Integrating Tobacco Dependence Counseling into Electronic Dental Records: A Multi-Method Approach


Abstract: Dentistry has historically seen tobacco dependence as a medical problem. As a consequence, dentistry has not adopted or developed effective interventions to deal with tobacco dependence. With the expanded use of electronic dental records, the authors identified an opportunity to incorporate standardized expert support for tobacco dependence counseling during the dental visit. Using qualitative results from observations and focus groups, a decision support system was designed that suggested discussion topics based on the patient’s desire to quit and his or her level of nicotine addiction. Because dental providers are always pressed for time, the goal was a three-minute average intervention interval. To fulfill the provider’s need for an easy way to track ongoing interventions, script usage was recorded. This process helped the provider track what he or she had said to the patient about tobacco dependence during previous encounters and to vary the messages. While the individual elements of the design process were not new, the combination of them proved to be very effective in designing a usable and accepted intervention. The heavy involvement of stakeholders in all components of the design gave providers and administrators ownership of the final product, which was ultimately adopted for use in all the clinics of a large dental group practice in Minnesota.

Dr. Rush is an Investigator, HealthPartners Institute for Education and Research; Dr. Schleyer is Clem McDonald Professor of Biomedical Informatics and Director, Center for Biomedical Informatics, Regenstrief Institute, Inc., Indianapolis, IN; Dr. Kirshner is Program Director, Oregon Institute of Technology; Dr. Boyle is Director of the Research Program, Clearway Minnesota; Ms. Thoele is Project Manager, HealthPartners Institute for Education and Research; Ms. Lenton is Research Coordinator, HealthPartners Institute for Education and Research; Mr. Asche is Investigator, Statistician, HealthPartners Institute for Education and Research; Dr. Thyvalikakath is Associate Professor and Director of Dental Informatics Core, Department of Restorative Dentistry, Indiana University School of Dentistry; Dr. Spallek is Assistant Professor, School of Dental Medicine, University of Pittsburgh; Ms. Durand is Senior Research Project Manager, HealthPartners Institute for Education and Research; Mr. Enstad is Research Study Coordinator, HealthPartners Institute for Education and Research; Mr. Huntley is Manager, Dental Clinic Systems, HealthPartners Institute for Education and Research; and Dr. Rindal is an Investigator, HealthPartners Institute for Education and Research. Direct correspondence and requests for reprints to Dr. William A. Rush, HealthPartners Institute for Education and Research, 8170 33rd Ave. S., Mail Stop 21111R, Minneapolis, MN 55425; 952-967-5082; william.a.rush@healthpartners.com.

Keywords: dental care, dental records, dentists, dental hygienists, electronic health records, electronic dental records, tobacco, tobacco dependence

Submitted for publication 9/20/12; accepted 1/31/13

The development of evidence-based knowledge has become a major focus of the dental profession. Consequently, the scale and scope of evidence-based resources to shape dental professionals’ practices (e.g., systematic reviews) have increased. The challenge is how to take the knowledge from a review or guideline and implement it in dental practice. Clinical implementation can be aided with the use of an electronic dental record (EDR). Research has shown that the presence of EDRs in dental offices increased from 25 percent in 2004 to 55.5 percent in 2007.1 While EDRs have been adopted because they improve tracking and billing for services, they also can provide evidence-based clinical support.2-4

In this study, we explored the feasibility of embedding an established tobacco dependence treatment in the EDR of HealthPartners Dental Group (HPDG), a large staff model group practice in Minnesota. Our primary goal was to help practitioners deliver tobacco dependence treatment. The setting was particularly conducive to our work because staff dentists have been using an EDR since 2002; thus, electronic record keeping and interaction with the computer in the clinic are well accepted and used for all aspects of patient care.

Developed by the U.S. Public Health Service, tobacco dependence guidelines have evolved from a sizeable, growing body of research.5-8 Regrettably,
despite the overwhelming evidence supporting their use, tobacco dependence treatments are inconsistently delivered to tobacco users in both medical and dental practices.\textsuperscript{9-11} There is a great need to improve the integration of tobacco dependence treatment into practice.\textsuperscript{12} The emergence of EDRs may offer opportunities to incorporate best practices (i.e., evidence-based dentistry) into clinical practice, going beyond the data capture functionality in the paper chart.

The goal of this project was to train and support providers in tobacco dependence treatment.\textsuperscript{13,14} However, to maximize the effectiveness of our EDR-based tobacco dependence treatment, we needed to understand how oral health providers (OHPs), who are primarily dentists and dental hygienists, use the EDR during delivery of care so that we did not negatively affect the existing flow of the patient encounter and frustrate the user. Therefore, before designing and implementing tobacco dependence treatment in the EDR, our aim was to conduct a qualitative study observing and discussing how OHPs use the EDR while providing direct patient care.

Methods

The dental encounters of interest for this study were new patient and recall visits in which preventive services, examinations, and medical history updates are performed. HPDG employs roughly 114 dentists and dental hygienists, who provide both prepaid and fee-for-service dental and oral care in sixteen dental clinics. In 2011, HPDG provided care for about 110,000 members. HPDG’s EDR is customized and marketed by General Systems Design (Cedar Rapids, IA, USA). In 2008, HPDG saw roughly 7,500 tobacco users. Both dental hygienists and dentists had been trained in 2001, before this study, on assessment and follow-up approaches to tobacco dependence treatment. However, no support was provided for integration of this training into the dental encounter.

To determine tobacco usage data collection and workflow, we observed a series of dental encounters in different clinics. We used this information to develop focus group discussion points about EDR improvements for supporting dentist- and dental hygienist-directed tobacco dependence treatment. We felt that the synergy of contextual inquiry,\textsuperscript{15} which produces observational data unbiased by attitudes, expectations, or opinions, along with focus group sessions that could elucidate observed behaviors would produce the most meaningful insights for designing our intervention. In addition, while the observations captured current tobacco dependence treatments, the focus group discussions could help us envision how they could be improved and how the EDR should be modified in response. Also, the focus groups gave participating providers ownership of the ideas produced, making adoption more likely after implementation. This information was used to design an automated tobacco dependence treatment expert system to be embedded in the tobacco usage section of the medical history. As a further development step, a functional mockup of a proposed system was iteratively presented to providers for feedback.

Observations

Following HealthPartners Institute for Education and Research Institutional Review Board approval of the study, a notice was sent to clinic supervisors at each HPDG clinic to announce and explain the EDR project. Supervisors were given two weeks to respond to this notice before we initiated subject recruitment. Clinic supervisors did not express any opposition.

Recruitment letters were then sent to all forty-four dentists and seventy dental hygienists employed in the HPDG clinics. The letters described the study and informed recipients that they might be asked to participate. Recipients were given two weeks to email or phone the study coordinator to opt out of being contacted. After the two-week intermission, the study coordinator called potential participants until thirty practitioners (sixteen dental hygienists and fourteen dentists) agreed to participate.

Clinic selection was based on sites in which at least one dental hygienist and one dentist had volunteered for the study. It was important to be able to observe the entire appointment, including the examination. Therefore, dental hygienists from clinics in which a dentist would not agree to be observed were not recruited, and vice versa. Once a dental hygienist-dentist team was identified at a given clinic, the coordinator focused on recruiting at another clinic. Nine of the sixteen HPDG locations in the greater Minneapolis-St. Paul, MN, area were included. This gave us a broad range of contacts with different providers and clinic cultures, which were surprisingly diverse.

The observers were selected on the basis of their experience as a dental hygienist and dental hygiene educator (PL) or as a systems analyst (WR). The observers’ combined expertise allowed them to capture an accurate representation of both the clinical and technical processes. Before study initiation,
both observers were taught how to use the EDR by the same person who trained HPDG personnel.

Twenty-five field observations were carried out by WR and PL at fifteen dental hygiene recall and ten dental hygiene new patient appointments. Contextual inquiry, an ethnographic method, was used to document work sequence, information acquisition and documentation, work process breakdowns, and verbal feedback. Before each observation, the observed clinician asked for the patient’s permission to allow the researchers in the cubicle during the appointment. Once the patient consented, the observers positioned themselves in the cubicle on opposite sides of the patient chair to observe from multiple vantage points. Care was taken to not disrupt the appointment. Numbered notes were made on a sheet with screenshots of the primary EDR screens used in an exam encounter. This allowed for a systematic, methodical collection of data about the process of the clinical encounter. Care was also taken to include all screens on which tobacco information could be collected. After the patient left the exam room, the observers asked the clinician about any procedural steps with the EDR that were not clear during the observation. Discussion of tobacco use assessment was not mentioned until the end of all observations in a session.

On the same day after each observation, PL and WR informed each other, in chronological order of the observations, of what each had observed. The observers then synthesized their written observations and elaborated on the details and actions while the information was fresh in their minds. Observer PL returned to the office, where she transcribed the field notes into an electronic document.

Observations were limited to two patient appointments per day. This scheduling facilitated field-note processing within forty-eight hours of each observation and limited observer fatigue and multiple-observation confusion. The transcribed field notes were subsequently reformulated as formal models—specifically, a flow model and sequence model. In addition, each model type was consolidated across offices and visits. Qualrus Version 2 helped develop themes, which were used as discussion points in the focus groups.

Focus Groups and Expert System Design

We conducted three focus groups at HPDG to determine dentists’/dental hygienists’ attitudes towards the EDR and perceived barriers and facilitators to its use to support tobacco counseling. One focus group consisted of dental hygienists, one contained only dentists, and the third was a mix of both dentists and dental hygienists. A trained focus group moderator led the focus groups, and discussions were audi-taped and transcribed. Two researchers reviewed the transcripts, and themes were identified. All participants were de-identified in the transcripts.

Each focus group consisted of two activities. First, the participants were given screenshots of the locations in the EDR where tobacco use was addressed. They were asked to rank the screens relative to their usefulness and position in the work flow for tobacco dependence treatments (Figure 1). Second, each group discussed current barriers and possible facilitators to improved support for tobacco dependence treatments. Through the two activities, we successfully identified sets of practice patterns that suggested the most effective locations and processes for tobacco clinical reminders in the EDR.

The next step was to use the observations and focus group results to mock up a functioning prototype of an expert system that would fulfill provider needs. We presented this prototype to HPDG system administrators, dentists, and dental hygienists for their feedback. This was an iterative process of presentation and revision between project personnel and stakeholders. An important consideration was our discovery early in the study that we could not modify the EDR locally; rather, we would have to spend considerable money and time to have the system vendor modify it. Therefore, we wanted to get it right the first time.

Results

A total of thirty-six dentists/hygienists at HPDG were phoned to recruit enough participants. The six who declined participation gave the following reasons for not wanting to be observed: felt that participating might cause the practitioner to run behind schedule and increase patient wait times; believed that the project was really a covert means of “Spying” on employees; dental hygienist was willing to participate, but dentist was not; dentist was willing to participate, but dental hygienist was not; reported undergoing chemotherapy; and reported planning to leave HPDG soon. Thirty practitioners (sixteen dental hygienists and fourteen dentists) agreed to participate. The dental hygienists were all female;
of the fourteen dentists, four were female, and ten were male.

Assessing Practice Patterns Relative to EDR Usage

Twenty-five exam encounters were observed. The observers noted that workflow through EDR screens was fairly consistent. Participants started with the health history, proceeded to tooth and periodontal assessments, and ended with evaluations of future risks. Most providers had favorable attitudes towards EDRs, although they wished the EDR could interact directly with the electronic medical record (EMR) to keep the overall health history up to date. Participating dental hygienists had most of the information acquisition and documentation responsibilities. They updated the health history and evaluated periodontal status. The dentists examined the patients but addressed their observations to the hygienists, who entered information into the EDR. With input from the hygienists, the dentists updated the caries, periodontal, and oral cancer risk assessments.

Barriers to workflow were limited but were serious when they occurred. Single-monitor use prevented EDR access while the dentist viewed radiographs. During this process, the dental hygienist was often forced to take paper notes and enter observations after radiograph examination. EDR breakdowns/lockdowns were infrequent but seriously interrupted workflow because providers had to reboot the system.

There were two types of functionality for recording tobacco usage in the EDR. The first, in the health history, allowed the dental hygienist to record information about the patient’s tobacco usage. This included type of tobacco, frequency of use, amount used, and number of previous quit attempts (Figure 2). The observers noted that the only one of these items consistently addressed by the dental hygienist was whether the patient was still using tobacco. Because the system carried forward tobacco information from the previous exam, any patient who had taken up tobacco use or was a tobacco use recidivist would not be identified or have his or her status updated. The second place for recording of tobacco usage status was in the periodontal risk assessment screen, which was typically performed toward the end of the exam. The screen was filled out with input from both the dentist and dental hygienist but was not linked in any programmatic way with the information obtained through the medical history. The second form of functionality related to recording activities centered on counseling or supporting the patient in tobacco dependence treatments. These issues were addressed in the dental hygiene information form, where dental hygiene education interventions were recorded, as well as on the treatment plan, where the dentist could refer the patient to tobacco usage phone counseling. Barriers to tobacco dependence
treatments were chosen as an important activity for focus group discussion. The other obvious issue to address in the focus groups was, considering workflow, which tobacco-related EDR screen would be the best place for treatment suggestions.

Study observations documented three main problems with how the EDR supported tobacco usage documentation and tobacco dependence treatment activities. First, the information related to tobacco usage was spread over several separate parts of the EDR that were not logically connected through the clinical workflow. When information was recorded in one place, it was not automatically updated in the others. Second, the answer to current tobacco use on the health history was, by default, carried over to subsequently updated history forms, making the question easy for providers to miss or ignore. In addition, because providers did not understand the purpose of or how to use the follow-up questions for determining level of dependence, they often left these fields blank. Third, if the provider did indeed conduct tobacco dependence treatments, there was no convenient place in any of the tobacco-related screens to record what was done for future reference. In summary, the EDR poorly supported executing the various steps involved in tobacco use assessment and treatment and made it hard to document them if they were done.

Focus Groups on Potential Treatments

The dental hygienists interviewed in the focus groups expressed the opinion that the appropriate place for the collection of tobacco information was the health history. They also reported being afraid of

![Figure 2. Original medical conditions page of the EDR, with tobacco usage questions highlighted](image)
offending a patient with no interest in quitting and that this was more likely when they did not know the patient’s previous responses to treatment approaches. Therefore, they expressed strongly that they needed some mechanism at this location to record notes about past reactions to questions about tobacco dependence treatments. These participants also said that, while it was up to them to collect the tobacco status information, the dentist should be involved in the treatment activities.

A very interesting finding was that the dental hygienists reported feeling that patients should be referred to the state-sponsored, telephone-based tobacco quitting support resources more often than it was being done. However, these dental hygienists provided as many excuses as there were participants for why they would be unable to get the form from the printer or access the fax machine to do so. We concluded that this important process needs to be simplified and streamlined.

The dentists’ perspectives on tobacco dependence treatments were different from those of the dental hygienists. The dentists’ suggestions tended to relate to using the tobacco information collection fields available in the health history. However, because these fields were completed by the dental hygienist, the dentists did not seem to know what was in them. They suggested that tobacco dependence treatments be chosen by the dentist at or near the end of the encounter and printed together with other selected interventions. We speculate that the dentists’ perspective was probably related to their interaction with the patient in the flow of the encounter. The dentist examined the patient after the medical history was taken. Therefore, if the dental hygienist did not point out the patient’s tobacco usage, the dentist might be unaware of it.

EDR Changes

Using the information collected in the observations and focus groups, we modified the existing EDR system (Figure 3) to provide much of the missing support to the oral health providers. This involved creating an expert support system in the health history to evaluate the patient’s tobacco usage and suggest approaches for treatment and tracking. To do this using the tobacco usage information collected, we automated the calculation of two of the most widely

Figure 3. Modified medical conditions page of the EDR, with tobacco usage questions highlighted
accepted approaches to classifying patients’ positions relative to presenting tobacco dependence treatment messages: desire to quit\textsuperscript{18,19} and level of tobacco dependence or nicotine addiction.\textsuperscript{20-22}

Dental providers are always under time constraints, and the addition of tobacco dependence treatments for the roughly 8 percent of the HPDG patients who reported using tobacco was clearly a factor in limiting provision of tobacco dependence treatment support. Therefore, the automation process was intended to encourage tobacco dependence treatments while providing the necessary support for a quick and accurate process. Our goal was a three-minute average treatment interval. To this end, we gave the providers scripts to use with the patients (Figure 4) based on their desire to quit, tobacco usage, and level of dependence. To fulfill the provider’s need for an easy way to track ongoing interventions, script usage was recorded through a single click (see the example of process flow in Figure 4). This process helped

---

Tobacco use is assessed as part of a comprehensive health history.

![Health History](image1)

A rules-based algorithm automatically generates a pop-up provider script (16 possible message combinations).

![Dependency Scripts](image2)

Clicking “Discussed” automatically documents dependency level and script use.

![Discussion Note](image3)

At next visit, discussion notes are reviewed as part of health history review.

Figure 4. Tracking system and scripts provided in modified EDR

---
providers track what they had said to the patient about tobacco dependence treatments during previous encounters and to vary their messages.

**Discussion**

Dentistry has historically seen tobacco usage as a medical problem. As a consequence, dentistry has not adopted or developed effective treatments to deal with tobacco usage. With the expanded use of EDRs, the dental profession has an opportunity to incorporate standardized expert support for tobacco dependence treatments during the dental visit. Our study addressed an approach to developing an intervention in which providers help shape tobacco dependence treatments. By involving providers, we were able to incorporate their insights and increase their acceptance of EDR-based tobacco dependence treatments.

The methods we used to design an EDR-based dental tobacco cessation strategy were not new, but the way we used them was. We first learned by observing the current practices of dentists and dental hygienists as they interacted with patients on tobacco dependence treatments in the EDR. Then, we analyzed these observations using contextual inquiry and qualitative analysis methods. Third, we used the results as guidelines for focus group discussions grounded in actual practice. This practice-based process allowed the participants to critically reflect on what clinicians were currently doing, why they were doing it, and how the EDR could support tobacco dependence treatment. This approach combined the expert knowledge of researchers with the experience and needs of practitioners. By designing a system that adapted to the tobacco use of the patient and supplied the provider with personalized talking points, this process supported tobacco dependence education optimized for each tobacco user. We also made practitioners partners in the process, and they became stakeholders in its success.

Our main findings in this study related to the degree and manner in which the existing EDR impeded clinical work on tobacco dependence treatments. The participating practitioners did not argue against the appropriateness of providing tobacco dependence treatments in dental practice, nor did they have any problem with doing so themselves. Aside from time pressures, most barriers to tobacco cessation interventions identified by our study were logistical. Of note, most logistical barriers were due to the design of the EDR. The purpose of this study was methodological: it was not to reduce tobacco usage among dental patients, but rather to increase and support the treatment of tobacco dependence by dentists and dental hygienists through improved EDR design.

In our study, the EDR made effective tobacco dependence treatment documentation difficult in a number of ways. Tobacco usage information was collected but not translated into any dependence metric. There was no attempt to support tobacco dependence treatments. It was also difficult and time-consuming for practitioners to record any type of documentation related to tobacco dependence treatment. However, through observation, provider focus groups, and an iterative provider-tested design process, we were able to design an effective tobacco dependence treatments process. The most satisfying outcome of this approach is that HPDG has adopted the resulting tobacco dependence treatment process in all its clinics.

**Acknowledgments**

This research was funded by the National Institutes of Health, National Institute of Dental and Craniofacial Research, American Reinvestment and Recovery Act 1RC1DE02095-01. This article was made possible, in part, by the Lilly Endowment, Inc. Physician Scientist Initiative.

**REFERENCES**