Clinical Decision Support Tool for Parental Tobacco Treatment in Primary Care

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abstract

OBJECTIVES: We created a clinical decision support (CDS) tool and evaluated its feasibility, acceptability, usability, and clinical impact within the electronic health record to help primary care pediatricians provide smoking cessation treatment to parents/caregivers who smoke.

METHODS: This prospective study of pediatric clinicians and parents was conducted at 1 urban primary care site. Clinicians received training in smoking cessation counseling, nicotine replacement therapy (NRT) prescribing, referral to an adult treatment program, and use of the CDS tool. The tool prompted clinicians to ask about secondhand smoke exposure, provide an electronic NRT prescription, and refer. Feasibility was measured by using electronic health record utilization data, and acceptability and usability were assessed with the use of clinician surveys. Parents reported clinical impact, including NRT accepted and used.

RESULTS: From June to August 2015, clinicians used the tool to screen for secondhand smoke exposure at 2286 (76%) of 3023 visits. Parent smokers were identified at 308 visits, and 165 parents (55% of smokers) were interested in and offered treatment. Twenty-four (80%) of 30 eligible pediatric clinicians used the tool. Ninety-four percent of clinicians surveyed (n = 17) were satisfied with the tool, and the average system usability scale score was 83 of 100 (good to excellent range). We reached 69 of 100 parents sampled who received treatment; 44 (64%) received NRT, and 17 (25%) were currently using NRT.

CONCLUSIONS: A CDS tool to help urban primary care pediatric clinicians provide smoking cessation treatment was feasible, acceptable, usable, and influenced clinical care. A larger scale investigation in varied practice settings is warranted.

WHAT'S KNOWN ON THIS SUBJECT: Secondhand smoke exposure is a significant public health problem with clear negative effects on children's health. Pediatric primary care–based smoking cessation interventions can be effective in helping parents quit, but barriers have limited adoption and sustainability.

WHAT THIS STUDY ADDS: A clinical decision support tool within the electronic health record to help primary care pediatricians provide smoking cessation counseling and prescribe nicotine replacement therapy to parents who smoke was feasible, acceptable, usable, and influenced clinical care.

Dr. Jenssen conceptualized and designed the study, designed the data collection instruments, conducted the initial analysis, and drafted the initial manuscript; Drs. Bryant-Stephens and Leone conceptualized and designed the study, supervised data collection, and reviewed and revised the manuscript; Dr. Grundmeier helped conceptualize and develop the intervention, supervised data collection, and reviewed and revised the manuscript; and Dr. Fiks designed the study, helped with data analysis, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted.

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Secondhand smoke (SHS) exposure is a significant public health problem, with clear negative effects on children's health, including increased risk of acute respiratory infections, asthma exacerbations, sudden infant death syndrome, and premature death.\(^1\) Approximately 17% of US adults smoke cigarettes,\(^2\) but >40% of US children have evidence of tobacco smoke exposure.\(^3\) Pediatricians are uniquely positioned to educate and motivate parents toward protecting their children from SHS.\(^4\) Parents expect their pediatrician to ask about their smoking status and are interested in their pediatrician providing smoking cessation medication and connecting them to additional resources.\(^5,6\) Pediatric clinicians, however, rarely provide such treatment options to parents who smoke.\(^7\) Nationally, of parents who smoke, 7% smoke.\(^8\) Nationally, of parents who smoke who had accompanied their child to the pediatric clinician in the past year, only 38% were advised to quit, and 15% had pharmacotherapy recommended to them.\(^6\)

Pediatric primary care–based smoking cessation interventions can be effective in helping parents quit, but barriers have prevented further adoption and sustainability of such practices.\(^8–10\) Time, recordkeeping challenges, logistical issues, scope of practice concerns, and lack of insurance reimbursement are cited as barriers to providing counseling and prescribing nicotine replacement therapy (NRT).\(^11,12\) To address some of these concerns, professional organizations have adopted policy statements and clinical guidelines that underscore the importance of all clinicians addressing tobacco smoke exposure, including recommendations that pediatricians provide counseling and treatment to adults who expose their children to SHS.\(^12–14\)

Electronic health records (EHRs) and clinical decision support (CDS) systems may improve the quality and standardization of clinical interventions for tobacco use.\(^15–17\) In pediatric settings, outpatient-based multilevel interventions are emerging to address these barriers; the interventions combine pediatric health care clinician advice and behavioral counseling with navigation to pharmacologic cessation aids approved by the US Food and Drug Administration (FDA).\(^18\) No studies, however, have made use of pediatrician counseling combined with decision and treatment guidance aided by health information technology. We sought to create a CDS tool and evaluate its feasibility, acceptability, usability, and clinical impact within the EHR to help primary care pediatric clinicians provide smoking cessation treatment to parents who smoke. We hypothesized that implementing CDS would prompt pediatric clinicians to provide such treatment.

**METHODS**

**Study Design**

This prospective study was conducted in primary care clinicians and parents, incorporating focus groups, EHR utilization data, and surveys. Surveys with closed- and open-ended questions were used to contextualize quantitative results. The intervention, called the tobacco treatment CDS tool, was developed from April to May 2015. Once the intervention was developed, the single-armed, prospective portion of the study was conducted from June to August 2015.

**Setting and Study Population**

This study was conducted within The Children's Hospital of Philadelphia (CHOP) Pediatric Research Consortium, a primary care practice–based research network that includes 31 practices in 2 states.\(^19\) One large urban practice participated in the study. This practice was selected based on clinician willingness to participate, practice size, and proximity to CHOP. Eligible primary subjects included all pediatric primary care attending pediatricians and nurse practitioners. Eligible secondary subjects were parents/caregivers (hereafter referred to as "parents"), aged ≥18 years, who were present for the child’s health care (both well-child and acute) visit, who smoke, and who were interested in receiving treatment. Exclusion criteria included those clinicians who declined to participate and, for secondary subjects, parents who smoked but were not present during the visit, who were <18 years of age, who did not speak English, or who were not interested in treatment. Only the first visit by an individual child was included in the final analysis. Age, demographic, and insurance status information was available for children. To ease the burden of data collection, we did not collect parent or clinician demographic information.

**Intervention**

We created the parental tobacco treatment CDS tool by using a usability framework approach,\(^20\) iteratively developing the tool while incorporating input from future users of that tool.\(^21–24\) The development team included researchers, clinical informaticians, clinical content experts, and end-users. To further inform tool development, we performed focus groups and 1-on-1 interviews with clinicians and the practice’s medical director in April and May 2015. Questions focused on barriers to current practice and workable solutions to overcome these barriers. End-users and informatics experts emphasized a reminder-type prompt that fit within clinician workflows combined with simple, easy-to-follow treatment guidance steps.

The intervention was modeled off the CEASE intervention, an evidence-based system for implementing
smoking cessation treatment of parents in the pediatric setting. The parental tobacco treatment CDS tool, which interfaced seamlessly within the EHR (EpicCare; Epic Systems, Inc, Verona, WI), included the following basic capabilities (Fig 1A):

1. Prompt the clinician (in a noninterruptive manner) to ask the parent about smoking status and assess interest in quitting, at all well-child and acute visits. The prompt (available for clinicians only) would appear at the start of the visit when the patient’s chart was initially opened, and it would remain available throughout the visit until the clinician responded;

2. Select 1 of 4 responses to assessment questions, either parent: “interested,” “not interested,” “not eligible” (ie, not a smoker), or “defer decision” (Fig 1B).

If the parent was interested in quitting (Fig 1C):

3. Link to an electronic NRT prescription, with dosing guidance (Fig 1D);

4. Prompt for clinicians to refer interested parents to the adult tobacco treatment program (clinicians would enter the parent’s name and contact information, noting that the adult program would contact the parent to schedule an appointment within 2 weeks of the referral);

5. Finally, guidance to add “Secondhand Smoke Exposure” to the problem list, provide additional resources to discharge instructions, including the PA Free Quitline, and document that NRT was prescribed, if appropriate.

Pediatric clinicians received a 1-hour training session in prescribing NRT and use of the tool, e-mails regarding use of the tool for reference, and additional training (as needed) in the clinical setting.

Outcome Measures

Feasibility

Feasibility of the intervention was evaluated by using EHR utilization data. Available information included the number of visits at which the tool prompted a clinician to ask about SHS exposure, as well as clinician selection of 1 of the 4 assessment answers (ie, interested, not interested, not eligible, defer decision). Use of the tool to screen for SHS exposure was defined as a clinician selecting the “interested,” “not interested,” or “not eligible” selections. Information was also available if the tool was “deferred” to a later visit or not used at all (ie, ignored by the clinician) (Fig 1A).

Pediatric Clinician Acceptability and Usability of Intervention

Pediatric clinician acceptability and usability of the intervention were measured by using a 20-question survey developed by the study team. Clinicians were surveyed at the end of the study period. The survey, which took ~5 to 10 minutes to complete, included questions about advantages, disadvantages, and suggested improvements for the tool, as well as a computer system usability scale. This scale is a reliable, low-cost, and effective tool for assessing physician usability of (and satisfaction with) a CDS tool. It is a questionnaire composed of 10 statements that uses a 5-point Likert scale to measure strength of agreement or disagreement with the statement; the final score ranges.
from 0 to 100, with high scores indicating increasing usability and satisfaction.  

**Parent Acceptability**

Parent acceptability of smoking cessation treatment was assessed by using an 11-question survey developed by the study team. The first 100 parents who received smoking cessation treatment in primary care were contacted within 2 to 4 weeks of the office visit to administer the survey. Three attempts were made to contact each parent. The survey, which took ~5 minutes to complete, included questions about satisfaction, barriers, and suggested improvements for primary care–based treatment and referral. One member of the study team (B.P.J.) administered the survey, followed an established survey script, and transcribed the survey responses.

**Clinical Impact**

Measures of clinical impact included counseling and advice received in the pediatric clinic (NRT offered by clinicians, NRT prescription received by parents, and NRT used by parents) and follow-up with the adult treatment program. These measures were collected via parent survey and reports from the adult treatment program back to the study team.

**Baseline Data Collection**

A retrospective chart review was performed to obtain information on baseline SHS exposure screening and treatment rates for the study clinic. A random sample of 200 patient charts was reviewed for all patients (newborn to ≤18 years of age) for all health care visits (both well-child and acute) from June to August 2014 (comparable period 1 year before the study period). SHS exposure screening was defined as the following: presence of, and answer to, the question “Does anyone smoke around the patient?” found in the vitals section (asked by the staff responsible for rooming the patient during the clinical visit); or any key words identifying SHS exposure, such as “smoking,” “secondhand smoke,” “smoker(s),” or “cigarettes” in the electronic clinician note, including the Problem List, Diagnoses, Social, or Counseling sections. Tobacco treatment was defined as documentation of key words suggesting smoking cessation counseling (eg, “smoking counseling”), prescription of NRT, or referral to the quitline or other tobacco treatment programs.

**Statistical Analysis**

Quantitative analyses were conducted by using Stata version 13.1 (Stata Corp, College Station, TX). The population was described and data reported with means and proportions as appropriate. Categorical data were compared by using a χ² test (P < .05 was considered significant). Using a content analysis approach, NVivo 11 qualitative data analysis software (QSR International, Melbourne, Australia) was used to code and identify themes for clinician and parent survey responses. The CHOP Institutional Review Board approved this study. Clinicians provided written informed consent, and parents provided verbal informed consent.

**RESULTS**

Baseline chart review (N = 200) identified SHS exposure screening at 82% (n = 163) of visits. When screening occurred, 20% (n = 33) of visits included a parent who smoked. The staff (registered nurse or medical assistant) responsible for rooming the patient performed the vast majority of SHS exposure screening (n = 156 [96%]). Of the smokers identified, 18% (n = 6) were offered treatment. Treatment involved counseling only. According...
to the medical record, no parents were prescribed NRT or referred to additional treatment options.

During the 3-month study period, of 3023 eligible child visits, pediatric clinicians used the tool at 2286 (75.6%) child visits to screen for SHS exposure resulting from parental smoking. The clinic serves a predominantly black, non-Hispanic, and Medicaid insurance population. Child characteristics of parents who were screened compared with those not screened are shown in Table 1. Male gender ($P = .03$), white or Asian race ($P = .04$), and having private insurance ($P = .02$) were associated with screening; patient age was not ($P = .2$). Twenty-four (80%) of 30 eligible pediatric clinicians used the tool at least once to provide treatment (ie, they used the tool to identify a parent who smoked who was interested in quitting); 18 (of 24 total) were physicians and 6 (of 6 total) were nurse practitioners.

**Feasibility**

Of the 2286 visits at which the tool was used, a parent who smoked was present at 308 (13.5%) of the visits. A total of 165 (54.6% of parents who smoke) were interested in quitting and were offered treatment. The tool was deferred at 636 (21.0%) visits, and it was ignored at only 101 (3.4%) visits (Fig 1). There were substantial differences in tool use according to individual clinician, but >75% of clinicians used the tool at >60% of visits (mean, 88%; 25th percentile, 60%; 75th percentile, 96%). One clinician was responsible for the vast majority of deferrals. Most clinicians did not defer tool use at all (Fig 2).

**Acceptability and Usability**

**Clinicians**

Seventeen (71%) of 24 clinicians who used the tool completed the survey. Ninety-four percent of responding clinicians were satisfied with the tool and found it helpful. The average system usability scale score was 83 of 100 (95% confidence interval, 78–88), which was in the good to excellent range. Clinician responses to open-ended questions generated several clinically relevant themes. Advantages of the tool included ease-of-use (47%), a reminder to screen all parents about smoking (29%), and access to an electronic NRT prescription (41%). A representative clinician comment noted that the tool “prompted me to address [smoking] consistently and help provide NRT to interested parents.” Disadvantages included inability to reaccess the tool once it was initially used (24%) (eg, if NRT prescriptions need to be reprinted). Participating clinicians preferred more information on contraindications for NRT use and additional treatment options to help guide care.

**Parents**

Of the parents interested in quitting smoking, the first 100 were contacted to complete a survey about their experiences; 69 were successfully surveyed, 9 parents declined, and 22 could not be reached. The majority
of parents surveyed (89%) reported being satisfied or very satisfied with clinician treatment. Parents were receptive to pediatricians offering services to help them quit smoking, and 28% of surveyed parents specifically noted that they became motivated to use treatment because quitting smoking was framed around helping their child. Reflecting the sentiments of many, 1 parent explained “Usually my doctor talks to me about it, but it makes sense for my baby’s doctor to talk with me because me smoking affects not just my health but the health of the baby as well. Now actually trying to help parents is great.”

Clinical Impact

Of parents surveyed (69 of 100 contacted), 66 (96% of those surveyed) received advice on quitting, 52 (75%) were offered an NRT prescription, 44 (64%) received a prescription, and 17 (25%) had filled the prescription and were currently using NRT. Many parents emphasized that the pediatrician offering NRT helped connect them to this treatment, with 1 parent noting they were “surprised that the pediatrician talked about smoking and offered the prescription. I didn’t know patches were covered [by insurance]. It’s been 10 years. Excited about quitting.” Although 165 parents were referred to the adult treatment program, no parents successfully followed up for an in-person session. Parent-reported barriers to program follow-up included general stress (20%), work (16%) and child care (10%) conflicts, cost (8%), referral issues with current insurance (6%), and lack of insurance coverage (4%). Although the majority of parents (51%) did not think any improvements to the intervention were needed, those who had suggestions recommended more office-based smoking cessation counseling (ideally provided while they were waiting with their child or immediately after the visit) with follow-up by telephone for continued support.

DISCUSSION

We conducted the present study to determine if effectively leveraging CDS would prompt pediatric clinicians to provide smoking cessation treatment of parents who smoke. Compared with baseline, our intervention resulted in comparable rates of SHS screening; it also more than doubled the rates of smoking cessation counseling and led to clinicians providing NRT for interested parents. In addition, the majority of pediatric clinicians used

### TABLE 1 Child Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total Screened (n = 2286 [75.6%])</th>
<th>Not Screened (n = 737 [24.3%])</th>
<th>P^a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>423 (18.5)</td>
<td>130 (17.6)</td>
<td>.2</td>
</tr>
<tr>
<td>1–5</td>
<td>856 (37.4)</td>
<td>292 (39.6)</td>
<td></td>
</tr>
<tr>
<td>6–12</td>
<td>689 (30.2)</td>
<td>196 (26.6)</td>
<td></td>
</tr>
<tr>
<td>13–19</td>
<td>318 (13.9)</td>
<td>119 (16.2)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
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<td></td>
</tr>
<tr>
<td>Female</td>
<td>1070 (46.8)</td>
<td>379 (51.4)</td>
<td>.03</td>
</tr>
<tr>
<td>Male</td>
<td>1216 (53.2)</td>
<td>358 (48.6)</td>
<td></td>
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<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1911 (83.6)</td>
<td>639 (86.7)</td>
<td>.04</td>
</tr>
<tr>
<td>White</td>
<td>126 (5.5)</td>
<td>23 (3.1)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>51 (2.2)</td>
<td>11 (1.5)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>188 (8.7)</td>
<td>84 (8.7)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
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</tr>
<tr>
<td>Hispanic or Latino</td>
<td>111 (4.9)</td>
<td>31 (4.2)</td>
<td>.5</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>2175 (95.1)</td>
<td>706 (95.8)</td>
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<tr>
<td>Insurance category</td>
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<td></td>
<td></td>
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<tr>
<td>Medicaid</td>
<td>1713 (74.9)</td>
<td>586 (79.5)</td>
<td>.02</td>
</tr>
<tr>
<td>Private</td>
<td>558 (24.4)</td>
<td>144 (19.5)</td>
<td></td>
</tr>
<tr>
<td>Self-pay</td>
<td>15 (0.7)</td>
<td>7 (1.0)</td>
<td></td>
</tr>
</tbody>
</table>

Data are presented as n (%).

^a Via χ² analysis.
the tool at most of the visits. Before the intervention, when treatment was provided, it only involved counseling, rather than prescription of FDA-approved medications.

Our adherence to informatics consensus guidelines in CDS system development helped create a tool that was feasible, acceptable, and usable. We emphasized usability in tool development and ensured that it fit within clinical workflows and complemented physician–patient/family communication around SHS exposure and tobacco treatment. In addition, the effectiveness of this intervention likely depended on the tool’s seamless integration into the EHR. These approaches ensured that the tool met the standards of effective CDS systems: appear at the point of care, offer a specific recommendation, and then enable compliance with that recommendation. Finally, we engineered the tool to match an existing workflow for CDS for other aspects of pediatric care already successfully in use by the practice.

Parents accepted pediatric primary care–based smoking cessation treatment and reported a clinical impact on smoking cessation. Parents who received counseling and NRT explained that they were using these medications with the intent of quitting smoking. Although simple clinician advice can lead to a small but meaningful increase in quit rates, use of NRT is 1 of the most effective strategies to help increase an individual’s likelihood of quitting. Consistent with the Public Health Service Clinical Practice Guideline, it is essential that clinicians and the health care delivery system consistently identify and document tobacco use status and treat every tobacco user with cessation counseling and FDA-approved medications, except when medically contraindicated.

Although parents interested in quitting smoking were receptive to treatment through a pediatric setting, referral to an adult tobacco treatment program did not help parents receive more intensive treatment. Additional treatment remains important because more intense counseling sessions improve cessation rates. Promoting adult treatment through pediatric office settings has been shown to be effective for increasing adult vaccination, treating postpartum depression, and reducing intimate partner violence in mothers. Future research is needed to investigate additional models, such as co-locating services or embedding experts in pediatric settings, to help enhance receipt of smoking treatment of parents.

Our study has several limitations. First, the study was a single-armed trial of pediatric clinicians at 1 outpatient urban academic practice. We did not have a comparison group to know the rates of smoking cessation counseling and treatment offered by clinicians who did not use the tool. Nonetheless, for parents who smoke, tool use by clinicians led to substantially higher rates of counseling and treatment offered compared with baseline data. Second, although we found that families of white and Asian race or who had a private insurance status were more likely to be screened for SHS exposure, explaining differences in screening based on race or insurance status was beyond the scope of this project and could be an area for future study. Third, further study is needed to determine how results will generalize to other settings. Fourth, there were limitations to the CDS tool itself. Tool use may have been negatively affected because clinicians could not re-access the tool. Development of the CDS tool targeted the initial conversation with parents on smoking cessation. We do not have information about how the tool affected subsequent office follow-up. Fifth, we evaluated process measures of counseling, treatment, and referral as the outcomes of this study. We could not verify the accuracy of parent self-report of other outcomes. Sixth, we did not offer all FDA-approved cessation medications, including additional NRT options, bupropion, or varenicline. This absence may have affected parent willingness to receive a prescription and/or their use of cessation medications. Finally, despite achieving a 69% response rate for the parent surveys, our findings could be susceptible to nonresponse bias.

CONCLUSIONS
A CDS tool to help primary care pediatric clinicians provide smoking cessation treatment was feasible, acceptable, and usable. More than three-quarters of parents were screened, and many accepted pediatric primary care–based smoking cessation treatment. These promising results suggest that a randomized trial of this approach, including varied practice settings and with additional measures of effectiveness such as biologically confirmed parent quit rates, is warranted.

ACKNOWLEDGMENTS
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ABBREVIATIONS
CDS: clinical decision support
CHOP: Children’s Hospital of Philadelphia
EHR: electronic health record
FDA: US Food and Drug Administration
NRT: nicotine replacement therapy
SHS: secondhand smoke
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POTENTIAL CONFLICT OF INTEREST: Drs Fiks and Grundmeier are co-inventors of the Care Assistant software that was used to provide clinical decision support in this study, and Drs Jenssen, Bryant-Stephens, and Leone have indicated they have no potential conflicts of interest to disclose.

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