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Utilization of a Clinical Decision Support Tool to Reduce Child Tobacco Smoke Exposure in the Urgent Care Setting

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Keywords

tobacco smoke; smoking; smoking cessation; clinical decision support systems; electronic health record; parent

Introduction

Approximately one in every two children presenting to the Pediatric Emergency Department (PED) and Urgent Care (UC) settings are exposed to tobacco smoke (TSE).¹ Thus, visits to the PED and UC are opportunities for emergency healthcare providers to provide TSE screening of children and tobacco counseling to caregivers. However, rates of screening and counseling for tobacco use by pediatric nurses are low, ranging from 22–43% for screening and 14–25% for advising caregivers to quit.^{2–4} Our previous research shows that pediatric UC nurses recognize the importance of TSE interventions and would like to provide tobacco treatment to caregivers, but they have competing clinical and patient flow issues.^{2,5,6} Efficient and easy-to-use tools are needed to help nurses incorporate TSE treatment into their workflow. Prior studies have shown that the incorporation of clinical decision support system (CDSS) tools into the electronic health record (EHR) facilitates tobacco screening and counseling in the pediatric outpatient and in-patient settings and that these tools are acceptable to pediatric practitioners.^{7–9} However, it is unknown if it is feasible for nurses to incorporate the use of such CDSS tools into their workflow so that they can quickly screen and counsel caregivers who smoke. Moreover, nurses report that if they knew that TSE-

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related treatment would help caregivers quit and decrease TSE in children, they would be more likely to uniformly screen and counsel;⁵ thus research is needed to evaluate the impact of the use of CDSS tools on tobacco-related outcomes.

We developed and incorporated an EHR-based, TSE reduction CDSS for use by nurses in UC sites operated by a large children's hospital. Details on the development, design, and implementation of the CDSS into the EHR are described elsewhere.^{6,10,11} In brief, changes were made to incorporate a modified version of the "5As" of the Clinical Practice Guidelines for Tobacco Use – Ask about tobacco use, Advice to quit, Assess willingness to quit, and Assist/Arrange those who wish to quit with follow-up and resources (e.g. state tobacco quitline (QL), smokefree.gov, smokefreeTXT).¹² Herein, we report on the characteristics, tobacco product use, and child TSE of a sample of caregivers and their children. We also assessed the feasibility of use of the CDSS by nurses, acceptability by caregivers, and potential associations of CDSS use on caregivers' tobacco use and child TSE.

Materials and Methods

Study Setting, CDSS, and Participants

This study occurred in the UC on the main campus at an urban, tertiary care children's hospital; this UC has over 31,000 visits annually. The hospital uses an enterprise EHR (Epic™, Verona, WI) which is fully integrated; all notes and orders are electronic. The "Ask" of the CDSS prompt was embedded within the EHR and the remaining steps were accessed via a link to direct the nurse to the "Advise", "Assess", "Assist/Arrange" prompts located in a Research Electronic Data Capture (REDCap) database.¹³

We recruited a convenience sample of caregivers during a three-month period starting in November 2015. A clinical research coordinator (CRC) approached and screened caregivers. Caregivers were eligible if they: (1) were the parent/legal guardian of a 0–17 year old child presenting to UC; and (2) had been screened by a study nurse using the CDSS and answered "yes" to the prompt: "Do any of the primary caregivers smoke inside or outside of the home?" These caregivers were approached, active smoking status verified, were told about study procedures, and eligibility assessed. Exclusion criteria were: currently in a cessation program; non-English speaking; no working phone number; or plans to move within four months. Eligible caregivers provided informed consent. Children $\geq$ age 11 provided assent. This study was approved by our hospital's Institutional Review Board.

Participant Characteristics, Tobacco Product Use, and Child TSE

At baseline, we collected caregiver and child demographics including: age; sex; race/ethnicity; and insurance type. At baseline and 3-months after baseline, we assessed caregivers' cigarette use, nicotine dependence, motivation to quit and prior quit attempts. To determine nicotine dependence, we used the Heavy Smoking Index (HSI), which is a validated, two-item self-report measure of nicotine dependence (range 0–8) derived from the Fagerstrom Test for Nicotine Dependence; HSI scores ≥ 4 were considered highly nicotine

dependent.^{14,15} Level of motivation to quit was assessed using the Contemplation Ladder (range 0–10).¹⁶

To assess child TSE, at baseline and 3-months, we asked caregivers questions related to smoking in the home or car; saliva samples were obtained to verify reports and biochemically assess TSE on approximately 10% of the sample of children. Children <7 years old were targeted as TSE is known to be higher in younger children.¹⁷ We aimed to obtain approximate uniform sampling by age and racial/ethnic categories seen in our UC. Thus we consented the first caregiver participants who had children in one of 16 strata defined by: age (0–1, 2–3, 4–5, 6–7 years old); sex; and racial (White and African American) groups. We used a standardized protocol to collect saliva; salivary cotinine assays were performed with Enzyme Immunoassay techniques by Salimetrics;¹⁸ children with a cotinine value of >1.0 ng/ml were classified as exposed to tobacco smoke.^{19,20} At baseline, we used adapted measures²¹ to assess if caregivers believed that their child's health would improve if they quit smoking or worsen if they kept smoking (1=strongly disagree to 5=strongly agree). Additionally, at baseline only, we assessed electronic cigarette (EC) use, reasons for use and subjective health effects from EC use, if applicable.

Feasibility

CDSS use was defined as completing any part of the tool beyond the “Ask” step. We collected data in Epic and REDCap on specific rates of nurses performing the “Advise”, “Assess”, “Assist/Arrange” steps on caregivers.

Tobacco Use after Baseline Visit

CRCs conducted phone follow-up at 3-months post-baseline to assess the primary outcome of smoking abstinence. Caregivers who responded affirmatively that: “I haven’t smoked at all, not even a puff”, were classified as abstinent. Self-reported abstinence was verified with exhaled carbon monoxide testing using a Bedfont MicroSmokerlyzerTM machine within four days of this response. We used a cutoff of >6 ppm to indicate a positive smoking result.²² Secondary outcomes were cigarette use, nicotine dependence, quit attempts, motivation to quit, and smoking in the home or car. Caregivers received \$10 compensation at baseline and \$30 at 3-months.

Acceptability of the CDSS

At baseline, we assessed caregivers’ satisfaction with the smoking advice and information they received from the nurse with two questions (1=very unsatisfied/very unhelpful to 5=very satisfied/very helpful). Acceptability of screening and counseling in the UC setting was assessed using two questions (1=strongly disagree to 5=strongly agree).

Analyses

We used descriptive statistics for reporting sociodemographics, tobacco use, and overall satisfaction with the information received. We conducted univariate analysis to examine distributional properties of variables and identify potential outliers. We used t-tests, one-way analysis of variance (ANOVAs), logistic and linear regression models to assess sociodemographic characteristics by baseline smoking behavior. We used multivariable

logistic regression models to determine sociodemographic differences between caregivers who received none of the 5As versus caregivers who received one or more of the 5As based on caregiver and child age, sex, race/ethnicity, education, and insurance, while adjusting for these sociodemographic characteristics independent of statistical significance in each model.

We used generalized estimating equations (GEE) with an exchangeable structure to fit repeated measures regression models to examine use of the CDSS by sociodemographic characteristics, including caregiver age, sex, race/ethnicity, education, insurance type, and changes in caregivers' smoking behaviors from baseline to 3-months. SPSS (version 23.0) and SAS version 9.4 (SAS Institute, Cary, NC) were used for analysis. The alpha level of significance was $<.05$.

Results

Screening and Enrollment

Screening and enrollment data are presented in Figure 1.

Participant Characteristics

Participant characteristics, tobacco use and child TSE, and EC use are displayed in Table 1.

CDSS Feasibility

There were fourteen study nurses and all used the CDSS more than once; the frequencies of use of the prompts was: "Ask"—149(100%); "Advise"—50(35.2%); "Assess"—51 (35.9%); and "Assist/Arrange"—46(32.4%). Of those assisted, 3(6.5%) were referred to the Quitline; 36(78.3%) and 14(30.4%) given information on smokefree.gov and smokefreeTXT, respectively; and 41(28.9%) given written information. There were no significant differences in sex, education, and insurance between caregivers who were advised, assessed, or assisted. Older caregivers had greater odds of being advised (OR for 5 each year increase in age: 1.3 [95%CI:1.1,1.4]), assessed (OR for 5 each year increase in age:1.2 [95%CI: 1.1,1.4), or assisted (OR for 5 each year increase in age: 1.3 [95%CI:1.1,1.4]). African American caregivers had greater odds of being advised (OR 1.4 [95%CI:1.1,1.8] or assessed [OR 1.3 [95%CI:1.1,1.8] compared to White caregivers; there were no statistical differences by race among caregivers who were assisted.

Changes in Tobacco Use

One hundred twenty nine (86.6%) participants completed questionnaires at 3-months; 14 (88%) child saliva samples were obtained. No differences were found between participants who completed 3-month follow-up versus those who were lost to follow-up except for higher motivation to quit in those who completed follow-up (6.60 ± 2.47 vs. 5.73 ± 2.62 , $p=0.006$, respectively).

At 3-months, 10(7.8%) caregivers reported abstinence. Three of 10 (30.0%) completed the CO test, and two-thirds(66.7%) were biochemically confirmed. In addition, 58.9%($n=76$) of caregivers made a quit attempt between baseline and 3-months. Of these, 67.1%($n=51$) had a Contemplation Ladder score of >6 at follow-up indicating that they were thinking about

cutting down or quitting. There were no difference in reported child TSE or cotinine levels from baseline to 3-months.

From baseline to 3-months, there were significant decreases in the number of caregivers who were highly nicotine dependent, and increases in motivation to quit in both unadjusted and adjusted models (Table 2).

CDSS Acceptability

Most caregivers indicated that they were very satisfied/satisfied with the information they received (65.0%;n=93), and that the information was very helpful/helpful (58.0%;n=83). The majority agreed/strongly agreed that “parents should be asked if they smoke in the UC” (68.1%;n=96), and that “smoking advice should be given in the UC” (73.2%;n=109).

Discussion

This study adds to the growing body of research on the use of CDSS to facilitate tobacco screening and counseling of caregivers in a pediatric setting.⁷⁻⁹ We found it was feasible for nurses to incorporate an EHR-based, TSE reduction CDSS into their workflow, and that the majority of caregivers felt screening for TSE and counseling caregivers about tobacco use was acceptable. We found high rates of nicotine dependence in caregivers who smoke consistent with our prior work.^{1,23} Additionally, we found high rates of caregiver-reported TSE with 50% of caregivers allowing smoking in the home or car. Children’s cotinine measurements revealed that 81% were exposed to tobacco smoke, consistent with prior PED research.²⁴ Encouragingly, and similar to our work,^{25,26} 73% of caregivers believed that smoking affected their child’s health, and 87% believed that quitting would improve their child’s health. Our findings that there were demographic differences in those who received counseling has been seen in prior work,⁷ but given the high rates of child TSE, it is essential that all caregivers receive counseling to help reduce TSE.

Although this study was not powered to detect differences in quit rates and TSE, our preliminary findings are promising. Our results show that when nurses incorporated the use of the CDSS into their workflow, caregivers took steps towards quitting smoking. There were significant decreases in heavy nicotine dependence and increases in caregivers’ motivation to quit. Almost 60% of caregivers reported that they made a quit attempt after the UC visit. Further, given the high rates of self-reported and biochemically validated TSE in children, even after this intervention, our findings further underscore the need to conduct TSE treatment in the UC setting.

Our study has several limitations. This study was conducted at one UC site within a large children’s hospital with a fully-integrated EHR, and had a small sample size. Thus, results may not be generalizable to other pediatric UC settings. The vast majority of the participants were women and recipients of government insurance. However, this is typical of studies of smokers in the emergency setting.^{1,27} Finally, no control condition was included.

In conclusion, this study demonstrates that the use of an EHR-embedded CDSS was feasible to incorporate into busy UC nurses’ workloads, acceptable to caregivers, and resulted in

encouraging changes in the smoking behavior of highly nicotine dependent caregivers. These findings warrant future research on EHR-based TSE CDSS to screen and counsel caregivers who smoke in the UC and other acute-care settings.

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Abbreviations:

TSE	tobacco smoke exposure
EHR	electronic health record
CDSS	clinical decision support system
UC	urgent care.

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Figure 1:
Flow of participants in the study

Table 1.**Participant Characteristics (N=149)**

Age	
< 30 years of age	51.0%
Sex	
Female	83.1%
Race	
White	47.0%
African American	45.6%
Education	
< college	61.5%
some college	38.5%
Insurance	
Public insurance or self-pay	84.6%
Mean (SD) cigarettes per day	10.2 (6.27)
Mean (SD) Heavy Smoking Index	4.0 (1.23)
Mean (SD) Motivation to quit (0–10)	5.73 (2.62)
Prior quit attempts	73.8%
Smoking allowed	
In the home	50.0%
In the car	50.7%
Mean (SD) number of smokers in the home	1.49 (0.60)
Mean (SD) days per week in room with smoker	1.59 (2.51)
Mean (SD) days per week in car with smoker	1.23 (2.09)
Mean (SD) child salivary cotinine (n=16; 10.7%)	7.64 (6.95) ng/ml (range 0.59–24.1 ng/ml)
Caregiver believes quitting smoking would make their child's health better/much better	87.2%
Caregiver concerned that smoking will make their child's health worse/much worse	72.6%
Electronic Cigarette Use	
Ever tried electronic cigarettes	47.0%
Current electronic cigarette use	12.8%
Reasons for use and some effects of use (n=70) *	
Used electronic cigarettes to quit smoking	48.6%

Electronic cigarettes helped to reduce smoking	41.4%
Electronic cigarettes were associated with negative health effects (n=70) *	
-Cough (n=16)	22.9%
-Chest tightness (n=8)	11.4%
-Chest pain (n=7)	10.0%
-Shortness of breath (n=5)	7.1%
-Wheezing (n=5)	7.1%
-Fast breathing (n=2)	2.9%
-Other (n=17)	24.3%
-None (n=8)	11.4%

* These questions were only asked of those participants who answered “yes” to ever or current use of electronic cigarettes.

Table 2.

Changes in Smoking Characteristics

	Baseline (N = 149)	3 Month (N = 129)	Unadjusted GEE Analysis OR / mean difference (95%CI / SEM) [p-value]	Adjusted* GEE Analysis OR / mean difference (95%CI / SEM) [p-value]
Number of cigarettes/day > 10	44 (29.9%)	30 (25.2%)	0.76 (0.52, 1.13) [p=0.18]	0.67 (0.42, 1.05) [p=0.08]
Minutes to first cigarette upon awakening 5	33 (22.9%)	25 (20.2%)	0.85 (0.53, 1.37) [p=0.51]	0.85 (0.51, 1.41) [p=0.52]
Heavy smoking 4**	101 (71.1%)	68 (57.1%)	0.53 (0.36, 0.79) [p=0.002]	0.51 (0.33, 0.78) [p=0.002]
Motivation to quit (Range 0–10; Mean, SD)	5.73, 2.62	6.60, 2.47	0.85 (0.22) [p=0.0004]	0.86 (0.24) [p=0.0004]
Smoking allowed inside the home	74 (50.0%)	58 (45.3%)	0.83 (0.61, 1.13) [p=0.23]	0.80 (0.55, 1.15) [p=0.22]
Smoking allowed inside the car (N=126)	75 (50.7%)	61 (48.4%)	0.92 (0.64, 1.34) [p=0.68]	0.95 (0.65, 1.40) [p=0.80]
Child Cotinine (N=16 at baseline, N=14 at 3- Months) 1 ng/mL	13 (81.3%)	12 (85.7%)	1.21 (0.30, 4.96) [p=0.79]	-

Bold font indicates statistical significance.

* Adjusted for parental race, age, and education (due to sample size adjusted analysis is not possible for child cotinine).

** Heavy Smoking Index is a validated, 2-item self-report measure of nicotine dependence derived from the Fagerstrom Test for Nicotine Dependence (FTND);^{14,15} please see text.