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Provider feedback to improve 5A's tobacco cessation in primary care: A cluster randomized clinical trial

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The electronic health record (EHR) may be an effective tool to help clinicians address tobacco use more consistently. To evaluate the impact of EHR-generated practice feedback on rates of referral to a state-level tobacco quitline, we conducted a cluster randomized clinical trial (feedback versus no feedback) within 19 primary care clinics in Oregon. Intervention clinics received provider-specific monthly feedback reports generated from EHR data. The reports rated provider performance in *asking, advising, assessing*, and *assisting* with tobacco cessation compared with a clinic average and an achievable benchmark of care. During 12 months of follow-up, EHR-documented rates of advising, assessing, and assisting were significantly improved in the intervention clinics compared with the control clinics ($p<.001$). A higher case-mix index and presence of a clinic champion were associated with higher rates of referral to a state-level quitline. EHR-generated provider feedback improved documentation of assistance with tobacco cessation. Connecting physician offices to a state-level quitline was feasible and well accepted.

Introduction

The tobacco cessation research literature strongly supports the use of a comprehensive, clinic-based approach to tobacco cessation, known as the 5A's—*ask, advise, assess, assist*, and *arrange* follow-up—although less than 30% of the smokers seen for primary care visits are offered any type of evidence-based assistance in quitting (Fiore et al., 2000). Even though rates of performance of the *ask, assess*, and *advise* components of the 5A's model are increasing, the most effective components of the model, offering assistance and arranging for follow-up, are far less common (Solberg, Asche, Boyle, Boucher, & Pronk, 2005). Rates of provision of the 5A's are higher for patients during preventive care visits and for patients with chronic diseases, especially diseases associated with tobacco, but significant opportunity for improvement remains (Jaén, Crabtree, Zyzanski, Goodwin, & Stange, 1998; Jaén, Stange, Tumiel, & Nutting, 1997; Smith, Scheffer, Payne, Applegate, & Crews, 2003). To help more smokers quit, physicians need a convenient and practical way to connect smokers to the services they need. We developed and tested one such model through three separate pilot projects in Oregon (Bentz, McAfee, & Willoughby, 2002; Bentz et al., 2006), in which smokers were advised by clinicians and connected to telephone tobacco quitline counselors (Stead, Lancaster, & Perera, 2004; Zhu et al., 1996) for additional help (Figure 1). These pilot studies showed that a ''quit-line connection'' is feasible, but they did not show how large numbers of clinicians could be encouraged to adopt and maintain this practice pattern.

Traditional continuing medical education does little to change provider behavior. Educational outreach and academic detailing, opinion leaders and clinic champions (Aug, 2001; Harper, Baker, &

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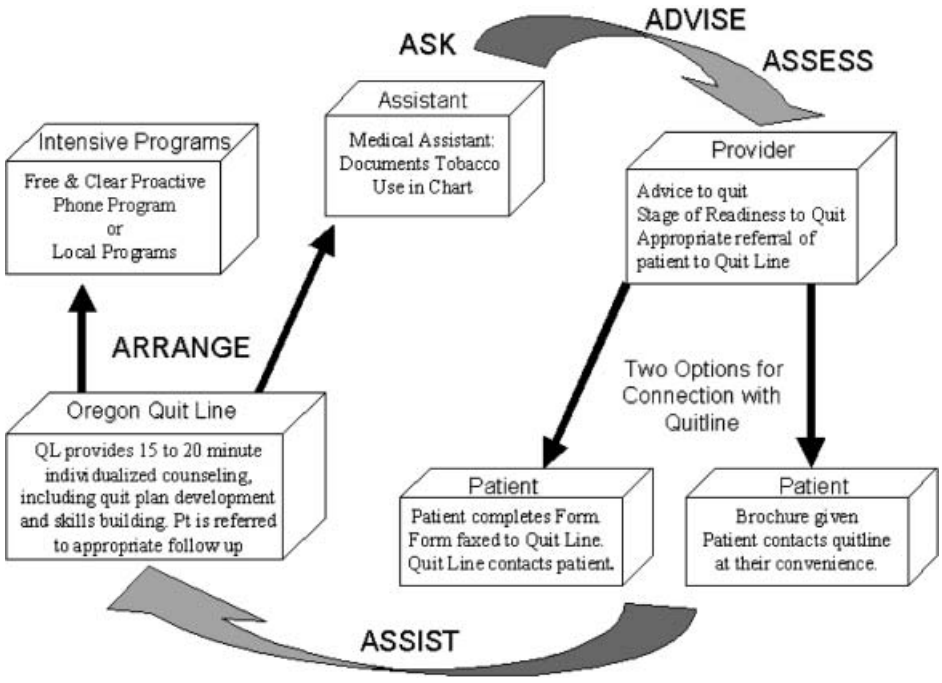

Figure 1. Oregon Quit Line Connection.

Reif, 2000; Thomson O'Brien, Oxman, Davis et al., 2003; Wise & Billi, 1995), and alerts and reminders are more likely to result in behavior change (Davis, Thomson, Oxman, & Haynes, 1995; Davis et al., 1999). Combining these strategies is more successful (Davis & Taylor-Vaisey, 1997; Shea, Dumonchel, & Bahamonde, 1996; Wensing, van der Weijden, & Grol, 1998). Performance feedback (Nathanson, 1994), especially with comparison to peers (Goebel, 1997), is another effective method of improving compliance with clinical practice guidelines (Balas et al., 1996; Beilby & Silagy, 1997). Although not enough is known about the optimal characteristics of feedback (Grimshaw et al., 2001; Grimshaw et al., 2004), comparison with an "achievable benchmark of care" appears promising (Kiefe et al., 2001). This paper reports the results of a randomized clinical trial to test the effect of feedback given to primary care providers on the delivery rate of assistance with tobacco cessation and referral to a state-level tobacco quitline.

Method

Design

A cluster randomized clinical trial was designed to determine whether electronic health record (EHR)-generated provider performance feedback increases tobacco cessation efforts in primary care clinics. After establishing a clinical pathway for quitline referral (Figure 1), we matched clinics (clusters) according to business affiliation, payer mix, and baseline *ask* rates, and then we randomized the clusters to receive feedback (intervention group) or no feedback (control group). The main outcomes were EHR-documented tobacco-related performance of *ask, advise, assess*, and *assist*, and referral of tobacco users to the Oregon Tobacco Quit Line (*arrange*) over a 12-month period.

Setting and participants

The study population consisted of 19 primary care clinics in Providence Health System, an integrated delivery system in Portland, Oregon. The clinics use Logician, a standard EHR for storage and retrieval of demographic information, diagnoses, medications, laboratory data, vital signs, and visit records. Providers within these clinics care for a diverse population of 175,000 patients. The Oregon Tobacco Quit Line is operated by Free & Clear, Inc., a Seattle-based health risk treatment company that delivers telephone-based tobacco cessation services to 10 states, 30 private health plans, and 20 major employers.

Preparatory phase

Building on previous work (Bentz, 2000; Bentz, Davis, & Bayley, 2002), we incorporated into Logician a standard method for EHR documentation of patients' tobacco status, provider advice to quit, assessment of readiness to quit, and assistance with quitting, including an electronic quitline fax-referral capability (Figure 2). All clinics had access to

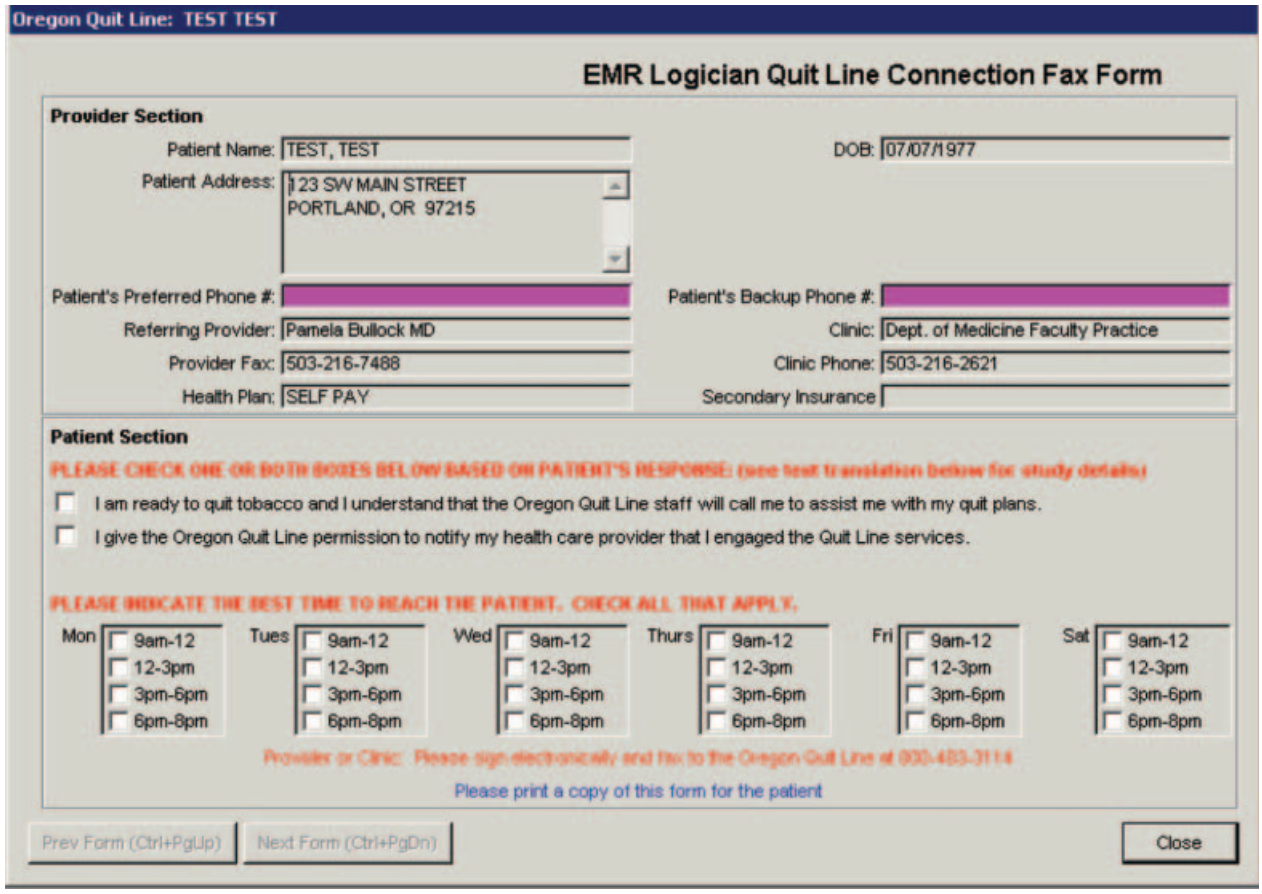

Figure 2. Electronic health record fax form.

the same resources for tobacco users. Physician trainers, blinded to study arm, held 30-min training sessions for providers and staff in all clinics to review evidence-based cessation strategies. In these sessions, providers were updated on motivational counseling techniques, given information on appropriate pharmacotherapy, and encouraged to consider referral to the Oregon Tobacco Quit Line as a "best practice" for tobacco cessation assistance. Arrangements were made to have EHR-generated fax referrals include HIPAA-compliant informed consent by patients to participate in the study. Quitline staff obtained informed consent from all other patients.

Intervention

For intervention clinics only, feedback reports from data extracted from the EHR (30,000 office visits per month) were created at the beginning of each month from current data, trended over time, to show individual provider and clinic performance in asking about tobacco use, advising to quit, assessing readiness to quit, and assisting with cessation. These reports contained information only on tobacco cessation and did not include information on other preventive health services. Assistance with cessation documented in the EHR was defined as follows: (a) Faxing a referral to the Oregon Quit Line, (b) giving the patient a quitline brochure, or (c) any type of "other" assistance with cessation (during the study "other" was defined as provision of written anti-smoking materials, discussion or counseling, development of a behavioral plan, or prescribed medications). Each provider's individual feedback report, created using Crystal Reports and displayed graphically using Pop Charts (Figure 3), included a summary of rates, a comparison of the provider's performance to the local clinic average and to an achievable benchmark of care, defined as the average performance of the top 10% of providers being measured (Kiefe et al., 2001). At a scheduled group meeting, a research team member introduced intervention clinics to their first feedback report. Subsequent reports were delivered monthly to the clinic manager for distribution to providers and medical assistants. Each clinician received a total of 12 reports over the 12-month study period.

Primary outcome measures

EHR-documented rates of *ask, advise, assess*, and *assist* comprised one set of outcome measures

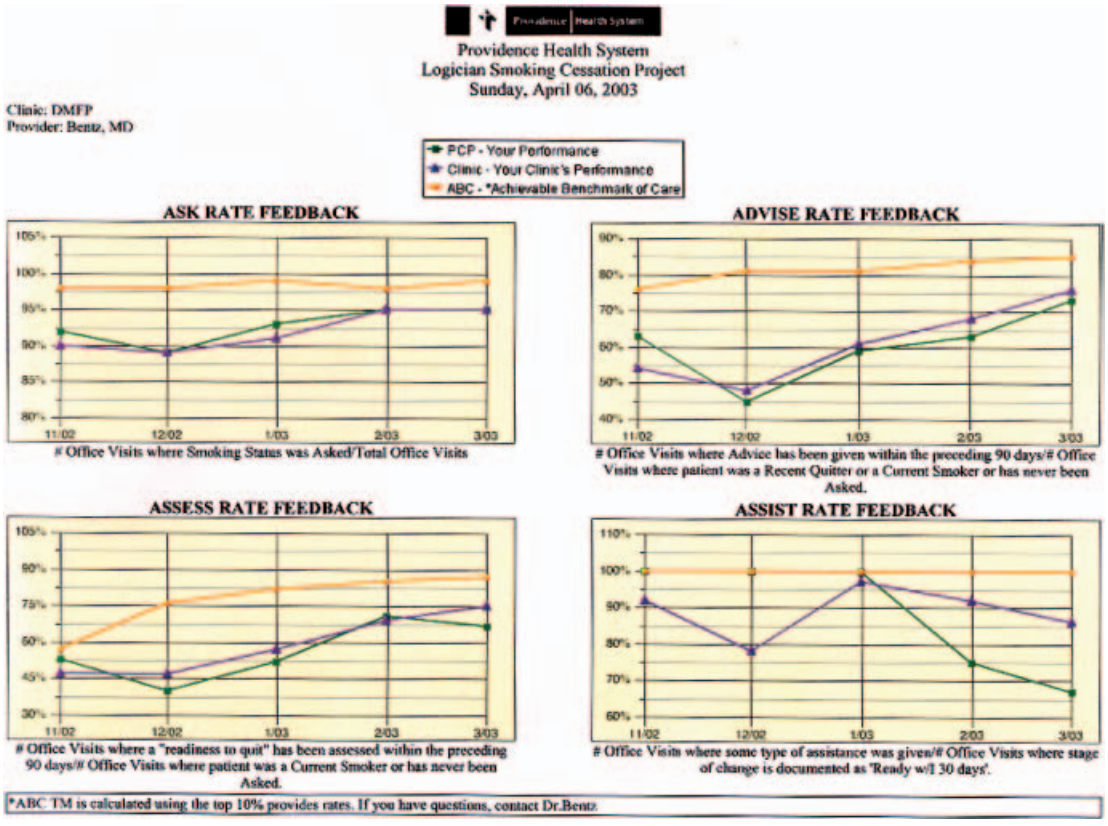

Figure 3. Intervention clinic feedback instrument.

calculated monthly throughout the study period. In addition, we measured the impact of feedback on actual connections made to the Oregon Tobacco Quit Line every month throughout the study period. Every call to the Oregon Tobacco Quit Line during the study period was assessed for relation to study clinics or study providers. Both fax referrals and self-referrals (calling the quitline after receipt of a brochure) were included in the analysis. Three different levels of "quitline connection" were predefined: (a) Referred, in which a valid fax referral was received by the quitline, (b) reached, in which the patient, after a fax or brochure referral, was connected via telephone with an intake person or call screener at the quitline, and (c) counseled, in which the patient accepted and received tobacco cessation counseling from a quitline counselor. Institutional review board approval was obtained from all organizations involved.

Measures of covariates

In addition to the clinic factors of payer mix, business affiliation, and baseline *ask* rates, we developed two other covariates during the study. First, we conducted structured interviews of the clinic managers or lead nurses to assess the presence or absence of a clinic champion. A champion was defined as someone who believed that tobacco cessation was important and who publicly advocated use of the fax-referral process in each clinic (Harper et al., 2000; Wise & Billi, 1995). Interview responses were scored as a dichotomous outcome (present or absent) and were independently reviewed by two blinded study investigators to ensure that the person identified had actually acted as a clinic champion (e.g., discussed tobacco cessation issues in meetings, supported the project, set an example). Interrater reliability, evaluated using a kappa statistic, showed that agreement on the presence or absence of a clinic champion was excellent ($\kappa = .889$). We also calculated a case-mix score based on age, sex, and diagnostic information gleaned from the EHR, on the premise that older and sicker patients might be more interested in quitting (Lando, Hennrikus, McCarty, & Vessey, 2003). This case-mix score, which was the ratio of actual health care costs compared with the expected costs in a referent database, developed and previously validated within this population (Thomas, 2003; Thomas, Grazier, & Ward, 2002), was calculated for all patients at baseline and again for all smokers at the end of the study.

Sample size and randomization

EHR data collected 6 months prior to the start of the study period and prior to implementation of the EHR tracking system showed a baseline smoking

Table 1. Clinic baseline characteristics.

Characteristic	Control clinics (n=9)	Intervention clinics (n=10)	p value
Patient variable			
Age (years), mean (*SD*)	50.7 (5.6)	54.2 (6.7)	.24
Gender, percent male	33.5	34.0	.82
Primary insurance			
Medicaid, percent	9	6.6	.47
Commercial, percent	61.1	57.4	.50
Medicare, percent	25.2	33.7	.09
Uninsured, percent	4.7	2.3	.11
Baseline smoking rate, percent (number of smokers/number of active patients)	7.1	8.0	.73
Provider variable			
Total number of physicians/faculty	55	57	
Gender, percent male	49.2	51.6	.75
Specialty			
Family practice, percent	59.4	41.7	.44
Internal medicine, percent	40.6	58.3	.44
Experience (years since graduation), mean (*SD*)	15.2 (2.8)	14.4 (4.3)	.65
Total number of active patients	140,058	120,686	
Clinic variable			
Number of office visits	34,724	34,778	
Length of time on EHR (years on EHR), mean (*SD*)	4.4 (0.7)	4.3 (1.2)	
Baseline *ask* rate, percent	77.6	82.6	.47
Baseline *advise* rate, percent	16.7	18.5	.74
Baseline case-mix score[a]	1.05	0.98	.55

Note. [a]A case-mix covariate (Thomas, 2002) for each smoker was calculated from EHR data using the variables of age, sex, number of problems, and type of medical problems. The case-mix score is the ratio of the expected health care costs for this patient compared with the actual per-member cost in a referent database (Providence Health Plan).

prevalence of 15% and a baseline asking rate of 30%. Sample size estimates were powered to detect changes in *ask* rates from 30% to 65%, *advice* rates from 30% to 60%, and *assist* rates from 10% to 30%. Based on these assumptions, we calculated that 17.4 clinics with 172,680 patients were required for this study. Intracluster correlation coefficients (ICCs) were calculated using an analysis of variance method proposed by Eldridge, Cryer, Feder, and Underwood (2001) and programmed using S-PLUS software. Conservative (unadjusted) ICCs estimated from pilot data for *ask*, *advise*, and *assist* were 0.22, 0.15, and 0.22, respectively. The final study ICCs for *ask, advise*, and *assist* were 0.13, 0.15, and 0.19. Therefore, the actual ICC coefficients were less than or equal to the ones estimated from pilot data. Three matching variables were used for randomization: (a) Business affiliation, (b) payer mix, and (c) baseline *ask* rates. Following 6 months of pilot data collection, matched clinics (clusters) were randomized to receive feedback (intervention group) or no feedback (control group) using the method described by Raab and Butcher (2001).

Data analyses

Baseline continuous variables were analyzed using weighted *t*-tests, and categorical variables were compared using chi-square tests. Analysis of all outcome variables was performed using generalized estimating equations (Donner & Klar, 2000) to accommodate cluster-level and several a priori defined individual-level covariates: (a) Clinic volume, defined as the number of patient visits in the preceding year, (b) size of clinic, defined as the number of physician providers in the clinic, (c) insurance mix, defined as the percentage of patients who had Medicare, Medicaid, or commercial coverage or who were uninsured, (d) baseline *ask* rate, calculated from EHR data in the preceding year, (e) the presence of a clinic champion, a binary variable based on the qualitative survey, and (f) the case-mix covariate.

Disruption of quitline services

Six months into the intervention period of this study, quitline services and media promotion ceased because of suspension of state funding for the Oregon Tobacco Quit Line. Despite the unavailability of quitline services for the entire state, all study clinics were able to continue to receive quitline counseling on a fee-per-call basis, supported by research grant funds using new telephone numbers for patient calls and fax referrals. In the second half of the study period, providers were updated on the quitline suspension and trained on the use of a new brochure, toll-free number, and fax number, and these brochures and fax forms were distributed to the clinics and the EHR was updated.

Results

Intervention and control clinics were similar on all patient-, provider-, and clinic-level variables measured

Table 2. EHR documentation of tobacco cessation.

Performance	Control (n=54,003)	Feedback (n=48,912)	Crude Odds ratio (95% *CI*)	p value
Asked rate[a]	88.1% (n=47,587)	94.5% (n=46,222)	1.072 (1.068–1.076)	.05
Advised rate[b]	52.7% (n=4,200)	71.6% (n=5,340)	1.36 (1.33–1.39)	<.001
Assessed rate[b]	40.1% (n=3,197)	65.5% (n=4,886)	1.63 (1.53–1.69)	<.001
Assisted rate[b]	10.5% (n=835)	20.1% (n=1,500)	1.92 (1.78–2.08)	<.001

Note. [a]Number patients asked/total number unique patients seen during study period. [b]EHR data on 7,976 smokers in control clinics and 7,459 smokers in intervention clinics.

in the 6-month period prior to randomization (Table 1). Modifications to the EHR occurred 6 months prior to the start of the study. The baseline *ask* rates at the beginning of the study period were much higher than the rates used in the sample size calculations because of spontaneous use of the EHR tobacco use forms by providers. All providers (150 medical doctors, 14 registered nurses, 8 nurse practitioners, and 107 medical assistants) in all clinics received the initial training at the start of the study period. Process measures indicated that in the intervention clinics the clinic manager or the lead nurse distributed the monthly EHR-generated feedback reports to all clinicians as intended over the 12-month study period. Reports were delivered individually to providers 52% of the time, delivered to the group during a provider meeting 30% of the time, and placed in the provider's mailbox for independent review 18% of the time. Smoking rates over the study period were similar in the intervention and control clinics (15.4% vs. 14.9%, respectively; p=*ns*).

Documentation

Over the 12-month study period, providers in the intervention clinics had higher rates of EHR documentation of asking about tobacco use, giving advice to quit, and assessing readiness to quit. Smokers in intervention clinics had almost double the rates of documentation of assistance with quitting (Table 2). Further analysis of the assistance measure revealed no difference in EHR documentation of quitline referral (either fax or brochure) between intervention and control clinics; however, in the intervention clinics, documentation of providing ''other'' types of assistance increased significantly.

Quitline connection

During the study period, of all patients referred to the quitline, 693 (4.4% of smokers) gave consent for inclusion in the study. Owing to systematic protocol violations, data from one provider's patients (n=77) were excluded, along with 29 other referrals for patients who were not identified as current smokers in the EHR database, leaving 587 referrals available for analysis.

A direct comparison of the effect of feedback on quitline referral rates showed no difference between intervention and control clinics. Statistical analysis using generalized estimating equations, however, revealed a statistically significant impact of feedback on quitline referral rates when two factors were taken into account: Case-mix score and the presence of a clinic champion.

High case-mix scores (a higher score indicates a sicker population) had a direct relationship to quitline referral (odds ratio=1.17, 95% *CI*=1.11–1.24, p<.001). Even though we found no significant difference between intervention and control clinics for all patients, the mean and median case-mix scores for smokers were higher in the control clinics at 1.57 (*Mdn*=1.2) compared with the intervention clinics at 1.36 (*Mdn*=0.9).

For the quitline referral outcome, the odds ratio for the presence of a clinic champion was 3.44 (95% *CI*=2.35–5.03); however, the randomization did not provide an equal balance of clinic champions, as this was not a matching variable at baseline. In the control arm, 67.5% of smokers (5,451/8,070) were seen in a clinic with a champion, compared with only 37.4% (2,823/7,545) in the intervention arm (p<.001).

After adjusting for case mix and the presence of a clinic champion, we found that the odds ratio for feedback was 1.53 (95% *CI*=1.05–2.23) for total referral rate. The adjusted odds ratios for feedback

Table 3. Quitline assistance with tobacco cessation.

Tobacco telephone quitline activity	Control (n=8,070)	Feedback (n=7,545)	Crude Odds ratio (95% *CI*)	p value	Adjusted odds ratio[a] (95% *CI*)	Adjusted p value[a]
Smokers referred	292 (3.6%)	295 (3.9%)	1.08 (0.65–1.80)	.755	1.533 (1.05–2.23)[b]	.026[b]
Smokers reached	195 (2.4%)	212 (2.8%)	1.16 (0.71–1.92)	.541	1.46 (1.01–2.12)[b]	.05[b]
Smokers counseled	182 (2.3%)	193 (2.6%)	1.14 (.069–1.87)	.93	1.53 (1.05–2.23)[b]	.028[b]

Note. Smokers referred=a valid referral was received at the quitline. Smokers reached=a quitline screener contacted the patient by phone. Smokers counseled=patient accepted and received intervention from quitline counselor. [a]Adjusted for presence of clinic champion, case mix, baseline *ask* rates, insurance mix, clinic size, and clinic volume. [b]In addition to feedback, the presence of a clinic champion (p<.001) and a higher mix (p<.001) were significant covariates in the model.

for those ''reached'' and for those ''counseled'' were 1.46 (95% *CI*=1.01–2.12) and 1.53 (95% *CI*=1.05–2.23), respectively (Table 3). Clinic volume, baseline *ask* rate, size of clinic, and insurance mix were not significant covariates in the model.

Discussion

In the present study, EHR-generated feedback increased the rate of documentation of assistance with tobacco cessation. This finding, a doubling of the amount of documentation of assistance in intervention clinics, compared with control clinics, is consistent with other studies using feedback, education (Andrews, Tingen, Waller, & Harper, 2001), and academic detailing (Swartz, Cowan, DePue, & Goldstein, 2002; Young, D'Este, & Ward, 2002). The effect of feedback on quitline referrals was not significant in unadjusted comparisons but became significant after adjusting for two other important predictors, patient case mix and the presence of a local clinic champion, which varied between treatment and control groups.

The multivariate model showed that the presence of a clinic champion was an important covariate in predicting connections to the quitline. This finding reinforces results from other studies on champions (Aug, 2001; Harper et al., 2000; Wise & Billi, 1995) and local opinion leaders (Thomson O'Brien, Oxman, Davis et al., 2003). Interestingly, the champions in this study were not necessarily physicians, as we found that lead nurses often were active in exhorting medical assistants to ask about tobacco use and to follow through with faxing referrals. Future studies need to focus on ways to recruit and reinforce behavior of clinic champions.

Patient case mix also appears to be an important factor in cessation efforts, as tobacco users with high case-mix scores were more likely to be referred for assistance. Older and sicker patients may be more interested in quitting (Lando et al., 2003). Moreover, clinicians may be more likely to make the case for cessation and patients may be more receptive when the negative health effects of smoking are present.

In the baseline analysis, however, we found no impact of feedback on EHR documentation of referral or receipt of calls at the quitline. This finding could have several causes, including that feedback is a relatively low-level intervention (Grimshaw et al., 2004) that is more useful when combined with other interventions such as alerts and reminders (Thomson O'Brien, Oxman, Haynes et al., 2003). Another possibility is that the feedback instrument provided feedback on too many targets (*ask, advise, assess*, and a generic *assist* measure) rather than focusing on a single key measure. Another reason why feedback improved documentation of assistance but not actual quitline referral rates may be the nature of the feedback itself. Our feedback instrument reports were based on documentation of any type of assistance, which included quitline referral, but the feedback was not on quitline referral per se. This may have diluted the power of the feedback and minimized the effect on referral rates. Future studies should focus on the effect of specific feedback on the target of successful quitline referral and also should include patient-level measures to verify if the finding of improved EHR documentation reflects an actual change in provider behavior.

Another limitation of the study is that there was no true usual-care control group given that both intervention and control clinics were provided convenient EHR tools for documenting tobacco control activities and all had received training and reinforcement for addressing tobacco, as evidenced by a significant amount of delivery of the 5A's in the control clinics. Also, all of the physicians studied were working within an integrated health care delivery system in which addressing tobacco has been a priority for over a decade. These background organizational change efforts related to tobacco control began well before the start of the present study of feedback, and the low overall smoking rate in our study population reflects the result of health system efforts to systematically address tobacco use (Bentz, Davis et al., 2002; Schroeder, 2005).

The most noteworthy accomplishment of the project was to demonstrate the feasibility of establishing a new clinical pathway for the 5A's. Because procedures were simple and convenient, we found that is was relatively easy to modify the EHR, redesign the clinic workflow, gain buy-in from staff, and incorporate the measurement and feedback procedures into the routine of clinic practice (Nelson, Splaine, Batalden, & Plume, 1998).

Although we were unable to assess overall impact of this quitline referral process, the 4% referral rate of smokers within the clinics represents a threefold increase, compared with population-based historical data in Oregon (El-Bastawissi et al., 2003) and Wisconsin (Perry, Keller, Fraser, & Fiore, 2005). Several hundred patients referred to the quitline did not give consent to be included in this study; inclusion of these patients would have raised our overall referral rate even further.

The disruption of quitline services had a major impact on quitline referral rates, which were initially quite high, then dropped precipitously at first and increased slowly toward the end of the study period. Efforts were made to educate providers on the new quitline numbers; however, despite this retraining, post-study interviews revealed that many providers were not aware that this service remained available to

all clinic patients. The loss of the quitline during this study period highlights the need for stable funding and reliable operation of the quitlines. Any health system considering the use of a state-level quitline as the prime referral source should meet with state agencies and the service provider to ensure that funding and type of service appears stable. If funding is not secure, other mechanisms such as direct contracting for services, as in this study, should be considered.

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