Published in final edited form as:

Am J Prev Med. 2013 March ; 44(3): 260–264. doi:10.1016/j.amepre.2012.10.023.

Computer-Assisted Guidance for Dental Office Tobacco Cessation Counseling

D. Brad Rindal, DDS, William A. Rush, PhD, Titus K.L. Schleyer, DMD, PhD, Michael Kirshner, DDS, MPH, Raymond G. Boyle, PhD, MPH, Merry Jo Thoele, RDH, MPH, Stephen E. Asche, MA, Thankam Thyvalikakath, DMD, MDS, PhD, Heiko Spallek, DMD, PhD, MSBA(CIS), Emily C.U. Durand, RDH, Chris J. Enstad, BS, and Charles L. Huntley, MBA
HealthPartners Research Foundation (Rindal, Rush, Asche, Durand, Enstad); ClearWay Minnesota (Boyle), HealthPartners Dental Group (Huntley), Minneapolis; Center for Health Promotion (Thoele), St. Paul, Minnesota; School of Dental Medicine (Schleyer, Spallek, Thyvalikakath), University of Pittsburgh, Pittsburgh, Pennsylvania; Health Informatics (Kirshner), Oregon Institute of Technology, Portland, Oregon

Abstract

Background—Decreases in smoking prevalence from recent decades have slowed, and national goals to reduce tobacco use remain unmet. Healthcare providers, including those in physician and dental teams, have access to evidence-based guidelines to help patients quit smoking. Translation of those guidelines into practice, however, remains low. Approaches that involve screening for drug use, brief intervention, and referral to treatment (SBIRT) are a promising, practical solution.

Purpose—This study examined whether dentists and dental hygienists would assess interest in quitting, deliver a brief tobacco intervention, and refer to a tobacco quitline more frequently as reported by patients if given computer-assisted guidance in an electronic patient record versus a control group providing usual care.

Methods—A blocked, group-randomized trial was conducted in HealthPartners dental clinics from November 2010 to April 2011. Randomization was conducted at the clinic level. Patients nested within clinics represented the lowest-level unit of observation. Intervention clinics were given a computer-assisted tool that suggested scripts for patient discussions. Usual care clinics provided care without the tool. Primary outcomes were post-appointment patient reports of the provider assessing interest in quitting, delivering a brief intervention, and referring them to a quitline.

Results—Patient telephone surveys (72% response rate) indicated that providers assessed interest in quitting (control 70% vs intervention 87%, $p=0.0006$); discussed specific strategies for quitting (control 26% vs intervention 47%, $p=0.003$); and referred the patient to a tobacco quitline (control 17% vs intervention 37%, $p=0.007$) more frequently with the support of a computer-assisted tool integrated into the electronic health record.

© 2012 American Journal of Preventive Medicine. Published by Elsevier Inc. All rights reserved.

Address correspondence to: D. Brad Rindal, HealthPartners Institute for Education and Research, 8170 33rd Avenue South, MS 21111R, Bloomington MN 55425. Donald.b.rindal@healthpartners.com.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

No other financial disclosures were made by the authors of this paper.

Trial registration: This study is registered at ClinicalTrials.gov NCT01584882.

Conclusions—Clinical decision support embedded in electronic health records can effectively help providers deliver tobacco interventions. These results build on evidence in medical settings supporting this approach to improve provider-delivered tobacco cessation.

Background

Tobacco use is the single most prevalent cause of preventable disease and premature death in the U.S.¹ Guidelines for assisting patients with tobacco cessation are readily available.^{2,3} Still, healthcare providers are missing opportunities to address tobacco use cessation as recommended.^{4–6} Medical providers cite limited time, lack of health behavior change expertise, and concern with failure as barriers.⁷ Similar concerns have been raised in the dental setting.⁸

Dental and medical providers report similar challenges to accommodating best-practice guidelines for tobacco cessation.^{7,8} Fortunately, innovative strategies are emerging in the behavioral sciences. Approaches involving screening for drug use, brief intervention, and referral to treatment (i.e., SBIRT) have been found to support both clinically relevant and cost-effective methods for reducing drug and alcohol use in medical settings.⁹

A recent Cochrane review¹⁰ examined the use of electronic health records (EHRs) to support smoking cessation and identified only two high-quality RCTs.^{11,12} Both were conducted in primary medical care settings, suggesting additional research is needed to investigate the role of other healthcare providers.

Purpose

The objectives of this study were to compare the frequency with which patients reported that their dental providers: (1) assessed interest in quitting; (2) delivered a brief tobacco intervention; and (3) referred patients to treatment for tobacco cessation in clinics using an evidence-based, computer-assisted, clinical decision support tool.

Methods

Design

A two-arm, group-randomized trial design tested the effectiveness of an electronic dental record (EDR)-based intervention on patient-reported actions of their dentist's and dental hygienist's tobacco-related actions during a recall dental visit. The study was approved by the HealthPartners IRB. The dental visit included an examination by the dentist and also preventive treatments and diagnostic procedures as appropriate. Recall visits were targeted for a smoking intervention because an update to the medical history would (as a standard of care) include an update on patients' current tobacco status.

Fifteen HealthPartners Dental Group (HPDG) clinics were stratified on number of patients, proportion of smokers, and proportion of public-pay visits. Clinics were then randomly assigned to the computer-assisted special intervention arm (intervention, $n=7$) or usual-care arm (UC, $n=8$; Figure 1). Randomization at the clinic level rather than the provider or patient level ensured the integrity of the intervention and controlled the risk of cross-contamination.¹³ The EDR was modified in the intervention clinics to present suggested provider scripts for addressing patient smoking. Scripts were tailored by a rule-based algorithm based on patient-specific variables.

Patient consent and outcome data were collected in patient phone surveys within 3 days of their dental visit occurring from November 15, 2010 to April 5, 2011. Validated items to assess outcomes of interest were not available. Therefore, a 23-item survey was developed

by an expert tobacco consultant in collaboration with the director of the HealthPartners Research Foundation Data Collection Center (DCC).

Primary outcome measures consisted of patient reports of whether providers: (1) asked them if they smoked; (2) asked about interest in quitting; (3) talked about reasons for quitting; (4) talked about strategies for quitting; or (5) referred them for additional quit-smoking assistance via a toll-free, statewide, telephone quitline (www.quitplan.com).

Setting/Participants

The study took place in the seven-county metropolitan area of Minneapolis and St. Paul MN in 15 HPDG clinics providing care to a diverse population of 110,000 patients in 2011. Usual care in HPDG has historically encouraged use of a provider-initiated tobacco quitline fax referral form. Use of the referral form was reportable by the EDR. Preliminary data suggested low utilization.

Subjects were patients who met inclusion criteria available from the EDR: (1) was a patient of record (i.e., not new); (2) had an exam visit scheduled during the intervention period; (3) was documented as a cigarette smoker at the last visit prior to the intervention; (4) spoke primarily English; (5) did not require an interpreter; and (6) had not opted out of research.

Intervention

A prior qualitative study utilizing user-centered design principles guided development of the computer-assisted tobacco intervention (CATI) tool to support workflow in a busy, multi-clinic, large group dental practice. The CATI tool was built on the SBIRT model and was designed to take no more than 3 minutes in a patient encounter.

Functionality of the CATI tool (Appendix A, available online at www.ajpmonline.org) required the dental provider to assess four health behavior variables for all patients who reported smoking cigarettes: (1) number of cigarettes smoked daily; (2) how soon on waking the first cigarette was smoked; (3) interest in quitting (i.e., stage of change); and (4) number of previous quit attempts. Dependency was then automatically calculated and displayed in the health history screen using the previously validated Heavy Smoking Index.¹⁴ Patient-centered evidence-based provider scripts were generated in a pop-up window using rule-based algorithms. In usual care, EDR tobacco assessment information fields were identical, but no script tool was provided.

Outcome Measures

Key binary outcome measures for this study were from patient phone surveys conducted within 3 days of the dental encounter that asked whether the dentist or dental hygienist: (1) asked if they smoked; (2) asked about interest in quitting; (3) talked about reasons to quit; (4) talked about specific strategies to quit; (5) referred them to the tobacco phone quitline.

Analysis and Power

Patient attributes from the EDR of those who completed the survey ($n=579$) and those who did not ($n=230$) were compared using *t*-tests, contingency tables, and chi-square tests. Those seen in intervention clinics ($n=263$) and UC clinics ($n=285$) were compared on attributes available from the EDR and phone survey using generalized linear mixed models (GzLMMs) with a logit link and random intercept for clinic. Providers' script use in intervention clinics as recorded by the EDR were summarized with descriptive statistics. Associations between script use and patient phone survey reports were tested using GzLMMs. Data were analyzed in 2011. This study was planned with a sample size of $n=450$

completed surveys across the 15 clinics to detect a difference of 17% in tobacco quitline referral proportions (from 20% in UC clinics to 37% in intervention arm clinics) with 80% power, assuming an intraclass correlation of 0.03,¹⁵ using two-sided tests, and $\alpha=0.05$.

Results

Survey Response Rate

Follow-up calls were attempted to 809 patient-smokers (Appendix B, available online at www.ajpmonline.org). Phone surveys were completed with 579 patient-smokers for a 72% response rate. Patients reporting nonsmoking status in the survey ($n=31$) were removed for an analytic file of $n=548$ (263 in the intervention arm, 285 in UC). Among nonresponders (230), 196 were unreachable within the 3-day window, and 34 refused the survey.

Survey Responders and Nonresponders

There were no significant differences between survey responders and nonresponders on gender, race/ethnicity, or number of cigarettes per day. However, responders were older (mean age 46 years, $SD=15.3$) than nonresponders (mean age 40.0, $SD=14.9$, $p<0.001$).

Characteristics of Patient-Smokers

Of the $n=548$ patient-smokers who completed the study, 59% were female, 88% were white, and their mean age was 46 years (Appendix B, available online at www.ajpmonline.org). Over half (60%) smoked 10 or fewer cigarettes per day, and 54% were in the moderate category of dependency. Smokers seen at UC and intervention clinics did not differ with respect to gender, age, race/ethnicity, number of cigarettes per day, dependency, how soon after waking tobacco was used, previous attempts to quit, or interest in quitting (Appendix B, available online at www.ajpmonline.org).

Outcomes Reported by Patient-Smokers

Patient-smokers seen in intervention clinics were more likely (87.0%) than those seen in UC clinics (70.2%) to report that their dental providers assessed their interest in quitting. Intervention clinic patient-smokers also reported that their dental provider suggested specific strategies for quitting and referred them to the quitline at nearly twice the rate of the patients who were provided with usual care (Table 1).

Additional Results

The EDR documented script use by hygienists and dentists in intervention clinics at 195/263 (74%) visits. Among visits in which any script use was documented, the number of scripts used ranged from 1 to 8, with a median of 2. Patients having an indication of script use in the EDR were more likely than those without to report that their dental providers asked about interest in quitting (90.4% vs 78.9%, $p=0.03$); talked about reasons to quit (80.7% vs 63.3%, $p=0.01$); and referred them to a tobacco quitline (43.2% vs 22.5%, $p=0.005$).

Discussion

A clinical decision support tool embedded in an EDR was effective at improving evidence-based tobacco cessation efforts in the dental setting for patients who smoke cigarettes. Results add to the body of knowledge supporting the use of clinical decision support tools within EHRs to increase provider delivery of tobacco cessation^{11,12} interventions and referral to telephone counseling.¹⁶

Provider script use was correlated with the patient-reported delivery of tobacco cessation messages. With more consistency across providers (potentially achieved through additional training or reinforcement), greater impact may be realized. There may be a need to investigate this issue further, taking barriers and facilitators into account.

This study took place in a large dental group practice positioned in a larger healthcare system in which education on tobacco cessation has been previously conducted, but not in the past 10 years.¹⁷ Risk assessments of all patients in HPDG clinics include tobacco use. Still, substantial gains were made in assisting patients with strategies for quitting and arranging for follow-up support—areas identified as weak by previous research¹⁸ and HPDG data. Further research should examine potential impacts in environments with fewer investments in addressing tobacco.

Limitations

This trial was not designed to assess subsequent quit rates. However, evidence supports the importance of healthcare providers' advice in encouraging tobacco cessation with their patients^{19,20} and suggests that provider support, regardless of patient's current readiness to change, is positively correlated with tobacco quit attempts.²¹

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding/Support: This research was funded by the NIH/National Institute of Dental and Craniofacial Research—American Reinvestment and Recovery Act 1RC1DE02095-01. **Financial Disclosure:** Dr. Rindal has received research funding from the National Institute of Dental and Craniofacial Research (NIDCR) and Agency for Healthcare Research and Quality (AHRQ). Dr. Rush has received research funding from NIDCR, the National Heart, Lung, and Blood Institute (NHLBI), and the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Dr. Schleyer has received research funding from NIDCR, the National Center for Research Resources (NCRR), and the National Library of Medicine (NLM), and is a consultant to the HealthPartners Research Foundation. Dr. Kirshner has received research funding from NIDCR and NHLBI, and is a consultant to the HealthPartners Research Foundation. Dr. Boyle has received research funding from the NIH, The Robert Wood Johnson Foundation, and ClearWay Minnesota, and is a consultant to the HealthPartners Research Foundation. Ms. Thoele is a consultant to the HealthPartners Research Foundation. Dr. Spallek has received research funding from the NIH, and is a consultant to Patterson Companies, Inc. and the HealthPartners Research Foundation. Dr. Thyvalikakath has received research funding from NCRR and NIDCR and is a consultant to Patterson Companies, Inc., and the HealthPartners Research Foundation.

References

1. DHHS, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General. [Report]. 2010.
2. DHHS PHS. Surgeon General's Treating Tobacco Use and Dependence: Quick Reference Guide for Clinicians. Washington, DC: DHHS; 2009. www.ahrq.gov/clinic/tobacco/tobaqrg.pdf.
3. U.S. Preventive Services Task Force. Counseling and interventions to prevent tobacco use and tobacco-caused disease in adults and pregnant women: U.S. Preventive Services Task Force reaffirmation recommendation statement. *Ann Intern Med*. 2009; 150(8):551–555. [PubMed: 19380855]
4. Conroy MB, Majchrzak NE, Silverman CB, et al. Measuring provider adherence to tobacco treatment guidelines: a comparison of electronic medical record review, patient survey, and provider survey. *Nicotine Tob Res*. 2005; 7(Suppl 1):S35–S43. [PubMed: 16036268]

5. Ferketich AK, Khan Y, Wewers ME. Are physicians asking about tobacco use and assisting with cessation? Results from the 2001–2004 national ambulatory medical care survey (NAMCS). *Prev Med.* 2006; 43(6):472–476. [PubMed: 16920185]
6. Quinn VP, Stevens VJ, Hollis JF, et al. Tobacco-cessation services and patient satisfaction in nine nonprofit HMOs. *Am J Prev Med.* 2005; 29(2):77–84. [PubMed: 16005802]
7. Schroeder SA. What to do with a patient who smokes. *JAMA.* 2005; 294(4):482–487. [PubMed: 16046655]
8. Rindal DB, Rush WA, Boyle RG. Clinical inertia in dentistry: a review of the phenomenon. *J Contemp Dent Pract.* 2008; 9(1):113–121. [PubMed: 18176657]
9. Clay RA. Substance Abuse and Mental Health Services Administration: Screening, Brief Intervention, and Referral to Treatment: New Populations, New Effectiveness Data. 2009; 17(6) www.samhsa.gov/samhsanewsletter/Volume_17_Number_6/SBIRT.aspx.
10. Boyle R, Solberg L, Fiore M. Use of electronic health records to support smoking cessation. *Cochrane Database Syst Rev.* 2011; (12):CD008743. [PubMed: 22161436]
11. Linder JA, Rigotti NA, Schneider LI, Kelley JH, Brawarsky P, Haas JS. An electronic health record-based intervention to improve tobacco treatment in primary care: a cluster-randomized controlled trial. *Arch Intern Med.* 2009; 169(8):781–787. [PubMed: 19398690]
12. Bentz CJ, Bayley KB, Bonin KE, et al. Provider feedback to improve 5A's tobacco cessation in primary care: a cluster randomized clinical trial. *Nicotine Tob Res.* 2007; 9(3):341–349. [PubMed: 17365766]
13. Friedman, C.; Wyatt, J. *Evaluation Methods in Biomedical Informatics.* Springer; 2010.
14. Heatherton TF, Kozlowski LT, Frecker RC, Rickert W, Robinson J. Measuring the heaviness of smoking: using self-reported time to the first cigarette of the day and number of cigarettes smoked per day. *Br J Addict.* 1989; 4(7):791–799. [PubMed: 2758152]
15. Baskerville NB, Hogg W, Lemelin J. The effect of cluster randomization on sample size in prevention research. *J Fam Pract.* 2001; 50(3):W241–W246. [PubMed: 11252223]
16. Sherman SE, Takahashi N, Kalra P, et al. Care coordination to increase referrals to smoking cessation telephone counseling: a demonstration project. *Am J Manag Care.* 2008; 14(3):141–148. [PubMed: 18333706]
17. Havlicek D, Stafne E, Pronk NP. Tobacco cessation interventions in dental networks: a practice-based evaluation of the impact of education on provider knowledge, referrals, and pharmacotherapy use. *Prev Chronic Dis.* 2006; 3(3):A96. [PubMed: 16776897]
18. Succar CT, Hardigan PC, Fleisher JM, Godel JH. Survey of tobacco control among Florida dentists. *J Community Health.* 2011; 36(2):211–218. [PubMed: 20714795]
19. Davila EP, Zhao W, Byrne M, et al. Correlates of smoking quit attempts: Florida Tobacco Callback Survey. 2007. *Tob Induc Dis.* 2009; 5:10. [PubMed: 19563642]
20. Kreuter MW, Chheda SG, Bull FC. How does physician advice influence patient behavior? Evidence for a priming effect. *Arch Fam Med.* 2000; 9(5):426–433. [PubMed: 10810947]
21. Aveyard P, Begh R, Parsons A, West R. Brief opportunistic smoking cessation interventions: a systematic review and meta-analysis to compare advice to quit and offer of assistance. *Addiction.* 2012; 107(6):1066–1073. [PubMed: 22175545]

Figure 1.
Study flow diagram

Table 1

Primary outcome results from the phone survey smokers, %

	Smokers seen at eight usual care clinics (n=285)	Smokers seen at seven intervention clinics (n=263)	p-value ^a
Did your dentist or hygienist ask if you smoke or have ever smoked in the past?	97.6	97.5	0.93
At your most recent visit, did your dentist or hygienist ask about your interest in quitting smoking?	70.2	87.0	0.0006
At your most recent visit, did your dentist or hygienist talk about reasons to quit smoking?	68.4	76.1	0.18
At your most recent visit, did your dentist or hygienist talk about specific strategies for quitting smoking?	25.6	46.8	0.003
At your most recent visit, did your dentist or hygienist refer you to a tobacco quitline (phone line for quitting)?	17.4	37.3	0.007

Note: Significant results are indicated by boldface.

^aPercentages and p-values based on generalized linear mixed model.