	View Results (495)
S22	S17 AND S21	Search modes - Find all my search terms	View Results (671)
S21	S18 OR S19 OR S20	Search modes - Find all my search terms	View Results (33,806)
S20	((facilitat* N2 ("use" or uptake or accept* or adopt*)) OR ((barrier* N2 ("use" or uptake or accept* or adopt*))) and (computer* or handheld or smartphone* or apps or electonic* or technolog* or "hand held" or "cell* phone*" or "mobile phone*" or ipad or ipod or iphone or "smart phone*")	Search modes - Find all my search terms	View Results (2,074)
S19	("ease of use" or acceptance or resistance or challenge* or perception* or "useful*" or belief* or attitude* or comfort* or avoidance or avoiding or intention*) AND (computer* or handheld or smartphone* or apps or electonic* or technolog* or "hand held" or "cell* phone*" or "mobile phone*" or ipad or ipod or iphone or "smart phone*"))	Search modes - Find all my search terms	View Results (32,092)
S18	(MH "Attitude to Computers")	Search modes - Find all my search terms	View Results (1,663)
S17	S15 AND S16	Search modes - Find all my search terms	View Results (76,881)
S16	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14	Search modes - Find all my search terms	View Results (127,542)
S15	S1 OR S2 OR S3 OR S4 OR S5 OR S6	Search modes - Find all my search terms	View Results (457,036)
S14	((ER or ED) N1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*)))	Search modes - Find all my search terms	View Results (7,950)
S13	emergicent* or casualty department* or emergency	Search modes - Find all my search terms	View Results (124,271)
S12	(MH "Emergency Nurse Practitioners")	Search modes - Find all my search terms	View Results (273)
S11	emergency nurse practitioner	Search modes - Find all my search terms	View Results (1,507)
S10	(MH "Emergency Nursing+")	Search modes - Find all my search terms	View Results (12,326)
S9	(MH "Physicians, Emergency")	Search modes - Find all my search terms	View Results (2,150)
S8	(MH "Emergency Medicine")	Search modes - Find all my search terms	View Results (8,046)
S7	(MH "Emergency Service+")	Search modes - Find all my search terms	View Results (37,850)
S6	(((cell* or mobile or smart) N1 (phone* or telephone*)) OR (("clinican support system*" or (("clinician decision support") and (computer* or electonic* or automat* or technology)) or "computeri?ed physician order*" or "computer based support*" or "point of care system*")))	Search modes - Find all my search terms	View Results (3,304)
S5	(MH "Decision Making, Computer Assisted+")	Search modes - Find all my search terms	View Results (27,448)
S4	(MH "Emergency Service Information Systems") OR (MH "Decision Support Systems, Clinical")	Search modes - Find all my search terms	View Results (3,333)
S3	(MH "Computer Systems+")	Search modes - Find all my search terms	View Results (298,805)
S2	(MH "Cellular Phone+")	Search modes - Find all my search terms	View Results (6,249)
S1	(MH "Emergency Service+") or (MH "Emergency Medicine") or (MH "Physicians, Emergency") OR (MH "Emergency Nurse Practitioners") or (MH "Emergency Nursing+") or "casualty department*" or ((emergenc* or ED) N1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*)) or (triage or critical care) or (trauma N1 (cent* or care)))	Search modes - Find all my search terms	View Results (138,251)

Canadian Business and Current Affairs Searched April 26, 2016 (citations=45)

Two searches

ab((emergency OR ED OR ER) NEAR/2 (medic* OR doctor* OR physician* OR clinican* OR nurs* OR room OR rooms OR ward OR wards OR department* OR accident* OR centre* OR center*)) AND all((comput* or "artificial intelligence" or "machine learning" or "medical decision system*" or iphone* or ipad or ehealth or "e-health" or "e-medicine" or Kindle or Kobo or wireless or ereader* or "e reader*" or "decision support system*" or minicomputer* or "personal digital assistant" or "point of care system" OR "electronic delivery" or "hand held*" or handheld or ((smart or mobile or cell*) NEAR/2 (device* or phone* or telephone*)))) AND all("ease of use" OR willing* OR challenge* OR perception* OR resistance* OR belief* OR attitude* OR unwilling* OR phobia* OR intention* OR avoid* OR aversion* OR barrier* OR facilitat* OR uptake OR adopt* OR accept*) NOT all(ambulance* OR emt OR "emergency medical tech*" OR prehospital OR "rescue personnel")

ti((emergency OR ED OR ER) NEAR/2 (medic* OR doctor* OR physician* OR clinican* OR nurs* OR room OR rooms OR ward OR wards OR department* OR accident* OR centre* OR center*)) AND all((comput* or "artificial intelligence" or "machine learning" or "medical decision system*" or iphone* or ipad or ehealth or "e-health" or "e-medicine" or Kindle or Kobo or wireless or ereader* or "e reader*" or "decision support system*" or minicomputer* or "personal digital assistant" or "point of care system" OR "electronic delivery" or "hand held*" or handheld or ((smart or mobile or cell*) NEAR/2 (device* or phone* or telephone*)))) AND all("ease of use" OR willing* OR challenge* OR perception* OR resistance* OR belief* OR attitude* OR unwilling* OR phobia* OR intention* OR avoid* OR aversion* OR barrier* OR facilitat* OR uptake OR adopt* OR accept*) NOT all(ambulance* OR emt OR "emergency medical tech*" OR prehospital OR "rescue personnel")

Inspec (Engineering Village Platform) 1985 – 2016 (citations=34)

(((((((emergency NEAR medic* or emergency near doctor* or emergency near physician* or emergency near department* or emergency near clinician* or emergency near ward* or emergency near room* or emergency near patient* or emergency near accident* or emergency near triage* or emergency near visit*) WN TI) AND ((ipad* or iphone*or kindle or kobo or ereader* or diagnos* or decision or cell* phone* or smartphone* or smart phone* or cell* telephone* or physician support* or mobile device* or mobile phone*) WN KY)) AND ((willing* OR challenge* OR perception* OR resistance* OR belief* OR attitude* OR unwilling* OR phobia* OR intention* OR avoid* OR aversion* OR barrier* OR facilitat* OR uptake OR adopt* OR accept*) WN KY)) NOT ((ambulance* or emt or helicopter* or ems or emergency medical tech* or rescue personnel) WN ALL))) AND ((2016 or 2015 OR 2014 OR 2013 OR 2012 OR 2011 OR 2010 OR 2009 OR 2007 OR 2006) WN YR))

Appendix B

Inclusion and Exclusion Criteria

POPULATION: Emergency clinicians	
Yes criteria: ✓ ED staff who are: medical residents, fellows, attending physicians, nurse practitioners, triage and staff nurses, or physician assistants (Sheehan et al., 2013)	*No* criteria: × Paramedics × Pharmacists × ICU staff × Visiting staff from other departments/specialties
INTERVENTION: Point-of-care cognitive support systems	
Yes criteria: ✓ Used **by the clinician** at the place and time of patient care ✓ Guides clinical practice by offering patient-/situation-specific reminders, alerts, notifications, or recommendations (Goergen et al., 2006) ✓ Delivered on a technology platform (i.e. electronic device and/or web-based application) ✓ Involved in the delivery of one or more of the following healthcare services: • Screening / Diagnostics • Medication prescribing • Ordering tests • Treatment / Intervention • Referral	*No* criteria: × Stand-alone electronic medical/health records <u>Note:</u> EMR/HR that are integrated on cognitive support systems are OK × Electronic patient handover × Remote telemedicine / wireless consultation × Monitoring / patient-tracking device × Formal diagnostic technology (i.e. EEG, echocardiography) × Diagnostic checklists, algorithms, scoring indexes that **do not** specify whether it is on an electronic platform × Push notifications
OUTCOME: User acceptance	
Yes criteria: ✓ Acceptance is identified as one outcome variable **and/or** ✓ One or more determinants of acceptance are identified as outcome variable(s). Determinants are derived from the adapted TAM2 (Venkatesh & Davis, 2000; Sedlmayr et al., 2013), includes: • Perceived ease of use [def.: Expectation of low effort using the system] • Perceived usefulness [def.: Expectation of enhanced job performance using the system] • Subjective norm [def.: Whether important others encourage using the system]	*No* criteria: × Neither acceptance or determinants of acceptance are outcomes of interest × Lacking variable analysis for guideline compliance frequency when using the cognitive support tool

• Image [def.: Whether social status is enhanced by using the system] • Job relevance [def.: Whether the system is applicable with an individual's job] • Output quality [def.: Whether the system performs well] • Result demonstrability [def.: Whether systems results are tangible] • Experience • Voluntariness [def.: Free will to adopt the system into practice] • Compatibility [def.: Whether the system is cohesive with the workflow and consistent with existing values, needs, experiences] • Resistance to change [def.: Maintaining status quo in a changing environment] Note: Acceptance includes attitudes, beliefs, intention to use, and actual uptake of cognitive support tool	

Appendix C

Questionnaire item development

Domain: Underlying concept	**Survey Item**	**Scaling** (Streiner & Norman, 1995)	**Supporting literature / Recommendations/ Other notes**
Background: Demographics	Profession 1) Physician status 2) Academic status 3) *[This option only visible to those who selected 'both']* What is the approximate breakdown of your commitment as a physician (i.e. seeing patients in the ED) and researcher	1) Resident / Fellow / Attending / If other, please specify: _____ 2) Academic / Non-academic / Both 3) Please provide percentage approximations for a combined value of 100%: Physician _____ Researcher ____	← Trainees are more receptive to CDSS (Rosenbloom et al., 2004) ←To determine how much time they spend seeing patients
	Age in years _____	Numerical value	
	Gender	Male / Female	
	Number of years in practice (approx.)	Numerical value	
	Average number of patients seen per hour	Numerical value	Must assess if this data will even be appropriate and/or valid
Background: Personal exposure to alcoholism	Have you ever had a problem with alcohol (i.e. addiction, and/or related illness, injury, DWI)?	No / Yes	D'Onofrio et al., 2002
	Has someone you personally know (other than one of your patients) had a problem with alcohol?	No / Yes	D'Onofrio et al., 2002
	[This option only visible to those who answered "yes" to previous question] How close was/is this person to you?	Passing acquaintance / Friend / Close friend / Extended family member / Immediate family member	D'Onofrio et al., 2002 While exposure is compared between intervention and control, an analysis of associations between exposure and attitudes, beliefs, and practices not been

			conducted
Background: Training	During your professional training, about how may lecture/seminar hours were devoted to alcohol problems?	None / 1-10 hours / 11-25 hours / >25 hours	D'Onofrio et al., 2002; Chun et al., 2011
	In the past year, about how many lecture/seminar hours have you attended on alcohol problems?	None / 1-2 hours / 3-5 hours / >5 hours	D'Onofrio et al., 2002; Chun et al., 2011; Sedlymar et al., 2013 Training effects on confidence and practice
	Please choose the statement that best describes the amount of career experience you have counseling adolescents about alcohol use	I have: Little or no experience / A small amount of experience / A moderate amount of experience / A large amount of experience / Very extensive amount of experience	Chun et al., 2011 Removed 'decline to answer' option because this response is not informative for this item
Background: Clinical Responsibility	It is my responsibility to address alcohol related problems among adolescents when it is clinically appropriate	Strongly disagree to strongly agree continuum [5-7 options]	D'Onofrio et al., 2002; Chun et al., 2011; O'Rourke et al., 2006; Indig et al., 2009

Alcohol SBIRT in the ED involves:
Screening: identifying hazardous and harmful alcohol consumption using instruments such as the CRAFFT, RAFFT, AUDIT, and CAGE.
Brief Intervention: Counseling to increase awareness of consequences and elicit change in consumption behaviour (ex. motivational interviewing and
normative feedback)
Referral to Treatment: Connecting identified high risk patients to specialty treatment services

SBIRT: Current Practice	Please choose the response that best describes your current clinical practice: When a patient with psychiatric problems is presented in the ED, I administer alcohol SBIRT When a patient is presented in the ED for alcohol-related problems, I administer alcohol SBIRT When the ED is busy, I administer alcohol SBIRT to patients presenting with alcohol-related problems	 Never / Rarely / Sometimes / Usually / Always Never / Rarely / Sometimes / Usually / Always Never / Rarely / Sometimes / Usually / Always	Scenario based item with scaling in this manner allows me to avoid positive/negative wording in my questions. (Streiner & Norman, 1995) ←High proportion of psychiatric ED presentations (D'Onofrio & Degutis, 2004/2005) SBIRT is currently a collective entity of screening, intervention and referral. This deviates from D'Onofrio et al. (2002) and Chun et al. (2011), which teases out each component.
Attitude: Mindset, or personal evaluation, of a situation that disposes an individual to react/behave in a particular way. Grounded on past experience, beliefs, and values.			
SBIRT: Attitudes	I am comfortable addressing alcohol drinking behavior with adolescent patients	Strongly disagree to strongly agree continuum [5-7 options]	A range of responses possible; thus, chose continuous Likert scaling rather than dichotomizing responses like Chun et al. (2011). Scaling choice for that survey most likely lead to loss of information. 5-7 categories produce a decent reliability coefficient. At least 5 to avoid loss of information. Evidence that people cannot discriminate beyond 7 levels, this

			is the upper practical level of usefulness. (Streiner & Norman, 1995) End-Aversion Bias: respondents tend to avoid the two extremes on a scale (Streiner & Norman, 1995)
	I am confident in my knowledge of the SBIRT protocol	Strongly disagree to strongly agree continuum [5-7 options]	This question is different than the following item because an individual's confidence in their intellect and performance ability may differ. If physicians are very confident in their knowledge of SBIRT protocols, but are not confident in their ability to deliver it, there may be an issue external to lack of training and education. Indig et al., 2009
	I am confident in my ability to administer SBIRT to adolescent patients	Strongly disagree to strongly agree continuum [5-7 options]	D'Onofrio et al., 2002; Chun et al., 2011 Indig et al., 2009; Vadlamudi et al., 2008
	Additional training in SBIRT would increase my confidence administering SBIRT to adolescent patients	Strongly disagree to strongly agree continuum [5-7 options]	Indig et al., 2009
Belief: Established perception of an object, person or event, which may not be the truth. Grounded on personal opinion.			

SBIRT: Beliefs	Alcohol use among adolescents is a problem that needs to be addressed	Strongly disagree to strongly agree continuum [5-7 options] with 'neutral' option available here	'Neutral' option given because impartiality can also be an informative indicator of indifference Mabood et al., 2012
	It takes too much times from my other duties to deal with adolescent drinking behavior	Strongly disagree to strongly agree continuum [5-7 options]	D'Onofrio et al., 2002; Chun et al., 2011
	Harmful and hazardous alcohol drinking behavior can be treated / Patients lack motivation to change their alcohol drinking behavior	Strongly disagree to strongly agree continuum [5-7 options]	Alteration of D'Onofrio et al., 2002 Mabood et al., 2012; O'Rourke et al., 2006; Vadlamudi et al., 2008
	The ED is an appropriate setting to treat harmful and hazardous alcohol behavior among adolescents	Strongly disagree to strongly agree continuum [5-7 options]	Mabood et al., 2012; O'Rourke et al., 2006
	By delivering SBIRT, I can make a difference in changing an adolescent's drinking behavior	Strongly disagree to strongly agree continuum [5-7 options]	D'Onofrio et al., 2002; Chun et al., 2011 O'Rourkeet al., 2006
	Inquiring about alcohol drinking behavior is offensive to adolescents	Strongly disagree to strongly agree continuum [5-7 options]	Alteration of Chun et al., 2011 Mabood et al., 2012
	Inquiring about alcohol drinking behavior will have a detrimental effect on patient-provider relationships	Strongly disagree to strongly agree continuum [5-7 options]	Mabood et al., 2012
	Adolescents' answers concerning their alcohol drinking behavior are reliable	Strongly disagree to strongly agree continuum [5-7 options]	Nordqvist et al., 2005
Technology-based SBIRT: Any electronic- or web-based platform that facilitates the delivery of screening, brief intervention, and referral to treatment (ex. waiting room kiosks, tablets/computers to access online clinician decision support systems concerning SBIRT protocol			

Technology: Baseline use	I am comfortable using technology platforms in the ED	Strongly disagree to strongly agree continuum [5-7 options]	Personal interest whether this has an effect
Technology: Attitudes	My involvement in the decision-making process to implement technology-based SBIRT programs in the ED would be: _____	Strongly unfavorable to strongly favorable continuum [5-7 options with neutral]	TAM3 (Venkatesh & Bala 2008) Concept of voluntariness
Technology: Beliefs (Perceived usefulness)	Using technology-based SBIRT would: Enable me to accomplish my tasks more quickly Improve my clinical care Increase my productivity (Not sure if this is a good term for the physician role; financial incentive?) Enhance my effectiveness on the job Make it easier to do my job Address issues concerning limited resources in the ED	Extremely unlikely Quite unlikely Slightly unlikely Slightly likely Quite likely Extremely likely	Davis 1989 (removed the 'neither' option) Consider removing: productivity and effectiveness due to redundancy
Technology: Beliefs (Perceived ease of use)	Learning to operate technology-based SBIRT would be easy for me My interaction with technology-based SBIRT programs would be clear and understandable It would be easy for me to become skillful	Extremely unlikely Quite unlikely Slightly unlikely Slightly likely Quite likely Extremely likely	Davis 1989 (removed second item: "I would find it easy to get technology-based SBIRT programs to do what I want it to do") These items were developed from users of IT, consider keeping only

	at using technology-based SBIRT programs I would find technology-based SBIRT programs easy to use		the third item.
Technology: Beliefs (Job relevance)	Technology-based SBIRT programs will be applicable to my job	Extremely unlikely / Quite unlikely / Slightly unlikely / Slightly likely / Quite likely / Extremely likely	Venkatesh et al., 2003
Technology: Beliefs (Computer self-efficacy)	I would be comfortable using technology platforms to deliver SBIRT	Strongly disagree to strongly agree continuum [5-7 options]	Compeau & Higgins, 1995 Not quite computer self-efficacy; might move to attitudes
Technology: Beliefs (Perception of external control)	The ED has the resources to support and sustain technology-based SBIRT programs	Extremely unlikely / Quite unlikely / Slightly unlikely / Slightly likely / Quite likely / Extremely likely	Venkatesh et al., 2003
Technology: Facilitators	_____ would increase my use of technology-based SBIRT programs, if available	Please check all that apply: - Personal involvement in the decision making process to implement technology - Participating in a trial of proposed technology programs - Receiving training lectures/seminars - Availability of technology support staff	Langhan et al., 2015

Technology: Readiness to change	The availability of technology-based SBIRT programs would _____ my current practice of SBIRT	Significantly increase Moderately increase Slightly increase Have no effect on Slightly decrease Moderately decrease Significantly decrease	
Technology: Intention to use	If available, I would use technology-based SBIRT programs If available, I would routinely use technology-based SBIRT programs for adolescent alcohol-related presentations	Extremely unlikely Quite unlikely Slightly unlikely Slightly likely Quite likely Extremely likely	

Appendix D

E-mails and Letters of Contact

E-mail 1. Pre-notice of Upcoming Survey & Invitation to Participate (Oct 11, 2016)

Subject: PERC Approved Survey: Adolescent Alcohol Interventions Survey

Dear Dr. ,

You are receiving this e-mail as a member of Pediatric Emergency Research Canada (PERC). You are invited to take part in a study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department". This study is being done to examine current practices of alcohol SBIRT and identify ways to integrate technology-enabled SBIRT into pediatric emergency care.

We would like you to participate in an on-line survey that should take no longer than 10 minutes to complete. Your involvement is voluntary and you may withdraw at any time. We do not anticipate any risks involved with study participation. All the information you provide will be kept confidential. The answers you provide for the survey will help us better understand how to implement technology-enabled, alcohol SBIRT that is compatible and acceptable to emergency clinicians.

This study will contribute to the graduate thesis project of Shelly Jun, an MSc student in the Department of Pediatrics at the University of Alberta (U of A), who will be leading this study. The primary supervisor is Dr. Amanda Newton, an Associate Professor in the Department of Pediatrics at the U of A, and Clinician Scientist with the Stollery Children's Hospital (Edmonton, AB, Canada). Graduate committee members are Dr. Sarah Curtis, an Associate Professor in the Department of Pediatrics at the U of A, and Dr. Amy Plint, a Professor in the Department of Pediatrics at the University of Ottawa.

In 5 days time, you will be e-mailed the link to participate in this survey. By completing the survey, you will have the option to enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card.

Please carefully read through the cover letter attached below for contact information and further details about the study.

Thank you for considering participating in this study.

Sincerely,

Shelly Jun | MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

UNIVERSITY OF ALBERTA

Study Title: Screening, Brief Intervention, and Referral to Treatment for Adolescent Alcohol Use in the Emergency Department

Study Principal Investigator: Shelly Jun, MSc Candidate, Department of Pediatrics, Faculty of Medicine & Dentistry, University of Alberta, Edmonton, AB, Canada
Contact Information: Tel: [redacted] E-mail: [redacted]
Investigator's Supervisor: Dr. Amanda Newton, PhD, Department of Pediatrics, University of Alberta, Tel: [redacted]
Supervisory Committee:
Dr. Sarah Curtis, MD, MSc, Dept. of Pediatrics, University of Alberta, Tel: [redacted]
Dr. Amy Plint, MD, MSc, Dept. of Pediatrics, University of Ottawa, Tel: [redacted]

Why am I being asked to take part in this research study?

You are invited to take part in a study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department". This study is being done to explore pediatric emergency physicians' attitudes and beliefs concerning adolescent alcohol drinking, current alcohol SBIRT practices, and acceptance of technology-enabled, alcohol SBIRT. All members belonging to Pediatric Emergency Research Canada are being invited to participate in an on-line survey.

What is the reason for doing the study?

The purpose of this study is to identify barriers and facilitators of alcohol SBIRT in the emergency department. The data collected from this survey will contribute to a graduate thesis project. If successfully integrated in routine pediatric emergency care, alcohol SBIRT has the potential to improve adolescent health and social outcomes. The information you provide will help to create a better understanding of the practice of alcohol SBIRT in the emergency department, and contribute to the planning and development of a clinical effectiveness trial of technology-enabled, alcohol SBIRT.

What will I be asked to do?

A survey will be emailed to you within 5 days. You will be asked to follow the hyperlink provided and complete an online survey to the best of your abilities. This survey should take no longer than 10 minutes to complete.

What are the risks and discomforts?

We do not anticipate any risks or discomforts for participating in this study. It is not possible to know all of the risks that may happen in a study, but the researchers have taken all reasonable safeguards to minimize any known risks to a study participant.

What are the benefits to me?

This study will contribute to the implementation of technology-enabled, alcohol SBIRT in the emergency department. We anticipate that one day these tools may guide clinical practice, and enable standardized and expedited care. However, you may not get any benefit from being in this research study.

Do I have to take part in the study?

Your involvement in this study is voluntary, and you may withdraw at any time. Your employment will not be affected should you choose to not participate or withdraw. In the event of opting out of the study, exit the online survey browser. Withdrawn survey data will not be collected. Since no identifying information will be collected, once you have submitted your completed survey, you will not be able to change or withdraw your responses.

Will I be paid to be in the research?

Upon survey completion, you will have the option to answer a skill testing question to enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card. The odds of winning is approximately 1 in 200.

Will my information be kept private?

To protect your anonymity, no identifying information will be collected. Nevertheless, we will ensure that all the information you provide is kept confidential in a secure database on a password protected computer at the University of Alberta. Study data will be securely stored for 5 years after the study is over, at which time it will be destroyed. We expect to disseminate study findings through academic conference presentations, journal publication, and a thesis dissertation.

What if I have questions?

If you have any further questions about the research, please contact the study principal investigator and/or the supervisory team. Contact information has been provided above. The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at 1 (780) 492-2615. This office has no affiliations with the study investigators.

Consent

By hitting the 'submit' button after you complete the survey, you are consenting to participate.

Thank you for considering participating in this study.

<< Signature>>

Shelly Jun, MSc Candidate

E-mail 2. Hyperlink to Survey & Instructions to Complete (Oct 18, 2016)

Subject: PERC Approved Survey: Adolescent Alcohol Interventions Survey

Dear Dr. ,

Last week you received an e-mail to participate in a study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department". This study is being done to examine current practices of alcohol SBIRT and identify ways to integrate technology-enabled SBIRT into pediatric emergency care.

By clicking on the link below, you will be connected to an on-line survey. This survey should take no longer than 10 minutes to complete. By hitting the "submit" button, you are consenting to participate. Survey responses cannot be changed or withdrawn after it has been submitted.

After completing the survey, you will have the option to enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card. This survey will close on December 6, 11:59PM MST.

Thank-you for completing this survey. The information you provide will help us better understand how to implement technology-enabled, alcohol SBIRT that is compatible and acceptable to emergency clinicians.

Sincerely,

Shelly Jun | MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

E-mail 3: Follow-up/Reminder E-mail (November 1, 2016)

Subject: PERC Approved Survey: Adolescent Alcohol Interventions Survey

Dear Dr. ,

Several weeks ago you were invited to participate in a study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department". This study is being done to examine current practices of alcohol SBIRT and identify ways to integrate technology-enabled SBIRT into pediatric emergency care.

If you have not had a chance to complete this survey, there is still time to participate. By clicking on the link below, you will be connected to an on-line survey. This survey should take no longer than 10 minutes to complete. By hitting the "submit" button, you are consenting to participate. Survey responses cannot be changed or withdrawn after it has been submitted.

Upon survey completion, you will have the option to enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card. This survey will close on December 6, 11:59PM MST.

Thank-you for completing this survey. The information you provided will help us better understand how to implement technology-enabled, alcohol SBIRT that is compatible and acceptable to emergency clinicians.

Sincerely,

Shelly Jun | MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

E-mail 4: Follow-up/Reminder E-mail (November 15, 2016)

Subject: PERC Approved Survey: Adolescent Alcohol Interventions Survey

Dear Dr. ,

We are still looking to hear from Canadian pediatric emergency clinicians regarding their alcohol SBIRT practices and acceptance of technology models. There is still time to participate in the study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department".

Upon survey completion, you will have the option to enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card.

By clicking on the link below, you will be connected to an on-line survey. This survey should take no longer than 10 minutes to complete. By hitting the "submit" button, you are consenting to participate. Survey responses cannot be changed or withdrawn after it has been submitted.

This survey will close on December 6, 11:59PM MST.

Thank-you for completing this survey. The information you provided will help us better understand how to implement technology-enabled, alcohol SBIRT that is compatible and acceptable to emergency clinicians.

Sincerely,

Shelly Jun | MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

Paper-based Copy: Final Follow-up/Reminder (Mailed out Nov, 24th); Sent to n=108

UNIVERSITY OF ALBERTA

Dear Dr._____,

We are still looking to hear from Canadian pediatric emergency clinicians regarding their alcohol SBIRT practices and acceptance of technology models. There is still time to participate in the study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department".

Please find attached a paper-based copy of the survey, with a stamped and addressed return envelope. By returning a completed survey, you are consenting to participate. Survey responses cannot be changed or withdrawn after it has been mailed.

You will have the option to enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card upon survey completion. This survey will close on December 6, 11:59PM MST.

Thank-you for completing this survey. The information you provided will help us better understand how to implement technology-enabled, alcohol SBIRT that is compatible and acceptable to emergency clinicians.

Sincerely,

<< signature>>

Shelly Jun, MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

<<Paper-based copy of survey and stamped return envelope to be attached to the mail>>

(Post-hoc Strategy) E-mail 5: Reminder E-mail (Dec 6, 2016)

Subject: PERC Approved Survey Reminder: Adolescent Alcohol Interventions

Dear PERC member,

A couple months ago, you were invited to participate in a study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department". There is still time to complete the questionnaire and enter a prize draw for a 16GB iPad Mini 4 or $50 Amazon gift card.

By clicking on the link below, you will be connected to an on-line survey. Alternatively, a paper-based survey and stamped return envelope has been mailed out two weeks ago. This survey should take no longer than 10 minutes to complete.

Thank you for your time and cooperation. The information you provide will help us better understand how to implement technology-enabled, alcohol SBIRT that is compatible and acceptable to emergency clinicians.

Sincerely,

Shelly Jun | MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

(Post-hoc) E-mail 6: Gratitude and Final Notice E-mail (Jan 11, 2017); with PERC permission

Subject: PERC Approved Survey: Adolescent Alcohol Interventions Final Correspondence

Dear PERC member,

A couple months ago, you were invited to participate in a study called "Screening, Brief Intervention, and Referral to Treatment (SBIRT) for Adolescent Alcohol Use in the Emergency Department".

The online survey is now closed. We would like to sincerely thank those who took the time to complete the survey. For those who received paper-based survey forms with a return stamped envelope, and still wish to participate, we will be accepting mail-ins until January 31, 2017. The random prize draw will be conducted after this deadline, and winners will be contacted.

Thank you for your patience and contribution!

Sincerely,

Shelly Jun | MSc Candidate (Principal Investigator)
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta
Tel: [redacted] E-mail: [redacted]

Appendix E

Survey Data Dictionary

Variable Name	Description of Survey Item	Code
record_id	Participant's unidentifiable record ID	Numerical
language	Language survey was completed in	1, English 2, French
Demographics		
experience	Number of years practicing as a physician	Numerical 999, Missing
experience_categorized	Experience categorized by cut-offs determined by 25th, 50th, and 75th percentiles	1, <5 years 2, 5-12 years 3, 13-20 years 4, >21 years
pemtrain	Pediatric emergency fellowship training	1, Yes 2, No 999, Missing
clinicalappt	Primary clinical work in the pediatric emergency department	1, Yes 2, No 999, Missing
age	Participant's age	Numerical 999, Missing
age_categorized	Age categorized in intervals	1, ≤30 years 2, 31-40 years 3, 41-50 years 4, 51-60 years 5, >60 years
sex	Participant's sex	1, Male 2, Female 999, Missing
Training		
training_during	Hours of lecture/seminar devoted to alcohol problems during professional training (i.e., medical school, residency, fellowship)	1, None 2, 1-10 hours 3, 11-25 hours 4, >25 hours 999, Missing
training_cme	Hours of continuing medical education (CME) completed on alcohol problems since professional training ended.	1, None 2, 1-2 hours 3, 3-5 hours 4, >5hours 999, Missing
training_alcexp	Amount of clinical experience counseling adolescents about alcohol use	1, little or no experience 2, small amount

		3, moderate amount 4, large amount 5, very extensive amount 999, Missing
Current Practice and Opinions on Alcohol Interventions		
current_sbirt	Administration of alcohol SBIRT when treating adolescents for alcohol-related problems	1, never 2, rarely 3, sometimes 4, usually 5, always 999, Missing
sbirt	current_sbirt re-categorized (Always has so few observations)	1, never 2, rarely 3, sometimes 4, usually/always 999, Missing
never_sbirt_1	Reason 1 – Not enough time 1	0, unchecked 1, checked 777, Valid skip 999, Missing
never_sbirt_2	Reason 2 – Not comfortable	0, unchecked 1, checked 777, Valid skip 999, Missing
never_sbirt_3	Reason 3 – No tools	0, unchecked 1, checked 777, Valid skip 999, Missing
never_sbirt_4	Reason 4 – No resources	0, unchecked 1, checked 777, Valid skip 999, Missing
never_sbirt_5	Reason 5 – Competing priorit6ies	0, unchecked 1, checked 777, Valid skip 999, Missing
never_sbirt_6	Reason 6 – Other	0, unchecked 1, checked 777, Valid skip 999, Missing
never_sbirt_other	Other reason(s) why participant never administers alcohol SBIRT when treating adolescents for alcohol-related problems	Text 777, Valid skip 999, Missing
screening	Conducts screening when treating adolescents with alcohol-related problems	1, Yes 2, No

		777, Valid skip 999, Missing
valid_tool	Uses validated tool(s) to screen	1, Yes 2, No 777, Valid skip 999, Missing
specify_tool_1	Validated tool 1 – CRAFFT	0, unchecked 1, checked 777, Valid skip 999, Missing
specify_tool_2	Validated tool 2 – RAFFT	0, unchecked 1, checked 777, Valid skip 999, Missing
specify_tool_3	Validated tool 3 – AUDIT	0, unchecked 1, checked 777, Valid skip 999, Missing
specify_tool_4	Validated tool 4 – CAGE	0, unchecked 1, checked 777, Valid skip 999, Missing
specify_tool_5	Validated tool 5 – Other	0, unchecked 1, checked 777, Valid skip 999, Missing
tool_other	Other tool(s) the participant uses to screen adolescents with alcohol-related problems	Text 777, Valid skip 999, Missing
bi	Conducts brief intervention when treating adolescents with alcohol-related problems	1, Yes 2, No 777, Valid skip 999, Missing
rt	Provides referral to treatment when treating adolescents with alcohol-related problems	1, Yes 2, No 777, Valid skip 999, Missing
comfort	Comfortable addressing alcohol drinking behaviours with adolescent patients	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Slightly agree 5, Moderately agree 6, Strongly agree 999, Missing
confident_knowledge	Confident in knowledge of alcohol SBIRT	1, Strongly disagree

	protocol	2, Moderately disagree 3, Slightly disagree 4, Slightly agree 5, Moderately agree 6, Strongly agree 999, Missing
confident_ability	Confident in ability to conduct alcohol SBIRT with adolescent patients	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Slightly agree 5, Moderately agree 6, Strongly agree 999, Missing
treatable	Opinion – Harmful and hazardous alcohol drinking can be treated in the ED	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Slightly agree 5, Moderately agree 6, Strongly agree 999, Missing
belief_edsuitability	Belief – Adolescent alcohol use is a problem that needs to be addressed in the ED	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Undecided/neutral 5, Slightly agree 6, Moderately agree 7, Strongly agree 999, Missing
belief_resp1	Belief – Clinical responsibility to address adolescent alcohol related problems when appropriate	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Undecided/neutral 5, Slightly agree 6, Moderately agree 7, Strongly agree 999, Missing
specify_resp	Opinion – specification of who should be responsible for addressing alcohol-related problems with adolescent patients	Text 777, Valid skip 999, Missing
Technology-based, Alcohol SBIRT		
baseline_technol	Comfortable using technology to facilitate	1, Strongly disagree

	patient care in the ED	2, Moderately disagree 3, Slightly disagree 4, Slightly agree 5, Moderately agree 6, Strongly agree 999, Missing
btech	baseline_technol recategorized	1, Disagree 2, Agree 999, Missing
pu1	Belief – Technology-based, alcohol SBIRT will improve clinical care	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Not sure 5, Slightly likely 6, Quite likely 7, Extremely likely 999, Missing
pu1_c	pu1 re-categorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Not sure 4, Slightly likely 5, Extremely/Quite likely
pu2	Belief – Technology-based, alcohol SBIRT will make job easier	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Not sure 5, Slightly likely 6, Quite likely 7, Extremely likely 999, Missing
pu2_c	pu2 re-categorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Not sure 4, Slightly likely 5, Extremely/Quite likely 999, Missing
pu3	Belief – Technology-based, alcohol SBIRT will enable higher efficiency during care	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Not sure 5, Slightly likely

		6, Quite likely 7, Extremely likely 999, Missing
pu3_c	pu3 re-categorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Not sure 4, Slightly likely 5, Extremely/Quite likely 999, Missing
peou	Belief – Will be easy becoming skillful at using a technology-based, alcohol SBIRT	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Not sure 5, Slightly likely 6, Quite likely 7, Extremely likely 999, Missing
peou_c	peou re-categorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Not sure 4, Slightly likely 5, Extremely/Quite likely 999, Missing
subjective_norm	Belief – Colleagues would advocate use of a technology-based, alcohol SBIRT	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Not sure 5, Slightly likely 6, Quite likely 7, Extremely likely 999, Missing
snorm	subjective_norm re-categorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Not sure 4, Slightly likely 5, Extremely/Quite likely
image	Belief – Implementing a technology-based, SBIRT would innovate care provided in participant's ED	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Not sure

		5, Slightly likely 6, Quite likely 7, Extremely likely 999, Missing
image_c	Image recategorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Not sure 4, Slightly likely 5, Extremely/Quite likely
job_relevance	Belief – Technology-based, alcohol SBIRT system is applicable to job	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Not sure 5, Slightly agree 6, Moderately agree 7, Strongly agree 999, Missing
jr	job_relevance recategorized	1, Strongly/Mod. disagree 2, Slightly disagree 3, Not sure 4, Slightly agree 5, Strongly/Mod. agree
external_control	Belief – Participant's ED has resources to support and sustain a technology-based, alcohol SBIRT system	1, Strongly disagree 2, Moderately disagree 3, Slightly disagree 4, Undecided/neutral 5, Slightly agree 6, Moderately agree 7, Strongly agree 999, Missing
ec	external_control recategorized	1, Strongly/Mod. disagree 2, Slightly disagree 3, Not sure 4, Slightly agree 5, Strongly/Mod. agree
readiness_change	Availability of technology-based, alcohol SBIRT would _____ current practice of alcohol SBIRT	1, Significantly decrease 2, Moderately

		decrease 3, Slightly decrease 4, Have no effect on 5, Slightly increase 6, Moderately increase 7, Significantly increase 999, Missing
rtc	Readiness_change re-categorized	1, Sig. /Mod. decrease 2, Slightly decrease 3, Have no effect on 4, Slightly increase 5, Sig. / Mod. increase 999, Missing
intention_use	If available, would use a technology-based, alcohol SBIRT system	1, Extremely unlikely 2, Quite unlikely 3, Slightly unlikely 4, Slightly likely 5, Quite likely 6, Extremely likely 999, Missing
itu	Intention_use re-categorized	1, Extremely/Quite unlikely 2, Slightly unlikely 3, Slightly likely 4, Extremely/Quite likely 999, Missing
Personal Experience		
personal_exposure	Personally know someone who had alcohol problem? (other than patients)	1, Yes 2, No 3, Decline to answer 999, Missing
specify_relation	Relationship with participant	1, Acquaintance 2, Friend 3, Extended family member 4, Immediate family member 5, Colleague 6, Decline to answer 777, Valid skip 999, Missing

Appendix F

Quality Assessment Scores for Studies in the Scoping Review

Author	Study Design	MMAT Score
Hypothetical or In Development Technology		
Sheehan et al. 2013	Qualitative	75
Ballard et al. 2013	Quantitative descriptive	100
Khan et al. 2016	Mixed methods	75
Griffey et al. 2014	Quantitative descriptive	100
Malo et al. 2012	Quantitative descriptive	100
Lee et al. 2013	Qualitative	75
Novel Technology		
Kline et al. 2014	Quantitative randomized controlled trial	100
Drescher et al. 2011	Mixed methods	50
O'Sullivan et al. 2011	Quantitative descriptive	50
O'Sullivan et al. 2014	Quantitative descriptive	75
Kunisch 2012	Quantitative descriptive	75
Fowler et al. 2014	Mixed methods	25
Venkat et al. 2012	Quantitative descriptive	100
Yadav et al. 2015	Mixed methods	50
Patapovas et al. 2012	Quantitative descriptive	75
Vandenberg et al. 2016	Qualitative	75
Carman et al. 2011	Quantitative non-randomized	25
Demonchy et al. 2014	Quantitative non-randomized	100
Georgen et al. 2006	Quantitative non-randomized	100
Boudreaux et al. 2009	Quantitative descriptive	100
Boudreaux et al. 2012	Mixed methods	75
Existing Technology		
Sard et al. 2008	Quantitative non-randomized	75
Sedlmayr et al. 2013	Mixed methods	75
Zafar 2012	Quantitative descriptive	75

Appendix G

Conceptualization of Acceptance Outcomes

Acceptance domain	Outcome
Attitudes/Beliefs	Usefulness Time expense Effort (Comfort/ Perceived competence) Medico-legalities Impact on care and resource utilization Availability of IT resources Appropriateness/ Compatibility with workflow Heuristic characteristics[1] Perceived control/ autonomy Professional and social norms (ED culture) Resistance to change
Experience	Relevancy of information Organization of information User interface Speed/ Efficiency Length Accessibility Understandability
Intention to Use	Intended frequency of use Intended use by differential diagnoses Intended absolute use
Actual Use	Proportion of patient cases/orders Frequency of use Adherence

Appendix H

Final Version of Questionnaire

Adolescent Alcohol Interventions in the Emergency Department: Clinician Practices and Technology Acceptance

Estimated time to complete: 10 minutes max.

Demographics

1. **How many years have you been practicing as a physician?** _____Years (Approx.)

2. **Do you have pediatric emergency fellowship training?** ☐ Yes ☐ No

3. **Is your primary clinical work in the pediatric emergency department?** ☐ Yes ☐ No

4. **What is your age?** _____ Years

5. **What is your sex?** ☐ Male ☐ Female

Training

6. **During your professional training (i.e., medical school, residency, fellowship), about how many lecture/seminar hours were devoted to alcohol problems?**

   ☐ None ☐ 1 – 10 hours ☐ 11 – 25 hours ☐ >25 hours

7. **Since your professional training ended, about how many continuing medical education (CME) hours have you completed on alcohol problems?**

   ☐ None ☐ 1 – 2 hours ☐ 3 – 5 hours ☐ >5 hours

8. **Please choose the statement that best describes the amount of clinical experience you have counseling adolescents about alcohol use.**

   I have:
   ☐ little or no experience.
   ☐ a small amount of experience.
   ☐ a moderate amount of experience.
   ☐ a large amount of experience.
   ☐ a very extensive amount of experience.

Current Practices and Opinions on Alcohol Interventions

Alcohol Intervention in the ED involves SBIRT (Screening, Brief Intervention, Referral to Treatment):

- **Screening:** Identifying hazardous and harmful alcohol consumption using validated instruments such as the CRAFFT, RAFFT, AUDIT, or CAGE. Abbreviations: CRAFFT – Car, Relax, Alone, Forget, Friends, Trouble; RAFFT – Relax, Alone, Forget, Friends, Trouble; AUDIT – Alcohol Use Disorders Identification Test; CAGE – Cut down, Annoyed, Guilty, Eye opener

  *(**Harmful drinking** refers to alcohol consumption patterns that cause damage to physical and/or mental health. **Hazardous drinking** refers to alcohol consumption patterns that are likely to cause harm and dysfunction if behavior persists.)*

- **Brief Intervention:** Counseling to increase awareness of consequences and elicit change in consumption behaviour (eg., motivational interviewing and feedback)
- **Referral to Treatment:** Connecting identified high risk patients to specialty treatment services

9. Please choose the response that best describes your current clinical practice:

When treating an adolescent for alcohol-related problems, I administer all of, or a part of, alcohol SBIRT.

☐ Never ☐ Rarely ☐ Sometimes ☐ Usually ☐ Always

If *"Never"* for 9, REDCap will take the participant to question 10.
If *"Rarely", "Sometimes", "Usually",* or *"Always"* for 9, REDCap will go to question 11.

10. Why? Please check all that apply: ☐ Not enough time ☐ No tools ☐ No resources
☐ Not comfortable ☐ Competing priorities
☐ Other, please specify: _____

11. On these occasions (when treating an adolescent with alcohol-related problems), do you conduct:

a) **Screening:** ☐ Yes ☐ No

If "Yes", **Do you use a validated tool?** ☐ Yes ☐ No

If "Yes", **Which tool(s) do you use? Check all that apply:** ☐ CRAFFT ☐ RAFFT
☐ AUDIT ☐ CAGE
☐ Other, please specify: _____

b) **Brief Intervention:** ☐ Yes ☐ No

c) **Referral to Treatment:** ☐ Yes ☐ No

12. I am comfortable addressing alcohol drinking behaviours with adolescent patients.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Slightly agree | **5** – Moderately agree | **6** – Strongly agree

13. I am confident in my knowledge of the alcohol SBIRT protocol.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Slightly agree | **5** – Moderately agree | **6** – Strongly agree

14. I am confident in my ability to conduct alcohol SBIRT with adolescent patients.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Slightly agree | **5** – Moderately agree | **6** – Strongly agree

15. Alcohol use among adolescents is a problem that needs to be addressed in the emergency department.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Undecided/ neutral | **5**– Slightly agree | **6** – Moderately agree | **7** – Strongly agree

16. It is my responsibility to address alcohol related problems with adolescent patients when it is clinically appropriate.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Undecided/ neutral | **5**– Slightly agree | **6** – Moderately agree | **7** – Strongly agree

If "Undecided/neutral", *"Slightly disagree", "Moderately Disagree",* or *"Strongly disagree"*, REDCap will take participant to question 17.

17. In your opinion, whose responsibility is it to address alcohol related problems with adolescent patients?

_____

18. In your opinion, harmful and hazardous alcohol drinking behaviour can be treated in the emergency department. *(Click here for definitions of harmful and hazardous drinking)*

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Slightly agree | **5** – Moderately agree | **6** – Strongly agree

Technology-based, Alcohol SBIRT

Technology-based, Alcohol SBIRT system: Any electronic- or web-based platform that facilitates the delivery of screening, brief intervention, and referral to treatment.

Examples: Waiting room kiosks for alcohol screening; tablets to access tailored feedback and clinician decision support on brief intervention and referral options.

19. I am comfortable using technology to facilitate patient care in the emergency department.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Slightly agree | **5** – Moderately agree | **6** – Strongly agree

20. Using a technology-based, alcohol SBIRT system would:

a) **Improve clinical care.**

1 – Extremely unlikely | **2** – Quite unlikely | **3** – Slightly unlikely | **4** – Not sure | **5**– Slightly likely | **6** – Quite likely | **7** – Extremely likely

b) **Make it easier to do my job.**

1 – Extremely unlikely | **2** – Quite unlikely | **3** – Slightly unlikely | **4** – Not sure | **5**– Slightly likely | **6** – Quite likely | **7** – Extremely likely

c) **Enable higher efficiency during clinical care.**

1 – Extremely unlikely | **2** – Quite unlikely | **3** – Slightly unlikely | **4** – Not sure | **5**– Slightly likely | **6** – Quite likely | **7** – Extremely likely

21. It would be easy for me to become skillful at using a technology-based, alcohol SBIRT system.

1 – Extremely unlikely | **2** – Quite unlikely | **3** – Slightly unlikely | **4** – Not sure | **5**– Slightly likely | **6** – Quite likely | **7** – Extremely likely

22. A technology-based, alcohol SBIRT system is applicable to my job.

1 – Strongly disagree | **2** – Moderately disagree | **3** – Slightly disagree | **4** – Not sure | **5**– Slightly agree | **6** – Moderately agree | **7** – Strongly agree

23. My colleagues would advocate the use of a technology-based, alcohol SBIRT system.

1 – Extremely unlikely | **2** – Quite unlikely | **3** – Slightly unlikely | **4** – Not sure | **5**– Slightly likely | **6** – Quite likely | **7** – Extremely likely

24. Implementing a technology-based, alcohol SBIRT system would modernize/ innovate the care that is provided in my emergency department.

1 – Extremely unlikely **2 –** Quite unlikely **3 –** Slightly unlikely **4 –** Not sure **5–** Slightly likely **6 –** Quite likely **7 –** Extremely likely

25. My emergency department has the resources to support and sustain a technology-based, alcohol SBIRT system

1 – Strongly disagree **2 –** Moderately disagree **3 –** Slightly disagree **4 –** Not sure **5–** Slightly agree **6 –** Moderately agree **7 –** Strongly agree

26. The availability of a technology-based, alcohol SBIRT system would _____ my current practice of alcohol SBIRT.

☐ Significantly increase ☐ Moderately increase ☐ Slightly increase ☐ Have no effect on

☐ Slightly decrease ☐ Moderately decrease ☐ Significantly decrease

27. If available, I would use a technology-based, alcohol SBIRT system.

1 – Extremely unlikely **2** – Quite unlikely **3** – Slightly unlikely **4** – Slightly likely **5** – Quite likely **6** – Extremely likely

Personal Experience

28. Has someone you personally know (other than one of your patients) had a problem with alcohol?

☐ Yes ☐ No ☐ Decline to answer

If "*Yes*", REDCap will take participant to question 29.

29. How close was/is this person to you?

☐ Acquaintance ☐ Friend ☐ Extended family member

☐ Immediate family member ☐ Colleague ☐ Decline to answer

(French version)

Interventions dans les services d'urgence pour les adolescents qui consomment de l'alcool : Acceptation des pratiques et de la technologie par les cliniciens

Temps estimé pour répondre au sondage : 10 minutes

Données démographiques

1. **Depuis combien d'années pratiquez-vous comme physicien?** _____ans (environ)

2. **En moyenne, combien de quarts de travail clinique travaillez-vous chaque mois dans le service d'urgence pédiatrique?** _____ quarts/mois

3. **Quel âge avez-vous?** _____ ans

4. **De quel sexe êtes-vous?** ☐ masculin ☐ féminin

Formation

5. **Durant votre formation, combien d'heures environ de conférences ou de séminaires ont-elles été consacrées aux problèmes liés à l'alcool?**

   ☐ Aucune ☐ 1 – 10 heures ☐ 11 – 25 heures ☐ >25 heures

6. **Depuis la fin de votre formation, combien d'heures environ de formation médicale continue (FMC) avez-vous consacrées aux problèmes liés à l'alcool?**

   ☐ Aucune ☐ 1 – 2 heures ☐ 3 – 5 heures ☐ >5 heures

7. **Veuillez choisir l'énoncé qui décrit le mieux votre expérience clinique acquise à conseiller les adolescents à propos de la consommation d'alcool.**

   J'ai : ☐ peu ou pas d'expérience.
   ☐ un peu d'expérience.
   ☐ une expérience moyenne.
   ☐ une expérience importante.
   ☐ une expérience très étendue.

Pratiques actuelles et convictions concernant les interventions liées à l'alcool

L'intervention liée à l'alcool dans les services d'urgence suit le modèle SBIRT (Screening, Brief Intervention, Referral to Treatment) :

- **Dépistage (Screening):** Déterminer qu'il existe une consommation d'alcool dangereuse et nocive à l'aide d'instruments validés tels que CRAFFT, RAFFT, AUDIT, ou CAGE.

  *(**La consommation d'alcool nocive** fait référence aux comportements de consommation d'alcool qui sont mauvais pour la santé physique ou mentale. **La consommation d'alcool dangereuse** fait référence aux comportements de consommation d'alcool pouvant être préjudiciable ou cause de dysfonction si le comportement persiste.)*

- **Intervention ponctuelle (Brief Intervention):** Consultation psychologique visant à améliorer la sensibilisation aux conséquences et à susciter un changement dans le comportement du consommateur d'alcool (par ex. : techniques d'entrevue motivationnelle et rétroaction).

- **Orientation vers le traitement (Referral to Treatment):** Mettre en contact des patients identifiés à risque élevé avec les services de traitement spécialisés.

8. Veuillez choisir la réponse qui décrit le mieux votre pratique clinique actuelle :

a) **Lors du traitement d'un adolescent ayant des problèmes mentaux, j'administre tout ou une partie du modèle SBIRT pour l'alcool.**

☐ Jamais ☐ Rarement ☐ Quelques fois ☐ Généralement ☐ Toujours

b) **Lors du traitement d'un adolescent ayant des problèmes liés à l'alcool, j'administre tout ou une partie du modèle SBIRT pour l'alcool.**

☐ Jamais ☐ Rarement ☐ Quelques fois ☐ Généralement ☐ Toujours

9. Pourquoi? Veuillez cocher toutes les réponses qui s'appliquent :

☐ Pas assez de temps ☐ Pas d'outils ☐ Pas de ressources

☐ Pas à l'aise ☐ Autres priorités

☐ Autre, veuillez préciser : _____

10. À ces occasions (lors du traitement d'un adolescent ayant des problèmes liés à l'alcool), effectuez-vous :

a) **Un dépistage :** ☐ Oui ☐ Non

Si « Oui », **utilisez-vous un outil validé?** ☐ Oui ☐ Non

Si « Oui », **quels outils utilisez-vous? Cochez tous ceux qui s'appliquent :**

☐ CRAFFT ☐ RAFFT

☐ AUDIT ☐ CAGE

☐ Autre, veuillez préciser : _____

b) **Une intervention ponctuelle :** ☐ Oui ☐ Non

c) **Une orientation vers le traitement :** ☐ Oui ☐ Non

11. Je n'ai pas d'inconvénient à parler des comportements de consommation d'alcool avec mes patients adolescents.

1. Pas du tout d'accord | 2. Modérément en désaccord | 3. Plutôt en désaccord | 4. Plutôt en accord | 5. Modérément en accord | 6. Tout à fait en accord

12. J'ai confiance en mes connaissances du protocole SBIRT pour l'alcool.

1. Pas du tout d'accord | 2. Modérément en désaccord | 3. Plutôt en désaccord | 4. Plutôt en accord | 5. Modérément en accord | 6. Tout à fait en accord

13. Je me sens compétent dans l'utilisation du modèle SBIRT pour l'alcool avec mes patients adolescents.

1. Pas du tout d'accord | 2. Modérément en désaccord | 3. Plutôt en désaccord | 4. Plutôt en accord | 5. Modérément en accord | 6. Tout à fait en accord

14. La consommation d'alcool chez les adolescents est un problème qui doit être abordé dans les services d'urgence.

1. Pas du tout d'accord | 2. Modérément en désaccord | 3. Plutôt en désaccord | 4. Indécis | 5. Plutôt en accord | 6. Modérément en accord | 6. Tout à fait en accord

15. Cela fait partie de mes responsabilités d'aborder les problèmes liés à l'alcool avec les patients adolescents, quand il est approprié.

1. Pas du tout d'accord | 2. Modérément en désaccord | 3. Plutôt en désaccord | 4. Indécis | 5. Plutôt en accord | 6. Modérément en accord | 6. Tout à fait en accord

16. À votre opinion, qui est responsable d'aborder les problèmes liés à l'alcool avec les patients adolescents?

_____

17. À votre opinion, les comportements de consommation d'alcool nocive et dangereuse peuvent-ils être traités dans les services d'urgence? *(Cliquez ici pour les définitions de consommation d'alcool nocive et dangereuse.)*

1. Pas du tout d'accord | 2. Modérément en désaccord | 3. Plutôt en désaccord | 4. Plutôt en accord | 5. Modérément en accord | 6. Tout à fait en accord

Modèle SBIRT technohabilité pour l'alcool

Système du modèle SBIRT technohabilité pour l'alcool : Toute plateforme électronique ou basée sur le Web qui facilite le dépistage, l'intervention ponctuelle et l'orientation vers le traitement.

Exemples : Kiosques dans les salles d'attente pour le dépistage de l'alcool; tablette pour accéder à la rétroaction personnalisée et pour le soutien à la décision du clinicien d'effectuer une intervention ponctuelle, et pour le soutien aux options d'orientation.

18. Je n'ai pas d'inconvénient à utiliser la technologie pour faciliter les soins aux patients dans le service d'urgence.

1. Pas du tout d'accord
2. Modérément en désaccord
3. Plutôt en désaccord
4. Plutôt en accord
5. Modérément en accord
6. Tout à fait en accord

19. L'usage du système SBIRT technohabilité pour l'alcool pourrait :

a) Améliorer les soins cliniques.

1. Très improbable
2. Assez improbable
3. Plutôt improbable
4. Je ne sais pas
5. Plutôt probable
6. Assez probable
7. Tout à fait probable

b) Rendre mon travail plus facile.

1. Très improbable
2. Assez improbable
3. Plutôt improbable
4. Je ne sais pas
5. Plutôt probable
6. Assez probable
7. Tout à fait probable

c) Améliorer l'efficience durant les soins cliniques.

1. Très improbable
2. Assez improbable
3. Plutôt improbable
4. Je ne sais pas
5. Plutôt probable
6. Assez probable
7. Tout à fait probable

20. Je pourrais facilement devenir compétent dans l'usage du système SBIRT technohabilité pour l'alcool.

1. Très improbable
2. Assez improbable
3. Plutôt improbable
4. Je ne sais pas
5. Plutôt probable
6. Assez probable
7. Tout à fait probable

21. Un système SBIRT technohabilité pour l'alcool peut s'appliquer à mon travail.

1. Pas du tout d'accord
2. Modérément en désaccord
3. Plutôt en désaccord
4. Je ne sais pas
5. Plutôt en accord
6. Modérément en accord
7. Tout à fait en accord

22. Mes collègues soutiendraient l'utilisation du système SBIRT technohabilité pour l'alcool.

1. Très improbable
2. Assez improbable
3. Plutôt improbable
4. Je ne sais pas
5. Plutôt probable
6. Assez probable
7. Tout à fait probable

23. L'implantation d'un système SBIRT technohabilité pour l'alcool moderniserait et innoverait les soins fournis dans mon service d'urgence.

1. Très improbable	2. Assez improbable	3. Plutôt improbable	4. Je ne sais pas	5. Plutôt probable	6. Assez probable	7. Tout à fait probable

24. Mon service d'urgence possède des ressources pour soutenir et maintenir un système SBIRT technohabilité pour l'alcool.

1. Pas du tout d'accord	2. Modérément en désaccord	3. Plutôt en désaccord	4. Je ne sais pas	5. Plutôt en accord	6. Modérément en accord	7. Tout à fait en accord

25. La disponibilité d'un système SBIRT technohabilité pour l'alcool pourrait_____ ma pratique actuelle du système SBIRT pour l'alcool.

☐ Beaucoup augmenter ☐ Modérément augmenter ☐ Légèrement augmenter

☐ N'avoir aucun effet sur

☐ Légèrement diminuer ☐ Modérément diminuer ☐ Beaucoup diminuer

26. Si disponible, j'utiliserais un système SBIRT technohabilité pour l'alcool.

1. Très improbable	2. Assez improbable	3. Plutôt improbable	4. Plutôt probable	5. Assez probable	6. Tout à fait probable

Expérience personnelle

27. Connaissez-vous personnellement une personne (autre que l'un de vos patients) ayant un problème d'alcool?

☐ Oui ☐ Non ☐ Refuse de répondre

28. Quelle est ou quelle était la nature de votre relation avec cette personne?

☐ Simple connaissance ☐ Ami ☐ Membre de la famille étendue

☐ Membre de la famille immédiate ☐ Collègue ☐ Refuse de répondre

Appendix I

Supplementary Technology Acceptance Analysis: Relationship with Physician Characteristics

	Jonckheere-Terpstra*	
	Readiness to change[∫]	Intention to use[‡]
Demographics		
Sex	1.31, p=0.19	1.48, p=0.14
Age (years)	-1.29, p=0.20	0.48, p=0.63
Experience practicing as a physician (years)	-1.86, p=0.06	-0.17, p=0.86
Primary clinical work in pediatric emergency department	-1.74, p=0.08	0.82, p=0.41
Personally know someone with alcohol problems	-0.52, p=0.61	-1.41, p=0.16
Training		
Pediatric emergency medicine fellowship training	-0.91, p=0.36	1.12, p=0.26
Alcohol education during professional training (hours)	0.68, p=0.50	0.76, p=0.45
Continuing medical education in alcohol training (hours)	0.07, p=0.95	0.81, p=0.42
Clinical experience counselling adolescents about alcohol use	-0.41, p=0.69	0.40, p=0.69
Attitudes and beliefs		
Comfort addressing alcohol drinking behaviors	-0.84, p=0.40	-0.21, p=0.83
Confidence in knowledge of SBIRT protocol	-1.95, p=0.05	-0.25, p=0.80
Confidence in ability to conduct SBIRT	-1.85, p=0.06	0.30, p=0.76
Harmful and hazardous drinking is treatable in the ED	1.74, p=0.08	3.49, ***p*=0.0005**
Adolescent alcohol use is a problem to be addressed in ED	2.65, ***p*=0.008**	5.31, ***p*=0.00**
Responsibility for addressing adolescent alcohol related problems when clinically indicated	3.39, ***p*=0.0007**	4.63, ***p*=0.00**
SBIRT practice		
Current conduct of SBIRT when treating adolescents for alcohol-related problems	0.90, p=0.37	1.29, p=0.20

Bolded p values are considered statistically significant with $p<0.05$
*Standardized Jonckheere-Terpstra test statistic
[∫]5-point scale (significantly/ moderately decrease, slightly decrease, no effect, slightly increase, significantly/ moderately increase)
[‡]6-point scale (extremely unlikely, quite unlikely, slightly unlikely, slightly likely, quite likely, extremely likely)