

NO MAGIC BULLETS: A SYSTEMATIC REVIEW OF 102 TRIALS OF INTERVENTIONS TO IMPROVE PROFESSIONAL PRACTICE

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Abstract • Résumé

Objective: To determine the effectiveness of different types of interventions in improving health professional performance and health outcomes.

Data sources: MEDLINE, SCISEARCH, CINAHL and the Research and Development Resource Base in CME were searched for trials of educational interventions in the health care professions published between 1970 and 1993 inclusive.

Study selection: Studies were selected if they provided objective measurements of health professional performance or health outcomes and employed random or quasi-random allocation methods in their study designs to assign individual subjects or groups. Interventions included such activities as conferences, outreach visits, the use of local opinion leaders, audit and feedback, and reminder systems.

Data extraction: Details extracted from the studies included the study design, the unit of allocation (e.g., patient, provider, practice, hospital); the characteristics of the targeted health care professionals, educational interventions and patients (when appropriate); and the main outcome measure.

Data synthesis: The inclusion criteria were met by 102 trials. Areas of behaviour change included general patient management, preventive services, prescribing practices, treatment of specific conditions such as hypertension or diabetes, and diagnostic service or hospital utilization. Dissemination-only strategies, such as conferences or the mailing of unsolicited materials, demonstrated little or no changes in health professional behaviour or health outcome when used alone. More complex interventions, such as the use of outreach visits or local opinion leaders, ranged from ineffective to highly effective but were most often moderately effective (resulting in reductions of 20% to 50% in the incidence of inappropriate performance).

Conclusion: There are no "magic bullets" for improving the quality of health care, but there are a wide range of interventions available that, if used appropriately, could lead to important improvements in professional practice and patient outcomes.

Objectif : Déterminer l'efficacité de différents types d'intervention destinés à améliorer le rendement des professionnels de la santé et à accroître les résultats sur la santé.

Source de données : On a cherché dans MEDLINE, SCISEARCH, CINAHL et la Base de ressources en recherche et développement sur EMC des tentatives d'interventions d'éducation auprès des professions de la santé, publiées entre 1970 et 1993 inclusivement.

Sélection des études : On a retenu les études qui présentaient une mesure objective du rendement des professionnels de la santé ou des résultats sur la santé et dont le plan d'étude recourait à des méthodes aléatoires ou quasi aléatoires de répartition des sujets individuels ou des groupes. Les interventions comprenaient diverses activités comme des conférences, des visites de liaison, le recours à des personnalités locales, des vérifications, la rétroaction et les systèmes de rappel.

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Extraction des données : Parmi les détails extraits des études, mentionnons le plan d'étude, l'unité d'attribution (comme le patient, le fournisseur, la pratique ou l'hôpital), les caractéristiques des professionnels de la santé visés, des interventions d'éducation et des patients (le cas échéant), et la principale mesure de résultats.

Synthèse des données : Les critères d'inclusion sont ressortis dans 102 études. Parmi les secteurs où s'est produit un changement de comportement, notons les relations générales avec les patients, les services de prévention, les pratiques de prescription, le traitement de certaines maladies comme l'hypertension ou le diabète, et le service diagnostic ou le recours à l'hôpital. Utilisées comme critères uniques, les stratégies axées uniquement sur la diffusion, comme les conférences ou l'envoi par la poste de documents non sollicités, n'ont suscité que très peu de changements en ce qui touche le comportement des professionnels de la santé ou les résultats sur la santé. Les interventions plus complexes, comme des visites de liaison ou le recours à des personnalités locales, ont donné des résultats allant de pauvres à excellents, mais, dans la plupart des cas, elles n'ont eu qu'un effet modéré (diminution de 20 % à 50 % de l'incidence d'une performance non appropriée).

Conclusion : Il n'y a aucune « formule magique » pour accroître la qualité des soins de santé, cependant il existe un vaste éventail d'interventions disponibles qui, si on les utilise comme il faut, pourraient donner lieu à d'importantes améliorations de la pratique des professionnels et des résultats au niveau des patients.

Although the importance of research evidence in guiding clinical decision making is generally unquestioned intellectually, at a practical level patterns of medical practice often diverge from evidence-based recommendations, robbing patients of the benefits of medical research.¹⁻¹⁴ For example, Williamson and associates¹⁴ found that one fifth to one half of primary care practitioners in the United States were not aware of or were not using new evidence about six common procedures. Similarly, in a systematic review of randomized controlled trials Lau and collaborators¹⁵ found overwhelming evidence for the use of thrombolytic therapy in patients who had suffered myocardial infarction; however, these findings were often not reflected in the recommendations by experts in textbooks and review articles¹⁶ or in practice.¹⁷ These and other studies reflect shortcomings in the management of health science information by physicians and other health care professionals as well as other constraints on the use of research evidence.¹⁸⁻²⁰

In 1992 Davis and colleagues²¹ systematically reviewed 50 randomized controlled trials of the effectiveness of continuing medical education (CME), which they broadly defined as all the ways by which physician learning and clinical practice might be altered by educational or persuasive means. The objective of our study was to update and enhance that body of knowledge by (a) including nonphysician health care professionals, (b) applying explicit criteria for assessing study quality, (c) defining specific types of interventions, described later, (d) analysing other published systematic reviews of interventions targeted at a specific problem (e.g., vaccination delivery²²) or provider (e.g., nurses²³), or of a specific type of intervention (e.g., audit and feedback²⁴), and (e) applying theoretic frameworks such as total quality management,²⁵ the PRECEDE (predisposing, reinforcing and enabling constructs in educational diagnosis and evaluation) health behaviour model²⁶ and various social science and adult edu-

cational models²⁷ to clarify the findings of trials. We present preliminary data resulting from these processes.

METHODS

LITERATURE SEARCH

We added to the search strategies described by Davis and coworkers²¹ by searching the following computerized bibliographic databases for the period January 1990 to December 1993: MEDLINE, SCISEARCH, CINAHL and the Research and Development Resource Base in Continuing Medical Education.²⁸

We included trials that met the following criteria: the studies involved health care providers (excluding students); outcomes were measured by objective assessments of provider performance in a health care setting or by any health outcome; and the study designs were such that individual subjects or groups were assigned to one of two or more alternative interventions or to a control group by means of random allocation or some quasi-random method of allocation (e.g., alternation). We included the following types of intervention:

- Educational materials: Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audiovisual materials and electronic publications.
- Conferences: Participation of health care providers in conferences, lectures, workshops or traineeships outside their practice settings.
- Outreach visits: Use of a trained person who meets with providers in their practice settings to provide information. The information given may include feedback on the provider's performance.
- Local opinion leaders: Use of providers explicitly nominated by their colleagues to be "educationally influential."

- **Patient-mediated interventions:** Any intervention aimed at changing the performance of health care providers for which information was sought from or given directly to patients by others (e.g., direct mailings to patients, patient counselling delivered by others, or clinical information collected directly from patients and given to the provider).
- **Audit and feedback:** Any summary of clinical performance of health care over a specified period, with or without recommendations for clinical action. The information may have been obtained from medical records, computerized databases or patients or by observation.
- **Reminders:** Any intervention (manual or computerized) that prompts the health care provider to perform a clinical action. Examples include concurrent or inter-visit reminders to professionals about desired actions such as screening or other preventive services, enhanced laboratory reports or administrative support (e.g., follow-up appointment systems or stickers on charts).
- **Marketing:** Use of personal interviewing, group discussion (focus groups) or a survey of targeted providers to identify barriers to change and the subsequent design of an intervention.
- **Multifaceted interventions:** Any intervention that includes two or more of the last six interventions described here.
- **Local consensus processes:** Inclusion of participating providers in discussion to ensure agreement that the chosen clinical problem is important and the approach to managing it appropriate.

The inclusion criteria were subject to a pilot study by all of us on a sample of five studies. Two of us (A.D.O. and M.A.T.) then independently applied the criteria to all potentially relevant studies for all 10 types of intervention. Disagreements were resolved by consensus.

ASSESSMENT OF TRIAL QUALITY

The following criteria were used to assess the quality of the trials: concealment of random allocation (protection against selection bias); completeness of follow-up; blind outcome assessment; reliable outcome, indicated by two or more raters with at least 90% agreement or achievement of a kappa value greater than 0.8; baseline measurement of performance or health outcomes measured before intervention; and assurance that contamination was unlikely (i.e., that the control group did not receive the experimental interventions). All four of us tested these on a sample of 10 studies, and then one of us (M.A.T.) applied them to each study included in the review.

DATA COLLECTION

The details extracted from the studies included, but were not limited to, the following: whether the study was a randomized controlled trial (parallel groups), a quasi-randomized controlled trial such as one using alternative allocation, or a crossover study; the unit of allocation (e.g., patient, provider, practice, hospital); the characteristics of the participating providers and patients; the characteristics of the intervention, including the content, format, source, recipient, setting and timing; and a description of the main outcome measure.

We attempted to obtain sufficient information to calculate the mean proportion (per provider) of times that performance was appropriate for each patient or episode of care in each study group. We also tried to obtain the proportion of baseline performance that was adequate and the absolute and relative percent change in performance for each study group.

RESULTS

We identified 102 trials²⁹⁻¹³⁰ investigating one or more interventions targeted at improving the performance of health care professionals. The number of trials assessing each type of intervention is shown in Table 1. The comparison groups by type of intervention are shown in Table 2. Table 3 lists the main type of behaviour targeted in each study.

EFFECTIVENESS OF INTERVENTIONS

- **Educational materials:** Most of the studies that used

Table 1: Types of intervention aimed at improving professional practice in 102 trials

Intervention	No. of studies*
Educational material	12 (9)
Conference	17 (8)
Outreach visit	8 (3)
Use of local opinion leader	5 (4)
Patient-mediated intervention	10 (4)
Audit and feedback	31 (21)
Reminder system	52 (35)
Marketing	3 (0)
Multifaceted intervention	15 (11)
Local consensus process	8 (2)

*Numbers add up to more than 102 because some of the trials examined more than one type of intervention. Numbers in parentheses indicate trials in which comparisons were made against a nonintervention, "usual-care" control group.

printed materials only^{29,30} failed to demonstrate changes in performance or health outcome, a finding that has been associated also with the distribution of guidelines.³¹ Conversely, Marton, Tul and Sox³² found printed materials to be as effective as audit and feedback in altering test-ordering behaviour.

- **Conferences:** Reflecting the dissemination-only characteristics of unsolicited printed materials, those conferences, rounds and workshops during which no explicit effort was made to determine practice needs or to facilitate practice change failed to demonstrate change in performance or health outcome. However, other, more comprehensive strategies employing workshops as a central focus did effect changes through intra-session practice rehearsal³⁴ or other patient educational and practice-reinforcing strategies.³⁵
- **Outreach visits:** Outreach visits, also known as academic detailing or counter detailing, were effective in reducing inappropriate prescribing and, to a lesser extent, increasing the delivery of preventive services. Reductions of 12% to 49% in inappropriate prescriptions as a result of counter detailing were reported in four studies.^{29,36-38} Second, Cummings and coworkers³⁹ reported the effectiveness of detailing in smoking cessation. Dietrich and associates⁴⁰ reported small increases (5% to 27%) in the delivery of 10 preventive services, 6 of which were statistically significant ($p < 0.05$). Finally, Putnam and Curry⁴¹ demonstrated a moderate, statistically significant effect of outreach visits combined with audit on essential elements in the management of five common conditions in family practice.
- **Local opinion leaders:** The effectiveness of opinion

leaders ranged from nonsignificant to substantial. Stross and collaborators⁴²⁻⁴⁴ found some improvement in the quality of care of patients with arthritis and respiratory disease. Lomas and colleagues³¹ demonstrated a substantial increase in the number of trials of vaginal delivery after previous cesarean section in hospitals in which a local opinion leader was used.

- **Patient-mediated interventions:** These included patient educational materials used widely in the literature for smoking cessation^{47,48} and diabetes mellitus.⁴⁶ Changes in performance were demonstrated in multifaceted interventions when patient-mediated interventions were combined with other interventions, such as academic detailing. Patient education effected statistically significant improvements in the

Table 3: Main type of behaviour targeted in the 102 trials

Behaviour	No. of trials
General management of a health problem	25
Preventive services	19
Prescribing practices	14
Diagnostic test ordering	12
Management of hypertension	9
Smoking cessation	6
Utilization of hospital services	5
Computer-assisted diagnosis	4
Management of diabetes mellitus	3
Performance of a procedure	3
Computer-assisted dosing	2

Table 2: Breakdown of comparison groups by intervention in the 102 trials

	Intervention; no. of trials										
	Cont	Educ	Conf	Out	Lead	Pat	Aud	Rem	Mar	Mul	Loc
Educ	9	3									
Conf	8	2	1								
Out	3	1	0	0							
Lead	4	1	0	0	1						
Pat	4	0	0	0	0	0					
Aud	21	4	2	0	1	1	7				
Rem	35	1	4	0	0	2	4	3			
Mar	0	0	0	0	0	0	0	0	0		
Mul	11	2	2	0	0	2	2	2	0	2	
Loc	0	0	0	0	0	0	0	1	0	1	0

*Cont = control, Educ = educational materials, Out = outreach visits, Lead = use of local opinion leaders, Pat = patient-mediated interventions, Aud = audit and feedback, Rem = reminders, Mar = marketing, Mul = multifaceted interventions, Loc = local consensus processes. Numbers in the last column of each row represent trials in which two interventions in the category (type) were compared (e.g., for educational materials, glossy [commercial] material v. academic-style material).

management of diabetes mellitus that were probably clinically important.⁴⁹ These effects were enhanced when patient education was combined with physician education. Other patient-mediated strategies, which made use of information derived from patients through questionnaires or interviews, demonstrated mixed results.^{50,51}

- Audit, feedback and reminders: The effectiveness of audit and feedback or of reminders across different types of clinical behaviour ranged from nil to moderate. The types of participants and the characteristics of the interventions and targeted behaviours varied across the studies. For example, among the trials of reminders 30 (58%) used computerized prompting, 14 (27%) relied on administrative assistance, and 8 (15%) used simple stickers or chart inserts. Using the audit/feedback strategy one study reported an absolute increase of over 40% in the median weighted rate of prescriptions for generic drugs.⁴⁵ Although another study achieved only a small change (6.7%) in the mean cost of prescriptions through this strategy, the ratio of savings to costs of the intervention was 50:1.
- Marketing: Studies have demonstrated that learning experiences based on objective practice-needs assessment or knowledge testing can alter at least some aspects of physician performance.^{52,53} The evidence is less clear, however, when more subjective needs or practice assessments are performed.⁵⁴ Market research was an important component of outreach visits targeted at reducing the incidence of inappropriate prescribing, but it is not possible to separate out the effect of this component of counter detailing.
- Multifaceted interventions and local consensus processes: The use of a variety of interventions, such as audit and feedback, reminders, outreach visits, patient-mediated interventions or opinion leaders, has demonstrated changes in professional performance and, less consistently, changes in health outcomes. The importance of local consensus processes is not clear. For example, Putnam and Curry⁴¹ demonstrated a moderate effect on performance of a local consensus process for generating criteria for optimal care but did not find a significant effect of such a process for essential care.

DISCUSSION

Interventions to improve professional performance are complex, and any cogent interpretation of the results of these trials requires a disentangling of the variation in the characteristics of the targeted professionals, the interventions studied, the targeted behaviours and the study designs. Because of these variations and inadequacies in reporting, it is not possible to compare or make

definitive conclusions about the effects of specific types of intervention, or to measure the size of the effects. Nevertheless, several interventions have been found to improve provider performance and, to a lesser degree, health outcomes. At the same time, some common forms of continuing education have either not been tested (e.g., journal reading) or have been tested and found wanting (e.g., unsolicited mailings).

It is helpful to draw an analogy between trials of interventions to improve the performance of health care professionals and drug trials. There are (arguably) no wonder drugs; often several medications are needed, along with lifestyle or environmental changes, to effect clinically important changes in health status. It is the same with the alteration of health professional performance: many interventions have modest or negligible practical effects when used alone. However, when coupled with other strategies the effects may be cumulative and significant.

Furthermore, just as there is a need for rational drug prescribing, there is a need in the area of health professional performance to include appropriate diagnostic strategies (to determine the reasons for suboptimal performance and to identify barriers to change) and to select carefully the interventions most likely to be effective in light of the diagnosed problem. For example, reminders are likely to be effective only if not having the right information at the right time is an important cause of suboptimal performance. These diagnostic strategies bear a direct relation to quality-assurance activities. Closer collaboration of researchers in the areas of health professional performance, health services and quality assurance appears to be both desirable and necessary.²¹ Future efforts should aim to improve and standardize reporting of trials of interventions to improve professional performance. A broad framework should be developed for designing and selecting appropriate interventions across the wide range of professional activities in which gaps between evidence and practice are found. An important initiative in this direction is the formation of the Cochrane Collaboration on Effective Professional Practice, which aims to prepare and keep up-to-date systematic reviews of the effects of interventions to improve professional practice.¹³¹

There are no "magic bullets" for improving the quality of health care. There are, however, a wide range of interventions available that, if used appropriately, could lead to substantial improvements in clinical care derived from the best available evidence.

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