

THE CARE PATH NOT TAKEN: THE PARADOX OF UNDERUSED PROVEN TREATMENTS

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Rose Pasano awakens suddenly in the middle of the night and grabs her husband's arm.

"Bill," she gasps, "call...an ambulance....I feel like I'm drowning...can't breathe!"

Panicked, Bill manages to give directions to the 911 dispatcher, and minutes later a paramedic team is rushing the couple from their suburban home to the renowned teaching hospital nearby.

On arrival, Rose is pale, sweaty, and laboring to breathe. A team of residents hurries her to a curtained room while Bill paces outside. When a nurse emerges, Bill asks what is happening.

"Your wife's having trouble breathing because of fluid in her lungs. Her heart isn't pumping properly. We're giving her medications to remove the fluid and to help her heart work better."

"It's heart failure?"

"Yes."

"This happened just 3 months ago. Why is it happening again?"

The nurse shakes her head with resignation, then quickly continues on her way. The medical team attends to Rose through the night, and early the next day her condition begins to stabilize. Three days later, Rose is well enough to be discharged home. At the time of discharge, the medical team congratulates itself on getting Rose "buffed up and out the door" in less than 4 days.

Had the team taken the time to dig a little deeper, however, they could have computed the average length of stay for Rose's three hospitalizations for heart failure in the prior year. Sensitive to proper academic medical management protocol, the consulting cardiologist had left all order writing, communications with "LMDs" (local medical doctors), and postdischarge management decisions in the able hands of his team of residents and cardiology fellows and Rose's excellent

primary care physician. The team, however, did not contact Rose's primary care doctor at the time of her admission.

Information concerning Rose's outpatient care was not readily available and no integrated system of medical records was accessible, despite the fact that two of her three admissions were to the community hospital affiliated with the teaching facility where she was being treated. Had Rose's inpatient team been able to review her previous hospital and outpatient records, they would have realized that although she was started on a regimen including angiotensin-converting enzyme (ACE) inhibitors, β -blockers, aspirin, and spironolactone each time she was hospitalized, she had not been receiving optimal doses of these medications between hospitalizations. Unfortunately, Rose's primary care physician believed the cardiologist was managing her heart failure, and so postdischarge medications, diet, and exercise regimens were never thoroughly followed up.

How could this patient have had three acute exacerbations of heart failure in 1 year? What factors conspired to produce such a poor outcome?

Although Rose Pasano is not a real patient, her story is regularly repeated in fragmented health care delivery systems throughout the United States. Poor coordination of care, failure to share critical medical information in a timely fashion, and underuse of proven treatments are just three of several commonly identified deficiencies in health care. While arguably the world's best, the U.S. health care system often does not deliver the health benefits it should. This failure of American health care to realize its full potential is the focus of a recent report by the Institute of Medicine (IOM) Committee on Quality of Health Care in America, *Crossing the Quality Chasm* [1]. The IOM reports, "Americans should be able to count on receiving care that meets their needs and is based on the best scientific knowledge. Yet there is strong evidence that this frequently is not the case." In the midst of an explosion of medical research and knowledge regarding potentially life-saving treatments, the health care system often fails to translate evidence into clinical practice [1] and to apply new technology and treatments safely and appropriately [2].

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Quality problems in health care are not new. Variations in the patterns of provision of health care services were first reported in the early 1970s in a seminal study by Wennberg and Gittelsohn [3]. Subsequent reports by Wennberg and others focused on unexplained disparities in rates of common surgical procedures [4,5] and hospital admissions [6] from one geographic area to the next. Since then, variations in clinical practice patterns have been widely documented [7,8], providing a compelling rationale for the dissemination and implementation of evidence-based guidelines for best practices. Yet, despite the availability of evidence proving their effectiveness, many clinical interventions continue to be variably applied in practice. Two recently reported examples include the prophylactic use of subcutaneous heparin in only 33% of hospitalized patients at high risk for venous thromboembolism [9] and the adequate control of blood pressure in only 23% of patients with hypertension [10]. Scores of additional examples could be cited.

The scope of health care quality problems in the United States has gradually come to light in recent years, aided by the efforts of the IOM. In early 1998, the IOM National Roundtable on Health Care Quality defined three types of problems (misuse, overuse, and underuse) that characterize critical defects in health care service delivery [11]. In late 1999, the IOM released its first in-depth report, *To Err is Human*, which focused on deficiencies in patient safety [2]. In its March 2001 publication, *Crossing the Quality Chasm*, the IOM cited an urgent need to improve health care performance not only in terms of its safety but also its effectiveness, patient-focus, timeliness, efficiency, and equity [1].

A central message of the IOM report on quality is that problems in health care can no longer be regarded as simply a matter of poor access or variations in practice patterns. Poor quality is now known to be pervasive, involving all types of care (preventive, acute, and chronic) [12] and affecting even those with health insurance and access to the best doctors and hospitals. Furthermore, the causes are complex, involving factors at the national, state, hospital, clinic, and individual patient and provider levels. Thus, the IOM concluded that major improvement will require systemic changes in the ways that care is organized and delivered and in the environment in which care is provided, including how it is financed and regulated.

This article focuses on the most paradoxical of the identified quality problems in health care: the underuse of proven interventions. The authors seek to raise the reader's awareness of the magnitude of this problem and to draw attention to important documented examples of underuse. In addition, factors that may contribute to the

underuse problem are considered and areas on which to focus improvement efforts are discussed.

The Underuse Problem: Scope and Impact

The IOM National Roundtable on Health Care Quality defined underuse as "a failure to provide a health care service when it would have produced a favorable outcome" for a particular patient [11]. By definition, underuse implies that the health care service that should have been provided is one consistent with known best practices. Although the number of published consensus recommendations regarding best practices has soared, the rate at which patients are treated according to such recommendations is often shockingly low. The consequences of failing to provide care consistent with best practices are serious and expensive, with patients shouldering profound burdens of illness, disability, and lost years of life [11].

Underuse has long been an issue for vulnerable, underserved populations who are at higher risk for illness and are less likely to be insured, and this problem persists today. Age, gender, racial/ethnic, and socioeconomic disparities in health care quality have been and continue to be well documented in the United States (Table 1) [13]. Factors contributing to health care disparities, however, are more complex than socioeconomic position, access to care, and enrollment in health insurance. Current research is exploring the impact of job-related and nonfinancial barriers to access, including lack of cultural and linguistic competency among providers and actual or perceived discrimination within the health care system [14]. Eliminating gaps in health care equity is a major initiative of the Healthy People 2010 program [15] and one of the IOM's six stated goals for improving health care quality.

Of critical significance is the observation that underuse is not simply a problem of vulnerable populations. Recent studies reveal that mainstream insured populations may encounter barriers to essential services as well [16]. In fact, underuse of proven interventions has been documented for many of the most common conditions that affect the general population.

Sources of Data Documenting Underuse

The most commonly cited data regarding underuse are from independent studies of the rates of interventions for prevention or treatment of disease-specific conditions. The medical literature is replete with reports of underuse of proven interventions, including failure to detect and adequately treat hypertension [10,17–19] and diabetes [20], to aggressively control symptoms of

Table 1. Documented Disparities in Health Care Received by Minority Racial/Ethnic Groups Compared with White Americans

Lower rates of preventive interventions (Papanicolaou tests, mammograms, childhood and influenza immunizations, diabetic eye examinations)
Lower rates of intensive hospital care (lung resections for cancer, kidney and bone marrow transplants, Cesarean deliveries, peripheral vascular procedures, orthopedic procedures)
Less aggressive treatment (prostate cancer, HIV, chest pain, mental illness)
Higher rates of poorer outcomes (extremity amputations due to diabetes, death due to coronary heart disease, orchiectomies due to testicular cancer)
Higher death rates (coronary heart disease, breast cancer, diabetes)

Data from Fiscella K, Franks P, Gold MR, Clancy CM. Inequality in quality. Addressing socioeconomic, racial, and ethnic disparities in health care. *JAMA* 2000;283:2579–84; Weinick RM, Zuvekas SH, Cohen JW. Racial and ethnic differences in access to and use of health care services, 1977 to 1996. *Med Care Res Rev* 2000;57 Suppl 1:36–54; Schuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States? *Millbank Q* 1998;76:517–63; and Mental health: culture, race, and ethnicity. A supplement to mental health: a report of the Surgeon General. Available at <http://www.mentalhealth.org/cre/toc.asp>. Accessed 3 Oct 2001.

asthma [21–24], and to provide adequate secondary prevention of coronary heart disease (CHD) [25–30].

Other sources of underuse data are publicly available health plan report cards. The most widely referenced report card is the Health Plan Employer Data and Information Set (HEDIS), a collection of performance measures intended to reflect the quality of care received by members of managed health care plans. More than 67% of health plans, covering more than 90% of patients annually enrolled in managed care plans, report HEDIS data to the National Committee for Quality Assurance (NCQA). The measures report the number of plan members who received appropriate preventive and health maintenance interventions for certain conditions such as cancer, smoking, asthma, diabetes, and heart disease [31]. The latest composite report, which contains HEDIS data from 372 participating health plans covering more than 63 million people, cites across-the-board improvements in all key areas of care and service [32]. However, assuming the quality of care provided by health plans that do not publicly report on their performance is likely to be poorer than the quality of plans that

Table 2. Selected HEDIS Results Reported in 2000

Measure	National Average, %
Breast cancer screening	74.5
Advising smokers to quit	66.3
Use of appropriate medications for people with asthma, aged 18 to 56 years	64.4
Controlling high blood pressure	51.5
Cholesterol management after a heart attack	53.4
Comprehensive diabetes care, eye exams	48.0
Comprehensive diabetes care, lipid control	44.3

HEDIS = Health Plan Employer Data and Information Set. (Data from State of managed care quality report: 2001. Washington (DC): National Committee for Quality Assurance; 2001. Available at <http://www.ncqa.org>. Accessed 4 Oct 2001.)

do, and given the less-than-ideal national averages for HEDIS measures reported in 2000 (Table 2), it seems safe to say that underuse remains an enormous problem.

Underused Therapies for Chronic Conditions

Chronic conditions have become the leading cause of illness, disability, and death in the United States, affecting nearly half of the population and accounting for the bulk of dollars spent on health care [33,34]. Effective therapies are available to treat most of these conditions, but too often patients do not receive them. The following are documented examples of proven therapies that are used far less frequently and to much less benefit than the scientific basis of their usefulness would make appropriate.

Secondary prevention of coronary heart disease.

The clinical and economic burdens of CHD are staggering. CHD is the number one killer of both men and women in the United States, causing 1 in 5 deaths [35]. CHD also is the leading cause of premature and permanent disability, affecting 19% of the U.S. workforce [32]. The American Heart Association (AHA) estimates that in 2001 approximately 1 million Americans will have a new or recurrent coronary attack, and more than 40% of those suffering an attack will die as a result [35]. In terms of economic toll, the AHA estimates that CHD will cost \$100.8 billion in direct (health expenditures) and indirect (lost productivity) costs in 2001 [35].

Randomized controlled trials have demonstrated the effectiveness of specific pharmacotherapies in improving patient outcomes after acute myocardial infarction (MI). These studies have resulted in explicit prescribing

recommendations in evidence-based guidelines for treating MI survivors [36]. For example, long-term β -blocker use after MI has been shown repeatedly to be effective in lowering the risk of another MI and in reducing morbidity and mortality associated with CHD [37–39]. Several studies provide evidence, however, that these agents routinely are underused in practice [26,27,30], particularly among women and elderly patients [25,28,29]. For 186,800 Medicare beneficiaries hospitalized for confirmed acute MI, a claims review revealed that only 49.5% of patients judged as “ideal” for receiving β -blockers were prescribed these agents at discharge [30]. NCQA reports that the average rate for β -blocker treatment among reporting health plan members was 89.4% in 2000, up from a mediocre 62.6% in 1996 [32]. Even at this improved level of performance, based on AHA figures for first-time coronary events, nearly 70,000 patients who might benefit from this therapy do not receive it.

Current guidelines for treating MI survivors with average or high cholesterol levels also include the use of lipid-lowering “statin” drugs [36]. Studies have shown that lowering cholesterol levels can help prevent the recurrence of a coronary event and reduce death rates among patients with established CHD [40–42]. Yet, NCQA reports that only 53.4% of health plan members with a history of a prior coronary event had their cholesterol levels appropriately controlled in 2000 [32]. It has been estimated that aggressive implementation of best practices in secondary prevention of CHD (eg, thrombolytic agents, β -blockers, aspirin, ACE inhibitors) could save as many as 18,000 lives annually [11].

Treatment of congestive heart failure. Often the final stage of cardiovascular disease, congestive heart failure (CHF) is the most frequent reason that Americans aged 65 and older are brought to emergency departments (EDs) and the most common cause for hospitalization and readmission on a yearly basis for this population. According to current AHA estimates, 4.7 million Americans have CHF, and \$21 billion will be spent on direct and indirect costs related to the disease in 2001 [35]. As the elderly population continues to increase and as more patients with cardiovascular disease survive with their illness, the incidence of CHF is expected to rise dramatically.

The prognosis following the diagnosis of CHF is poor, with a 5-year mortality rate approaching 50% [43]. Many published guidelines for management of patients with CHF recommend ACE inhibitors and β -blockers as initial therapy [44–46], as these agents have been shown in large trials to significantly improve

survival and to reduce mortality [47–50]. However, wide variations in care patterns continue to be observed, with physician prescribing of ACE inhibitors, for example, continuing to fall below recommended levels [51–53]. In a study of more than 16,000 patients with heart failure, only 50% of eligible patients received ACE inhibitor therapy and only 36% of patients were prescribed the recommended target dose [53].

Detection and control of hypertension. According to current AHA estimates, 50 million Americans have hypertension, including 1 in 4 adults [35]. The disease is the number one reason why people see a physician [54]. The AHA estimates that \$40.4 billion will be spent on direct and indirect costs related to hypertension in 2001 [35].

If left uncontrolled, high blood pressure can lead to stroke, blindness, cardiac disease, and renal failure. The risk of developing both hypertension and its sequelae increases with age, making blood pressure control critically important as Americans continue to age. Yet, despite the fact that hypertension is easily detected and often controllable, based on data from the third National Health and Nutrition Examination Survey [55], only an estimated 27% of people with hypertension have adequate blood pressure control; the majority either are unaware that they have the disease (32%), are aware but not receiving treatment (15%), or are receiving treatment that is not adequately controlling their hypertension (26%) [17].

Although lack of access to health care and minority racial/ethnic status have been commonly regarded as reasons for poor recognition and treatment of hypertension, there is increasing evidence that individuals who have good access to health care and see their physicians regularly also have uncontrolled hypertension [10,18,19]. For example, in a study of hypertensive patients seen regularly at a Veterans Affairs clinic, where care and medications were provided free of charge, only 25% of patients had blood pressure levels below 140/90 mm Hg (considered “well controlled”) and only 40% had levels below 160/90 mm Hg after 3 years of follow-up [18]. Similarly, in a recent study of the role of access to and use of health care in the control of hypertension, analysis of 16,095 adults with known blood pressure values revealed that only 23% of those with hypertension were receiving treatment that afforded good control, and the great majority of those with untreated or uncontrolled hypertension had health insurance [10]. NCQA reports that only 51.5% of people belonging to a reporting health plan had their hypertension adequately controlled in 2000 [32].

Asthma management. Asthma affects an estimated

17 million people in the United States; it is the sixth most common chronic condition overall and the most common childhood disease [32]. It also is the most frequent reason children are treated in emergency units and hospitalized in this country. In 1997, asthma accounted for approximately 1.2 million ED visits and 445,000 hospital days [56]. The total cost of treating asthma in 2000 has been estimated at \$14.5 billion, with \$1 billion in hospital costs and \$300 million in ED costs [32]. Indirect (lost productivity) costs in 1998 have been estimated at \$3.8 billion [32]. Adults miss an estimated 2.1 million workdays per year; lost work is estimated to cost \$800 million per year for adults with asthma and \$900 million per year for parents who must stay home to care for asthmatic children [32].

The clinical and economic burdens of asthma could be reduced if patients consistently received care in accordance with the National Heart, Lung, and Blood Institute (NHLBI) guidelines [57]. A critical component of these guidelines is the recommendation for patients with moderate, persistent asthma to be treated with daily inhaled corticosteroids. Inhaled corticosteroids have been shown to be the most effective medications available for long-term control of the airway inflammation characteristic of asthma [58,59]. Yet, studies show that physicians underprescribe these medications [21,23], and patients underuse them [24]. In a study of children requiring emergency treatment for asthma, only 16% were using inhaled corticosteroids daily [22]. Furthermore, 36% of the ED visits were made by a subset of patients who were seen repeatedly for wheezing but who lacked adequate management. The authors concluded that these at-risk patients were identifiable, suggesting that such ED visits for asthma may be preventable with appropriate use of medications and continuity of care.

One HEDIS measure assesses the rate of asthma patients receiving prescriptions for medications recommended in the NHLBI guidelines. In 2000, the reported rates of prescriptions for recommended asthma medications were only 61.4% for patients aged 5 to 9 years, 59.5% for patients aged 10 to 17 years, and 64.4% for patients aged 18 to 56 years [32].

Prevention of diabetes complications. Diabetes is a serious and costly disease that affects 16 million people in the United States [60]. In 1997, the total cost of diabetes was \$98.2 billion, including \$44.1 billion in direct costs and \$54.1 billion in indirect costs such as disability, lost wages, and premature death [60,61]. Approximately 90% of Americans with diabetes have type 2 disease, which is frequently associated with dyslipidemia and hypertension. Much of the cost of dia-

betes can be attributed to the long-term complications of blindness, heart disease, and kidney disease [62]. For example, of the \$44.1 billion spent in 1997 for diabetes-specific health care, \$11.8 billion was spent on managing the chronic complications of the disease versus \$7.7 billion spent on diabetes and acute glycemic care [60,61].

Tight glycemic control has been strongly associated with reduced risk for diabetic complications [63–65]; each incremental reduction in the glycosylated hemoglobin (HbA_{1c}) level down to 6% is associated with a significant decrease in complication risk [64,65]. Similarly, the use of statins to control hyperlipidemia has been shown to reduce the risk of cardiovascular complications in patients with diabetes and CHD [40,66].

In 1998, the American Diabetes Association (ADA) reported that the average HbA_{1c} level among treated diabetic patients in the United States was 9.5%, well above the ADA target level of 7% [20]. Similar HbA_{1c} levels were reported to NCQA in 2000; although 78.4% of diabetic patients belonging to reporting health plans had their HbA_{1c} levels measured in 2000, 42.5% of patients had levels indicating poor glycemic control (ie, HbA_{1c} levels greater than 9.5%) [32]. Similarly, although 76.5% of the health plan patients with diabetes had a serum cholesterol level measured in 2000, only 44.3% had this level controlled to less than 130 mg/dL [32].

Diagnosis and treatment of depression. Major depressive disorder has been described as the most common clinical diagnosis made in primary care, mental health, and community practice settings. Its prevalence is increasing [67]. The direct and indirect costs of depression were estimated to be \$44 billion in 1990 [68]. Unfortunately, there is significant evidence that individuals with depression are both underrecognized and undertreated [69–71]. Several patient factors may contribute to this problem, including lack of insurance or limited access, underreporting or underestimating severity of symptoms to providers, and noncompliance with treatment due to poorly tolerated medication side effects [69,71]. Provider factors may include time limitations, gaps in clinical knowledge, poor training in interpersonal skills, and inadequate prescribing of antidepressants [70].

A large study of outpatient management of patients with depression revealed that only 12% were treated with antidepressants and 59% received no medication at all [72]. These findings aside, selective serotonin reuptake inhibitor (SSRI) antidepressants are, in fact, among the most widely prescribed medications in ambulatory care populations. However, studies show

that of those patients started on an SSRI in a primary care setting, less than half will complete a full course of therapy, and of those who do complete a full course, less than half will do so at a therapeutic dose [73–75]. Without adequate follow-up, education, and supportive interventions, many patients may elect to discontinue the drugs [67]. It has been estimated that as many as 1 in 4 patients who discontinue treatment prematurely will experience a return of their depression within 2 months. Several studies reveal that untreated depression has a significant effect on patient quality of life and functional status [76]. Previous research also indicates that failure to complete an adequate course of therapy may result in an increase in the total cost of overall medical treatment [77].

Underused Preventive Interventions

Breast cancer screening. Breast cancer is the most frequently occurring cancer in the United States and the second leading cause of cancer death among women. Screening mammography is an effective means of diagnosing breast cancer, and periodic mammograms have been shown to save lives by detecting cancer at an early stage. Routine mammography for women aged 50 to 69 years, as recommended by the U.S. Preventive Services Task Force, can reduce breast cancer mortality by 20% to 30% [78]. Yet, screening mammography rates for the U.S. population are low, with various studies showing that only 30% to 60% of women over the age of 50 receive routine mammograms [79]. Breast cancer screening rates in health plans reporting to the NCQA from 1996 to 2000 ranged from 70.4% to 74.5% [32]. NCQA estimates that an increase of 1.1% in the mammography rate would translate into an additional 35,000 mammograms and 130 lives saved [32].

Immunization. Prevention of disease through immunization is a priority for pediatricians and a major goal of comprehensive pediatric health care [80]. Nevertheless, childhood immunization rates reported to NCQA in 2000 were all below the 90% target rate set in the Healthy People 2000 program [81]. Rates were as follows: diphtheria-pertussis-tetanus (80.4%), polio (84.2%), measles-mumps-rubella (88.4%), *Haemophilus influenzae* type B (82.7%), hepatitis B (77.9%), and varicella (70.5%) [32]. In addition, NCQA reports that vaccination rates among adolescents remain low for measles-mumps-rubella (62.3%) and hepatitis B (41.1%) [32].

In those aged 65 years or older, pneumococcal vaccination is associated with decreased rates of hospitalization and bacteremia, increased quality-adjusted days of life, and cost savings [82–84]. Similarly, vaccination against influenza in this age-group leads to decreased

mortality, hospitalization rates, and medical costs [85–87]. Nevertheless, only 45% of patients aged 65 or older receive pneumococcal vaccines and only 66% are vaccinated against influenza [88].

Factors Contributing to Underuse

Like most significant health care defects, the underuse of proven interventions is the result of a complex interplay of fundamental aspects of the U.S. health care system, including the ways in which care is organized and delivered as well as how it is financed and regulated. In addition, physicians and patients play a role. **Table 3** identifies factors at all levels of the health care system that currently impede the delivery of proven treatments to eligible patients.

Factors Related to Health Policy and Financing

The manner in which health care services are reimbursed can affect whether or not patients will have ready access to effective interventions. The most obvious financial barrier to receiving appropriate care is lack of insurance. In 1999, approximately 42 million Americans lacked health insurance (15% of the total population and 17% of those older than age 65) [89]. A new study released by the IOM indicates that the number of people without coverage is expected to grow over time as health care costs rise and the economy falters [90].

Vulnerable populations (eg, the poor, uninsured individuals, patients with Medicaid coverage) more often fail to receive appropriate care than the general population. In particular, they receive fewer preventive services and treatments for chronic illnesses [91], resulting in demonstrably higher risks of death and disability and worsening of chronic diseases [92–94]. Studies reveal that vulnerable populations have a lower likelihood of seeing a doctor, are more likely to delay seeking care, and receive much of their health care in emergency or urgent care settings [91,95–97], where management of chronic illness is not even considered as a goal.

It is well documented that Medicaid patients also receive fewer discretionary services. Explanations for these discrepancies include possible greater incidence of coexisting illness in Medicaid patients, real or anticipated financial and cultural barriers to adequate postprocedural medical care, and constrained reimbursement or other financial disincentives placed on providers (hospitals and physicians) [98]. For instance, patients with Medicaid insurance treated for acute MI are less likely to undergo invasive cardiac procedures than patients with other forms of insurance, suggesting a different and perhaps inferior process of care [99]. Ethnic minority

Table 3. Factors Contributing to Underuse of Proven Interventions

Factors related to health care policy and financing

- Uninsured populations
- Inadequate health care financing (eg, limited benefits for preventive care)
- Misaligned financial incentives (eg, financial disincentives to provide discretionary services; no reimbursement for preventive care)
- Managed care effects (eg, cost containment strategies)

System-based factors

- Financial constraints
- Inadequate information systems
- Lack of real-time medical information
- Culture of fragmented care (ie, multiple providers, distributed sites)
- Lack of funding and infrastructure for disease management of chronic conditions
- Limited development and dissemination of expert systems to support evidence-based best practices

Provider-based factors

- Information overload
- Problems translating scientific evidence into clinical practice
- Information deficits (ie, inadequate ability to track patient needs)
- Lack of seamless communication with other providers across care continuum
- Deficits in knowledge, skills, or experience
- Provider bias or preferences

Patient-based factors

- Problems accessing health care services (eg, no insurance, providers or services not covered, no established relationship with a primary provider, referral services not provided, logistical barriers, financial barriers such as inability to cover copayments for medications)
- Socioeconomic position/education
- Patient beliefs, values, preferences, attitudes (eg, avoidance of invasive procedures, preference not to make lifestyle changes)
- Lack of skills or knowledge needed to participate in one's own care (eg, inability to communicate needs or share vital information, lack of important medical information to support adherence)

patients with health insurance through Medicaid, Medicare, or a health maintenance organization seem to be at particular risk for underuse [100]. Possible explanations for this disparity include cost sensitivity, variation in

provider practice styles, patient preference and factors that shape it (eg, lack of trust in health care providers), patient fear of long-term disability with resulting income loss, or overt discrimination [100].

For some types of health care financing, the link to underuse is less clear. For example, several studies show about the same level of underuse in capitated versus fee-for-service plans for a variety of therapeutic services [101–103]. Financial barriers such as copayments, deductibles, and benefits programs that do not include all services (eg, preventive care) can result in underuse. For instance, copayments have been shown to lead to underuse of preventive care services and to poorer control of blood pressure in hypertensive patients [104,105]. Although managed care plans may provide more preventive services than fee-for-service plans, the level of underuse in both arrangements remains high [106,107].

Factors Related to Health Care Organizations

Inadequate information systems. A major contributor to underuse is the lack of sophisticated information systems to provide timely communication of critical medical information to providers and between patients and providers. In most hospitals, medical groups, and provider practices, clinical information is not accessible when it is needed to ensure that patients receive appropriate services. In outpatient settings, information systems are not equipped to identify patients due for routine health maintenance care, to track patients who miss a scheduled appointment or diagnostic test, or to provide ongoing information, reminders, and support to patients with particularly complex courses of treatment [108]. Similarly, on inpatient units, information systems are not able to provide surveillance and immediate feedback when an underuse problem arises. Unfortunately, critical patient data are not readily available in most health care systems because of the high cost of gathering, analyzing, and disseminating this information [109]. In an era of ever-shrinking reimbursement for patient care, financing expert information systems to provide clinical decision support has not been an option for most provider organizations [108].

Fragmented, uncoordinated care. Few delivery systems have the necessary infrastructure to coordinate treatments across the continuum of acute, chronic, home, and rehabilitative care to ensure provision of the full range of services needed by individuals with common diseases [110]. Physicians, hospitals, EDs, and other health care providers operate in isolation, so that care too often is given with incomplete knowledge about a patient's history, condition, services provided in other settings, or medications prescribed by other clinicians [1].

Disease management programs, which assign a care manager to create and implement an individualized and integrated care plan for patients with complex conditions or multiple comorbidities, are in short supply in most health care delivery systems and are seldom eligible for third party reimbursement [111].

Provider Factors

Deficits in knowledge, skills, or experience. Poor understanding of disease processes appears to be one source of problems contributing to underuse. For example, inadequate understanding by family practitioners of the pathophysiology of CHF has been linked to lower rates of measuring left-ventricular ejection fraction for the diagnosis of this disorder and underuse of ACE inhibitors for its treatment [112]. In the same study, family practitioners' lack of familiarity with managing the side effects of anticoagulants in patients with CHF complicated by atrial fibrillation led to underuse of these agents because providers overestimated the risk of bleeding side effects. Similarly, undertreatment of depression by primary care physicians has been linked to gaps in clinical knowledge, poor training in interpersonal skills, and prescribing antidepressants at too low a dose or for too short a period of time [69]. Primary care providers also may fail to recognize that certain patients may require augmentation of their initial antidepressant medication, a change of medication, or psychiatric consultation to overcome partial or non-response to treatment.

Practice patterns. Practice styles of individual providers also may play a role in underuse. For example, patterns of practice are recognized as a contributor to poor control of hypertension. Based on a national survey of primary care physicians, it appears that one third of providers do not recommend treatment for patients with diastolic blood pressures of 90 to 100 mm Hg, and an even larger proportion of providers do not treat or intensify treatment for patients with systolic blood pressures of 140 to 160 mm Hg [113]. These results are supported by other studies confirming that physicians are unlikely to regard persistently elevated systolic pressures in patients with diastolic pressures less than 90 mm Hg as hypertension or to treat this condition aggressively [18,114].

Information overload and problems translating evidence into practice. Physicians are constantly challenged to identify and appropriately apply scientifically proven clinical strategies to improve outcomes. This task has become increasingly complex, as the amount of clinical research being conducted has increased dramatically. Since the publication of the first randomized trial in 1952, nearly 100,000 journal articles have been pub-

lished describing randomized controlled trials [10,108]. The number of evidence-based guidelines published also has soared in the past few decades to at least 2000 [115]. Physicians are expected to stay apprised of an overwhelming volume of information, including medical journal articles, government-published guidelines and reports, clinical alerts from pharmaceutical companies, scientific conference presentations, and even reports of unpublished findings from the popular press [116]. Although newly available information may suggest that an urgent action is necessary, whether a physician learns of it is left to such chance factors as the extent of media coverage given to the new findings, which journals the physician reads, and word of mouth [116].

Not surprisingly, physicians often cannot stay current with the expanding base of available evidence. Furthermore, they often lack the skills, tools, and time needed to effectively search the literature for appropriate, high-quality studies that apply to a given patient and to use that research to answer a specific clinical question relevant to the case at hand [117–119]. Underuse of treatments potentially beneficial to patients is an understandable result.

It has been suggested that underuse also may occur when health care providers fail to embrace clinical trials or guidelines, particularly if data conflict with a practitioner's preconceived notions [120]. The disparity between physicians' self-reported compliance with guideline recommendations and actual practice based on directly observed behavior or chart review suggests that physicians frequently overestimate adherence to such patterns of practice [121,122]. Thus, even when physicians believe they are complying with guidelines, often they are not.

Patient Factors

Several patient factors can contribute to underuse, including demographic factors (eg, low socioeconomic position, minority race/ethnic group) and financial barriers (eg, lack of insurance, cost of medications, inability to cover copayments or deductibles). In addition, a patient's knowledge, attitudes, beliefs, values, preferences, and skills (eg, ability to communicate with a physician and understand treatment recommendations, capacity to self-manage) can affect the rate of underuse. Gender, race/ethnicity, and education may influence patient preferences and result in underuse of recommended treatments. This has been observed in certain groups of patients who decline invasive cardiac procedures [123–126].

Another well-studied patient factor contributing to underuse is nonadherence [127–132]. Perhaps the

most common reason why patients may not take recommended medications is to avoid unpleasant side effects. For example, patients being treated with SSRIs may fail to successfully complete an appropriate course of treatment because of poorly tolerated side effects such as nausea, headaches, or sexual dysfunction. However, patients also may stop taking prescribed antidepressants because of inadequate education and support to remain on the medications until side effects abate. They also may fail to understand the need for continued treatment beyond the point of symptom alleviation.

Finally, whether or not a patient has an established relationship with a primary provider also can be an important factor. Studies have shown a strong correlation between having a consistent and ongoing relationship with a care provider and the use of preventive services for both adults and children. Patients without a primary care physician to provide counseling, understanding, and treatment follow-up may experience higher rates of underuse [133,134].

The Challenge Ahead

Addressing the underuse problem will not be easy given the complex and interdependent factors that prevent patients from receiving necessary, evidence-based care and services. These barriers are as great as health care affordability, poor distribution of basic services, and inequitable access; as straightforward as inadequate transportation and child care services; and as culturally complicated as patient literacy, beliefs, and personal preferences.

The IOM has outlined several ambitious goals for addressing underuse and other major defects in health care quality in the 21st century. Key strategies are to focus on priority conditions of chronic illness; to revise health care reimbursement to align economic incentives with quality improvement by rewarding better care and outcomes financially; and to invest in the creation of an information infrastructure to support the processes of health care delivery, quality measurement and improvement, health services research, and clinical education [1]. The IOM envisions an ideal health care delivery system that provides universal insurance; care based upon continuous healing relationships; reimbursement for proactive, customized care management programs; and seamless, real-time availability and transportability of critical patient health information. Such a system would likely have an enormous effect on reducing underuse of proven treatments. While these global strategic agendas are laudable, they will require massive long-term capital investments and efforts that depend both on the eco-

nomie vigor of the country and the political will of leaders yet to be elected.

What Can Be Done Now

Considering the enormous effect of underuse and the complexity of factors contributing to its perpetuation, it would be easy to feel that solving this problem is the health care equivalent to trying to eradicate world hunger. Yet, evidence indicates that lean approaches to providing the right information at the right time and place to clinicians and patients can significantly improve the rates at which the health care system delivers proven preventive, health maintenance, and therapeutic interventions [135–138]. Aggressive application of simple and effective information interventions has the potential to save lives and improve the quality of care for thousands of patients annually [11,116,138,139]. This approach has been described as the use of “information therapy” to improve the quality of patient care [140].

Balas and colleagues [136], in their valuable meta-analysis of the impact of prompting physicians to “do the right thing,” cite an investigation [141] that reveals the simple but profound truth that the most frequent explanation offered by women for not undergoing screening for breast and cervical cancer is the failure of their physicians to offer or recommend it. The results of this meta-analysis indicate that physician prompting can significantly increase the performance of preventive care procedures, including cancer screening (fecal occult blood test, mammography, Papanicolaou smear), immunization (influenza, pneumococcal, tetanus), chronic disease management (blood glucose, hemoglobin, blood pressure, cholesterol), cardiac care, smoking cessation, glaucoma screening, alcohol abuse counseling, prenatal care, and tuberculosis testing. It is worth noting that the conditions in which improvement was documented are essentially the same as those in the IOM’s list of priority conditions.

Of the various prompting tools studied, those that were equally effective and readily applicable to most health care organizations included checklists attached to the patient chart, tagged notes, computer-generated encounter forms, prompting stickers, and patient-carried prompting cards [136]. Thus, there appear to be countless opportunities to improve preventive and health maintenance care through the use of inexpensive technologies. Prompts, alerts, and reminders can be implemented to provide essential suggestions and clinical decision support to clinicians and patients at the time of intervention.

Reports of relatively low-cost technologies designed to combat underuse are increasingly common. A recent

study revealed that over half of patients eligible for preventive measures failed to receive them [142]. In this study, the use of a computerized reminder system to increase preventive care for hospitalized patients significantly increased the rates of pneumococcal and influenza vaccination (from practically zero to approximately 35% and 50%, respectively), use of preventive subcutaneous heparin, and use of prophylactic aspirin for patients with evidence-based indications. As to the significant cost of implementing a computerized physician order entry system, the authors note that such a system is not mandatory, as most of the reminders generated were “triggered by information that is routinely available in basic hospital information systems” (eg, patient age, admitting diagnosis, and service) that would allow identification of patients eligible for vaccination, aspirin, or subcutaneous heparin.

In a yet to be published study, a hospital—building on a proprietary computerized medication dose-checking system—has linked reports of positive troponin levels (troponin I > 1.5 ng/mL) from the laboratory data system to the pharmacy database to alert clinical pharmacists when patients hospitalized for acute MI are not receiving best practice-based care in the form of aspirin, ACE inhibitors, β -blockers, and statins. Implementation of this system has resulted in significant improvement in rates of lipid screening and discharge of patients on evidence-based treatments (T. Bailey, MD, unpublished data, November 2001). Only a limited number of prompting studies provide information concerning the additional costs of implementing alerting strategies such as the one in this study. However, some reported costs include \$0.78 per patient per year to operate a computerized reminder system [143], \$0.43 per incremental vaccination [144], \$1.70 for each additional blood pressure screening [145], and less than \$5 per additional preventive procedure completed [146].

Provider organizations have reported substantial improvements in diabetic preventive care as measured by rates of annual foot and eye examinations from the deployment of tools as simple as posters in examination rooms that read, “If you are diabetic, please take off your shoes and socks” (A. McDonald, MN, SSM Health System, personal communication). Patients also can be engaged in the effort to reduce underuse through the use of telephone, postcard [145–149], or e-mail reminders and prompts at modest cost.

Balas et al [136] note that several studies in their meta-analysis suggest that combining alerts to both patients and providers “amplifies the effect of the intervention.” While these relatively simple tools of quality improvement and lean process strategies do not carry the

caché of dramatic breakthroughs in medical research, technology, and instrumentation, they may have the ability to make as meaningful a contribution to improved care delivery as some of the most innovative scientific advances [136]. It seems clear that physician and patient alerting, prompting, and reminding are an inexpensive, low-risk, high-gain approach to battling underuse.

Conclusion

Underuse of proven effective health care interventions is perhaps the most paradoxical of all health care defects, because it occurs in an era of both explosive growth in medical knowledge and extravagant use of diagnostic techniques, expensive technologies, and novel therapeutic agents that all too often *do not* significantly improve clinical outcomes. Underuse is well documented, remarkably common, and associated with a broad array of conditions and disorders. But perhaps the most striking fact is that the problem is not limited to the socioeconomically disadvantaged, the elderly, or racial and ethnic minorities. While it is true that socioeconomically disadvantaged patients consistently receive fewer Papanicolaou tests, mammograms, immunizations, diabetic eye examinations, and appropriate medications for treatment of asthma, hypertension, and heart disease, there is no immunity from the problem of insufficient care even for the insured, the advantaged, and the well-informed.

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References

1. Institute of Medicine Committee on Quality of Health Care in America. Crossing the quality chasm: a new health system for the 21st century. Washington (DC): National Academy Press; 2001.
2. Kohn LT, Corrigan JM, Donaldson MS, editors. To err is human: building a safer health system. Washington (DC): National Academy Press; 2000.
3. Wennberg J, Gittelsohn A. Small area variations in health care delivery. *Science* 1973;182:1102–8.
4. Wennberg J, Gittelsohn A. Variations in medical care in small areas. *Sci Am* 1982;246:120–34.
5. McPherson K, Wennberg JE, Hovind OB, Clifford P. Small-area variations in the use of common surgical procedures: an international comparison of New England, England, and Norway. *N Engl J Med* 1982;307:1310–4.
6. Wennberg JE, Freeman JL, Culp WJ. Are hospital services rationed in New Haven or over-utilised in Boston? *Lancet* 1987;1:1185–9.

7. Wennberg DE. Variation in the delivery of health care: the stakes are high. *Ann Intern Med* 1998;128:866–8.
8. Wennberg JE, Cooper MM, editors. *The Dartmouth atlas of health care*. Chicago (IL): American Hospital Association; 1999.
9. Geerts WH, Heit JA, Clagett GP, et al. Prevention of venous thromboembolism. *Chest* 2001;119(1 Suppl): 132S–175S.
10. Hyman DJ, Pavlik VN. Characteristics of patients with uncontrolled hypertension in the United States. *N Engl J Med* 2001;345:479–86.
11. Chassin MR, Galvin RW. The urgent need to improve health care quality. Institute of Medicine National Roundtable on Health Care Quality. *JAMA* 1998;280: 1000–5.
12. Schuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States? *Milbank Q* 1998;76:517–63.
13. Fiscella K, Franks P, Gold MR, Clancy CM. Inequality in quality: addressing socioeconomic, racial, and ethnic disparities in health care. *JAMA* 2000;283:2579–84.
14. Weinick RM, Zuvekas SH, Cohen JW. Racial and ethnic differences in access to and use of health care services, 1977 to 1996. *Med Care Res Rev* 2000;57 Suppl 1: 36–54.
15. U.S. Department of Health and Human Services. *Healthy people 2010: understanding and improving health*. 2nd ed. Washington (DC): U.S. Government Printing Office; Nov 2000. Available at <http://www.health.gov/healthypeople/document>. Accessed 11 Oct 2001.
16. Asch SM, Sloss EM, Hogan C, et al. Measuring underuse of necessary care among elderly Medicare beneficiaries using inpatient and outpatient claims. *JAMA* 2000; 284:2325–33.
17. The sixth report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. *Arch Intern Med* 1997;157:2413–46.
18. Berlowitz DR, Ash AS, Hickey EC, et al. Inadequate management of blood pressure in a hypertensive population. *N Engl J Med* 1998;339:1957–63.
19. Alexander M, Tekawa I, Hunkeler E, et al. Evaluating hypertension control in a managed care setting. *Arch Intern Med* 1999;159:2673–7.
20. American Diabetes Association. *Clinical practice recommendations*. *Diabetes Care* 1998;21 Suppl 1:1–70.
21. Lang DM, Sherman MS, Polansky M. Guidelines and realities of asthma management. The Philadelphia story. *Arch Intern Med* 1997;157:1193–200.
22. Friday GA Jr, Khine H, Lin MS, Caliguiri LA. Profile of children requiring emergency treatment for asthma. *Ann Allergy Asthma Immunol* 1997;78:221–4.
23. Grant EN, Moy JN, Turner-Roan K, et al. Asthma care practices, perceptions, and beliefs of Chicago-area primary-care physicians. Chicago Asthma Surveillance Initiative Project Team. *Chest* 1999;116(4 Suppl 1): 145S–154S.
24. Spector S. Noncompliance with asthma therapy—are there solutions? *J Asthma* 2000;37:381–8.
25. Gurwitz JH, Goldberg RJ, Chen Z, et al. Beta-blocker therapy in acute myocardial infarction: evidence for underutilization in the elderly. *Am J Med* 1992;93: 605–10.
26. Viskin S, Kitzis I, Lev E, et al. Treatment with beta-adrenergic blocking agents after myocardial infarction: from randomized trials to clinical practice. *J Am Coll Cardiol* 1995;25:1327–32.
27. Kennedy HL, Rosenson RS. Physician use of beta-adrenergic blocking therapy: a changing perspective. *J Am Coll Cardiol* 1995;26:547–52.
28. Brand DA, Newcomer LN, Freiburger A, Tian H. Cardiologists' practices compared with practice guidelines: use of beta-blockade after acute myocardial infarction. *J Am Coll Cardiol* 1995;26:1432–6.
29. Soumerai SB, McLaughlin TJ, Spiegelman D, et al. Adverse outcomes of underuse of beta-blockers in elderly survivors of acute myocardial infarction. *JAMA* 1997; 277:115–21.
30. O'Connor GT, Quinton HB, Traven ND, et al. Geographic variation in the treatment of acute myocardial infarction: the Cooperative Cardiovascular Project. *JAMA* 1999;281:627–33.
31. National Committee for Quality Assurance (NCQA). Available at <http://www.ncqa.org>. Accessed 16 Oct 2001.
32. State of managed care quality report: 2001. Washington (DC): National Committee for Quality Assurance; 2001. Available at <http://www.ncqa.org>. Accessed 4 Oct 2001.
33. Hoffman C, Rice D, Sung HY. Persons with chronic conditions. Their prevalence and costs. *JAMA* 1996;276: 1473–9.
34. The Robert Wood Johnson Foundation. *Chronic care in America: a 21st century challenge*. Princeton (NJ): The Foundation; 1996.
35. American Heart Association. *2001 Heart and stroke statistical update*. Dallas (TX): The Association; 2000. Available at <http://www.americanheart.org/statistics/>. Accessed 9 Oct 2001.
36. Ryan TJ, Antman EM, Brooks NH, et al. 1999 update: ACC/AHA guidelines for the management of patients with acute myocardial infarction. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). *J Am Coll Cardiol* 1999;34:890–911.
37. Yusuf S, Peto R, Lewis J, et al. Beta blockade during and after myocardial infarction: an overview of the randomized trials. *Prog Cardiovasc Dis* 1985;27: 335–71.
38. Gottlieb SS, McCarter RJ, Vogel RA. Effect of beta-blockade on mortality among high-risk and low-risk patients after myocardial infarction. *N Engl J Med* 1998;339:489–97.

39. Krumholz HM, Radford MJ, Wang Y, et al. National use and effectiveness of beta-blockers for the treatment of elderly patients after acute myocardial infarction: National Cooperative Cardiovascular Project. *JAMA* 1998;280:623-9.
40. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). *Lancet* 1994;344:1383-9.
41. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. The Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group. *N Engl J Med* 1998;339:1349-57.
42. Lewis SJ, Moye LA, Sacks FM, et al. Effect of pravastatin on cardiovascular events in older patients with myocardial infarction and cholesterol levels in the average range. Results of the Cholesterol and Recurrent Events (CARE) trial. *Ann Intern Med* 1998;129:681-9.
43. Gheorghade M, Bonow RO. Chronic heart failure in the United States: a manifestation of coronary artery disease. *Circulation* 1998;97:282-9.
44. Agency for Health Care Policy and Research. Heart failure: management of patients with left ventricular systolic dysfunction. Rockville (MD): The Agency; 1994. Publication No. 94-0613.
45. Guidelines for the evaluation and management of heart failure. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Evaluation and Management of Heart Failure). *J Am Coll Cardiol* 1995;26:1376-98.
46. Consensus recommendations for the management of chronic heart failure. On behalf of the membership of the advisory council to improve outcomes nationwide in heart failure. *Am J Cardiol* 1999;83:1A-38A.
47. Effects of enalapril on mortality in severe congestive heart failure. Results of the Cooperative North Scandinavian Enalapril Survival Study (CONSENSUS). The CONSENSUS Trial Study Group. *N Engl J Med* 1987;316:1429-35.
48. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. The SOLVD Investigators. *N Engl J Med* 1991;325:293-302.
49. Konstam MA, Rousseau MF, Kronenberg MW, et al. Effects of the angiotensin-converting enzyme inhibitor enalapril on the long-term progression of left ventricular dysfunction in patients with heart failure. SOLVD Investigators. *Circulation* 1992;86:431-8.
50. Garg R, Yusuf S. Overview of randomized trials of angiotensin-converting inhibitors on mortality and morbidity in patients with heart failure. Collaborative Group on ACE Inhibitor Trials. [published erratum appears in *JAMA* 1995;274:462]. *JAMA* 1995;273:1450-6.
51. Stafford RS, Saglam D, Blumenthal D. National patterns of angiotensin-converting enzyme inhibitor use in congestive heart failure. *Arch Intern Med* 1997;157:2460-4.
52. Philbin EF. Factors determining angiotensin-converting enzyme inhibitor underutilization in heart failure in a community setting. *Clin Cardiol* 1998;21:103-8.
53. Sueta CA, Chowdhury M, Boccuzzi SJ et al. Analysis of the degree of undertreatment of hyperlipidemia and congestive heart failure secondary to coronary artery disease. *Am J Cardiol* 1999;83:1303-7.
54. Schappert SM, Nelson C. National Ambulatory Medical Care Survey: 1995-96 summary. *Vital Health Stat* 1999;142:i-vi.
55. Plan and operation of the third National Health and Nutrition Examination Survey, 1988-94. Series 1: programs and collection procedures. *Vital Health Stat* 1994;32:1-407.
56. Smith DH, Malone DC, Lawson KA, et al. A national estimate of the economic costs of asthma. *Am J Respir Crit Care Med* 1997;156(3 Pt 1):787-93.
57. National Heart, Lung, and Blood Institute, National Asthma Education and Prevention Program. Expert Panel Report 2: guidelines for the diagnosis and management of asthma. Bethesda (MD): U.S. Department of Health and Human Services, National Institutes of Health; 1997. NIH Publication No. 97-4051.
58. van Essen-Zandvliet EE, Hughes MD, Waalkens HJ, et al. Effects of 22 months of treatment with inhaled corticosteroids and/or beta-2-agonists on lung function, airway responsiveness, and symptoms in children with asthma. The Dutch Chronic Non-specific Lung Disease Study Group. *Am Rev Respir Dis* 1992;146:547-54.
59. Haahtela T, Jarvinen M, Kava T, et al. Effects of reducing or discontinuing inhaled budesonide in patients with mild asthma. *N Engl J Med* 1994;331:700-5.
60. National diabetes fact sheet: national estimates and general information on diabetes in the United States. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 1997.
61. Economic consequences of diabetes mellitus in the U.S. in 1997. American Diabetes Association. *Diabetes Care* 1998;21:296-309.
62. American Diabetes Association clinical practice recommendations 2001. *Diabetes Care* 2001;24 Suppl 1: S1-133.
63. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. The Diabetes Control and Complications Trial Research Group. *N Engl J Med* 1993;329:977-86.
64. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet* 1998;352:837-53.

65. Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). UK Prospective Diabetes Study (UKPDS) Group [published erratum appears in *Lancet* 1998;352:1557]. *Lancet* 1998;352:854-65.
66. Sacks FM, Pfeffer MA, Moye LA, et al. The effect of pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels. Cholesterol and Recurrent Events Trial investigators. *N Engl J Med* 1996;335:1001-9.
67. Venturini F, Sung JCY, Nichol MB, Sellner JC. Utilization patterns of antidepressant medications in a patient population served by a primary care medical group. *J Managed Care Pharm* 1999;5:243-9.
68. Treatment of depression—newer pharmacotherapies. Evidence report/technology assessment: number 7. Rockville (MD): Agency for Health Care Policy and Research; March 1999. AHCPR Publication No. 99-E013. Available at <http://www.ahrq.gov/clinic/deprsumm.htm>. Accessed 11 Oct 2001.
69. Hirschfeld RM, Keller MB, Panico S, et al. The National Depressive and Manic-Depressive Association consensus statement on the undertreatment of depression. *JAMA* 1997;277:333-40.
70. Davidson JR, Meltzer-Brody SE. The underrecognition and undertreatment of depression: what is the breadth and depth of the problem? *J Clin Psychiatry* 1999; 60 Suppl 7:4-9.
71. Druss BG, Hoff RA, Rosenheck RA. Underuse of antidepressants in major depression: prevalence and correlates in a national sample of young adults. *J Clin Psychiatry* 2000;61:234-7.
72. Wells KB, Katon W, Camp P. Use of minor tranquilizers and antidepressant medications by depressed outpatients: results from the medical outcomes study. *Am J Psychiatry* 1994;151:694-700.
73. McCombs JS, Nichol MB, Stimmel GL, et al. The cost of antidepressant drug therapy failure: a study of antidepressant use patterns in a Medicaid population. *J Clin Psychiatry* 1990;51 Suppl:60-9.
74. Katon W, von Korff M, Lin E, et al. Adequacy and duration of antidepressant treatment in primary care. *Med Care* 1992;30:67-76.
75. Simon GE, Lin EH, Katon W, et al. Outcomes of "inadequate" antidepressant treatment. *J Gen Intern Med* 1995;10:663-70.
76. Hays RD, Wells KB, Sherbourne CD, et al. Functioning and well-being outcomes of patients with depression compared with chronic general medical illnesses. *Arch Gen Psychiatry* 1995;52:11-9.
77. Thompson D. Patterns of antidepressant use and their relation to cost of care. *J Managed Care Pharm* 1997; 3:453-65.
78. U.S. Preventive Services Task Force. Guide to clinical preventive services. 2nd ed. Washington (DC): U.S. Department of Health and Human Services; 1996: 73-87.
79. Breast cancer national project overview. Available at <http://www.hcfa.gov/quality/3v.htm>. Accessed 1 Aug 2001.
80. Implementation of the immunization policy (S94-26). American Academy of Pediatrics Committee on Practice and Ambulatory Medicine. *Pediatrics* 1995; 96(2 Pt 1):360-1.
81. U.S. Department of Health and Human Services. Healthy people 2000: national health promotion and disease prevention objectives. Washington (DC): U.S. Government Printing Office; 1991.
82. Prevention of pneumococcal disease: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* 1997;46(RR-8):1-24.
83. Fedson DS. The clinical effectiveness of pneumococcal vaccination: a brief review. *Vaccine* 1999;17 Suppl 1: S85-90.
84. Sisk JE, Moskowitz AJ, Whang W, et al. Cost-effectiveness of vaccination against pneumococcal bacteremia among elderly people [published erratum appears in *JAMA* 2000;283:341]. *JAMA* 1997;278:1333-9.
85. McDonald CJ, Hui SL, Tierney WM. Effects of computer reminders for influenza vaccination on morbidity during influenza epidemics. *MD Comput* 1992;9: 304-12.
86. Gross PA, Hermogenes AW, Sacks HS, et al. The efficacy of influenza vaccine in elderly persons. A meta-analysis and review of the literature. *Ann Intern Med* 1995;123:518-27.
87. Nichol KL, Baken L, Nelson A. Relation between influenza vaccination and outpatient visits, hospitalization, and mortality in elderly persons with chronic lung disease. *Ann Intern Med* 1999;130:397-403.
88. Influenza and pneumococcal vaccination levels among adults aged > or = 65 years—United States, 1997. *MMWR Morb Mortal Wkly Rep* 1998;47:797-802.
89. Mills RJ. Health insurance coverage: 1999. Current population reports. Washington (DC): U.S. Census Bureau; 2000:60-2111.
90. Institute of Medicine. Coverage matters: insurance and health care. Washington (DC): National Academy Press; 2001.
91. Hafner-Eaton C. Physician utilization disparities between the uninsured and insured. Comparisons of the chronically ill, acutely ill, and well nonelderly populations. *JAMA* 1993;269:787-92.
92. Lurie N, Ward NB, Shapiro ME, et al. Termination of Medi-Cal benefits. A follow-up study one year later. *N Engl J Med* 1986;314:1266-8.
93. Franks P, Clancy CM, Gold MR. Health insurance and mortality. Evidence from a national cohort. *JAMA* 1993; 270:737-41.
94. Franks P, Clancy CM, Gold MR, Nutting PA. Health insurance and subjective health status: data from the 1987 National Medical Expenditure survey. *Am J Public Health* 1993;83:1295-9.

95. Woolhandler S, Himmelstein DU. Reverse targeting of preventive care due to lack of health insurance. *JAMA* 1988;259:2872-4.
96. Kahn KL, Pearson ML, Harrison ER, et al. Health care for black and poor hospitalized Medicare patients. *JAMA* 1994;271:1169-74.
97. Physician Payment Review Commission. Access for Medicare beneficiaries. In: Annual report to Congress, 1994. Washington (DC): The Commission; 1994.
98. Philbin EF, McCollough PA, DiSalvo TG, et al. Underuse of invasive procedures among Medicaid patients with acute myocardial infarction. *Am J Public Health* 2001;91:1082-8.
99. Sada MJ, French WJ, Carlisle DM, et al. Influence of payor on use of invasive cardiac procedures and patient outcome after myocardial infarction in the United States. Participants in the National Registry of Myocardial Infarction. *J Am Coll Cardiol* 1998;31:1474-80.
100. Carlisle DM, Leake BD, Shapiro MF. Racial and ethnic disparities in the use of cardiovascular procedures: associations with type of health insurance. *Am J Public Health* 1997;87:263-7.
101. Wells KB, Hays RD, Burnam MA, et al. Detection of depressive disorder for patients receiving prepaid or fee-for-service care. Results from the Medical Outcomes Study. *JAMA* 1989;262:3298-302.
102. Udvarhelyi IS, Jennison K, Phillips RS, Epstein AM. Comparison of the quality of ambulatory care for fee-for-service and prepaid patients. *Ann Intern Med* 1991;115:394-400.
103. Retchin SM, Preston J. Effects of cost containment on the care of elderly diabetics. *Arch Intern Med* 1991;151:2244-8.
104. Keeler EB, Brook RH, Goldberg GA, et al. How free care reduced hypertension in the health insurance experiment. *JAMA* 1985;254:1926-31.
105. Lurie N, Manning WG, Peterson C, et al. Preventive care: do we practice what we preach? *Am J Public Health* 1987;77:801-4.
106. Dudley RA, Miller RH, Korenbrot TY, Luft HS. The impact of financial incentives on quality of health care. *Milbank Q* 1998;76:649-86.
107. Dudley RA, Luft HS. Managed care in transition. *N Engl J Med* 2001;344:1087-92.
108. Chassin MR. Is health care ready for Six Sigma quality? *Milbank Q* 1998;76:565-91.
109. A road map for information systems: evolving systems to support performance measurement. Washington (DC): National Committee for Quality Assurance; 1997.
110. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q* 1996;74:511-44.
111. Harris JM Jr. Disease management: new wine in new bottles? *Ann Intern Med* 1996;340:1202-5.
112. Baker DW, Hayes RP, Massie BM, Craig CA. Variations in family physicians' and cardiologists' care for patients with heart failure. *Am Heart J* 1999;138(5 Pt 1):826-34.
113. Hyman DJ, Pavlik VN. Self-reported hypertension treatment practices among primary care physicians: blood pressure thresholds, drug choices, and the role of guidelines and evidence-based medicine. *Arch Intern Med* 2000;160:2281-6.
114. Hyman D, Pavlik V, Vallbona C. Physician role in lack of awareness and control of hypertension. *J Clin Hypertens* 2000;2:324-30.
115. American Medical Association. Clinical practice guidelines directory. Chicago (IL): The Association; 1999.
116. Gawande AA, Bates DW. The use of information technology in improving medical performance. Part II. Physician-support tools. *Medscape Gen Med* 2000 Feb 14;Sect. E13.
117. Sheldon TA, Guyatt GH, Haines A. Getting research findings into practice. When to act on the evidence. *BMJ* 1998;317:139-42.
118. Sackett DL, Straus SE. Finding and applying evidence during clinical rounds: the "evidence cart." *JAMA* 1998;280:1336-8.
119. Sackett DL, Straus SE, Richardson WS, et al. Evidence-based medicine. How to practice and teach EBM. 2nd edition. London (GB): Churchill Livingstone; 2000.
120. Lange RA, Hillis LD. Use and overuse of angiography and revascularization for acute coronary syndromes. *N Engl J Med* 1998;338:1838-9.
121. McPhee SJ, Richard RJ, Solkowitz SN. Performance of cancer screening in a university general internal medicine practice: comparison with the 1980 American Cancer Society Guidelines. *J Gen Intern Med* 1986;1:275-81.
122. Henry K, Campbell S, Maki M. A comparison of observed and self-reported compliance with universal precautions among emergency department personnel at a Minnesota public teaching hospital: implications for assessing infection control programs. *Ann Emerg Med* 1992;21:940-6.
123. Maynard C, Fisher LD, Passamani ER, Pullum T. Blacks in the coronary artery surgery study (CASS): race and clinical decision making. *Am J Public Health* 1986;76:1446-8.
124. Schecter AD, Goldschmidt-Clermont PJ, McKee G, et al. Influence of gender, race, and education on patient preferences and receipt of cardiac catheterizations among coronary care unit patients. *Am J Cardiol* 1996;78:996-1001.
125. Laouri M, Kravitz RL, French WJ, et al. Underuse of coronary revascularization procedures: application of a clinical method. *J Am Coll Cardiol* 1997;29:891-7.
126. Leape LL, Hilborne LH, Bell R, et al. Underuse of cardiac procedures: do women, ethnic minorities, and the uninsured fail to receive needed revascularization? *Ann Intern Med* 1999;130:183-92.
127. Feenstra J, Grobbee DE, Jonkman FA, et al. Prevention of relapse in patients with congestive heart failure: the role of precipitating factors. *Heart* 1998;80:432-6.

128. Lerner BH, Gulick RM, Dubler NN. Rethinking non-adherence: historical perspectives on triple-drug therapy for HIV disease. *Ann Intern Med* 1998;129:573-8.
129. LaRosa JH, LaRosa JC. Enhancing drug compliance in lipid-lowering treatment. *Arch Fam Med* 2000;9:1169-75.
130. Freis ED. Improving treatment effectiveness in hypertension. *Arch Intern Med* 1999;159:2517-21.
131. Lutfey KE, Wishner WJ. Beyond "compliance" is "adherence." Improving the prospect of diabetes care. *Diabetes Care* 1999;22:635-9.
132. Kyngas H, Duffy ME, Kroll T. Conceptual analysis of compliance. *J Clin Nurs* 2000;9:5-12.
133. Lutz ME. The effects of family structure and regular places of care on preventive health care for children. *Health Values* 1990;14:38-45.
134. Weinick RM, Beauregard KM. Women's use of preventive screening services: a comparison of HMO versus fee-for-service enrollees. *Med Care Res Rev* 1997;54:176-99.
135. Teich JM, Merchia PR, Schmitz JL, et al. Effects of computerized physician order entry on prescribing practices. *Arch Intern Med* 2000;160:2741-7.
136. Balas EA, Weingarten S, Garb CT, et al. Improving preventive care by prompting physicians. *Arch Intern Med* 2000;160:301-8.
137. Bates DW, Cohen M, Leape LL, et al. Reducing the frequency of errors in medicine using information technology. *JAMIA* 2001;8:299-308.
138. Gawande AA, Bates DW. The use of information technology in improving medical performance. Part III. Patient-support tools. *Medscape Gen Med* 2000 Feb 22;Sect. E12.
139. Bates DW, Teich JM, Lee J, et al. The impact of computerized physician order entry on medication error prevention. *JAMIA* 1999;6:313-21.
140. Landro L. Health groups push for "information therapy" to treat patients. *The Wall Street Journal* 2001 Feb 2;Sect. B:1(col. 1).
141. Lurie N, Slater J, McGovern P, et al. Preventive care for women. Does the sex of the physician matter? *N Engl J Med* 1993;329:478-82.
142. Dexter PR, Perkins S, Overhage JM, et al. A computerized reminder system to increase the use of preventive care for hospitalized patients. *N Engl J Med* 2001;345:965-70.
143. Chambers CV, Balaban DJ, Carlson BL, Grasberger DM. The effect of microcomputer-generated reminders on influenza vaccination rates in a university-based family practice center. *J Am Board Fam Pract* 1991;4:19-26.
144. Rosser WW, Hutchison BG, McDowell I, Newell C. Use of reminders to increase compliance with tetanus booster vaccination. *CMAJ* 1992;146:911-7.
145. McDowell I, Newell C, Rosser W. A randomized trial of computerized reminders for blood pressure screening in primary care. *Med Care* 1989;27:297-305.
146. Rosser WW, McDowell I, Newell C. Use of reminders for preventive procedures in family medicine. *CMAJ* 1991;145:807-14.
147. Becker DM, Gomez EB, Kaiser DL, et al. Improving preventive care at a medical clinic: how can the patient help? *Am J Prev Med* 1989;5:353-9.
148. Pritchard DA, Straton JA, Hyndman J. Cervical screening in general practice. *Aust J Public Health* 1995;19:167-72.
149. Turner RC, Waivers LE, O'Brien K. The effect of patient-carried reminder cards on the performance of health maintenance measures. *Arch Intern Med* 1990;150:645-7.

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