



Clinical decision support for tobacco screening and counseling parents of pediatric patients: A qualitative analysis of pediatric emergency department and urgent care professionals

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ABSTRACT

Background: Clinical Decision Support Systems (CDSS) embedded into electronic medical records is a best practices approach. However, information is needed on how to incorporate a CDSS to facilitate parental tobacco cessation counseling and reduce child tobacco smoke exposure (TSE) in Pediatric Emergency Department (PED) and Urgent Care (UC) settings. The objective was to explore the barriers and enablers of CDSS use to facilitate child TSE screening and parental tobacco cessation counseling by PED/UC nurses and physicians.

Methods: We conducted 29 semi-structured, focused interviews with nurses ($n = 17$) and physicians ($n = 12$) at a children's hospital PED/UC. The interview guide included a brief presentation about the design and components of a prior CDSS tobacco intervention. Participants were asked their opinions about CDSS components and recommendations for adapting and implementing the CDSS tobacco intervention in the PED/UC setting. A thematic framework analysis method was used to code and analyze qualitative data.

Results: Participant mean (\pm SD) age was 42 (\pm 10.1) years; the majority were female (82.8%), non-Hispanic white (93.1%), and never tobacco users (86.2%); all were never electronic cigarette users. Four themes emerged: (1) explore optimal timing to complete CDSS screening and counseling during visits; (2) CDSS additional information and feedback needs; (3) perceived enablers to CDSS use, such as the systematic approach; and (4) perceived barriers to CDSS use, such as lack of time and staff.

Conclusions: The CDSS intervention for child TSE screening and parental tobacco cessation during PED/UC visits received endorsements and suggestions for optimal implementation from nurses and physicians.

1. Introduction

Nearly 17% of U.S. children have visited an emergency department (ED) within the past 12 months (National Center for Health Statistics, 2018). ED visit rates are highest among children who are racial/ethnic minorities and have low socioeconomic status (National Center for Health Statistics, 2018). These groups are disproportionately

burdened by tobacco smoke exposure (TSE) (Brody et al., 2019). Several of the leading reasons for ED visits among U.S. children are for potentially TSE-related complaints such as cough, ear pain, and nasal congestion (Rui and Kang, 2017). Approximately half (48%) of children who present to the pediatric ED (PED) and urgent care (UC) settings are exposed to tobacco smoke (Mahabee-Gittens et al., 2015). Many PED/UC visits are for treatment of TSE-related illnesses (Merianos et al., 2016). When compared to unexposed children, chil-

Abbreviations: ED, emergency department; TSE, tobacco smoke exposure; PED, pediatric emergency department; UC, urgent care; EMR, electronic medical record; CDSS, clinical decision support system; BPA, best practice alert; NRT, nicotine replacement therapy; e-cigarette, electronic cigarette.

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dren with TSE have higher healthcare resource utilization (e.g., diagnostic testing), hospital admissions (Merianos et al., 2020), and PED costs at their initial visits, followed by higher frequencies of UC visits and hospital admissions over 12-months (Merianos et al., 2021). Thus, educating parents about the harmful effects of TSE on their child's health during PED/UC visits may motivate parents to accept tobacco dependence treatment (Lepore et al., 2013; Collins et al., 2018), which may lead to decreases in child TSE and associated visits and costs.

Literature reviews revealed that interventions that initiate tobacco cessation counseling and/or referral to outpatient treatment during adult ED visits promote tobacco abstinence (Rabe et al., 2013; Lemhoefer et al., 2017). However, reviews of behavioral interventions designed for parental tobacco cessation and child TSE reduction report these efforts have yielded small improvements in the pediatric clinical setting, calling for more research to gain a better understanding of how to disseminate efficient and effective interventions (Rosen et al., 2014; Behbod et al., 2018). One study conducted in the PED/UC setting showed that a brief smoking cessation intervention promoted a higher number of parents' successful quits and attempted quits, and voluntary home and car smoking bans (Mahabee-Gittens et al., 2015). TSE screening and documentation remain lower in the PED/UC setting than recommended by national organizations. National best practices recommend universal (100%) screening for tobacco use and TSE during all patient encounters (Clinical Practice Guideline Treating Tobacco Use and Dependence 2008 Update Panel, Liaisons, and Staff, 2008; Farber et al., 2015). Currently, only about 60% of PED/UC patients with a potentially TSE-related illness undergo screening (Lustre et al., 2016). Additionally, while PED/UC practitioners are comfortable screening for parental tobacco use, they cite multiple perceived barriers such as lack of training, time, and available materials as hindrances to providing smoking cessation counseling (Mahabee-Gittens et al., 2014). Practitioners have suggested electronic medical record (EMR) prompts to overcome these barriers and help facilitate intervention adoption (Mahabee-Gittens et al., 2014).

A Clinical Decision Support System (CDSS) embedded in the EMR system is a systematic approach that can increase the likelihood of addressing tobacco use screening and counseling (Fiore et al., 2007; Centers for Disease Control and Prevention, 2014). The American Academy of Pediatrics (AAP) considers the use of EMR systems as a best practice to identify children exposed to tobacco smoke and treat parents for tobacco dependence during their child's medical encounter (Farber et al., 2015). The "5A's" is an evidence-based, U.S. Public Health Service guideline for healthcare professionals and systems on tobacco dependence treatment (U.S. Department of Health and Human Services, 2020). The five steps are to "ask" about tobacco use, "advise" tobacco users to quit, "assess" tobacco users' willingness to make a quit attempt, "assist" willing tobacco users to make a quit attempt, and "arrange" follow-up for tobacco users (U.S. Department of Health and Human Services, 2020).

Our team developed and pilot tested an EMR-embedded CDSS to facilitate the "5A's" of parental tobacco cessation counseling among pediatric UC nurses in order to reduce child TSE (Mahabee-Gittens et al., 2016). This two-phase study started with the development and programming of the CDSS plus feedback reports (Phase I), followed by a feasibility and acceptability trial of the CDSS and feedback reports with UC registered nurses over a 3-month period (Phase II) (Mahabee-Gittens et al., 2016). Results from this pilot trial indicated that the CDSS increased screening and counseling by study nurses (Mahabee-Gittens et al., 2017), decreased parents' nicotine dependence and increased parents' motivation to quit smoking, was feasible to incorporate into the busy UC workflow, and was accepted by both study nurses and parental smokers (Mahabee-Gittens et al., 2018). While the CDSS was successful among pediatric study nurses in the UC setting during the trial in 2015–2016, CDSS use was discontinued after the trial due to cessation of funding for CDSS maintenance. Thus, more information is needed on how to expand this tool for use among currently employed

PED/UC nurses and physicians during PED/UC visits. Therefore, the present qualitative study primarily aimed to explore the potential barriers to and enablers of using the CDSS among nurses and physicians during PED/UC visits. A sub-sample of nurses who participated in the current study revealed during the interviews that they also participated in the completed CDSS feasibility trial. Therefore, we explored their historical perspectives on factors that may influence CDSS uptake and use separate from that of non-study nurses.

2. Methods

2.1. CDSS Overview

In Phase I, the CDSS was developed using a mixed-methods design (Mahabee-Gittens et al., 2016). In Phase II, the prospective cohort trial was conducted among UC study nurses. The feasibility and acceptability of the CDSS that facilitated the "5A's" of parental tobacco cessation counseling was tested by study nurses during UC visits from November 2015–January 2016. Phase II included the assessment of intervention components, parental tobacco use behavior, and child TSE.

The CDSS protocol that includes detailed information on the prompts for each of the "5A's" is available elsewhere (Mahabee-Gittens et al., 2016). In brief, the CDSS was added to EMR documentation after the chief complaint in the patients' "Social History" section. The CDSS contained nonmandatory prompts for study nurses to "ask": (1) if the parent smoked inside or outside of the home; and (2) if the child was exposed to tobacco smoke (Mahabee-Gittens et al., 2016). If the EMR-documented answer was "yes" to one of these questions, then a Best Practice Alert (BPA) was provided to prompt nurses to perform the "advise," "assess," and "assist/arrange" steps to be documented outside of the pediatric patients' EMR using the REDCap research database. This process allowed nurses to provide information to parental smokers on quitting smoking and reducing their child's TSE via implementing home and car smoking bans. Nurses were offered an opt-out option to not "advise" (e.g., in case they were too busy or parents refused). Nurses who opted-in to "advise" were provided with assistance on assessing parents' perceptions of the impact smoking has on their child's health, barriers and health benefits to quitting smoking and implementing smoking bans, and goal setting for quitting smoking and reducing child TSE. Nurses then moved onto the "assess" step, which guided them in asking parents if they might be ready to quit smoking in the next 30 days. Parents who answered "yes" were offered assistance. Parents who answered "no" were offered an information packet to use when they were ready to quit.

The "assist" and "arrange" steps were consolidated into the "assist" prompt (Mahabee-Gittens et al., 2016). This included facilitating several direct, "active" referral options selected by the parental smokers who were interested in quitting smoking and providing instructions on implementing home and car smoking bans. Referral options included evidence-based tobacco cessation programs and resources. Nurses could fax a referral to the Quitline or help parents sign up for txt2quit or smokefreeTXT during the visit. Parental smokers were also provided with printed self-help and motivational materials. While information on nicotine replacement therapy (NRT) and other pharmacotherapy options were shared by nurses, parental smokers were directed to over-the-counter sources or their own healthcare providers to be prescribed these options.

In the prior CDSS trial, nurses advised about 26% of parental smokers to quit and 29% assessed their readiness to quit smoking (Mahabee-Gittens et al., 2017). Of those parental smokers, about two-thirds (67%) were interested in quitting in the next 30 days, and study nurses assisted/arranged all parental smokers with information or referrals. Parental smokers were able to select more than one option. Specifically, the majority (84%) of parental smokers received printed self-help and motivational materials and 8% were referred to the Quitline. Parental smokers were also shown smokefree.gov (52%) and txt2quit or smokefreeTXT (16%) and assisted to sign up, if requested. Study nurses re-

ported that they completed all “5A’s” in less than three minutes on average; spending more time with parents who were interested in quitting (Mahabee-Gittens et al., 2017).

Prior to participation, study nurses received training via a 30-minute webinar and attended a 60-minute workshop on how to: facilitate active referrals during the “assist/arrange” steps; document information in the EMR while completing prompts; and how to incorporate the CDSS intervention into the UC visit. For more specific information, please refer to the CDSS study protocol (Mahabee-Gittens et al., 2016). For the current qualitative study, we created a PowerPoint presentation (described below) that demonstrated the CDSS’ user interface, functionality, and components (e.g., training and resources).

2.2. Study sample

For the current qualitative study, we used a stratified purposive sampling design to recruit nurses and physicians in order to gain adequate representation from each of their respective professional groups (Creswell and Creswell, 2013). We sent a recruitment email to invite a total of 297 nurses and 76 physicians to participate via three different listservs. Guided by qualitative research sample size recommendations to gather enough information to “saturate” the topic with no new emerging themes (Creswell and Creswell, 2013), we initially limited study enrollment to the first 30 interested and eligible clinical staff. Eligible participants had direct patient contact and were employed at the children’s hospital where the CDSS was originally developed and tested. This Midwestern, tertiary care children’s hospital has two PEDs and five UCs that is one of the busiest nationwide. Interested potential participants emailed the study team who sent the study information sheet along with a brief PowerPoint presentation about CDSS for them to review prior to the interview, and to schedule an interview time. We recruited 30 participants, but one nurse withdrew. The sample size of 29 was deemed adequate in identifying all themes related to the CDSS and reaching qualitative data “saturation” where no new themes emerged among the PED/UC nurses ($n = 17$) and physicians ($n = 12$). Therefore, no additional recruitment was needed. Our recruitment efforts did not intentionally target prior CDSS study nurses, but five of the 17 (29.4%) nurses included in this study revealed they participated in the prior CDSS trial during their interviews.

2.3. Procedures

The study team conducted all 29 interviews from April 28, 2020 – May 5, 2020. All interviews were conducted virtually due to COVID-19 safety restrictions using a research compliant, internet-based conferencing tool. Two interviewers (ALM, KAF) used the semi-structured interview guide described below to administer the virtual interviews. Each interview lasted about 30–45 min, and began by introducing the study purpose, answering any questions about the study, and receiving verbal consent to participate and be digitally recorded. The conferencing tool’s technology provided moderately accurate mechanical transcriptions of the interviews that were used by the study team to transcribe interviews verbatim and remove any identifying information. Participants were mailed a \$50 debit card upon completion of study activities. A university’s institutional review board reviewed and approved all study procedures.

2.4. Data collection and analysis

The semi-structured interview guide was developed by the study team with expertise in qualitative methods, behavior change, public health, clinical and translational research, and implementation science. Members on the team were two professors with doctoral-level degrees in either health education or clinical psychology, two practicing PED/UC and ED MDs with master-level degrees in either environmental health or public health, and one doctoral-level student research assistant.

The CDSS interview guide included two parts. The first part was a brief oral presentation about the CDSS intervention that corresponded with the visual PowerPoint presentation the study team emailed to all participants and asked them to review prior to the interview. During the first part of the interview, the interviewers walked through the presentation with the interviewees and answered any questions about the CDSS presentation content. The presentation covered details on the CDSS study design, feedback reports, required training, resources (e.g., smokefree.gov), and pictures of the EMR screening prompt (“ask”) followed by the BPA prompts (“advise,” “assess,” “assist/arrange,” and “remind me later” options). During the second part of the interview, participants were asked what they liked and disliked about the CDSS, and what their colleagues might think about it. Participants were also asked about recommendations for adapting the CDSS intervention to make it successful in the PED/UC setting.

Two study team members (ALM and KAF) conducted the interviews. They were responsible for qualitative data coding and analysis using an inductive approach, and met on a regular basis to discuss the iterative process. A thematic framework analysis method was used to develop common themes across the interview transcripts and codes for nurses and physicians (Ritchie et al., 2013). Data obtained from CDSS study nurses were separated from data from non-study nurses during the qualitative analysis since study nurses brought a unique, historical perspective of actual CDSS use to the interview that is important for future implementation strategies (e.g., how CDSS use affected patient flow). The two team members started by independently reading five transcripts, openly coding the text, and generating themes to develop the codebook. The process continued for the remaining 24 interviews. While all discrepancies were resolved via consensus between the two study team members, a third study team member (JSG) was available to resolve any disagreements. After the first round of coding and analyzing all interviews, all transcripts were read a second time to make sure “saturation” was reached with no new information identified, reaching substantial interrater reliability (Cohen’s kappa = 0.61) (McHugh, 2012).

3. Results

Overall, participant mean (\pm SD) age was about 42 (\pm 10.1) years, and the majority were female (82.8%), non-Hispanic white (93.1%), and never tobacco users (86.2%); all were never electronic cigarette (e-cigarette) users (100%) (Table 1). The sample of 17 nurses and 12 physicians had highly similar group averages (\pm SD) on the number of patients they cared for per week (50.9 ± 37.8 and 51.0 ± 29.5 , respectively), and the number of years employed in their current position (7.9 ± 9.2 and 8.3 ± 7.6 , respectively) and employed by the hospital (14.2 ± 8.6 and 14.0 ± 8.5 , respectively). Nurses worked an average of about 31 h per week, and physicians worked an average of about 41 h per week. Of the 29 participants, only one physician reported having received tobacco counseling training in the past year.

Table 2 presents the main themes, sub-themes, and explicatory quotes that emerged on CDSS use to facilitate child TSE screening and parental tobacco cessation counseling in the PED/UC setting.

3.1. Explore optimal timing of CDSS screening and counseling during PED/UC visits

Participants discussed potential optimal timing of using the CDSS during their largely unpredictable PED/UC shifts, which vary in patient acuity and patient volume. The following three sub-themes emerged: (1) incorporate CDSS screening into the clinical flow during triage; (2) incorporate CDSS use into the clinical flow during the PED/UC visit; and (3) incorporate CDSS use into the clinical flow during respiratory care of patients. Nurses and physicians suggested that triage may be a good time to initiate the CDSS by screening for tobacco use and TSE, and following up with parents and their children who screen “positive” for

Table 1
Characteristics of PED/UC Nurses and Physicians.

Characteristic	Overall (N = 29) n (%) ^a	Nurse (n = 17) n (%) ^a	Physician (n = 12) n (%) ^a
Age, M (±SD)	42.4 (±10.1)	39.3 (±9.6)	46.8 (±9.5)
Sex			
Female	24 (82.8)	17 (100.0)	7 (58.3)
Male	5 (17.2)	0 (0.0)	5 (41.7)
Race/Ethnicity			
Non-Hispanic White	27 (93.1)	17 (100.0)	10 (83.4)
Non-Hispanic Other/Unknown	2 (6.9)	0 (0.0)	2 (16.6)
Education Level			
College graduate/some post-college	9 (31.0)	9 (52.9)	0 (0.0)
Master's degree	8 (27.6)	8 (47.1)	0 (0.0)
MD/DO	12 (41.4)	0 (0.0)	12 (100.0)
Tobacco Use Status			
Never tobacco user	25 (86.2)	15 (88.2)	10 (83.4)
Former tobacco user	3 (10.3)	2 (11.8)	1 (8.3)
Unknown (did not wish to answer)	1 (3.5)	0 (0.0)	1 (8.3)
E-Cigarette Use Status			
Never e-cigarette user	29 (100.0)	17 (100.0)	12 (100.0)
Number of Work Hours/Week, M (±SD)	35.0 (±10.9)	30.7 (±7.4)	41.0 (±12.5)
Number of Patients Cared For/Week, M (±SD)	51.0 (±34.0)	50.9 (±37.8)	51.0 (±29.5)
Number of Years in Current Position, M (±SD)	8.1 (±8.5)	7.9 (±9.2)	8.3 (±7.6)
Number of Years at the Hospital in Any Position, M (±SD)	14.1 (±8.4)	14.2 (±8.6)	14.0 (±8.5)
Tobacco Counseling Training in Past Year			
No	26 (89.7)	16 (94.1)	10 (83.4)
Yes	1 (3.4)	0 (0.0)	1 (8.3)
Don't know	2 (6.9)	1 (5.9)	1 (8.3)

^a n and column percent unless noted otherwise.

tobacco use and TSE and provide the CDSS pop-up portion of counseling during the PED/UC visit. It was recommended that CDSS counseling should be provided during the middle of the visit when patients are in their PED/UC rooms. This timing was perceived as having the most potential for engaging families' full attention during their long wait times while not interrupting pediatric patients' acute care or having them extend their stay past discharge when they are ready to leave. Non-study nurses (i.e., those who did not participate in the prior CDSS trial) and physicians recommended that another optimal time to complete CDSS screening and counseling could be when patients are receiving care for respiratory illnesses (e.g., nebulizer treatments, suctioning) during their PED/UC visits.

3.2. CDSS additional information and feedback needs

Participants discussed additional information and feedback needs for CDSS use including: (1) add a super trainer resource; (2) add a NRT option to the CDSS intervention and receive related training on NRT administration to adults; (3) add an option to the CDSS intervention to follow-up with families who received counseling and referrals; (4) add cannabis screening and counseling options to the CDSS intervention; (5) receive feedback on individual CDSS use patterns; and (6) receive feedback on the impact of CDSS use on patient health outcomes. Participants liked the idea of having a super trainer or a "practice leader" available during their PED/UC shift to answer any questions and to provide ongoing training, when needed. While nurses and physicians suggested adding an option to offer NRT to parents, they expressed the need for training on administration to parents who are not their direct patients. Participants also expressed interest in the option to follow-up with families who received tobacco counseling and referrals to ensure parents were successful with signing up and using the resources (e.g., Quitline). Due to the perceived prevalence of cannabis smoking in the PED/UC setting, nurses discussed the need to add cannabis screening and counseling prompts to the CDSS. One study nurse indicated, "When I asked smoking questions, I ended up having to change to 'do you smoke tobacco' because people would just laugh or it was really awkward." Concerning feedback, all professional groups stated that they would like feedback on their individual use patterns as well as feedback on the impact CDSS use has

on treatment efficacy and patients' health outcomes to encourage their future CDSS use.

3.3. Perceived enablers to CDSS use in the PED/UC setting

Perceived enablers to CDSS use in the PED/UC setting sub-themes that emerged were the: (1) systematic approach of CDSS; (2) EMR-embedded CDSS functionality; and (3) CDSS brief electronic prompts and referrals. Participants of all professional groups discussed the systematic approach of the CDSS as an enabler for future use, such as describing the CDSS as "clear step-wise" and "standard and could be done pretty efficiently and quickly." Participants also appreciated the EMR-embedded CDSS functionality, such as how it is "automated" and "makes it a lot more part of the routine to have it in [the hospital's EMR system]." Participants "liked the prompting" and referral features that "seem not to take too much time" and would allow them to be "actively engaging with the family and setting them up with resources then and there."

3.4. Perceived barriers to CDSS use in the PED/UC setting

Perceived barriers to CDSS use in the PED/UC setting sub-themes that emerged were: (1) EMR alert fatigue; (2) lack of time and staff; and (3) adult tobacco treatment in the pediatric healthcare setting. Physicians, unlike the two nurse groups, mentioned EMR alert fatigue and that they "have so many BPAs that it would be easy to skip over it saying 'I don't have time right now'." A shared concern among all professional groups was perceiving lack of time and staffing issues as barriers to using the CDSS for every patient in the PED/UC setting. Another shared concern among non-study nurses and physicians, but not expressed by prior CDSS study nurses, was providing tobacco treatment in the pediatric healthcare setting to adults who are "not the patient [and] you do not know anything about their health history," and so they "do not feel comfortable prescribing medications for adults in general."

4. Discussion

The use of the CDSS intervention to facilitate parental tobacco cessation and reduce child TSE in the PED/UC setting was largely endorsed by

Table 2

Themes of CDSS Use to Facilitate Child TSE Screening and Parental Tobacco Cessation Counseling among Nurses and Physicians in the PED/UC Setting.

Main Theme	Sub-theme	Professional Group Non-Study Nurse (n = 12)	Study Nurse (n = 5)	Physician (n = 12)	Sample Responses
Explore Optimal Timing to Complete CDSS Screening and Counseling during PED/UC Visits	Incorporate CDSS Screening into the Clinical Flow during Triage	✓	✓	✓	"Five minutes is not very long, but in the triage setting it might be very difficult to add on five more minutes. If they could ask part of it and the rest could be followed up in the back when they get into a room, I think that would be awesome." – Non-Study Nurse
	Incorporate CDSS Use into the Clinical Flow during the PED/UC Visit	✓	✓	✓	"A lot of people do not want to wait after their visit to do more questions. When they are ready to go, they are ready to go. There are two places people do not want to be interfered with: when they are at the beginning when they think that the doctor is going to hurry up and come in, and at the very end when they are ready to go home. They do not want anything to interfere with those two points of their visit. If you are going to get them to do anything, it has got to be in the middle... but almost every patient has two hours in the middle when they are just waiting." – Physician
	Incorporate CDSS Use into the Clinical Flow during Respiratory Care of Patients	✓		✓	"With the respiratory kids, when they get their breathing treatment they are stuck in the room for a while so that would be something respiratory therapists could talk with the parents [about] or even the nurses. There are times during that type of care that you are in the room for a little bit. Even with [patients with] bronchiolitis, when you are in there suctioning or when you are giving education regarding the use of the spacer, there is times when you are in the room going over education. That might not be a bad time to implement that kind of discussion." – Non-Study Nurse
CDSS Use Additional Information and Feedback Needs	Add a Super Trainer Resource	✓	✓	✓	"I like super users. I think it helps to have some ongoing support, just as I think reminders are good especially as we have new people come in. It is nice for them to have regular training like everybody else versus being taught by someone else. Just make sure what they are getting is accurate." – CDSS Study Nurse
	Add NRT Option to CDSS and Receive Training on NRT Administration to Adults	✓	✓	✓	"A lot of times you do not have any tools to offer them. I would prescribe [NRT medication] if I was given the training." – Physician
	Add Option to CDSS to Follow-Up with Families who Received Counseling and Referrals	✓	✓	✓	"I would like [CDSS] if there was a little bit more of an option for somebody following up with outpatients like a post-visit nurse. If there was a way for us to send a message to a parent [that] had expressed interest in quitting, and then they could follow-up with the parent and say did you have any problem signing up for Quitline?" – Non-Study Nurse
	Add Cannabis Screening and Counseling Options to CDSS	✓	✓		"It would be interesting if there could be an addition for marijuana because we do get a lot of like marijuana smokers in the emergency room as well." – Non-Study Nurse
	Receive Feedback on Individual CDSS Use Patterns	✓	✓	✓	"I think that [feedback is] good. That way we can see how we are making improvements or what we are doing is good. I think that is nice and I know a lot of people I work with do like feedback." – Non-Study Nurse
Enablers of CDSS Use	Receive Feedback on the Impact of CDSS Use on Patient Health Outcomes	✓	✓	✓	"I think it is very well-designed, and especially if you have the data to show that it is effective, I think that is very powerful. If you look at it in isolation, I think it would be a no brainer to try to put in the outcomes [that] are important." – Physician
	Systematic Approach of CDSS	✓	✓	✓	"I like how it is set up in a systematic approach. That there is not like 'you need to go here'. It is like this is how you ask them, these are resources that you can say we can set you up [with] right now. We can refer them. You are not just saying here is your handout, put you on your way. If you have somebody who is engaged in quitting smoking, you are setting them up with all of the handouts and referrals to be successful. You are setting them up so they will not fail." – Non-study Nurse
	EMR-Embedded CDSS Functionality	✓	✓	✓	"The automatic prompt within the charting, I mean if that was not there then I probably would not have done it, but as soon as you click it you are at the smoking cessation questions there for us to read." – CDSS Study Nurse
Barriers of CDSS Use	CDSS Brief Electronic Prompts and Referrals	✓	✓	✓	"I like that it has resources easily built into it. This follows a very logical tree, and it gives you the next step to be able to, even if you did not have much or any training in this, but just by following through the prompts you could probably do a relatively decent job with this. I like that it has an element of foolproof-ness built into it and it also has meaningful resources that you get to use, if applicable." – Physician
	EMR Alert Fatigue			✓	"We do have BPA or alert fatigue. You just have so many pop ups or so many alerts." – Physician
	Lack of Time and Staff	✓	✓	✓	"In the UC setting, some days it seems like all of those steps we would have time for and another day it does not seem like we would. We just do not have the resources as far as people goes to spend a lot of time going over extra stuff. Not that I do not think it impacts my patients' health. It does, but just from a standpoint of we only have so many beds and only have so many nurses and a patient care assistant, and we have a lot of people waiting." – CDSS Study Nurse
	Adult Treatment in the Pediatric Healthcare Setting	✓		✓	"We are pediatricians. I am not super comfortable treating adults. The knowledge that I am not going to harm them by giving them this [NRT] patch. I know that they are being harmed by smoking, but that is not me giving them the prescription to smoke. I am giving them the nicotine and so I am intimidated by that." – Physician

Abbreviations: CDSS, clinical decision support system; PED, pediatric emergency department; UC, urgent care; NRT, nicotine replacement therapy; EMR, electronic medical record.

nurses and physicians. The current study identified four major themes shared among the 24 interviews with non-study nurses and physicians as well as the sub-sample of five prior CDSS study nurses who participated in the feasibility trial. While all three professional groups shared each theme, several sub-themes differed slightly between the groups. For example, the sub-sample of prior study nurses did not suggest incorporating CDSS use into the clinical flow during patients' respiratory care and did not express the barrier of adult treatment in the pediatric healthcare setting. One potential explanation is that the majority of CDSS study nurses who participated in the feasibility trial perceived the CDSS as fitting easily into the clinical flow and useful to help address parental smoking (Mahabee-Gittens et al., 2017). Therefore, non-study nurses and physicians who have not yet used the CDSS may have different perceptions on optimal timing recommendations after actually using the CDSS in the PED/UC environment.

The systematic approach and potential timing of automatic prompts of offering the CDSS during visits are important, as found in other qualitative and systematic review studies on incorporating an interface into hospital EMRs (Kawamoto et al., 2005; Koskela et al., 2016; Jensen and Bossen, 2016). Nurses and physicians in the current study expressed that the CDSS' systematic approach and EMR-embedded nature would encourage them to use the CDSS in the unique PED/UC setting, which has been proven acceptable and usable for parental tobacco treatment in UC, primary care, and inpatient settings (Jenssen et al., 2016, 2016; Mahabee-Gittens et al., 2017). However, lack of time and lack of staff during shifts were identified by all professional groups in the current study as potential barriers to regular CDSS use. EMR alert fatigue was also mentioned as a barrier by the physician group. One potential explanation for the difference in perspectives between both nurse groups versus the physician group is that nurses may have higher EMR alert acceptance rates compared to physicians, which has been found in prior work (Ancker et al., 2017). Physicians may be less accepting of alerts due to a high number of medication alerts, which lead to fatigue and high override rates (Van Dort et al., 2021). Similar to prior literature (Castillo and Kelemen, 2013; Ford et al., 2021; Shi et al., 2021), our findings indicate that clinical flow, education, resources, and the right number of automated alerts are vital to facilitating successful CDSS use in a future intervention study and reducing alert proliferation leading to alert fatigue. Further, involving end users (e.g., nurses and physicians) in the design of CDSS alerts is important as it may lead to acceptance and use of the CDSS (Van Dort et al., 2021). Further, all professional groups suggested firing the pop-up alert for the CDSS screening portion during triage to be completed by the triage nurse. If the family member screened "positive" for current tobacco use or the child screened "positive" for TSE, participants suggested firing the alerts for the CDSS counseling and referral portion during the middle of the PED/UC visits when patients and their families typically have ample time while waiting for care. This approach could potentially reduce the barriers of interfering with clinical flow and staffing, and reduce the BPAs to fire only among patients and their parents who screen "positive" for parental tobacco use and child TSE during triage.

All nurse groups mentioned the need to add cannabis screening and counseling to enhance the CDSS tool, but this was not shared by the physician group. One possible reason for professional group differences is that nurses are typically the ones who ask the screening questions, and who would thus identify parents who smoke cannabis. Specifically, one prior CDSS study nurse mentioned that when she asked the screening question about whether the parent smoked inside or outside of the home, she had to specify smoking tobacco rather than cannabis. Adult cannabis use trends have increased in recent years (Schulenberg et al., 2020), including frequency of use and cannabis use disorders after recreational cannabis legalization in some U.S. states (Cerdá et al., 2020). Cannabis smoke exposure could be detrimental to children's health (National Academies of Sciences, Engineering, and Medicine et al., 2017), and trends show that cannabis use is four-fold greater among cigarette smokers who live with children (Goodwin et al., 2018). There-

fore, future research is needed on cannabis use and smoke exposure programming for the pediatric healthcare setting, especially for concurrent tobacco and cannabis use and exposures.

Another key finding was that participants were very interested in receiving feedback on their individual use patterns as well as the impact CDSS use may have on their patients' health. A review of EMR use for prompting and providing feedback on clinical tobacco treatment yielded promising findings, but called for additional studies to quantify the effects EMR use has on providers' use behavior and patients' smoking behavior (Boyle et al., 2010). While we are planning a future intervention to test the efficacy of the CDSS, systematic reviews found general CDSS use has positive effects on practitioners' performance, including prescribing medications, as well as patients' health outcomes (Kruse and Ehrbar, 2020; Taheri Moghadam et al., 2021). More specifically, CDSS use has been effective for many illnesses (e.g., pulmonary diseases such as pediatric asthma) as indicated by patients' improved symptoms, feedback from providers, disease management, treatment efficacy, and/or screening (Kruse and Ehrbar, 2020; Taheri Moghadam et al., 2021). Further, the current study revealed that all professional groups shared the need for a point of contact as a training resource (e.g., super trainer) and intervention training on offering NRT to adults during their child's visit. This would help to alleviate the perceived barrier of treating adults in the pediatric healthcare setting, especially since promoting adult prevention treatments in pediatric settings is recommended for treatment of tobacco use (Farber et al., 2015), as well as other prevention efforts (e.g., vaccinations, postpartum depression) (Lessin et al., 2012; Earls et al., 2019). Additionally, professional groups perceived that the PED/UC visit could be leveraged to initiate tobacco counseling, but would like the option to follow-up with families regarding referral to treatment during the intervention. While brief advice to quit from physicians has a small effect on adult tobacco cessation rates (Stead et al., 2013), NRT is helpful in increasing tobacco quit rates, and NRT combined with counseling sessions improve rates even further (Clinical Practice Guideline Treating Tobacco Use and Dependence 2008 Update Panel, Liaisons, and Staff, 2008). This supports the need to incorporate an option in our CDSS intervention to follow-up with adult tobacco users and ensure they were able to receive NRT and assistance after efforts were initiated during their child's visits. Potential options to enhance tobacco treatment efficacy could be to add certified tobacco treatment specialists or health education specialists in the PED/UC settings who could focus on follow-up and ensure families have access to appropriate prevention services (e.g., Tobacco Quitline).

4.1. Limitations

This study has several limitations. We used a convenience sample of nurses and physicians who were employed at one children's hospital PED/UC system in the U.S. Midwest. Findings may not be generalizable to other hospital PED/UC systems due to varying clinical flow and EMR systems as well as other geographical locations. Similarly, our findings may not be generalizable to other pediatric health care settings (e.g., preventive care). Finally, social desirability bias may have influenced qualitative reports of PED/UC nurses and physicians.

4.2. Conclusions

The current qualitative study found that an EMR-embedded CDSS intervention to facilitate brief child TSE screening and parental tobacco cessation treatment was mainly supported for future use in the PED/UC setting. Study findings that may be generalized to other PEDs/UCs include the use of an EMR-embedded, systematic approach to facilitate the "5 A's", and using the CDSS during optimal visit times that do not interfere with the variable, daily PED/UC flow. One suggestion based on this study's findings is to "ask" about parental tobacco use and child TSE with the triage questions. Then, follow up with those who screen

“positive” by performing the “assess,” “assist,” and “arrange” steps during the middle of the children’s visits when waiting to be seen by the physician. Another suggestion for CDSS implementation in the PED/UC setting is to add an NRT option to the “assist/arrange” step along with pharmacological training for providers so that they can actively prescribe NRT to parents during their child’s visits. Adding an option to follow up with the families after initiating tobacco cessation counseling is highly encouraged to provide additional support to increase quit rates and implementation of home and car smoking bans. Screening for other parental substance use (e.g., cannabis use) that may impact the health of the pediatric patient population is also recommended. More research is needed to develop and test a comprehensive CDSS that addresses individual substance use as well as concurrent use (e.g., concurrent tobacco and cannabis use).

Future CDSS intervention planning in our PED/UC setting will consider optimal timing recommendations for CDSS use, incorporate additional information needs (e.g., add NRT option and training, cannabis use screening) and feedback requests (e.g., treatment efficacy), leverage enablers to CDSS use, and address barriers to CDSS use to increase adoption and use by PED/UC professionals. In conclusion, the current study will inform our implementation plan, which will address previously identified healthcare system barriers to providing evidence-based tobacco treatment in the pediatric healthcare setting including: insufficient health information technology use to identify and treat tobacco use; insufficient training on behavioral and pharmacological treatment; misunderstanding about tobacco treatment safety, usefulness, and effectiveness; and lack of therapeutic support from clinicians and lack of time (Rojewski et al., 2019).

Contributors

ALM conceptualized and designed the study, conducted interviews, analyzed and interpreted the data, drafted the manuscript, and approved the final manuscript as submitted. KAF conducted interviews, analyzed and interpreted the data, drafted the manuscript, and approved the final manuscript as submitted. EMMG conceptualized and designed the study, supervised the acquisition and interpretation of data, revised the manuscript for important intellectual content, and approved the final manuscript as submitted. MSL conceptualized and designed the study, revised the manuscript for important intellectual content, and approved the final manuscript as submitted. LS revised the manuscript for important intellectual content and approved the final manuscript as submitted. JSG conceptualized and designed the study, supervised the analysis and interpretation of data, revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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