

# Technology-Driven Interactive Care Management Identifies and Resolves More Clinical Issues than a Claims-Based Alerting System

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## ABSTRACT

Due to patient or physician factors, people with chronic diseases frequently do not receive evidence-based care. While a physician-directed claims-based alerting system targeting gaps in care was previously shown to increase resolution of specific clinical issues, many apparently relevant issues remained unresolved. The purpose of this research was to demonstrate that adding member interaction with a nurse to a physician alerting system can uncover additional care gaps beyond those identified by a claims, prescription, and lab results-based alerting system, and increase successful resolution of alerts by communicating care gaps to members. An opt-in nurse-managed pilot program focusing on identification and resolution of specific clinical issues was implemented for 205,463 members of self-insured health plans that had been utilizing the claims-based physician alerting system. Specific clinical issues identified by the claims-based system were communicated to both program enrollees and physicians, and new clinical issues were identified based on nurse-directed participant feedback. Participants were encouraged to discuss issues with their physicians. Issue resolution rates were tracked using subsequent claims, pharmacy, and lab data. At 1 year, we studied the rate of new clinical issue identification and compared the program's resolution rate of claims-identifiable issues to that of non-enrollees. While program participants accounted for 0.65% of total member-months in the pilot year, they triggered 4.82% (644) of the population's claims-based clinical alerts, and an additional 514 alerts from data based on participant-supplied data—80.8% more than claims/pharmacy/lab-generated alerts. Of the participants' claims-based alerts, 207 (32.1%) showed claims/lab evidence of successful resolution, compared with 3,380 of 12,714 (26.6%) for non-participants, a 20.9% increase in resolutions ( $\chi^2 = 9.8, p < 0.01$ ). Care management technology complemented by a nurse-directed interactive program increased the rate of identification of clinical issues compared to claims alerts alone. Use of this program to communicate specific issues to both patients and physicians significantly increased the rate of issue resolution. (Disease Management 2005;8:188–197)

## INTRODUCTION

**A**S MORBIDITY AND MORTALITY from acute infectious and traumatic diseases declined throughout the 20th century, the industrialized

world experienced a rise in the prevalence of many chronic diseases, such as diabetes, coronary artery disease, heart failure, and chronic obstructive pulmonary disease. Much of this increasing prevalence was due to the ageing of

the population, and the influence of multiple lifestyle-associated factors, such as smoking, obesity, and a sedentary lifestyle. In concert with this prevalence rise, the past two decades have seen a multitude of advances in our evidence base for optimum management of many chronic diseases. This management includes primary and secondary prevention as well as optimizing function and the quality of life for individuals with chronic conditions.

Ideally, dissemination of the findings of evidence-based medicine should bring about greater uniformity in clinical practice of performance of these findings. The past 20 years of medical research is replete with well-conducted studies demonstrating meaningful reductions in adverse events related to chronic diseases. For example, beta-blockers<sup>1-6</sup> and angiotensin converting enzyme (ACE) inhibitors<sup>7,8</sup> reduce exacerbations for people with systolic heart failure; screening for diabetic nephropathy (urine albumin) and use of ACE inhibitors in those showing early nephropathy prevents deterioration to overt nephropathy and end-stage renal disease<sup>9-11</sup>; and use of ACE inhibitors in patients with established coronary heart disease or diabetics with risk factors prevents several cardiovascular adverse events.<sup>12</sup>

Despite the wide dissemination of evidence showing how physicians can order specific tests or prescribe (or avoid prescribing) specific medications in their patients with chronic disease, substantial evidence indicates the presence of substantial gaps between what should happen and what does happen.<sup>13,14</sup>

Studies show that it takes many years to adopt clinical practice guidelines into practice. The studies quoted are several years old. Contemporary studies, especially on patients with health insurance, give somewhat better results, but perhaps only because public agencies such as the National Committee on Quality Assurance (NCQA) has been measuring these items annually for a decade—and publicly posting the results.<sup>15</sup> Longitudinal studies of adoption of clinical practice guidelines show the many-year course of innovation diffusion.<sup>16-18</sup>

Studies of the use of medications, other treatments, and monitoring in the ongoing world of the outpatient setting serve as better indicators of the quality of care for chronic diseases than

do the rates of such services performed during hospitalizations. Physicians forget to prescribe indicated tests and therapies; patients receive care from multiple sources (and therefore contraindicated therapies can be prescribed, as with calcium channel blockers in heart failure),<sup>19</sup> and patients are sometimes non-adherent to their treatment. A RAND study of 439 indicators of the quality of health care demonstrated that nearly half of services important to optimal outcomes in quality care were not being delivered.<sup>20</sup> Because of the diffuse nature of outpatient care, alert and reminder systems that may be effective in a hospital setting are often unsuited to the outpatient world.

Multiple strategies have been attempted to increase physician and patient adherence to established clinical practice guidelines. Many of these strategies have recognized that people adopt innovations at varying rates. Adopting an innovation (ie, a behavior associated with a practice guideline) is different from acquiring new knowledge. The classic work of Everett Rogers on innovation diffusion theory (showing an S-shape adoption curve from innovators and early adopters through the early majority, late majority, and late adopters or resisters)<sup>21</sup> suggests that physicians will adopt an innovation (such as the findings of a major clinical study or a clinical practice guideline) if the potential adopter judges that the benefits of the innovation outweigh its risks, if it can be tried without disrupting usual workflows, if the physician can watch others using it, if respected “opinion leaders” are using the innovation, and if the innovation can be tried out without involving great commitment.

However, the method of innovation diffusion plays a key role in physicians’ adoption as well. Passive information dissemination (brochures, mailings, and continuing education courses) that does not provide patient-specific, clinical scenario-specific feedback has little influence on physician performance, while active participation (eg, workshop groups), use of opinion leaders, and patient-specific guideline alerts showed improvement in measured performance and sometimes in outcomes.<sup>13,22-25</sup> Studies of use of computer-supported decision support systems (such as alerts and reminders at the point of care or shortly thereafter), which

do provide patient- and scenario-specific feedback, showed significant improvements in physician adherence to guidelines.<sup>25,26</sup> Further, systems that alert or remind both physician and patient might be even more effective.<sup>24</sup> While studies show that patient education can be an effective method of implementing practice guidelines,<sup>25,27</sup> the strategy was more likely to be effective if the service specified in the guideline was straightforward and intended to be delivered once (such as a mammogram or glycosylated hemoglobin test) rather than complex, involving individualized decision-making and adherence to a possibly changing treatment regimen over time.<sup>28</sup>

The question remains as to whether for a relatively complex practice guideline, such as use of ACE inhibitors in patients with established cardiovascular disease or diabetes with certain risk factors<sup>12</sup>—especially those where clinical judgment is required and dose adjustment over time may be required—adding patient to already-existing physician engagement improves guideline adherence for specified chronic diseases.

We therefore undertook to study the addition of patient engagement in specific clinical circumstances to an established physician-directed alerting system that had previously shown (in a randomized study) improved adherence to practice guidelines.<sup>29</sup>

## MATERIALS AND METHODS

In January 2003, an interactive, patient-focused chronic disease care management program was added to an existing care management program of five large corporations' employees and their dependents. The health care of these approximately 200,000 insured had been under surveillance of an alerting system (The CareEngine System<sup>SM</sup>, Active Health Management, Inc., New York) for the previous three years. This system consisted of evaluation of medical, surgical, and pharmacy claims, as well as laboratory test results, by algorithmic case-finding software.

Examples of alerts included recommendations to start a beta-blocker in patients with heart failure; to stop Viagra in patients taking

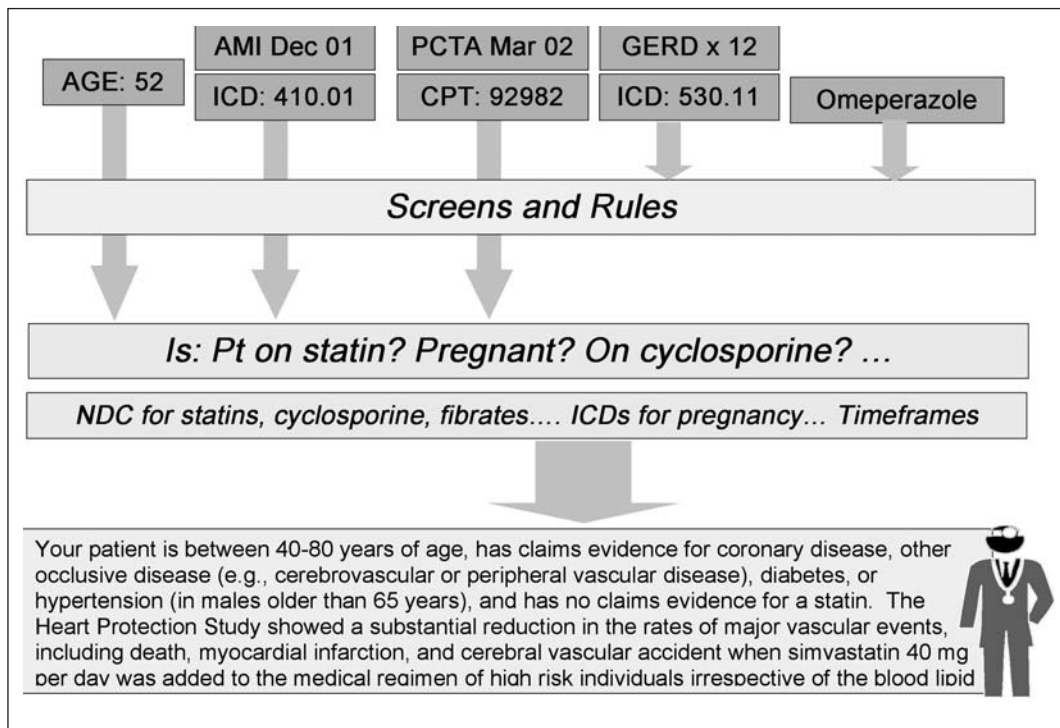
nitrates; to start a statin in patients age 40–80 with cardiovascular diseases; or to perform urinary screening for diabetic nephropathy. An alert would not be issued in the presence of a clinically compelling exception (such as COPD for beta-blockers).

The operation of this algorithmic system for an alert based on the Heart Protection Study (which showed that patients with cardiovascular disease age 40–80 benefit from statin therapy regardless of LDL-cholesterol level) is illustrated in Figure 1. New claims for health care services trigger the system to look over historical claims against a set of clinical rules that include clinically important exceptions, and to issue a provisional recommendation that is then subjected to human or automated clinician review. Cases that pass review become alerts (“care considerations”) sent to the treating physician telephonically, by fax, or by mail. The alerts are worded in such a way as to recognize that the claims system may not have all relevant information about a patient, and include key supporting literature citations such as major clinical trials, national-level clinical practice guideline statements, or FDA “black box” warnings.

A previous randomized study<sup>29</sup> showed that issuing care considerations only to physicians in this manner significantly increased the likelihood of subsequent resolution (eg, that an ACE inhibitor would be prescribed, or that a calcium channel blocker would be discontinued, for a heart failure patient). Such alerts could be considered active interventions because they were specific to a single patient and clinical scenario, and by their nature invited interaction (such as pulling the chart or talking with the patient).

In 2003, the patient-engagement process was added under the theory that discussing the alert and its meaning with the patient, as well as advising the patient (after determining that the alert remained valid) to discuss its subject with their physician, would improve the likelihood of successful resolution. In addition, we recognized that talking with the patient would trigger additional alerts due to more complete collection and surfacing of disease-related issues.

Accordingly, after allowing 2 weeks following notification of the physician of the poten-



**FIG. 1.** How the alerting system works (physician communication portion). Example of the alerting system taken from the Heart Protection Study, which recommends statins in patients age 40–80 with a history of coronary artery disease. Data from claims (or enrollee report) are fed into a clinical rules-based algorithmic software engine. If the member's data indicates a fit to the pattern for the clinical practice guideline, the indicated treatment (a statin) is checked for. If the treatment is not present, the system checks for contraindications. If no contraindications are found, an alert (bottom box) is issued to the physician and after an appropriate interval (and in patient-friendly language), to the member as well. Since the presence of GERD is not material to this alert, claims for GERD are ignored. ICD, International Classification of Diseases (version 9); PCTA, percutaneous transluminal (coronary artery) angioplasty; CPT, Common Procedural Terminology (version 4); NDC, National Drug Code; GERD, gastroesophageal reflux disease.

tial gap in care, the patient was contacted and the care consideration discussed. (The physician alert mentioned the possibility that their patient might be contacted and the physician could request that we not contact their patient.) Claims were reviewed prior to patient contact to determine whether (from the claims perspective) the alert remained current. We later examined claims to determine whether the care consideration had successfully resolved.

Discussing an already generated care alert with a participant in "patient-friendly language" is straightforward, but how the care management program generated additional alerts may be understood through an example; see Appendix.

Care considerations recommending doing a test or starting a drug were counted as successful if the claims and test results system showed the presence of the specified test or

drug 0–270 days following the delivery of the care consideration. Care considerations recommending that a drug be stopped were counted as successful if the claims and test results system showed the absence of a filled prescription for a drug in that class 60–150 days following delivery of the care consideration.

Following the first year of the program, we studied the extent to which the program identified new clinical issues and also compared the program's resolution rate of claims-identified issues to that of non-enrollees, and to the pre-program results.

## RESULTS

The Informed Care Management program began inviting health plan members to opt-in in mid-January and enrollees first interacted

with nurses in late January. Because the five participating health plans had staggered start points through April, results are calculated using member-years of active participation during 2003. For each month, each health plan member was designated as being a program enrollee or non-enrollee.

In the first 12 program months, there were 205,463 health plan member-years and 1336 member-years of active participation (enrollee-years)—0.7 enrollee-years per 100 member-years overall. However, because of rapid ramp-up during the second half of the year, the program had enrolled 2,936 members by year's end. Enrollees were older (57.9 versus 34.8 years) and more likely to be female (57.0% versus 51.4%) compared to non-enrollees.

Evaluating the urgent clinical alerts, enrollees accounted for 644 of the 13,358 (4.82%) claims/lab-based alerts issued during the year. The claims/lab-based alert rate was 48.2 per 100 enrollee-years and 6.23 for non-enrollees, reflecting enrollees having been drawn from a group considered to have significant (and often multiple) chronic conditions. Table 1 summarizes the demographics, and Table 2 the alert status for enrollees and non-enrollees.

For claims/lab-based urgent alerts, the resolution rate (as of December 31, 2003) was 3,380 of 12,714 (26.6%) for non-enrollees and 205 of 636 (32.3%) for enrollees, representing a 21.2% increase for enrollees ( $\chi^2 = 9.836, p < 0.01$ ). The non-enrollee resolution rate is in line with rates for the same clients in years prior to the Informed Care Management program.

There were 514 enrollee report-based urgent alerts during the program year, of which 136 (26.5%) were noted as resolved by December

31, 2003. Thus, enrollee report-based alerts represented an increase of 80.8% in the volume of alerts for this group.

The distribution of alerts by clinical severity/urgency level, and examples, is shown in Table 3. Approximately 81% of alerts involved important, but not highly urgent, clinical issues such as lack of secondary screening in chronic disease, moderate drug/disease contraindications, or omissions of probably appropriate care for people with specific chronic diseases. Two percent involved extremely urgent potential gaps in care, and 17% involved lack of primary prevention, early detection, or disease or drug monitoring activities.

## DISCUSSION

Many studies—and popular media—have documented disturbing deviations from evidence-based health care. Despite an explosion of nationally-promoted clinical practice guidelines based on well-conducted clinical trials and meta-analyses, physician adherence to these guidelines remains low, and diffusion of clinical evidence and best practices can take years.<sup>30,31</sup>

Studies of physician awareness, adoption, and adherence to clinical practice guidelines have shown that simple knowledge dissemination may increase awareness but fails to improve adherence to guidelines and evidence-based medicine in clinical practice.<sup>25,32</sup> Yet a course in evidence-based medicine, in which physicians learned to actively participate in evaluating clinical evidence and its meaning for their practices, improved both knowledge

TABLE 1. DISTRIBUTION OF ENROLLEES AND NON-ENROLLEES BY DEMOGRAPHICS

<i>Group</i>	<i>Member-years (% of total)</i>	<i>Mean age (years)</i>	<i>Percent female</i>
All plan members	205,463 (100%)	35.1	51.5%
Non-enrollees	204,127 (99.3%)	34.8	51.4%
Enrollees	1,336 (0.7%)	57.9	57.0%

Member-years indicates the number of member-months (divided by 12) spent by health plan members in enrollee or non-enrollee status. A health plan member may occupy either (or both) status during the year.

TABLE 2. URGENT CLINICAL ALERTS ISSUED TO, AND RESOLVED, FOR ENROLLEES AND NON-ENROLLEES

Group	Claims-based alerts		Enrollee report-based alerts	
	n (% of total)	Resolved (%)	n	Resolved (rate)
All plan members	13,358 (100)	3,587 (26.85)		
Non-enrollees	12,714 (95.18)	3,380 (26.58)		
Enrollees	644 (4.76)	207 (32.14)	514	136 (26.5)

Chi-square = 9.836 ( $p < 0.01$ ).

and outcomes, possibly because it stimulated greater "evidence vigilance."<sup>33</sup> Many studies have shown that active participation by the physician, as well as use of decision support systems (especially if computerized), can meaningfully increase the likelihood that a physician will take the action (when appropriate) in the guideline. This points up the difference between knowledge and innovation diffusion; the latter is required to step from awareness to practice.

Even with effective use of methods of knowledge and innovation diffusion, our state of clinical knowledge is constantly shifting. A study performed by the Agency for Healthcare Research and Quality showed that three quarters

of guidelines currently promoted at the national (federal or medical society) level already were out of date.<sup>34</sup> By the time new knowledge has diffused and been incorporated into clinical practice, it is likely to have been superseded by knowledge that could lead to better outcomes. This highlights the urgent need for effective clinical knowledge diffusion systems.

Some studies have highlighted the importance of the patient in adherence to best clinical practices. This patient contribution can occur in three ways. First, the informed and actively participating patient can better accept and adhere to the physician's recommendation. Second, the patient who understands key clinical practice guidelines relevant to his or her

TABLE 3. DISTRIBUTION OF ALERTS BY TYPE AMONG PROGRAM ENROLLEES

	Examples	n (% of total)	Percent resolved
Extremely urgent	Metformin/heart failure Overlapping sildenafil + nitrates Class 1 C antiarrhythmic in structural heart disease Cilostazol/heart failure	31 (2.2)	60.0%
Clinically important, urgent, such as secondary prevention	Cardiovascular candidate for ACEI Cardiovascular disease or diabetic/no statin Diabetic with microalbuminuria/no ACEI CAD or diabetes/no ASA (enrollee)	1127 (80.9)	31.6%
Prevention, early detection, and monitoring	Monitor LFTs in statin use Monitor CBCs with azulfidine Diabetic/no retinal exam No mammographic screening	235 (16.9)	19.7%

All alerts may be triggered by claims and/or enrollee-supplied information.

ACEI, Angiotensin converting enzyme inhibitor; CAD, coronary artery disease; ASA, aspirin; CBC, complete blood count; LFT, liver function tests.

condition and who feels empowered to discuss these guidelines with his or her physician can serve as a sort of physician reminder. Third, as shown by the 80% increase in alerts in program participants, the patient serves as an important data source.

It is not enough for disease management systems to promote carrying out the physician's directives. It is even more important to help ensure that the physician's recommendation is based on current best evidence. Previous studies also have demonstrated that adding patient education about specific, guideline-based disease treatment components increased the likelihood that a practice guideline would be implemented.<sup>13,24,35,36</sup>

Disease management programs, which engage the patient as an active participant in achieving important process and outcomes goals, have shown improvement in clinical processes and outcomes,<sup>37,38</sup> and some have demonstrated improvements in disease-related utilization and cost outcomes.<sup>39</sup> However, disease management programs have usually been studied as a whole—involving not only patient education about clinical practice guideline components, but behavior change, coordination of care, and general disease education. The contribution of each of these components to outcomes improvement is not known.

We hypothesized that much of disease management's potential to improve disease management processes and outcomes could be related to the implementation of specific, evidence-based clinical practice guidelines for individuals whose care appeared to fall short of the guideline. These guidelines are based on medical evidence demonstrating reduction in adverse events related to specific clinical activities, such as using beta-blockers in heart failure when not contraindicated. However, even though in a previous randomized study we had shown statistically significant improvement in adherence to specific guidelines with a physician-engagement alerting system, we believed that engaging the patient, via communicating the alert and discussing its meaning, and recommending discussion with the physician, would further improve resolution of the alerts as shown in claims data, and thus expand the value of disease management. In addition, we

regarded the patient-engagement portion of the system as supporting the adoption of innovation (behavior)—helping bring physician awareness of new knowledge into daily practice.

In the first year of an opt-in pilot patient-engagement program called Informed Care Management, we engaged 1,336 of 205,463 members member-years and approximately 3,000 members overall by the year's end. Alerts for which all triggering information was derived from claims showed a 20.9% relative increase in likelihood of successful resolution among enrollees compared with non-enrollees. In addition, talking directly with the enrollee generated an increase of 80.8% in alert volume over claims/lab-based alerts.

The major limitation of the study was a potential for volunteer bias, in which those who "opted-in" (enrolled) may have a different propensity to resolve clinical issues than those who do not enroll. To explore this possibility, we compared the baseline year alert resolution rate in the study year enrollee cohort versus that in the study year non-enrollee cohort. A significant difference in resolution between these groups would suggest a greater propensity for one group to resolve clinical issues. As shown in Table 4, the baseline year resolution rate of the non-enrollee cohort was 30.2% versus 31.6% in the enrollee cohort—a nonsignificant difference. This suggests that volunteer bias did not play a role in the resolution rate difference observed during the study year.

We conclude that the program's first year strongly suggested that communicating directly with patients about gaps in specific services impacting their care increases the likelihood that the gaps will be resolved, and that gathering condition-related information from

TABLE 4. COMPARISON OF ALERTS RESOLUTIONS OF ENROLLEES IN THE STUDY AND BASELINE YEAR

	<i>Enrollees</i>	<i>Non-enrollees</i>	<i>Difference</i>	<i>Significance</i>
2003	32.1%	26.6%	20.7%	<0.01
2002	31.6%	30.2%	4.4%	NS

The study year was 2003; the baseline year was 2002. NS, non-significant ( $p > 0.05$ ).

program enrollees dramatically increases the generation of clinical alerts.

Consistent with the program's nature as a pilot effort, the current study needs to be extended and certain potential biases addressed. Because the program was opt-in, the increased resolution rate of claims-based alerts in the enrollee group may be due to volunteer bias. A control group would be needed to determine whether this was the case. The 32.1% overall alert resolution has room for improvement. In 2003, alerts were communicated only once; in 2004, alerts will be followed up to check for resolution or to discuss further action with enrollees. This would be expected to further increase resolutions or weed out false-positive alerts. In 2004, the Informed Care Management program will be extended to a greater proportion of health plan members and alert issuance and resolution rates will be evaluated in the population segmented by degree of engagement.

Finally, while the medical literature says that successful resolution of clinical alerts should lead to a reduction in adverse events, this study focused only on the rates of alert resolution and the generation of new alerts arising from talking with enrollees. To evaluate the effect of a program of patient engagement on adverse event outcomes awaits a study with larger enrollment and adequate study power.

## CONCLUSION

The addition of a nurse-directed interactive care management program substantially increased the rate of identification of specific clinical issues (alerts) compared to those generated by a claims system alone. In addition, the use of the program to communicate specific issues to both patients and physicians increased the rate of alert resolution. Adding patient engagement increases the likelihood of adherence to clinical practice guidelines.

## APPENDIX: PATIENT ENGAGEMENT CASE SCENARIO

X is a 60-year-old male smoker whose claims show diabetes, but no history of hypertension

or coronary, cerebral, or peripheral vascular disease. His medications (claims) include Metformin and a diuretic but with no explanatory ICD codes. His claims show a HbA1C, eye exam, and urine for albumin performed in the appropriate timeframe. Under the physician alerting system, X would not have received any alerts related to his diabetes. However, he also had claims for COPD and was found to have had ER visits for COPD but was not taking a long-acting beta agonist or other controller medication.

Due to scoring on the case-finding system, X was invited to the care management program and accepted. He told the nurse that he didn't know why the diuretic had been prescribed, and that he was a smoker. In addition to interactions related to lifestyle factors and his COPD, as well as reminders to continue to have periodic monitoring for his conditions, an alert was generated recommending consideration be given to treatment with an ACE inhibitor, as the diabetic arm of the HOPE Trial demonstrated that diabetics with additional risk factors—including smoking—benefited from treatment.

In addition, X was not taking aspirin, as recommended by the U.S. Preventive Services Task Force, and had no contra-indications; thus an alert was generated recommending consideration of low-dose preventive aspirin therapy.<sup>40</sup>

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## REFERENCES

1. Brophy JM. Beta-blockers in congestive heart failure: a Bayesian meta-analysis. *Ann Intern Med* 2001;134:550-560.
2. Avezum A. Beta-blocker therapy for congestive heart failure: a systematic overview and critical appraisal of the published trials. *Can J Cardiol* 1998;14:1045-1053.

3. Packer M. The effect of carvedilol on morbidity and mortality in patients with chronic heart failure. U.S. Carvedilol HF Study Group. *N Engl J Med* 1996;334:1349–1355.
4. U.S. Carvedilol HF Study Group. Influence of carvedilol on hospitalizations in heart failure: incidence, resource utilization, and costs. *J Am Coll Cardiol* 2001;37:1692–1699.
5. MERIT-HF Study Group. Effect of metoprolol CR/XL in chronic heart failure: metoprolol CR/XL randomized intervention trial in congestive heart failure (MERIT-HF). *Lancet* 1999;353:2001–2007.
6. MERIT-HF Study Group. Effects of controlled-release metoprolol on total mortality, hospitalizations, and well-being in patients with heart failure. The Metoprolol CR/XL randomized intervention trial in congestive heart failure. *JAMA* 2000;283:1295–1302.
7. The SOLVD Investigators. Effect of enalapril on survival in patients with reduced left ventricular ejection fraction and congestive heart failure. *N Engl J Med* 1991;325:293–302.
8. The SOLVD Investigators. Effect of enalapril on mortality and the development of heart failure I asymptomatic patients with reduced left ventricular ejection fractions. *N Engl J Med* 1992;327:685–691.
9. Cook DJ, Guyatt GH. Interpreting, integrating, and individualizing evidence about the prevention of diabetic nephropathy. *Ann Intern Med* 1999;131:707–708.
10. Ritz E, Orth SR. Nephropathy in patients with type 2 diabetes mellitus. *N Engl J Med* 1999;341:1127–1133.
11. Kshirsagar AV. Effect of ACE inhibitors in diabetic and nondiabetic chronic renal disease: a systematic overview of randomized placebo-controlled trials. *Am J Kidney Dis* 2000;35:695–707.
12. The Heart Outcomes Prevention Evaluation Trial Investigators. Effects of an angiotensin converting-enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. *N Engl J Med* 2000;342:145–153.
13. Clarke JL, Nash DB. The effectiveness of heart failure disease management: Initial findings from a comprehensive program. *Dis Manage* 2002;5:215–223.
14. Saadine JB, Engelgau MM, Beckles GL, Gregg EW, Thompson TJ, Venkat Narayan KM. A diabetes report card for the United States: quality of care in the 1990s. *Ann Intern Med* 2002;136:565–574.
15. Assurance NCfQ. Health Plan Employer and Data Information Set (HEDIS) Commercial HEDIS 2003 audit means, percentiles and ratios. Available: <[www.ncqa.org/Programs/HEDIS/Audit/HEDIS\\_2003\\_Audit\\_Means\\_Ratios.htm](http://www.ncqa.org/Programs/HEDIS/Audit/HEDIS_2003_Audit_Means_Ratios.htm)>, 2004.
16. Ezekowitz MD, Levine JA. Preventing stroke in patients with atrial fibrillation. *JAMA* 1999;281:1830–1835.
17. Atrial Fibrillation Investigators. Risk factors for stroke and efficacy of antithrombotic therapy in atrial fibrillation: analysis of pooled data from five randomized controlled trials. *Arch Intern Med* 1994;154:1449–1457.
18. Beta-blocker Heart Attack Study Group. A randomized trial of propranolol in patients with acute myocardial infarction. I. Mortality results. *JAMA* 1982;247:1707–1714.
19. Kostis JB, Lacy CR. Association of calcium channel blocker use with increased rate of acute myocardial infarction in patients with left ventricular dysfunction. *Am Heart J* 1997;133:550–557.
20. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. *N Engl J Med* 2003;348:2635–2645.
21. Cain M, Mittman R. Diffusion of innovation in health care. Institute for the Future (prepared for the California HealthCare Foundation), 2002.
22. Oxman DA, Thompson MA, Davis DA, Haynes RB. No magic bullets: a systematic review of 102 trials of interventions to improve professional practice. *Can Med Assoc J* 1995;153:1423–1431.
23. Cockburn J. Adoption of evidence into practice: can change be sustainable? *Med J Aust* 2004;180:S66–S67.
24. Bodenheimer T. Interventions to improve chronic illness care: evaluating their effectiveness. *Dis Manage* 2003;6:63–71.
25. Greco PJ, Eisenberg JM. Changing physicians' practices. *N Engl J Med* 1993;329:1271–1273.
26. Hunt DL, Haynes RB, Hanna SE, Smith K. Effects of computer-based clinical decision support systems on physician performance and patient outcomes. *JAMA* 1998;280:1339–1346.
27. Schneider EC, Eisenberg JM. Strategies and methods for aligning current and best medical practices: the role of information technologies. *West J Med* 1998;168:311–318.
28. Anari M, Shlipak MG, Heidenreich PA, et al. Improving guideline adherence: a randomized trial evaluating strategies to increase  $\beta$ -blocker use in heart failure. *Circulation* 2003;107:2799–2804.
29. Javitt JC, Steinberg G, Locke T, Couch JB, Jacques J, Juster IA, and Reisman L. Using a claims data-based sentinel system to improve compliance with clinical guidelines: Results of a randomized prospective study. *Am J Manag Care* 2005;11:93–102.
30. Stafford RS, Radley DC. The underutilization of cardiac medications of proven benefit, 1990 to 2002. *J Am Coll Cardiol* 2003;41:56–61.
31. Koelling TM, Eagle KA. Editorial comment: measuring quality of outpatient cardiovascular care. *J Am Coll Cardiol* 2003;41:69–72.
32. Davis DA, Thompson MA, Oxman DA, Haynes RB. Evidence for the effectiveness of CME: a review of 50 randomized controlled trials. *JAMA* 1992;268:1111–1117.
33. Fritsche L, Greenhalgh T, Falck-Ytter Y, Neumayer H-H, Kunz R. Do short courses in evidence based medicine improve knowledge and skills? Validation of Berlin questionnaire and before and after study of courses in evidence-based medicine. *BMJ* 2002;325:1338–1341.
34. Shekelle PG, Oritz E, Rhodes S. Validity of the Agency

- for Healthcare Research and Quality clinical practice guidelines. JAMA 2001;286:1461–1467.
35. Gibson PG, Coughlan J, Wilson AJ. Self-management education and regular practitioner review for adults with asthma. Cochrane Library 2001; January.
  36. Lorig KR, Ritter P, Stewart AL. Chronic disease self-management program: 2-year health status and health care utilization outcomes. Med Care 2001;39:1217–1223.
  37. Aubert RE. Nurse case management to improve glycemic control in diabetic patients in a health maintenance organization: a randomized, controlled trial. Ann Intern Med 1998;129:605–612.
  38. Siderov J, Gabbay R, Harris R, et al. Disease management for diabetes mellitus: impact on hemoglobin A1c. Am J Manage Care 2000;6:1217–1226.
  39. Villagra VG, Ahmed T. Effectiveness of a disease management program for patients with diabetes. Health Aff (Millwood) 2004;21:255–266.
  40. U.S. Preventive Services Task Force. Aspirin for the primary prevention of cardiovascular events. Ann Intern Med 2002;136:157–160.

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