

Efficacy of Educational Interventions Targeting Primary Care Providers' Practice Behaviors: an Overview of Published Systematic Reviews

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Abstract

Objectives: Primary care providers (e.g., family physicians, pediatricians, registered nurses, physician assistants, and nurse practitioners) could play a pivotal role in the provision of preventive services, especially for very young children (younger than 3 years old) and population groups with limited access to dental care. Given the current problems with access to dental care among low-income Americans, we contend there is a need to involve nondental primary health care providers in screening for and preventing oral health problems. The objective of this overview is to present findings from systematic reviews on the efficacy of continuing medical education, printed educational material, academic outreach, reminders, and local opinion leaders on the adoption of new knowledge and practices by primary care providers. **Methods:** A search was conducted using the Cochrane Library and MEDLINE. The search aimed to locate systematic reviews published between January 1988 and March 2003. Two researchers independently extracted data and assessed study quality using a modified version of the QUOROM statement. **Results:** Eleven systematic reviews were included in this overview. The evidence from the included systematic reviews showed that formal continuing medical education (CME) and distributing educational materials did not effectively change primary care providers' behaviors. There are effective interventions available to increase knowledge and change behaviors of primary care providers, such as small group discussion, interactive workshops, educational outreach visits, and reminders. **Conclusion:** There is a limited knowledge base on the efficacy of the selected interventions on oral health screening by primary care providers. Considering the potential role of primary care providers in improving oral health of underserved populations, this research area should receive more attention. [J Public Health Dent 2004;64(3):164-72]

Key Words: systematic review, educational intervention, primary care providers, oral health screening.

While oral health status of American children and young adults has improved significantly during the past three decades, the burden of oral diseases is still high among underserved low-income population groups who lack access to adequate dental care and have higher exposure than other Americans to risk factors associated with poor oral health (1). The Third National Health and Nutrition Examination Survey (NHANES III) found that about one-third of preschoolers from low-income families had at least one primary tooth with untreated de-

cay, whereas only 12 percent or fewer children from higher-income families had such cavities (2).

Among other reasons, infrequent dental visits due to limited access to dental care services are attributed to the oral health disparities among children (3,4). Although publicly funded programs such as Medicaid have succeeded dramatically in providing regular medical care to children from low-income families, Medicaid's record of ensuring regular access to dentists and providing effective dental care is less successful (1). Fewer than

one in five Medicaid-covered children received a single preventive dental visit between 1992 and 1993, according to the US inspector general (5). The study indicated that three-fourths of states provided preventive services to fewer than 30 percent of eligible children, and no state provided preventive dental care to more than 50 percent of all eligible children. A 1998 survey of state Medicaid programs by the National Conference of State Legislatures (6) reported that, on average, only 16 percent of dentists in the 35 responding states participated actively in Medicaid.

Given the current problems with access to dental care among low-income Americans, we contend there is a need to involve nondental primary care providers (e.g., family physicians, pediatricians, registered nurses, physician assistants, and nurse practitioners) to play a role in promoting oral health by providing advice and referring patients for dental care. In areas with severe shortage of dentists, primary care providers (primary care providers) may provide preventive screening in collaboration with organized dental groups or associations. There are currently initiatives in some states, such as North Carolina and Washington, to train primary care providers to provide early oral health screening and preventive care for low-income children. Primary care providers could play a pivotal role in the provision of preventive services, especially for very young children (younger than 3 years old) and population groups with limited access to dental care (7,8).

Currently, there is limited information on adoption levels of early screening and prevention of oral health problems by primary care providers. There

are many barriers to engaging primary care providers in promoting oral health in their practices and no concerted plan exists to translate and disseminate information on oral health to primary care providers. Recent surveys targeting physicians have consistently reported that primary care physicians (family physicians and pediatricians) are well aware of the importance of their role in promoting oral health and are willing to participate in programs to achieve this goal, but they have limited knowledge of issues related to oral health and new fluoride supplementation guidelines (7; unpublished report, copies available from the authors). There is a need to investigate methods of translating and disseminating information on oral health to primary care providers to modify their practice behaviors to include oral health screening and prevention.

The objective of this paper is to present findings from systematic reviews on the efficacy of educational interventions in the form of continuing medical education and dissemination of educational materials, academic outreach, reminders and local opinion leaders, on the adoption of new knowledge and practices by primary care providers. These four interventions were chosen as a focus of this overview because they represent the methods that are widely used to disseminate information to primary care providers. These methods can also be used practically by dental public health professionals in programs that aim to involve primary care providers in early screening and prevention of oral health problems in low-income Americans.

Methods

Interventions. The definitions of the interventions included in this overview are: (modified from the definitions by Oxman et al.) (9):

Educational Materials: Transferring information through disseminating educational materials such as printed recommendations for clinical care including clinical practice guidelines, audiovisual materials, and electronic publications.

Formal Continuing Medical Education: Education provided in the forms of conferences, lectures, workshops, or educational meetings.

Educational Outreach Visits (Academic Detailing): Presentation by a

trained person who meets with providers in their practices to provide information in an interactive format. The information given may include feedback on the provider's performance.

Local Opinion Leaders: Distribution of educational materials by providers who are nominated or considered by their colleagues as "educationally influential."

Reminders: Any intervention (manual or computerized) that prompts the health care providers to perform a clinical action. Examples include concurrent or intervisit reminders to professionals about desired actions such as screening or other preventive services, enhanced laboratory reports, or administrative support (e.g., follow-up appointment system or stickers on chart). Computerized reminder system was not included in this review.

Search Strategy. A search for relevant systematic reviews was conducted using the Cochrane Library and MEDLINE. The search aimed to locate systematic reviews published between January 1988 and March 2003. The search terms used were the following: "continuing medical education," "CME," "educational material," "practice guideline," "opinion leader," "consensus process," "outreach visit," "academic detailing," "reminder." These terms were used in combination with "primary care provider," "nurse," "physician," "health care provider," "medical practice," "primary health care," "family practice," "physician's practice patterns," "mass screening," and "professional practice." A filter that included the following terms was used: "meta-analysis," "quantitative review/overview," "systematic review/overview," "methodologic review/overview," "medline," and "pooled." Letters, editorials, or comments were excluded. The reference list of the systematic reviews identified by the search were screened to locate additional reviews. Decisions on inclusion/exclusion of each review were made separately by two of the authors (WS and AI); any disagreements were resolved by consensus.

Inclusion Criteria. For this overview, only completed systematic reviews of interventions that aimed to promote adoption of new practice behaviors by health care providers were

included. The inclusion criteria were:

Interventions: Included reviews focused on the efficacy of at least one of the following interventions: formal continuing medical education including dissemination of educational materials, outreach visits (academic detailing), reminders, and local opinion leaders on health care professionals' adoption of new practices and practice behaviors. This overview focused on the efficacy of single interventions. Therefore, systematic reviews that reported on the efficacy of combinations of these interventions were included only if information on the efficacy of each single intervention was described.

Outcome Measures: There was a wide range of outcome measures described in the systematic reviews located by the search. While our primary outcome measures of interest were primary care providers' adoption of new procedures or their knowledge level, we included reviews that have described a broad range of outcomes (e.g., adoption of new preventive practices, improvement in preventive practices, clinical management of medical conditions, and prescribing practice). However, reviews that focused solely on the efficacy of interventions on reducing cost of prescription were excluded. Reviews that solely focused on patient outcomes rather than primary care providers' performance or knowledge also were not included in this overview.

Participants: Main participants of each systematic review were primary care providers including physicians, nurses, nurse practitioners, and physician assistants.

Quality of Reporting: Only reviews that clearly reported the search terms, databases searched, and explicit inclusion/exclusion criteria were selected.

Primary Study Design: We selected reviews that included randomized controlled trials (RCT), controlled trials with at least two arms (CCT), or controlled before and after studies (CBA) and interrupted time series analyses (ITA).

Language: We selected reviews reported in English.

Multiple Publication: In case a systematic review was published with multiple updates, only the most recent version was included.

Data Abstraction: Abstraction form included information on interven-

tions, databases searched, designs of included studies, targeted professional groups, results of each included systematic review, number of studies included, their findings, and the authors' conclusions. Data abstraction was performed by two authors (WS and MT) and disagreements were resolved by consensus.

The quality of included systematic reviews was evaluated using the QUOROM checklist of standards for reporting of systematic reviews (10). A total of 17 items was evaluated and a quantitative score was generated based on the number of items that fulfilled the criteria. From this quantitative score, we assigned one of the following ratings of the scientific quality to each systematic review: (1) minimal flaws (15 or more items fulfilled), (2) minor flaws (13–14 items fulfilled), (3) major flaws (11–12 items fulfilled), and (4) extensive flaws (10 or fewer items fulfilled).

Results

A search of the Cochrane Library yielded 77 systematic reviews. Additionally, a MEDLINE search yielded 119 reviews. We located one additional systematic review through hand search. As a total we located 197 systematic reviews. By screening titles and abstracts, we selected 24 systematic reviews that focused on the 5 interventions of interest targeting health care professionals and their practice behaviors. From the 24 systematic reviews, we selected 11 reviews that met the inclusion criteria (Table 1). The remaining 13 reviews were excluded mainly because the efficacy of a single intervention could not be assessed separately, or because a review did not include any outcome measures related to primary care provider performance (Table 2). The quality of reporting of the included systematic reviews was generally high. The quality score based on the QUOROM check list ranged from minor to minimal flaws, indicating they fulfilled at least 13 items out of 17 in the list (Table 3). Efficacy of each single intervention is briefly summarized in Table 4.

Dissemination of Educational Materials. Four systematic reviews that met our inclusion criteria described the efficacy of disseminating educational materials or clinical guidelines. Davis et al. (11) reported that seven out of 11 studies that compared educa-

TABLE 1
List of Included Systematic Reviews by Intervention (*n*=11 Reviews)

Intervention	Included Systematic Reviews (Reference)
Dissemination of educational materials/ clinical practice guidelines	Davis et al., 1995 (11)* Hulscher et al., 2002 (13)* Thomas et al., 2002 (14) Wensing et al., 1998 (12)*
Formal continuing medical education	Davis et al., 1995 (11)* Harvey et al 2002 (16) Hulscher et al., 2002 (13)* Thomson O'Brien et al., 2002 (15)
Educational outreach (academic detailing)	Oxman et al., 1995 (9)* Thomson O'Brien et al., 2002 (17)
Local opinion leaders (social influence)	Hulscher et al., 2002 (13)* Thomson O'Brien et al., 2002 (18) Wensing et al., 1998 (12)*
Reminders	Davis et al., 1995 (11)* Hulscher et al., 2002 (13)* Mandelblatt and Kanetsky, 1995 (19) Snell and Buck, 1996 (20)

*Studies appeared multiple times because they included more than one intervention.

TABLE 2
List of Excluded Studies (*n*=13)

Excluded Study (Reference)	Reasons for Exclusion
Beaudry, 1989 (27)	Efficacy of single interventions was not assessable
Beilby et al., 1997 (28)	Outcome not relevant- change in prescription behavior/ costs reduction
Davis, 1998 (29)	Overlap with newer publication
Davis & Taylor-Vaisey, 1997 (26)	Overlap with newer publication
Davis et al., 1992 (30)	Efficacy of single interventions was not assessable
Figueiras et al., 2001(31)	Efficacy of single interventions was not assessable
Freemantle et al., 2000 (32)	Withdrawn from the Cochrane Library
Grimshaw & Russell, 1993 (33)	Efficacy of single interventions was not assessable
Hulscher et al., 1999 (34)	Overlap with newer publication
Lancaster et al., 2002 (35)	Efficacy of single interventions was not assessable
Waddell, 1991 (36)	Efficacy of single interventions was not assessable
Worrall et al., 1997 (37)	Outcome not relevant—only patient outcome measured
Yano et al., 1995 (38)	Efficacy of single interventions was not assessable

tional materials such as printed monographs or audiovisual programs with no intervention control failed to dem-

onstrate a positive effect on professional performance or patient outcomes. Wensing et al. (12) reported

TABLE 3
Quality Assessment for Systematic Reviews Included

Author (Reference)	Database Searched	Level of Flaws*
Davis et al., 1995 (11)	MEDLINE, ERIC, NTIS, and other data sources (1975–94)	Minor
Harvey et al., 2001 (16)	Cochrane Effective Practice and Organization of care group and others (1997–2000). MEDLINE, EMBASE, Cinahl, and others (1973–2000)	Minor
Hulscher et al., 2002 (13)	EPOC, MEDLINE, CINAHL (up to 2001)	Minor
Mandelblatt et al., 1995 (19)	MEDLINE (1980–93)	Minimal
Oxman et al., 1995 (9)	MEDLINE, SCISEARCH, CINAHL and others (1970–93)	Minor
Thomas et al., 2002 (14)	MEDLINE, CINAHL, PsycLit, EMBASE, NHS Economic Evaluations Database; DHSS-Data and DARE (1975–76)	Minor
Thomson O'Brien et al., 2002 (15)	EPOC, RBRD/CME MEDLINE (1966–99)	Minor
Thomson O'Brien et al., 2002(17)	MEDLINE (up to March 1997), RBRD/CME and others	Minimal
Thomson O'Brien et al., 2002 (18)	MEDLINE (up to May 1998), RBRD/CME and others	Minimal
Snell et al., 1996 (20)	National Library of Medicine (MESH 1989–94)	Minimal
Wensing et al., 1998 (12)	MEDLINE (1980–94)	Minor

*Level of flaws is based on 17 items of the Quorum checklist: (1) minimal flaws (15 or more items fulfilled), (2) minor flaws (13–14 items fulfilled), (3) major flaws (11–12 items fulfilled), and (4) extensive flaws (10 or fewer items fulfilled).

that information transfer through dissemination of educational materials showed no effect in nine out of 17 studies. Hulscher et al. (13) reviewed three studies and reported that two studies showed positive effects and one study found no differences. None of these reviews specifically described the target behaviors and the contents of disseminated information. There was one review that specifically compared disseminating clinical guidelines versus control (14). This review reported that three out of five studies showed significant improvements in clinical management by disseminating clinical guidelines.

Overall, evidence from systematic reviews on efficacy of disseminating educational materials was inconclusive. Clinical guidelines may have a positive effect on practice behaviors of primary care providers; however, there is no information to draw conclusions on which behaviors it might suit better. None of the reviews provided either the details in outcomes or statistical significance of the results.

Formal Continuing Medical Education. This group of educational interventions covered a wide range of activities including lectures, workshops, educational meetings, and group trainings. The efficacy of continuing medical education was assessed on a broad range of outcomes (e.g., clinical management, prescribing, prescribing counseling, and preventive procedures).

Four reviews that evaluated the impact of formal continuing medical education on primary care providers' practice behaviors met the inclusion criteria. Davis et al. (11) reported that the majority (six out of seven) of the studies focusing on continuing medical education provided in a short session showed no change or inconclusive results on primary care providers' behaviors. This review, however, did not describe in detail for which specific type of outcomes these interventions were efficacious or not. Thomson-O'Brien et al. (15) reported that six out of seven studies using didactic presentations did not improve primary care provider's behaviors, whereas seven out of eight studies with interactive workshops produced significant improvements in professional behaviors. A review by Hulscher et al. (13) reported that four out of five studies with small group education (seminar, workshop, and educational meeting) showed improvements (relative differences ranged from –11 percent to 194%) on preventive care in a primary care setting. This review also pointed that the largest difference was found in small group discussion and teleconference targeting hypertension monitoring or colorectal cancer screening. Another review by Harvey et al. (16) also reported positive changes in two studies out of three, at least for short term, in primary care providers' obesity management after a brief medical education session. However, the

authors pointed out that the results were neither conclusive nor generalizable due to overall poor quality of included studies.

Drawing conclusions from the four included reviews was not easy, because the reviews dealt with a broad range of outcomes and there were substantial differences in focus, design, and reporting. Nevertheless, one common message that could be summarized from these reviews was that the dissemination of information through traditional continuing medical education methods such as lectures or workshops did not effectively change primary care providers' behavior. It was indicated that some forms of continuing medical education such as small, more targeted, interactive group discussion and teleconferencing sessions might be more efficacious.

Educational Outreach Visits (Academic Detailing). We located two systematic reviews of educational outreach visits. Oxman and colleagues (9) reported results from seven out of eight studies on educational outreach and concluded that outreach visits were effective in reducing inappropriate prescribing and delivery of preventive procedures. The results showed that there were reduction of 12 percent to 49 percent in inappropriate prescription from 4 studies and 5 percent to 27 percent increase in adoption of preventive practices including smoking cessation from two studies. (One study was a report of outreach

TABLE 4 [cont p 169]
Summary of Included Reviews on Specific Interventions (Single Intervention vs No Intervention)

Author/Year	Total No. of Included Studies (Design)	Characteristics of Specific Comparison	Results	Authors' Conclusion (Remarks)
Educational materials				
Davis et al., 1995 (11)*	99 studies (RCT, CCT)	11 studies included educational materials vs no intervention	4 out of 11 studies showed improvement, but 7 did not. No description of outcome measurements.	No intervention-specific conclusion provided.
Hulscher et al., 2002 (13)*	55 studies (37 RCT, 18 CCT)	3 studies regarding educational materials vs no intervention	2 out of 3 studies reported improvement in the intervention group. No further details were described.	No specific conclusion for this intervention provided.
Thomas et al., 2002 (14)	18 studies (13 RCT, 2 CBA, 3 ITS)	5 studies compared guidelines vs no guideline control	3 out of 5 studies that compared clinical guidelines vs no guidelines showed significant improvement in clinical management by professions allied to medicine (mainly nurses).	Findings provide some evidence that guideline-driven care can be effective in changing the process and outcome of care provided by professions allied to medicine.
Wensing et al., 1998 (12)*	61 studies (39 RCTs and 22 CBAs)	17 comparisons information transfer vs no intervention	9 out of 17 comparisons showed no improvements, 6 were partially efficacious, and only 2 showed efficacy. Efficacy on preventive practices was not separately assessable.	Information transfer is probably always needed, but more interventions are usually needed to achieve real changes in the practice routines of clinicians.
Formal CME (conferences/ educational meetings)				
Davis et al., 1995 (11)*	99 studies (RCT, CCT)	7 studies included conference vs no intervention	Formal CME conferences (6 out of 7 studies) showed negative or inconclusive results. No description of outcome measurements.	Widely used CME delivery methods such as conferences have little direct impact on improving professional practice.
Harvey et al 2002 (16)*	18 studies (RT, CBA, Time series analysis)	3 studies included brief educational session vs no intervention	2 studies suggest positive change in professionals' behavior of obesity management in the short-term period. Results of the other study were not conclusive because of overall poor quality methodology.	Brief educational intervention on obesity management may be effective in changing practice. More rigorous evaluations are necessary to determine whether these changes are generalizable.
Hulscher et al., 2002 (13)*	55 studies (37 RCT, 18 CCT)	5 comparisons regarding educational conference vs. no intervention	4 out of 5 comparisons showed outcome favorable to intervention group. The largest difference was found in small group discussion and teleconference.	No intervention-specific conclusion provided.
Thomson O'Brien et al., 2002 (15)	32 studies (30 RCTs, 2 NEGDs)	Continuing education meetings and workshops vs no intervention	6 of 7 studies with lectures or didactic presentations showed no improvements. 7 of 8 studies with interactive workshops showed significant improvements.	Interactive workshops can improve professional practice. Lectures (didactic sessions) alone are unlikely to change professional practice.
Educational outreach visits (academic detailing)				
Oxman et al., 1995 (9)*	102 trials	7 studies compared educational outreach vs no intervention	4 studies showed 12–49 percent reduction in inappropriate prescribing and 3 studies showed improvements in preventive practices (including smoking cessation and 10 other preventive practices).	Outreach visits were effective in (reducing inappropriate prescribing and) increasing the delivery of preventive services.
Thomson O'Brien et al., 2002 (17)	18 RCTs	3 trials compared outreach visits with no intervention.	3 trials of outreach visits alone vs no intervention showed 24 percent to 50 percent relative improvements in appropriate prescribing practices.	Educational outreach visits, particularly when combined with social marketing, appear to be a promising approach to modifying health professional behavior, especially prescribing.

visits with other interventions.) Thompson-O'Brien and colleagues (17) reported 24 percent to 50 percent

relative improvements in appropriate prescribing practices from the results of three trials that compared outreach

visits with no intervention.

Educational outreach visits or academic detailing has been widely used

TABLE 4 [cont from p 168]
Summary of Included Reviews on Specific Interventions (Single Intervention vs No Intervention)

Author/Year	Total No. of Included Studies (Design)	Characteristics of Specific Comparison	Results	Authors' Conclusion (Remarks)
Local opinion leaders				
Hulscher et al., 2002 (13)*	55 studies (37 RCT, 18 CCT)	1 comparison regarding social influence vs no intervention	An individual tutorial session from a local opinion leader showed 187.2 percent relative increase (44% absolute increase) in preventive services	No intervention-specific conclusion provided.
Thomson O'Brien et al., 2002 (18)	8 RCTs	6 trials compared the local opinion leaders vs no intervention	5 out of 6 trials showed improvements in clinical management regarding specific patient problems. Only one study showed strong evidence of efficacy with statistical significance.	Using local opinion leaders results in mixed effects on professional practice change. It is not clear what local opinion leaders do and in which circumstances they are likely to influence the practice.
Wensing et al., 1998 (12)*	61 studies (39 RCTs and 22 CBAs)	7 comparisons for social influence as intervention	2 showed efficacy, 3 showed partial efficacy and 2 showed no efficacy. Efficacy of social influence on preventive practices was not separately reported.	No intervention-specific conclusion provided.
Reminders				
Davis et al., 1995 (11)*	99 studies (RCT, CCT)	26 studies compared reminders as single intervention	Physician reminders showed positive changes (22 out of 26 studies). Outcome measures were not specified.	Physician reminder was an effective single-method intervention.
Hulscher et al., 2002 (13)*	55 studies (37 RCT, 18 CCT)	9 RCTs compared physician reminders vs control	9 studies showed improvement in the intervention group (13% to 264% relative change) in preventive services.	No intervention-specific conclusion provided.
Mandelblatt and Kanetsky, 1995 (19)	20 trials (9 CT, 11 RT)	6 trials included noncomputerized physician reminders	5 out of 6 trials showed improvement in using mammography or clinical breast exam for cancer screening (8 to 28 % increase). One study showed decrease (-24%).	Physician-based interventions (reminders) can be effective in increasing screening use.
Snell and Buck, 1996 (20)	38 studies	14 comparisons included manual reminders	Meta-analysis showed effect size of 0.21 showing increase in cancer screening by reminders targeting physicians compared to control.	No intervention-specific conclusion provided.

*Studies appeared multiple times because they included more than one intervention methods. Acronyms in primary study design: RCT—randomized controlled trial, CCT—controlled clinical trial, ITS—interrupted time series, CBA—controlled before-and-after studies, NEGD—nonequivalent group design (nonrandom controlled trials).

by pharmaceutical companies in marketing. However, there is paucity of reports about its efficacy in adoption of preventive practices. Given the limitation of small number of studies, the summary from the two systematic reviews indicated that educational outreach visits were effective in increasing the delivery of preventive services, as well as in reducing inappropriate prescribing practices.

Local Opinion Leaders. We located three systematic reviews that specifically focused on the influence of local opinion leaders on the change in primary care providers' behavior. The first review (18) included eight ran-

domized trials that compared local opinion leaders to no intervention and reported absolute risk reductions ranging from 0.11 to 0.30 in managing various medical problems such as acute myocardial infarction, cancer pain, and osteoarthritis among others. Since the target outcome was clinical management of various medical problems, the efficacy on adoption of preventive procedures was not described. The second review showed 44 percent absolute increase in delivery of preventive services such as dietary counseling and hypertension monitoring (13). No further details including statistical significance were reported. The

third review reported that five out of seven studies showed some improvements on outcomes such as recording routines or consultation skills, when local opinion leaders were used (12). This review, however, did not provide details with regard to characteristics of primary studies such as target behaviors and outcome measures.

It was not clear from these reviews whether interventions relying on local opinion leaders were efficacious in changing primary care providers' behaviors, especially regarding preventive procedures. Also, as pointed out in a review (18), there is not enough information to clarify for which target

behaviors and in which circumstances the local opinion leaders are likely to influence the practice of their peers.

Reminders. Reminders can be manual or computerized. We focused only on manual reminders in our overview due to feasibility of application in dental public health programs. Reviews that focused only on computerized reminder system were excluded in this overview (Table 2). We located four systematic reviews of reminder. Davis et al. (11) reported reminders showed improvements in professional behavior in 22 out of 26 studies in their review. Hulscher et al. (13) reported 13 percent to 264 percent relative improvements in preventive services by reminders from the results of nine studies. In these reviews, there was no further detailed information on the nature of the intervention (e.g., manual or computerized) and target behaviors. Mandelblatt and Kanetsky (19) reported an increase in breast cancer screening from 6 percent to 28 percent from the results of five out of six studies of manual reminders. The authors reported the results of manual reminders and computerized reminders were similar in magnitude. Snell and Buck (20) reported increase (effect size $d=0.21$) in cancer screening frequency from a meta-analysis of 14 comparisons of manual-reminder-targeted physicians.

Overall, there are consistent findings among the four systematic reviews (including one meta-analysis) showing that manual reminders are efficacious in promoting primary care providers to adopt preventive practices. While no study has reported efficacy of reminders on adopting oral health screening by primary care providers, this would be one method that can be used by dental public health professionals to promote oral health screening in the primary health care setting.

Discussion

Modifying primary care providers' practice behavior to adopt new procedures or guidelines in their practice is a challenging task (9,11). In this overview, 12 systematic reviews that focused on efficacy of single interventions on changes in professional behaviors of health care providers were evaluated. The evidence from the included systematic reviews showed that disseminating printed educa-

tional materials and traditional (didactic) continuing medical education in a large group setting did not effectively change primary care providers' behaviors. There are effective interventions available to increase knowledge and change behaviors of primary care providers, such as group discussion, interactive workshops, educational outreach visits, and reminders. The findings of this overview that focused on single educational interventions generally agree with the conclusions from previous overviews (21,22) focusing on multiple educational interventions. Information on the efficacy of single interventions may be more appropriate and single interventions are less costly for dental public health programs that plan to design educational interventions to change the practice of primary care providers.

Caution is needed when the results of this overview are applied to a specific behavior or a target group. The majority of the reviews included in this overview did not have conclusive findings regarding the efficacy of single interventions on primary care providers' practice behaviors. Only one review reported results from meta-analysis. All other reviews described the results qualitatively or quantitatively without being able to synthesize the results. Although the body of the research focusing on the efficacy of interventions to improve primary care providers' behavior is relatively large, the knowledge base is clearly limited when specific behaviors and interventions are considered. There was large heterogeneity among primary trials in each systematic review. Most systematic reviews also pointed to the paucity of good quality primary studies: reporting quality of primary studies in general was poor, specifically regarding randomization, blinding, and unit of analysis.

Given the difficulties of each systematic review due to heterogeneity and the low quality of primary trials, summarizing results from systematic reviews imposes more difficulties in drawing conclusive findings for a specific intervention. There was wide variation among the reviews regarding the interventions, target outcomes, and comparison groups. Therefore, direct comparison among systematic reviews was not feasible.

In this overview, we included results only from systematic reviews

that were published in English. Possibly trials that failed to detect a significant impact of a given intervention were less likely to be included in a systematic review than those reporting positive findings, which are more likely to be published (i.e., publication bias). Some primary studies were included in more than one systematic review. The extent to which the multiple inclusions of the same study in multiple reviews could affect the conclusions of this overview cannot be assessed.

We did not include reviews on interventions that aimed only at patients or at organization level because our main interest was the efficacy of interventions targeting primary care providers that can be implemented without significant cost or administrative changes. Obviously, other factors beyond individual knowledge and attitude influence primary care providers' practice behaviors (23). Other barriers to behavior change might include an inadequate practice organization, lack of time, negative financial incentives, negative attitudes among colleagues, or resistance from patients (12). The primary interest of this overview was to evaluate interventions to improve the primary care provider's knowledge and adoption of oral health screening, referral, and prevention. However, our overview yielded neither directly relevant systematic reviews nor well-designed randomized clinical trials focusing on this topic.

Changing primary care providers' behavior, especially to incorporate oral health screening, requires more than just selecting and implementing one or more efficacious interventions. To be successful, barriers that exist in specific contexts should be identified and addressed. A major barrier is lack of knowledge on oral health (7,24). Currently, there is little information and guidelines available to primary care providers on prevention of oral diseases and oral health promotion (7). It is necessary to develop well-designed educational information and guidelines targeting primary care providers. One nationwide survey showed that pediatricians are more likely to follow clinical practice guidelines if they were simple to follow, feasible/practical, and effective (25). However, as already indicated, dissemination-only activities would incur little behavioral change. It should

be augmented by other interventions, such as reminders.

Changing primary care providers' behavior should be approached in a comprehensive and contextual manner considering the large social and political forces such as group norms, professional regulations, and environmental considerations that include practice location, demographics, setting, and patient issues (26). Selection and application of interventions should be carefully tailored by the characteristics of providers, patients, and practice-related factors in a specific context. Dental professionals who plan to design and implement educational interventions should use focus groups to define the context specific to their communities.

This overview provides a synopsis on interventions to improve primary care providers' practice behaviors. While there has been a growing interest in research of educational interventions targeting primary care providers, the knowledge base on the efficacy of various interventions for different outcomes in primary care setting is limited; there is virtually no information on the efficacy of these interventions on oral health screening by primary care providers. Considering the strategic position of primary care providers in improving oral health of underserved population, this area deserves much greater attention and research.

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