

IF DIABETES IS A PUBLIC HEALTH PROBLEM, WHY NOT TREAT IT AS ONE? A POPULATION-BASED APPROACH TO CHRONIC ILLNESS¹

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ABSTRACT

It is increasingly acknowledged that diabetes and other chronic illnesses are major public health problems. Medicare and many managed health care organizations have recognized the enormous personal and societal costs of uncontrolled diabetes in terms of complications, patient quality of life, and health care system resources. However, the current system of reactive acute-episode focused disease care practiced in many settings does not adequately address this public health problem. An alternative proactive, population-based approach to chronic illnesses such as diabetes is proposed and illustrated. This multilevel systems approach addresses supportive and inhibitory social-environmental factors at multiple levels (personal, family, health care team, work, neighborhood, community). Key disciplines contributing to a population-based approach to diabetes include epidemiology, behavioral science, health care services, public health, health economics, and quality of life professions. Current and potential contributions of each of these disciplines are illustrated and an integrative, population-based systems approach to diabetes management and prevention of complications is proposed. This approach is also seen as applicable to other chronic illnesses.

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INTRODUCTION

Among the complex and challenging issues that face society today (1), it is important that the health of individuals, as well as

the society, receive public attention and scrutiny. Certain diseases are readily perceived as threats to the public and thus deserving of national attention and effort. Acquired immune deficiency syndrome (AIDS), measles, multiple-drug-resistant tuberculosis, and, to some extent, cancer are examples of conditions that have been accepted as legitimate societal health issues by the government, the media, and the general public. Diabetes and many other chronic illnesses, such as arthritis, asthma, and heart disease, continue to be viewed primarily as "clinical diseases."

Why certain disorders are quickly accepted as "public health" conditions is not completely understood. However, disease burden, rapid change in disease incidence (suggesting preventability), and public and private concern about risk are three essential characteristics that define a public health disorder (2). Diabetes is associated with a very high burden to individuals with the disease, as well as to society in general (3). Many Americans, particularly the elderly and people of color, are at substantial risk of developing diabetes mellitus (DM). Further, there is convincing and increasing evidence that primary, secondary, and tertiary prevention strategies are effective in reducing the disease burden associated with diabetes. The disease and economic burdens of diabetes mellitus in the U.S. is large and growing (4-6). Within each 24-hour period, approximately 2,000 persons are diagnosed with DM. It is the leading cause of amputations (150/day), blindness in working-aged adults (70/day), and new cases of end-stage renal disease (75/day). Recent economic studies indicate that DM costs the nation approximately \$98 billion (5).

In 1997, 10.2 million Americans were diagnosed with DM. An estimated additional 5.4 million have DM but are undiagnosed, and between 12 and 15 million have impaired fasting glucose (7,8). Age- and sex-adjusted rates for non-Hispanic Blacks and Mexican-Americans were 1.6 and 1.9 times the rate for non-Hispanic Whites. Perhaps even more distressing than the extant burden of DM is that in the U.S., and especially in developing countries (9-11), the burden of DM will increase dramatically. In simple terms, DM is a very common, serious, and costly disorder, one that will likely get worse before it gets better.

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The two major categories of DM are now labeled as Type 1 (previously insulin-dependent or juvenile-onset) and Type 2 (previously non-insulin-dependent or adult-onset) DM (7). The former is now viewed as a long-term immunological disorder, always requiring insulin after clinical diagnosis. Type 2 DM is associated with insulin resistance, obesity, and physical inactivity and is, in its earlier stages, responsive to behavioral interventions as well as oral hypoglycemic agents. Secondary and tertiary prevention strategies have been shown to be efficacious in both Types 1 and 2, and trials are now underway to test the efficacy of primary prevention of DM (12).

Yet, most would still consider DM primarily a clinical disease. It is dealt with in the doctor's office or a hospital bed, and diabetes care often reflects an acute-illness model. Much of the burden associated with DM is insidious, coming on gradually only after many years. Since the publication of an article on DM as a public health disorder by Vinicor (2), there has been increasing acceptance of the magnitude and burden of DM and of the potential advantages of conceptualizing DM as a public health problem. The purpose of this article is to consider the intervention implications of treating DM as a public health problem. We propose that population-based public health thinking and approaches to DM should become an important component of diabetes care. Further, we argue that this approach can and should be integrated with a clinical approach and is also applicable to other chronic illnesses.

From a historical perspective, contemporary medicine in the U.S. is in the midst of a paradigm shift (13,14). In contrast to the "find it—fix it" model that emphasizes acute medical care, we are now faced with problems for which the medical care system was not designed. Most of the resources in the health care system are used for older adults with multiple chronic illnesses (15). Few people, for example, have Type 2 DM without other diagnoses. Finding and fixing one problem may leave the person in an equal level of disability because they have many other medical problems. In addition, both DM itself and other conditions such as hypertension, dyslipidemia, and overweight that frequently accompany DM (3) increase the risk of heart disease. With a chronic illness, one needs to deal not just with a biologic condition, but also with numerous life-style, family, psychosocial, cultural, and economic issues as well (16,17).

The traditional acute care model presumes that there is an initial exchange of information between a patient and physician. The physician identifies the disease, remedies it, and sends the patient on his/her way. In contrast, a chronic care model requires ongoing, long-term interactions between providers and patients and recognizes illness in addition to disease. Self-management is the key feature (15). Patients clearly are the interpreters, managers, and creators of the meaning of their health (18). The experience of illness can be altered by emotional and environmental factors, and treatments typically bring side effects as well as benefits. Instead of a single provider contact to fix a disease, the care of chronic illness is ongoing and encounters are multiple. One-way communication (e.g. instructions from the provider) can suffice in acute care, but two-way communication is the central component of chronic care. Our health care system, established and grounded in the acute care paradigm, is poorly equipped for this interaction (19).

The above issues apply to all chronic illnesses (15,20,21). In the following sections, we describe a multidisciplinary approach to DM, which, if adopted, would improve the care and reduce the public health burden of DM. American society is painfully discovering that there are very real limits to how far our health care resources can go. We simply cannot provide all the services that patients and providers would desire and we must learn to live

within limits (16,22). This article proposes a population-based approach which treats DM as a public health issue, and which is compatible with the changing U.S. health care environment (2,16,22).

INFLUENCES ON ILLNESS SELF-MANAGEMENT AND PATIENT CARE

Diabetes self-management and patient care are influenced by multiple factors. Most research and practice has approached DM management as if it were solely a function of patient characteristics, such as knowledge and health beliefs, and metabolic factors. As illustrated in Table 1, however, there are several additional levels of influence on diabetes care and self-management. Unfortunately, neither health care providers nor researchers have devoted much attention to these other factors, especially social environment and public policy. A key point is that the more distal factors toward the bottom of the table tend to impact far larger numbers of persons—thus, they have a broader "reach" (23,24) and are more population-based. They look beyond the care of individual patients to the health of the entire community (25,26) or population of persons with DM (e.g. in a given practice, health system, or state).

As one goes down the table, the factors also tend to be more complex and more difficult to change in a short period of time. Perhaps because of this and the fact that methodologies for assessing these latter levels of influence have not been widely taught, there has been a paucity of attention to these factors and to interventions to modify these influences. This does not mean, however, that these factors are any less important or less influential. As described below, we are witnessing a shift toward a systems approach to DM (27–30) that integrates individual, family, health care, community, and policy factors.

Throughout this paper we will discuss key factors that act to either support or serve as barriers to self-management and care at the various levels of influence noted in Table 1. Understanding these influences and designing interventions to affect them requires the input of multiple disciplines including behavioral science, epidemiology, health education, community organization, and health care policy, as well as medicine and nursing. The following sections illustrate strategies and frameworks that contribute to a comprehensive, public health approach to DM. By a public health approach, we mean a broad, multidisciplinary perspective that is concerned with improving outcomes in all people who have DM, with attention to equity and the most efficient use of resources in ways that enhance patient and community quality of life.

We discuss five such key components to this approach: (a) a focus on an entire defined population of people with DM (e.g. members of an HMO), (b) health care systems-based approaches, (c) the application of behavioral principles, (d) community-level public health factors, and (e) policy–legislative activities and a patient quality of life focus. We provide examples of how each of these five perspectives has been applied to improve the quality and cost-effectiveness of care for DM (and other chronic illnesses).

To date, these approaches have been underutilized and, when applied, generally have been implemented in isolation rather than as part of an integrated, population-based plan. We posit that an integrated, preferably multidisciplinary team approach can address the shortcomings of the clinical, acute-illness oriented approach to DM practiced in many settings (30–32). Such a population-based approach is compatible with and positioned to take advantage of the revolution in information management and telecommunications (33–36), the move toward managed and primary care (37,38), and the changing demographics of both the U.S. population and the DM population (3,39).

TABLE 1
Factors Supporting and Interfering with Diabetes Care and Self-Management at Each Level of Influence

Level of Influence	Supportive Factors	Inhibitory Factors
1. Personal	Empowerment; High self-efficacy; Good problem-solving skills.	Lack of knowledge; Low self-efficacy; depression.
2. Family/Significant Other	Social support; Shared exercise and eating patterns.	Nagging or lack of involvement; Poor role models.
3. Health Care Provider/System	Integrated, systems approaches; Collaborative goal-setting; Surveillance and follow-up support; Outreach and proactive contacts.	Lack of reimbursement or insurance coverage; Inconsistency among different team members; Lack of access to care.
4. Worksite/School/Organization	Smoking policies; Availability of nutritious foods; Flexible schedules; Physical activity resources and opportunities.	Lack of control over schedules; Embarrassment; Lack of privacy for glucose testing or insulin injection; No accommodation to diabetes needs; Low priority on wellness.
5. Neighborhood/Community	Awareness and use of nutrition, physical activity resources; Support groups; Strong library and volunteer programs.	Lack of nutrition education or self-management resources; Lack of safe, convenient exercise locations.
6. Regulatory, Policy, and Incentive	Taxes on tobacco products; Labeling information on food; Media coverage of seriousness of diabetes and related topics; Outcomes report cards for health care plans and clinics.	Automobile-oriented society; Media that do not consider diabetes serious; Lack of reimbursement for education and self-management supplies; Denial of health insurance.

TABLE 2
Differences Between Standard Acute Care and a System-Wide, Population-Based Approach to Diabetes and Chronic Illness Management

Issue	Standard Acute Care Approach	System-Wide Population-Based Approach
1. Underlying Philosophy	Diagnosis and cure; What's best for each patient; Treat disease and complications.	What's best for all patients based on evidence-based guidelines; Prevent and manage disease.
2. Key Values	Best care for acute exacerbations; Medical diagnosis.	Reaching patients at all stages; Environmental and behavioral diagnosis.
3. Focus	Glycemic control; Most severe or high-risk cases; Medical management.	Self-management; Entire population; Maintain functioning; Behavior change.
4. Intervention Drivers	Symptoms; Pharmacologic protocols; Physiologic abnormalities; Acute events.	Risk factors; Guidelines, integrated care plan; Continuity of care.
5. Metaphors, Influences	Hormones—internal environment.	Social environment; Provider, health care system, and community context.
6. Patient Role	Passive; Comply with prescribed regimen.	Active; Collaborative, define goals, self-management.
7. Health Care Provider Role	Reactive—responds.	Proactive—initiates.
8. Key Outcomes	Physiologic.	Behavioral; Quality of life; Quality and consistency of implementation; Cost-effectiveness.
9. Interventions	Pharmacologic and adjunctive treatment.	Behavioral, psycho-educational; Community; System level change.
10. Intensiveness and Cost	High, as needed; Centered on most ill.	Lower, distributed across entire defined population.

Because such an approach may be new to the reader, we first summarize key differences between standard care (31,32) and a population-systems oriented approach. "Standard care" (40,41) as currently practiced in most primary care settings in our country is well-intentioned; however, it emphasizes acute disease and treatment of symptoms and physiologic abnormalities (21,42-44). In contrast, the population-based public health approach in the right hand column of Table 2 differs in objectives, role of patient and provider, outcome criteria, and several other characteristics.

Focus on the Entire Population

The underlying values and philosophy of the acute-care oriented approach focus on differential diagnosis and management of individual patients who present with symptoms, elevated blood sugars, distress, or complications. The focus is on treatment using sophisticated technological and surgical interventions for high-risk or severe cases, often after the patient has developed complications. The population-based, systems approach is more proactive

and focuses on what is best for all patients and on maintenance of function and prevention of complications.

Rows 4-7 in Table 2 summarize the key influences, goals, and patient roles in these two approaches. In the acute-care approach, the focus is on the patient's internal environment (hormones), and pharmacological interventions are prescribed to patients who are to adhere to that regimen. The population-based approach focuses on delivering a systematic set of services and continuity of care. Attention is focused on the external social (as well as internal) environments, and self-management goals and interventions are collaboratively identified by patients and teams. The standard clinical approach emphasizes physiologic outcomes (e.g. HbA_{1c} level) and pharmacologic interventions (intensive insulin therapy) at relatively high expense for high-risk patients (rows 8-10 of Table 2). The population-based approach emphasizes behavioral and psychosocial interventions; functional, quality of life outcomes; and routine delivery of screening measures for early detection of complications. The population-based approach tends

to be less intensive for a given individual but more consistent and comprehensive across individuals by providing a set of evidence-based procedures to all patients.

Health Care Systems

Mounting evidence indicates that standard medical care often fails to meet the needs of persons with DM and other chronic diseases (31.32.45). Substantial proportions of patients do not receive proven preventive practices, such as a dilated retinal exam, foot inspection and education, or effective self-management support, even at the very best specialty centers, let alone in most primary or managed care settings (31.32.41.45). In contrast, a visible, landmark success in care was the Diabetes Control and Complications Trial (DCCT) (46). Aside from more intensive insulin therapy, DCCT patients saw care oriented and organized very differently from their usual medical care. Most notably, care was proactive, with assessments, education, and follow-up delivered according to a plan at predefined intervals. To execute the plan, each DCCT clinic team met regularly to organize care, delineate the tasks involved, assign them to staff (usually nonphysicians), and make certain that staff had the time and training to perform them (47). Although much of the day-to-day care was rendered by study nurses, skilled diabetologists were on hand to help with difficult patient problems or answer questions. Follow-up was intensive and relied heavily on practice-initiated phone calls. The net effect was a level of adherence and maintenance of behavior change (46) that was unusually high, even for much simpler therapy.

The features that distinguish DCCT care (beyond the intensive regimen)—protocol-driven planned care, delegated roles, practice-initiated follow-up, consistent self-management support (47), access to clinical and behavioral expertise—are, in fact, the same aspects of care associated with improved outcomes in other studies of interventions in chronic illness (21.48). The DCCT and other successful programs had another advantage: they knew who all their patients were and what they needed to achieve (quality of care indicators). Information on the entire population (i.e., a registry) is the foundation on which organized approaches to diabetes care are built. A common reaction to the DCCT is that, because of the intensity of the intervention and the interdisciplinary team approach, such a system is not realistic in the real world of clinical care, especially primary care for Type 2 DM. Our point about the DCCT is not about the intensity of care provided (which we agree is not realistic), but the proactive, systems- and population-based emphases on consistency and monitoring of all patients (49–51). In one way, the DCCT was definitely not a population-based approach. The recruitment procedure was extremely selective—admitting only uncomplicated, highly motivated individuals (46). This is the opposite of the population-based approach we are advocating, which focuses on reaching all persons with DM (see Table 2).

Many health care systems, provider groups, and technology companies have recognized the deficiencies in diabetes care and are taking steps to remedy the situation. These disease management approaches will only increase the costs and fragmentation of care unless they comprehensively address the differences between standard medical care and care that meets the needs of DM patients. This requires cultural and environmental changes in usual medical care. Good care has a large preventive component, and several authors have noted that the acute care orientation of most medical practice leads to a clinical style and system designed to handle emergencies, rule out life-threatening illnesses, and swat symptoms, not practice prevention (15.42).

Physicians, their teams, and their practice systems are typically positioned to react to patient demand rather than initiate

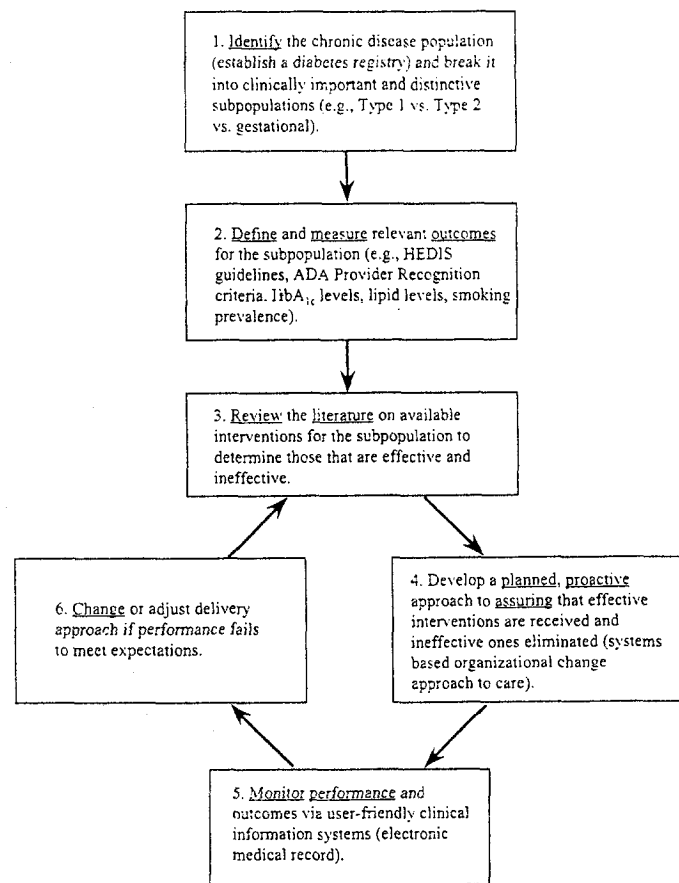


FIGURE 1: Population-Based Management of Care.

action. High-quality diabetes care requires practice initiative and systems that facilitate initiation through outreach, reminder systems, and/or practice team members delegated to initiate prevention. Outreach is a hallmark of the public health approach. For example, studies consistently find that practice-initiated follow-up telephone calls increase patient adherence to medical and behavioral regimens, enhance patient satisfaction, reduce health care utilization, and improve health outcomes (52.53). Efficacy and economic studies, especially cost-effectiveness analyses, support the value and appropriateness of both secondary and tertiary prevention in DM (12.54). As shown in Figure 1, good, population-based health care begins with knowing who one's patients are—in this instance, a DM registry.²

Thus, good medical care for DM requires the application of public health perspectives and methods. Practice teams must enlarge their perspective from the individual patient with DM to encompass the entire population with DM served by that practice

² As an anonymous reviewer pointed out, this paper does not address issues of primary prevention of DM. While primary prevention is an important public health activity and the risk factor status of factors such as obesity, high-fat diet, and lack of physical activity is well-established, data are not currently available on the efficacy and cost-effectiveness of primary prevention for DM (2.110.131). There are currently two large collaborative trials, as discussed elsewhere in this paper, that are investigating interventions to reduce risks of developing Type 1 DM (DPP-I) and Type 2 DM (DPP-II). As our knowledge of the causes and natural history of DM evolves (e.g. genetic predisposition; sedentary life-style and high-fat diet; impaired glucose tolerance, Syndrome X or borderline DM, overt DM), we can move our interventions and policies to prevent DM even further upstream (132.133).

or organization. The focus on all patients with DM, not just the one on the gurney or in the waiting room, explains our preference for the use of the term population-based care to describe systematic efforts to improve outcomes among all patients or enrollees with DM (26). The overarching objective of systems-oriented, population-based care is to improve the health, functional status, and satisfaction with care of the population with DM at a reasonable cost.

Population-based care also helps health care organizations think about broader community interventions that may be important parts of care strategies for their own enrollees, as well as for others in the community (see Level 5 of Table 1). Many elements of good diabetes care may be delivered most efficiently and conveniently in the community as long as they are of high quality and coordinated with medical care. For example, Group Health Cooperative of Puget Sound, a major regional health care organization, and Senior Services of Seattle-King County, a community agency, are working together to implement a well-tested physical activity program (21) for older and chronically ill adults in senior centers throughout the county. This program provides both health care systems and the community at large with a low-cost, high-quality resource at a convenient location that is familiar to the target population.

Examination of successful efforts like the DCCT suggests that it will take a coordinated set of interventions to improve outcomes (21,42) (see Figure 1). A broader perspective without fundamental changes to the acute care-oriented medical care system may not be sufficient to see significant improvements in outcomes. As they are the foundation for the population perspective, registries and information systems enable practices to be reminded, to plan care, and to monitor their performance (see Steps 1, 2, 4, and 5 in Figure 1). Perhaps the most difficult step for busy health care systems is Step 4, instituting system changes that will affect clinical performance.

Practices need a framework for planning care improvements that is based on scientific evidence and translates the evidence into usable clinical guidelines. They need to plan their basic approach to handling patients with chronic disease differently (practice redesign) and facilitate the shift from reactive, acute care to planned, preventive care. This plan should include explicit delegation of the roles of various members of the practice team: changing the appointment system to accommodate the clinical, educational, and support needs of patients; and systematic follow-up. Since generalists will continue to provide the bulk of diabetes care (32,38), organized strategies must assure timely and relevant access to diabetes/endocrine expertise (26,49). The traditional specialty referral may not be the optimal way to provide such expertise. Health care systems are experimenting with different ways of bringing specialists to primary care (49)—to share in the care of difficult patients, to foster a population perspective and disseminate new innovations in care, and to educate primary care providers and allied health professionals.

Managed care organizations—at least those that wish to focus on quality and not simply cost-containment—with their defined population and preventive orientation are well-positioned to adopt a public health model. However, such organizations have limited resources to provide care. Their incentive is to maximize population health status given the resources available. (This does not mean that all managed care organizations practice such a public health approach or that these principles cannot be applied in other types of health care systems.)

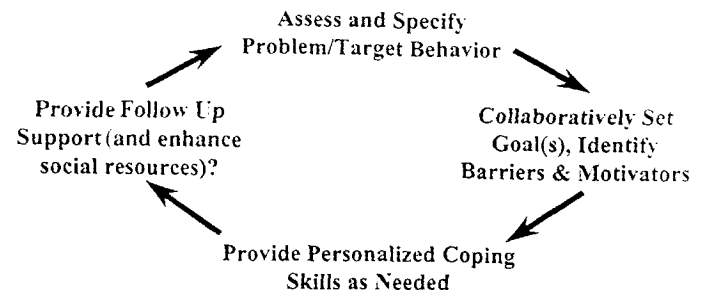


FIGURE 2: Schematic of Behavioral Management Principles Applied to Chronic Illness Self-Management.

Behavioral Science Principles

Psychologic, sociologic, and anthropologic research principles are helpful in understanding and modifying social and environmental factors that impact illness management (55). These forces act at multiple levels, ranging from the individual to societal (56), as shown in Table 1. Although changing the practices of the media, health care insurers, land use planners, food manufacturers, legislators, medical schools, pharmaceutical companies, funding agencies, state governments, and city/county planning councils (Levels 4–6 in Table 1) may seem beyond the scope of this paper, change in these contextual factors must occur if we are to achieve permanent and meaningful improvements in health (16,22,57). Such change will be slow and incremental and will be resisted by special interest groups. However, to ignore such factors and pretend that they do not affect DM management is short-sighted (58). Models and recommendations for how to address these larger social factors are available (57–59). In particular, an important series of articles on behavioral–environmental and policy approaches to nutrition, tobacco use, and physical activity was published recently (60). Implementation of these recommendations would go a long way toward addressing these key behavioral factors and improving management of DM.

Behavioral research and theory has contributed much that can be used to help design and deliver DM management in a way that is more efficient, effective, personalized, and lasting. Behavioral research approaches and principles are vital in implementing the population-based, patient-focused approach outlined in Table 2. The following paragraphs summarize the potential of these behavioral approaches; more detailed discussions are available for DM in particular (28,29,47,61–64) and management of chronic illness in general (42,48,65).

For patient self-management (see Level 1 of Table 2), behavioral research has shown that outcomes can be improved if one elicits the patients' concerns, identifies personal barriers and support for behavior change, understands how patients view their DM, and collaboratively tailors regimen goals and recommendations based upon these factors (18,66–68). Controlled studies demonstrate that these principles can be implemented in busy medical settings in ways that are efficient and effective (66,69–76). Of particular relevance is the research on patient activation (77), patient empowerment (66,78), and on brief negotiation and motivational interviewing (67), all of which emphasize listening to the patient and making her/him a more active, equal participant in the medical visit.

Behavioral principles have been used to restructure the medical office environment and interactions with the health care team (Level 3 of Table 1 and Figure 2) (23,27,63,79). Ways in which these principles can be applied include identifying and mutually negotiating self-management goals (48); discussing

patient perceptions of self-management barriers and tasks (18.80); training patients, family members, and health care teams in problem-solving (81.82); developing a systems-based approach to DM risk factors (27.72); and regular practice-initiated follow-up activities (83.84). Figure 2 illustrates one way of implementing these principles in a collaborative, patient-centered manner that fits the continuity of care cycle of primary care.

One well-established behavioral finding is that DM self-management is multidimensional; there is little relation between how well patients do in one aspect of the regimen and how they do in others (85-87). Traditional care typically ignores this fact and instead assumes that self-management is unidimensional, indexed by physiologic results (e.g. HbA_{1c}) (it is not), or due solely to patient motivation ("blaming the victim") (85.86). The information revolution has made it possible to reach more patients, at more convenient times, on a more ongoing basis (34.88-90). These tools can be used to deliver behavioral training to both health care professionals and patients (91). Examples include telemedicine, interactive television, the internet, etc. (32.88,92.93). Especially when combined with electronic clinical information systems (26), these advances will dramatically improve patient care and chronic illness management, but only if they are developed with attention to patient concerns and behavioral research findings (90.94).

Finally, a behavioral science policy implication (Level 6 of Table 1), which would advance application of behavioral aspects of DM management more quickly than any other, would be to include behavioral measures in the Health Plan Employer Data Information System (HEDIS) (95) and other report care systems and evidence-based behavioral procedures in critical pathways and care guidelines (47.96.97). For example, smoking cessation; regular physical activity; eating a low-saturated fat, high-fiber diet; regular foot care; and setting self-management goals should be a standard part of DM guidelines (47.96.97).

Community--Statewide Focus

The nation's public health system has a key role to play in promoting a population-based approach to DM. The landmark 1988 report by the Institute of Medicine, *The Future of Public Health*, clarified the mission of a public health system (98). The report outlined and called for the reinstitution of three key public health core functions: assessment, policy development, and assurance. These three functions can be applied to each level of Table 1. We illustrate how a statewide community-based focus has been applied to DM in Oregon and Washington.

Assessment is a key responsibility of public health. Surveillance of the morbidity and mortality associated with DM at the national, state, and county level is an important contribution toward defining, and subsequently reducing, the burden of DM. For example, the Washington State Diabetes Control Program has produced *An Assessment of Diabetes in Washington State* (99) to assist health planners, policymakers, and providers in understanding the burden of DM. Assessment attention also needs to be directed further upstream to the real causes of death: societal conditions such as poverty (25.100) and unhealthy life-styles that include tobacco use, inactivity, and poor dietary habits (101). Behavioral contributors to DM morbidity and mortality are monitored through the national annual Behavioral Risk Factor Surveillance System (BRFSS) (102) coordinated by the Centers for Disease Control (CDC) and now conducted annually in 49 states. In Oregon and Washington, BRFSS data specific to each county are summarized to enable local health departments and their partners to have local information for goal-setting and

community mobilization specific to eating and exercise behaviors, hypertension control, and tobacco use.

There is increasing recognition of the crucial role that social-environmental factors play in health behaviors (25.57,100,103). Assessment of health-promoting community health indicators (Level 5 of Table 1) such as acres of park per population, miles of sidewalks, percent of nonsmoking workplaces, and amount of grocery store shelf space devoted to low-fat foods are indicators that can provide a basis for community health planning. The medical care system itself (Level 3 of Table 1) is an appropriate focus for assessment. In Oregon and Washington, public health and the health care delivery systems are developing collaborations to assess interest in and capacity for DM registries, care guidelines, and quality improvement activities.

The policy development and advocacy function of public health (Level 6 in Table 1) encompasses several activities of importance to diabetes care. People with DM have long been disenfranchised from the health care delivery system through preexisting condition clauses in insurance policies. The public health system needs to work with health researchers, voluntary associations, payers, providers, and elected officials to institute changes in insurance laws to ensure access to health care for people with DM, including reimbursement and coverage for prevention-based treatment like DM education and supplies for blood glucose self-monitoring (HR 1073 and 1074). Public health has an important role to play in guidelines development. The CDC-funded Oregon Diabetes Project worked with a multidisciplinary advisory group to develop a set of population-based guidelines for diabetes care with input from clinicians, payers, health care researchers, consumers, and the state American Diabetes Association (ADA) affiliate. Targeted at managed care organizations, the document (96) outlines specific steps for a population-based approach to DM, from defining the population with DM to monitoring specific long-term outcomes. State health departments can be important partners of managed care systems and health care consortiums in defining activities which assure quality care for all people with DM.

The assurance function of public health works to carry out policies to improve the health of people with chronic illness. Since the population at risk for DM overlaps to a great extent with the historically disenfranchised, special efforts need to be made to address issues of equity. For example, many poor people and people of color do not have insurance, even though low-cost, sliding scale basic health plans exist. The Washington Diabetes Control Program provides grants to community and rural health centers to build infrastructures to assure consistent delivery of key components of diabetes care (dilated eye exams, foot risk assessments, kidney evaluations, etc.). Diabetes self-management education is a critical element of each component of care. Monitoring progress toward goals is a key assurance function and highlights the leadership role for public health in furthering a population-based approach to DM. National diabetes goals (such as the Healthy People 2000 objectives) (104) and state health status indicators (105,106) are critical for keeping (or getting) DM and health promotion issues in the spotlight and for providing a basis for state and national planning to reduce burden from DM.

Policy Approaches and Health-Related Quality of Life

Monitoring progress toward public health goals requires measures of health outcome. Historically, DM programs were evaluated using measures specific to DM. A growing interest in outcomes research has attempted to broaden measures of health

benefit. One important distinction is between disease-oriented medicine and patient-oriented medicine. In disease-oriented medicine, the goal is to make a disease better. Control of DM, for example, might be measured through lower HbA_{1c}. Patient-oriented medicine achieves its goal if the patient is better, as reflected in longer life and higher life quality. In the new paradigm of health care, patient-reported outcomes are recognized as a goal of treatment (107). Measures of health-related quality of life are central to this effort (108). Further, these measures have value for resource allocation decisions that may involve comparing diabetes care with other aspects of health care. This section integrates these issues by discussing the importance of adopting a patient perspective (Level 1 in Table 1), quality of life, and considerations in allocating limited resources (Level 6) (109,110). Our current health care system is facing a "tragedy of the commons" (111) in which allowing each individual citizen to have what they want (e.g. unlimited access to expensive tertiary interventions) is depleting our common health care resources such as employer health care coverage and Medicare/Medicaid.

Patient Perspective: Patients and physicians often have different opinions, and physicians are often inaccurate in assessing patient preference (112). The failure to involve patients in decisions about diabetes care is problematic because many interventions affect quality of life in addition to life expectancy. In some cases, the benefits of treatment are reflected in better behavioral functioning or improved symptoms, while in other cases treatments cause new symptoms or functional limitations. Determining potential benefit requires the integration of patient utilities and the assessment of various outcomes weighted by their probabilities. These outcomes include both benefits and side effects.

Viewed from the vantage point of the patient, some health care decisions will be different than those from a provider perspective. For example, one result of the DCCT was that intensively treated patients gained more weight and had more hypoglycemic events than patients using the standard regimen (46). The University Group Diabetes Program (UGPD) was a large, cooperative, randomized trial to show that tight control of Type 2 DM reduced the probability of complications. Several oral agents were successful in lowering blood sugar. However, those randomized to receive Tolbutamide experienced a significant increase in the probability of death due to cardiovascular diseases (113).

Treatments do not assure benefits. For example, in comparison to usual care, aggressive management of Type 1 DM changes the probability of complications. However, aggressive treatment also increases the probability of side effects. A growing consensus suggests that patients should be involved in decisions affecting their health care (15,16,78). Many decisions involve trade-offs between desire to reduce the probability of complications in the future versus willingness to accept the increased nuisance and risk associated with more aggressive treatment. Achieving a 10% reduction in the probability of retinopathy, for example, might mean willingness to accept a doubled risk of hypoglycemia in the near term (114). Studies evaluating the benefit of patient participation in decision-making have demonstrated improved patient outcomes (77).

Quality of Life: Quality of Life (QOL) measures incorporate the patient perspective and can provide a common metric to compare different treatments with one another, treatment side effects versus benefits, or the output of different sectors of health

care. These activities require a common conceptualization of health. Components of QOL measures include physical activity, social activity, symptoms, and patient preferences for these outcomes. Many QOL measures (115) have been evaluated and used in clinical trials. Perhaps the most sophisticated approach to economic evaluation is cost/utility analysis. This form of analysis divides program costs by a measure of life expectancy adjusted for QOL. To perform cost/utility analysis, it is necessary to use measures that combine morbidity and mortality into a single index (116). The denominator in the equation, typically called the Quality-Adjusted Life Year (QALY), is similar to a measure of life expectancy but adjusted for level of functioning. Competition for health care resources will require endocrinologists and DM educators to compete with other health care providers. A general conceptualization of health outcome, such as the cost to produce one QALY, will allow direct comparisons among the productivity of different sectors (95,117,118).

Resource Allocation: There is no question that the medical treatment of DM is a necessary and cost-effective intervention. The State of Oregon, under their innovative Medicaid Experiment, studied the medical effectiveness of over 700 medical procedures. These services were prioritized for funding using the available resources. Medical treatment of Type 1 DM was placed at the very top of the list (16). Given the high benefit of Type 1 treatment, it is inconceivable that any policy analysis would exclude such services. However, reorganization of diabetes care may result in more efficient use of limited resources.

A clear consensus that Type 1 DM should be treated medically does not necessarily mean that all services offered to Type 1 patients should be supported or reimbursed by third-party payers. Historically, American medicine has been based on an acute-care, fee for service system under which providers are reimbursed for units of service. The more services offered, the more reimbursement (14). As a result, Type 1 patients in the U.S. have come to receive significantly more services than those in other countries. However, some evidence suggests that this greater level of care under the acute care approach outlined in Table 2 has not resulted in better patient outcomes. Indeed, some evidence shows that DM patients in the United Kingdom, for whom costs are significantly lower, have equivalent outcomes to those in the U.S. (119,120). More care is not necessarily better care. This is also true for Type 2 DM (110,119).

In addition to the patient and the provider perspectives (Levels 1 and 3 in Table 1), the societal perspective needs to be considered. Opportunity costs (13) are the missed opportunities as a result of using resources to support a particular decision. If we spend a lot of money in one sector of health care, we necessarily spend less money elsewhere. Using expensive care for tertiary treatment of people with DM (see Table 2) may divert resources away from other valuable uses of these funds. It may be agreed that all people with DM deserve care. However, insurance plans and public programs must decide what services to support. Some evidence suggests that basic preventive care for people with DM is a good use of resources, in comparison to alternatives. Eastman et al. (121) compared the cost/utility of Type 2 DM treatment with other health care programs. The analysis clearly demonstrated that preventive care for patients with DM is a good use of public health resources. Effective prevention of diabetic complications produces QALYs at a cost considerably lower than most widely-advocated medical or surgical programs (121).

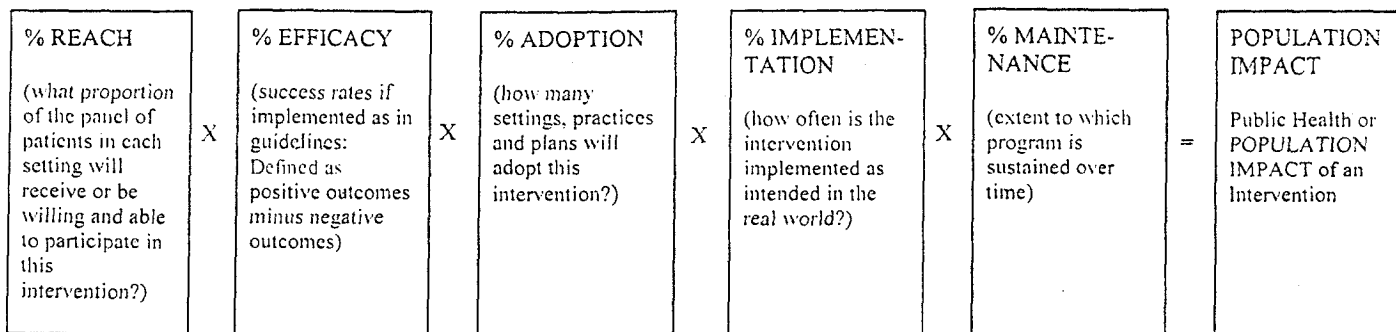


FIGURE 3: Algebraic Model of Public Health Impact of Intervention.

AN EVALUATION AND METHODOLOGIC NOTE (OR WHERE WE LOOK)

The way that scientific studies are conducted and reported greatly influences what is done with the results and the world view that scientists, elected officials, organizational decision-makers, the media, and general public have of DM. Our current gold standard (the double blind, placebo controlled, randomized intervention trial) (122) serves to reinforce the acute illness-oriented perception of DM. This type of efficacy research (123)—that emphasizes treatment under optimal conditions, usually with highly selected, uncomplicated and very motivated, stable patients and drug run-in periods and is usually delivered by a highly skilled interdisciplinary team of experts in tertiary care centers having resources unavailable in the world of primary care—is important and has contributed greatly to the advances in knowledge, such as the DCCT.

However, this paradigm, when it is the only type of research study valued or considered quality science, also has limitations (124,125). Foremost among these are a lack of emphasis on the representativeness of the findings, patients, and intervention settings involved. Needed to further the public health significance of clinical research—and enhance the QOL of the majority of patients with DM—are reporting on additional criteria such as the percent and representativeness of participating agencies or clinics; the patients who participate; the quality and consistency of implementation in real world, and especially primary care, settings in which research, or even DM, is not their primary responsibility; and finally, long-term maintenance of behavior change and outcomes among both intervention staff and patients. None of these issues are frequently reported in major medical studies or DM journals (19,126).

Figure 3 illustrates the role of these critical public health issues in determining the population-based impact of an intervention or policy innovation. The issues of and relationships among Reach, Efficacy, Adoption, Implementation, and Maintenance (the RE-AIM model) are discussed in greater detail elsewhere (64,127). An important point is that these dimensions are interrelated; for example, an intervention that is 99% efficacious, but will be adopted by only 2% of clinics and acceptable to only 5% of patients in these clinics will have far less overall public health impact ($.99 \times .02 \times .05 = .001$) than will a less efficacious intervention that is say 50% efficacious, but will be adopted by 70% of clinics and acceptable to 70% of patients ($.7 \times .7 \times .5 = .25$). Future studies should place greater emphasis on the factors summarized in Figure 3. Such concerns must be addressed if our

science is to have an impact on medical care as practiced in most settings (42,125,127).

SUMMARY AND CONCLUSIONS

The acute care model of disease management has emphasized quality of care from the provider perspective. Providers often feel, understandably, that the best care is associated with greater use of specialists and diagnostic tests. To a large extent, this is based on measures of biologic process (Table 2). However, not all studies show that the most detailed and most expensive care results in the best patient outcomes. A public health perspective also emphasizes inclusion of patient QOL, behavioral, functional, and economic outcomes. Further, a population-based perspective attempts to use resources in the most cost-effective manner. The acute care approach and population-based systems approaches outlined in Table 2 can often—but do not inevitably—result in different conclusions about the wisest use of resources.

Nevertheless, a public health perspective on DM should not be viewed as competitive with or antithetical to a clinical approach. When integrated with effective clinical care, public health strategies can benefit individuals with DM, their families, and society at large. To initiate meaningful management changes for chronic diseases like Type 2 DM, several related interventions must address all components of the health care system. The National Diabetes Education Program (110), like the National Cholesterol and High Blood Pressure Programs, will address the public, patients with DM, providers, payers, and policymakers in an effort to broadly address the health and economic burdens of DM. All of these vested interests must work together to achieve needed improvements in how we view and manage DM (18,128).

A development that may help bridge the gap between the individual focused, acute care model in column 1 of Table 2 and the population-based, proactive approach in the right hand column is DM guidelines. Although the ADA has long had recommended standards of care (6), only recently have they condensed these into a reduced number of more evidence-based preventive practices in the new Provider Recognition Program (97). Also exciting is the collaborative Diabetes Quality Improvement Project (DQIP), a joint endeavor of Health Care Financing Administration (HCFA), National Committee on Quality Assurance (NCQA), Foundation for Accountability (FAACT), and ADA, to develop a common set of diabetes care guidelines that will soon be included in the HEDIS measures (129). It would advance the cause of public health and the QOL of those with DM, if the DQIP measures included

behavioral, QOL, and patient-centered measures as well as biologic measures.

In conclusion, considerably more research is necessary to identify which specific approaches to diabetes care result in the best patient outcomes. However, enough limitations have been documented with the standard clinical approach (2,31,32,45), and enough promising data have emerged in support of the preventive, integrated systems based approach outlined in this paper (26,30,44) to support increased adoption of such a population-focused public health approach. Such a shift should increase the number and equity of patients reached and the quality of care received and produce both biologic and QOL outcomes equivalent to or better than the acute care approach. As Caswell Evans (130) concluded in his Presidential address to the American Public Health Association, "Society either supports public health or it supports public disease." Is this not true of DM and chronic illness also?

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