Can We Alter Physician Behavior by Educational Methods? Lessons Learned from Studies of the Management and Follow-up of Hypertension

Karen Tu, MD, CCFP, MSc, and Dave Davis, MD, CCFP, FCFP

Abstract

Introduction: As expectations for effective continuing medical education (CME) grow, so, too, does the need to identify relationships among educational methods, physician performance, and patient outcomes associated with specific disease entities. Thus, we set out to review the literature on the effectiveness of physician educational interventions in the management and follow-up of hypertension.

Method: We searched PubMed and the Research and Development Resource Base in Continuing Medical Education for randomized controlled trials of physician educational interventions. We included only those studies that (a) used replicable educational interventions with > 50% physician involvement and that employed objective methods to measure physician behavior change or patient outcomes, (b) indicated a physician or patient dropout rate of < 30%, and (c) followed outcome measurement for > 30 days. Studies were designated “positive” if one or more of the primary outcome measures demonstrated a statistically significant change in physician performance or health care outcome.

Results: We found 12 studies in which 7 different physician educational interventions were employed, alone or in combination, including reminders (computer or chart), formal CME, computerized decision support systems/risk stratification, printed educational materials, academic detailing, continuous quality improvement projects, and disease management aids in patient charts. Of the 12, 7 were positive and 4 were negative. One had mixed results.

Discussion: Although physician educational interventions, especially reminders, improved the follow-up of hypertension, they were ineffective in changing blood pressure levels. However, they may have some utility in improving compliance with guideline recommendations.

Key Words: Continuing medical education (CME), educational interventions, effectiveness, hypertension, physician behavior, quality improvement

Introduction

The past decade witnessed continuing medical education (CME) and expectations for its effectiveness grow in importance, as evidenced by reviews\(^1\text{-}^4\) of CME impact on provider performance and health outcomes, and a recognition of the multifaceted nature of CME.\(^5\) The reviews indicated that no sin-
The single method appears sufficient to change provider behavior. Although useful in broadening our understanding of the tools and nature of physician learning and change, the reviews have been nearly silent on the interplay between the management of specific disease states and the educational and change process. This silence may reflect the dearth of literature on the broad topic of CME (compared with the huge biomedical and clinical literature). What explanatory literature exists in CME and continuing professional development focuses on three areas related to changing physician performance: (1) theories about the initiation of change focus on a priming event or about forces for change from professional, personal, and societal perspectives; (2) theories about factors in the intervention that lead to change; among these, that of Green et al., called the PRECEDE model, mentions the importance of predisposing, enabling, and reinforcing elements; and (3) a cluster of theories on the learner and the stages through which he/she may pass to change performance. One of the most frequently quoted theories of staged change is the Transtheoretical Model, used to demonstrate the movement from precontemplation to action. The complexities in management of specific disease entities provide a platform for analysis and discussion of the impact of educational methods—an increasingly important topic given the gap between optimal and real performance in the delivery of health care.

The choice of hypertension as a specific clinical entity to examine the impact of continuing education is a logical one for several reasons. First, hypertension is a significant contributor to morbidity and mortality: the subject of several recent guidelines, it is an important (if not the most important) risk factor for cardiovascular disease, its prevalence is high, its control is estimated to be less than adequate, and its detection and prevention are known to significantly reduce cardiovascular morbidity and mortality. Second, the increasingly large literature of CME housed in the Research and Development Resource Base in Continuing Medical Education at the University of Toronto contains 106 references (of over 10,000) pertaining to hypertension, thus providing a rich resource from which to select studies for review and from which to draw conclusions. Third, hypertension presents a number of clinical domains in which physicians can improve their performance, including increased screening and detection, accurate diagnosis and follow-up, promoting positive lifestyle change in patients, improved patient adherence, appropriate choice of antihypertensive medication, and, finally, good blood pressure control.

The present review examines the impact of educational methods on physician behavior in the management of a specific disease entity, hypertension, in the dimensions of management and follow-up.

Methods

Search Strategy

In August 2000, we searched MEDLINE (retrospectively to 1966), including the most recent addition of citations from The Cochrane Database of Systematic Reviews. With PubMed and the Research and Development Resource Base in Continuing Medical Education located at the University of Toronto, using Reference Manager Version 9.0 Bibliographic Software, we employed search strategies that included the terms listed in Table 1.

Selection Criteria

We included only randomized controlled trials describing replicable interventions with > 50% physician involvement, as well as those that used objective methods to measure physician behavior change or patient outcomes and that indicated a physician or patient dropout rate of < 30%. Further, given the chronicity of hypertension, we elected to review only those studies in which there was a follow-up of outcome of > 30 days. The inclusion criteria were developed and synthesized by both authors and were initially applied by one author (KT) followed by verification and agreement with the other (DD).
Table 1  Cumulative Search Terms Using PubMed* and the Research and Development Resource Base in Continuing Medical Education

<table>
<thead>
<tr>
<th>学术内容详细</th>
<th>算法*</th>
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<tr>
<td>学术内容详细</td>
<td>图表审查*</td>
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<td>学术内容详细</td>
<td>合规</td>
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<td>学术内容详细</td>
<td>共识会议</td>
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<td>学术内容详细</td>
<td>教育* 干预</td>
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<td>学术内容详细</td>
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<td>学术内容详细</td>
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<td>学术内容详细</td>
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<td>管理护理</td>
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<td>学术内容详细</td>
<td>护士从业者*</td>
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<td>学术内容详细</td>
<td>开拓</td>
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<td>学术内容详细</td>
<td>患者教育</td>
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<td>学术内容详细</td>
<td>同行评审</td>
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<tr>
<td>学术内容详细</td>
<td>医生行为 OR 医生行为</td>
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<tr>
<td>学术内容详细</td>
<td>实践指南</td>
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<tr>
<td>学术内容详细</td>
<td>程序评估*</td>
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<td>学术内容详细</td>
<td>质量保证</td>
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<tr>
<td>学术内容详细</td>
<td>召回系统*</td>
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<td>学术内容详细</td>
<td>提醒系统*</td>
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(“hypertension” [MeSH Terms] OR hypertension[Text Word])
AND (“education, medical, continuing” [MeSH Terms] OR continuing medical education[Text Word])
AND [see terms above]
AND (randomized controlled trial [PT] OR randomized controlled trials [MeSH Term] OR random* [All Fields]).

As regulatory activities can lead to alternative practices, with the potential for more deleterious physician behaviors,18 we studied broadly construed educational interventions as defined previously1,2,5 rather than incentives, disincentives, regulations,18 or purely administrative strategies, believing these to operate at a different level for the performance of health professionals. We chose only those educational interventions directed at physicians as they would seem most practicable to replicate on a large scale. In addition, we chose only those studies that used objective methods of physician change or patient outcomes as measuring results of self-reported change or competency assessment tests do not necessarily translate to change in practice.

Classification of Studies

We selected two categories of outcomes and clustered the 12 studies according to those that addressed broader issues of management and those that focused on follow-up of diagnosed patients. Further, we classified interventions as “positive” if one (or more) of the primary outcome measures of the studies demonstrated a statistically significant change in physician performance or health care outcome and as “negative” those that failed to achieve this outcome.

Results

Literature Search

Twelve studies met our criteria. Search strategies employing PubMed led to 7 usable studies,
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Results from PubMed Search
Potentially relevant citations identified and screened (n = 204)

Citations excluded after preliminary screening (n = 170)

Citations retrieved for more detailed evaluation (n = 34)

Citations excluded from the study (n = 27)
- 6 not a randomized controlled trial
- 14 not a physician educational intervention
- 2 no objective measure of physician behavior patient outcome
- 2 not on hypertension
- 3 incorporated into another study

Randomized controlled trials included in the study (n = 7)

Results from Research and Development Resource Base in Continuing Medical Education
Potentially relevant citations identified and retrieved for more detailed evaluation (n = 39)

Citations excluded from the study (n = 29)
- 11 not a randomized controlled trial
- 7 not a physician educational intervention
- 1 no objective measure of physician behavior patient outcome
- 3 not on hypertension
- 6 incorporated into another study
- 1 a patient dropout rate greater than 70%

Randomized controlled trials included in the study (n = 10)

Figure 1  Results from the PubMed and Research and Development Resource Base in Continuing Medical Education searches.

whereas those using the Research and Development Resource Base in Continuing Medical Education led to 10 (Figure 1). Manual searching yielded one additional study. Six of the suitable studies found in PubMed were also found in the Research and Development Resource Base in Continuing Medical Education, resulting in a total of 12 studies.

The interventions used in the 12 studies fitting our inclusion criteria were classified into 7 clusters: reminders (both computer generated and in patient charts) (3); formal CME workshops, seminars, and other group learning activities; computerized decision support systems/risk stratification; educational materials; academic detailing; continuous quality improvement projects; and multidisciplinary teams with the purpose of improving suboptimal processes by monitoring and collecting data on the achievement of stated goals (1) and management aids in patient charts (2). Six studies employed two interventions.

Overall Outcomes

Of these 12 studies, 58% (7) were positive, 33% (4) were negative, and one had positive outcomes relative to follow-up but was negative in the dimension of blood pressure management (Table 2).

Blood Pressure Management

Ten studies were located in this dimension of care. Of these, five were classified as positive and five as negative.
<table>
<thead>
<tr>
<th>Blood pressure management</th>
<th>Montgomery et al., 2000\textsuperscript{26}</th>
<th>Hetlevik et al., 1999\textsuperscript{27}</th>
<th>Rossi and Every, 1997\textsuperscript{30}</th>
<th>Goldberg et al., 1998\textsuperscript{29}</th>
<th>Lang et al., 1995\textsuperscript{21}</th>
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<tbody>
<tr>
<td>I—cardiovascular risk chart or risk chart plus computer-based clinical decision support system for elderly with hypertension</td>
<td>I—computer-based clinical decision support system for patients with hypertension</td>
<td>I—a guideline reminder placed in the chart of patients receiving calcium channel blockers for hypertension</td>
<td>I—academic detailing and academic detailing combined with continuous quality improvement projects</td>
<td>I—training sessions for worksite physicians and invitations to patients for regular follow-up</td>
<td>I—training sessions for worksite physicians and invitations to patients for regular follow-up</td>
</tr>
<tr>
<td>R—positive for decreasing systolic blood pressure and higher number of cardiovascular drugs prescribed with risk chart alone</td>
<td>R—positive for decrease in end diastolic blood pressure</td>
<td>R—positive switching to other antihypertensive medications</td>
<td>R—positive decrease in systolic blood pressure</td>
<td>R—no difference in percentage of patients with controlled blood pressure</td>
<td>R—no difference in systolic blood pressure</td>
</tr>
<tr>
<td>No difference for decreasing cardiovascular risk or decreasing diastolic blood pressure with computerization or with risk chart</td>
<td>No decrease in systolic blood pressure, serum cholesterol, BMI, risk score for myocardial infarction, and fractions of smokers</td>
<td>Management aid in patient chart</td>
<td>No long-term change in diastolic blood pressure, alcohol consumption, GGT, BMI, and pattern of antihypertensive medication use</td>
<td>No improvement in prescribing patterns</td>
<td>No long-term change in diastolic blood pressure, alcohol consumption, GGT, BMI, and pattern of antihypertensive medication use</td>
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**Table 2: Randomized Controlled Trials of Physician Educational Interventions on the Management and Follow-up of Hypertension**

- **Computerized decision support systems/risk stratification**
- **Management aid in patient chart**
- **Academic detailing or academic detailing + continuous quality improvement project**
- **Formal CME**
<table>
<thead>
<tr>
<th>Blood pressure management</th>
<th>Putnam and Curry, 1989&lt;sup&gt;26&lt;/sup&gt;</th>
<th>Gullion et al., 1987&lt;sup&gt;25&lt;/sup&gt;</th>
<th>Evans et al., 1986&lt;sup&gt;25&lt;/sup&gt;</th>
<th>Rogers et al., 1982&lt;sup&gt;21&lt;/sup&gt;</th>
<th>Dickinson et al., 1981&lt;sup&gt;30&lt;/sup&gt;</th>
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<tbody>
<tr>
<td>1—1-day educational workshop involving family physicians in establishing criteria for hypertension management or physicians receiving list of criteria but not involved in its development</td>
<td>1—syllabus material, a 1-hour telephone conference call with a faculty expert and either a feedback report (medication education) or patient survey summaries (behavioral education)</td>
<td>1—14 weekly installments of practice-oriented information on hypertension including office aids, workup and management charts, chart stickers, and a follow-up appointment system</td>
<td>1—computerized medical record summary system with reminders to adhere to various standards of care vs. manual patient record only</td>
<td>1—positive increase in some hypertension monitoring measures</td>
<td>1—computer-generated feedback to identify poorly controlled hypertension patients and/or physician education program on management strategies emphasizing patient compliance</td>
</tr>
<tr>
<td>R—no decrease in number of patients with uncontrolled blood pressure</td>
<td>R—no difference in blood pressure control, little change for some physician behaviors, and some negative change for patient behaviors</td>
<td>R—no difference in physician knowledge or blood pressure control</td>
<td>R—positive increase in follow-up visits for feedback physicians</td>
<td>R—positive increase in physician knowledge for education program physicians</td>
<td>R—positive increase in physician knowledge for education program physicians</td>
</tr>
</tbody>
</table>

**Formal CME or educational materials**

**Educational materials**

**Reminders**

**Reminders and formal CME**
positive study was successful in decreasing the use of calcium channel blockers for the initial treatment of hypertension. It accomplished this by employing a computer program (identifying those patients on calcium channel blockers for hypertension) and a guideline reminder in the chart. The latter highlighted the prescription and offered alternative medications and dosages to encourage physicians to consider using an alternative antihypertensive medication. The other positive studies improved systolic or diastolic blood pressure but did not change all of the outcomes measured. Two of these studies used a form of computerized clinical decision support system. One placed a risk chart in the patient chart, alone or with a computer-based clinical decision support system. The study demonstrated that neither intervention decreased cardiovascular risk; however, the risk chart alone did decrease systolic blood pressure and increased the number of cardiovascular drugs prescribed. The other positive study using a risk stratification computer system also did not decrease the risk score for myocardial infarction but did find a slight statistically significant reduction in diastolic blood pressure among the intervention group. Another study used computerized reminders for physicians to adhere to various standards of care. Although no change in blood pressure was noted, two of the four hypertension monitoring measures, namely K+ renal function measurement, were increased. Formal CME was used in the other positive study by training workplace physicians in the management of alcoholic hypertensives. This technique did show a decrease in systolic blood pressure (one of the primary outcome measures) but did not improve other outcome measures.

The negative studies measured blood pressure control and used formal CME, educational materials, academic detailing, continuous quality improvement projects, or computer-generated reminders; either individu-
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ally or in various combinations, all failed to lower blood pressure.

**Follow-up**

Three studies were located that attempted to improve follow-up of patients with hypertension or elevated blood pressure.\(^{19,20,22}\) Each of these studies deployed various strategies (educational materials, formal CME, reminders), and each produced positive outcomes. One study used educational materials and formal CME to increase identified desirable physician behaviors with respect to diagnosis and follow-up of patients with elevated blood pressure.\(^{22}\) A second study found that computer-generated reminders increased follow-up rates of patients with newly identified elevated diastolic blood pressure.\(^{19}\) The third study in this area used computer-generated feedback to identify poorly controlled hypertensives and/or a physician education program on management strategies emphasizing patient compliance; the feedback group made more follow-up appointments, and the education program physicians scored higher on a knowledge test.\(^{20}\)

**Discussion**

This review builds on earlier efforts in this area,\(^{1-3}\) with two major differences: it uses a particular disease entity and related clinical management steps to study the effect of educational interventions; further, it follows the effect of these strategies for longer periods. We offer several limitations to interpretation. First, publication bias may operate here to generate a pool of studies, possibly overrepresenting those that are "positive." Second, the generalizability of this review may be limited in part by the volunteer nature of physician participation, the relatively small number of trials in each category (especially in the follow-up dimension), and—since many of the studies were conducted prior to the advent of managed care—the current nature of the practice setting. Third, these are randomized controlled trials, measuring quantitative outcomes; as such, the process and dimensions of physician learning and change were not explored to any great extent by authors. Fourth, flaws may exist in our process of searching for articles, data extraction, classification, and reporting of outcomes. Despite these cautions, we believe, however, that we can offer comments about the size and scope of the field of physician performance change related to hypertension, the effect of educational interventions targeted to management and follow-up of hypertension, and implications for research and practice.

**Relationship between Hypertension and the Study of Educational Interventions**

It is not surprising that a large number of trials related to hypertension focus on the effect of broadly defined educational or CME strategies: hypertension is an important clinical subject with profound sequelae, and its management and outcomes are heavily influenced by new findings, principles of diagnosis, and follow-up and compliance, among other issues. As such, and because of its ease of outcome measurement, many studies in hypertension have focused on so-called educational interventions and their impact on provider performance or patient outcomes. Thus, these 12 trials permit a preliminary attempt at modeling effective educational strategies.

**Management**

In contrast to the simpler, one-step response to issues of follow-up, studies attempting to change the more complex patterns of disease management yield more negative or mixed outcomes. Although this issue is clouded by the hard to achieve (yet more often used) outcome measure in hypertension studies, blood pressure, there is little evidence that physician interventions reported in these trials improve this measure. We offer the following comments on this relative failure. First, computerized decision support systems, though able to effect modest change in outcomes,\(^{26,27}\) are
complex and not compatible with the modes of practice of most clinicians. Second, more traditional educational interventions (mailed materials, conferences, and workshops), and even innovative strategies such as continuous quality improvement projects and academic detailing, fail to change outcomes, consistent with earlier reviews and suggesting deficiencies in the need to produce point-of-need, point-of-learning care. Third, it strikes us that issues of hypertension management, with their interrelated phenomena of compliance, patient education, and socioeconomic status of patients, appear to require more patient-centered interventions. This holistic approach is reinforced by the physician learning and change model elaborated by the landmark study of Fox, Mazmanian, and Putnam: here multiple forces appear to be required before change occurs, including professional, regulatory, and societal change.

Finally, amid the mostly negative findings in this section, there appears to be a positive message in at least one study: improved physician compliance with guidelines for prescribing is likely to occur if one specific issue is targeted rather than distributing a general guideline with multiple recommendations. Thus, targeting an intervention to a relatively small outcome or change (e.g., the use of calcium channel blockers or first-line antihypertensive medications) may be more effective than a comprehensive approach.

Follow-up

Although other strategies exist to increase effective diagnosis and follow-up in hypertension (e.g., establishing community clinics, increasing patient awareness, and employing physicians’ assistants), it appears that simple computerized reminders are effective in improving provider performance in this dimension of care. Rogers offered that innovations that may be observed by others, are simple, may be tried out, offer relative advantages over current practices, and are compatible with current practices (e.g., adding a computer-generated reminder to an already existing paper chart) are likely to be used. Further, Green et al.’s PRECEDE model stresses the importance of predisposing, enabling, and reinforcing strategies for change. Given the commonly applied approaches of educational material and formal CME (predisposing) to hypertension follow-up, reminders may act as both practice-enabling and reinforcers of change.

Implications for Practice and Research

There are several messages here for the profession in general and for the developer of guidelines and the provider of CME in particular. First, it appears necessary to examine the performance tasks of the health professional, breaking it into its component parts and targeting simple endpoints by simple interventions at point of need. Second, the data from these studies suggest that interventions should be multiphasic and, where possible, sequenced to predispose to the change, enable it, and reinforce it when made. For example, a comprehensive strategy to improve the management of hypertension might include computer reminders to increase screening, diagnosis, and follow-up; traditional CME and educational materials to increase physician knowledge; and patient-centered interventions to achieve blood pressure control. This modeling conforms to the conceptual framework provided by Fox and Bennett regarding physician
learning and change, reflecting the manner in which physicians adopt new information. Further, to improve guideline compliance or to improve specific prescribing behavior, a concentrated effort on one aspect with recurrent reminders in specific patient charts is more likely to achieve positive results.

Conclusion

Although clinical decisions are increasingly based on a firmer understanding of the nature and importance of evidence, it appears that the dissemination of guidelines and the provision of CME fall behind in this process, delivering messages in ways that are most often ineffective. Taken in the abstract context (i.e., instances in which no clinical outcomes are measured or considered), this failure assumes little importance. However, in the context of a disease state or condition of the magnitude and severity of hypertension, the picture assumes the importance of a neglected clinical condition. The piece of the puzzle addressed by these studies—the educational effort to optimize health care delivery—is clearly a central and necessary theme in answering the questions raised by Chassin and Galvin in the quest to meet the “urgent need to improve health care quality.” Two implications assume large proportions in this quest: the practical and the theoretical or research oriented.

First, recent Canadian, World Health Organization, and British guidelines for hypertension have been endorsed and disseminated. Despite extensive efforts in their development, few contain or recommend implementation strategies, and few governments, endorsing organizations, or other institutions channel support to or even address implementation strategies. Further, there is little attempt to integrate implementation strategies with those of other purveyors of education: medical schools, professional associations, other CME providers, and health service systems including hospitals or clinics.

Second, although there is growing evidence about the differential effect of educational interventions, clearly more research is urgently needed in this important area. We envisage this work to occur in a three-dimensional matrix. Along one axis, we need to further refine and test the wide variety of educational interventions, some of which are mentioned in this review and elsewhere and some of which (e.g., Web-based continuing education) have yet to be subjected to rigorous scrutiny. Further, we need to understand better the appropriate timing and sequencing of change agents and more clearly articulate the nature of interventions themselves.

A second axis in this model addresses the question of appropriate research methodologies. Although these reviews have focused on the randomized controlled trial as the major vehicle for analysis, it is clear that refinements need to be made in the conduct and reporting of this kind of trial. In addition, we also need to put forward more qualitative studies, enriching our understanding of the process of physician learning and change. The final axis contains the questions of a clinical or practical nature that we have attempted to address in this review: Are these findings generalizable to other clinical dimensions of care, for example, the management of the diabetic patient? Are they generalizable to surgical rather than medical primary care subject areas? Do they hold for innovations as well as well-established practices?

A full practical and research agenda awaits the attention of a new brand of researchers and clinicians, collaborators in a research program devoted to the study of knowledge translation, assessing, understanding, and implementing ways in which information may be transferred to clinicians by practical, usable, and effective means. Necessary in hypertension and important in all clinical disciplines, the study and advance of this discipline afford us the opportunity to implement effective educational change strategies for health care workers and to produce better outcomes for their patients.
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References


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