

# The Impact of Comorbid Chronic Conditions on Diabetes Care

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**E**ffective diabetes management often presents enormous challenges. Not surprisingly, clinicians and patients alike can be overwhelmed by the need to address comorbid chronic conditions in addition to patients' diabetes-specific treatment goals. Ignoring concurrent disease management, however, can lead to ineffective control of diabetes-specific risk factors and may miss opportunities to improve patients' functioning, quality of life, and mortality risk.

Other chronic conditions are common among people with diabetes and account for much of the morbidity these patients face. According to the Medical Expenditure Panel Survey, most adults with diabetes have at least one comorbid chronic disease (1) and as many as 40% have at least three (2,3). The increasing prevalence of multimorbidity among older diabetic adults is at least in part an unintended consequence of our success in improving diabetes treatment quality. Improvements in HbA<sub>1c</sub> (A1C) monitoring and glycemic control have been documented in several large systems of care (4–7). More widespread use of treatments such as ACE inhibitors and aspirin have decreased patients' risk of cardiovascular death (8–10). Diabetic patients are living longer, and like all Americans, this increases their chance of acquiring one of the many chronic diseases associated with aging.

Other more troubling trends have conspired to increase the impact of multimorbidity on diabetes management. In many health care systems, providers see patients during brief office visits and are overwhelmed by the number of health maintenance activities recommended by guidelines and quality monitoring agencies (11,12). When diabetic patients have multiple chronic conditions, screening,

counseling, and treatment needs can far exceed the time available for patient-provider visits. Health problems that used to be treated in inpatient settings are increasingly managed within outpatient care, further straining providers' resources for addressing diabetes-specific management goals (13). With inadequate health system support and little guidance about how to manage multimorbid patients, diabetes providers can become frustrated with their inability to meet patients' multiple treatment demands (14–16).

Comorbidities can have profound effects on patients' ability to manage their self-care. Depression and arthritis impair patients' functioning and pose significant barriers to lifestyle changes and regimen adherence (17–19). Conditions such as emphysema and chronic low back pain can have a more debilitating impact on patients' health status than diabetes per se (20) and are among the most important determinants of diabetic patients' functioning and mental health (21). In addition, disabling conditions such as advanced heart failure and dementia may make standard diabetes self-care goals impossible to reach. Even when comorbid chronic conditions do not directly limit patients' ability to self-manage their diabetes, these conditions can serve as competing demands (22,23). Diabetes self-management requires a substantial investment of patients' time (24,25), and activities such as work and childcare place very real limits on the attention patients can devote to managing their health. When comorbid illnesses must be comanaged, the amount of time and energy left for diabetes self-care can be substantially reduced. Medication adherence alone can be difficult when patients are

juggling regimens for multiple conditions (26,27).

Comorbid illnesses can sap the financial resources of people with diabetes by increasing their out-of-pocket costs for medical care. Diabetic patients face higher out-of-pocket medication costs than people with almost any other chronic condition (28,29), and some underuse preventive services as a result of cost pressures (30,31). Patients reporting cost-related medication underuse have poorer glycemic control, more symptoms, and poorer functioning (32). Given a fixed budget, diabetic patients with comorbid conditions may have to make difficult choices between forgoing necessary treatments for their diabetes, treatments for their comorbid conditions, or even cutting back on essentials such as food or heat (31,33).

In sum, clinicians and health systems seeking to improve diabetes management cannot avoid addressing the ways in which patients' other chronic health problems affect their diabetes care. Rather, improving diabetes management requires a more wholistic, patient-centered approach. Many health systems are still poorly designed to support effective diabetes management (34), let alone grapple with the challenges that arise when patients are struggling with multiple concurrent conditions. General principles of the Chronic Care Model undoubtedly apply (7), but the path from current practice to more effective diabetes care in the context of comorbidities remains uncertain.

## A framework for understanding diabetes care within the context of comorbid chronic conditions

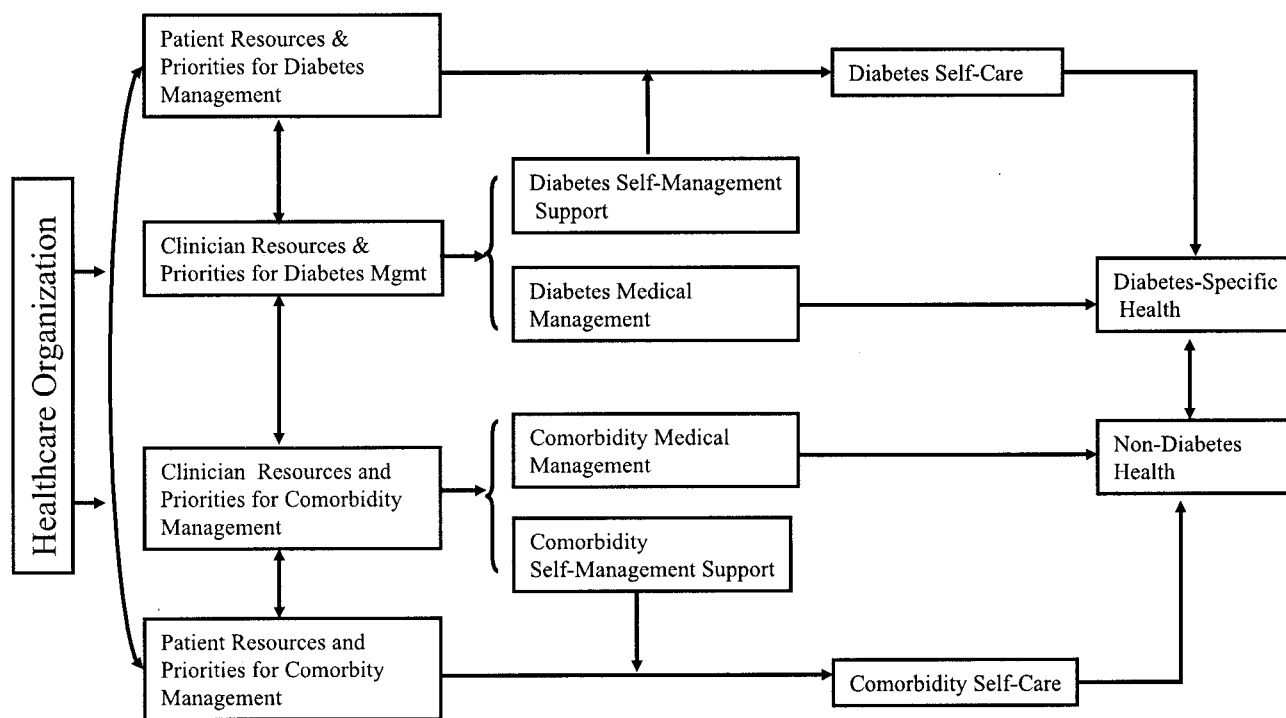
In Fig. 1, we present a framework for considering the ways in which comorbid chronic conditions can influence diabetic patients' medical care, self-management, and outcomes. Such a framework may assist health systems and researchers in developing more effective models for improving diabetes care in the context of comorbidities. The model suggests points of intervention for improving systems of care for diabetic patients with comorbid illnesses, using strategies such as increasing patients' resources for self-management

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**Figure 1**—The interplay between diabetes management and management of comorbid chronic conditions.

between visits (e.g., through telephone care) as well as by helping clinicians identify important priorities during encounters (e.g., with evidence-based decision supports). The model also provides a framework for understanding why diabetes-specific health system changes sometimes have little impact on patients' overall functioning, health status, and service use; when nondiabetes conditions are present, their associated self-care barriers and treatment needs may mute the impact of even the most well-considered diabetes-specific interventions. Below, we highlight what is and is not known about the management of multimorbid diabetic patients and areas for future health systems research to promote more effective care of their complex needs.

**Typologies for comorbid chronic conditions**

**State of the science.** Clearly, not all comorbidities are the same, and their characteristics may well influence how health care systems, clinicians, and patients approach their management relative to diabetes care. In the past, researchers examining the influence of comorbidities on diabetic patients' treatment and outcomes often have taken one of two approaches.

Many studies examining diabetes and comorbidity have focused on specific

conditions such as depression (17,35) under the assumption that the condition's impact on diabetes care is primarily due to its unique pathophysiology, symptoms, and treatment challenges. Such clinically focused research has led to important insights, although one recent rigorous trial evaluating health system changes to improve care for comorbid depression found little impact on diabetes-specific outcomes (36). By focusing too narrowly on the unique characteristics of individual comorbid illnesses, researchers and clinicians may miss larger patterns in the ways that treatments for diabetes and comorbidities interact.

Other studies (21,32) have used simple counts of diagnoses or other unidimensional scores as a means of capturing the effect of comorbidity on diabetic patients' resource use and health status. Implicit in this strategy is the assumption that all comorbid conditions have a similar effect, and that their overall impact on patients' lives is driven primarily by the number of conditions being managed. Such measures may capture the overall burden of illness (37,38), but they cannot identify the characteristics of comorbid conditions that influence how patients and clinicians make decisions about diabetes care.

Research examining the impact of comorbidities on diabetes care needs to

move beyond these familiar approaches. General dimensions of comorbid conditions may be relevant when designing health systems for multimorbid patients (Fig. 2). Some of these key features of comorbidities are described below.

**Clinically dominant comorbid conditions.** Some comorbid conditions are so complex or serious that they eclipse the management of other health problems, including diabetes. Conditions associated with a significantly shortened life expectancy (e.g., stage IV lung cancer or class IV heart failure) may appropriately preclude attention to patients' diabetes-related risk factors for longer-term adverse events. Often, diabetes itself represents the most serious long-term risk to patients, but conditions such as depression or low back pain may dominate self-care and medical management soon after they are diagnosed or after a change in treatment plan. Some conditions may be considered dominant by clinicians or patients even though continued vigilance to diabetes care is warranted. For example, a study of patients with HIV disease found that 72% of those hospitalized in the prior year were admitted exclusively for non-HIV related conditions; 14% were admitted for both HIV and non-HIV disorders, and only 14% were admitted exclusively for complications of

### Clinically Dominant Conditions

*Definition: Comorbid chronic conditions that are so complex or serious that they eclipse the management of other health problems (in the short-term or long-term).*

- End-stage disease
  - Metastatic renal cell carcinoma
  - End-stage renal failure
  - Severe cognitive impairment/dementia
- Severely symptomatic
  - Class IV chronic heart failure
  - Severe depression
- Recently diagnosed
  - Breast cancer
  - Rheumatoid arthritis

### Concordant versus Discordant Chronic Conditions

*Definition: Concordant conditions represent parts of the same overall pathophysiologic risk profile and are more likely to be the focus of the same disease and self management plan. Discordant treatments are not directly related in either their pathogenesis or management.*

- Concordant with diabetes:
  - Hypertension, coronary artery disease, peripheral vascular disease
- Discordant with diabetes:
  - Chronic low back pain, prostate cancer, asthma

### Symptomatic versus Asymptomatic Chronic Conditions

*Definition: Treatment for symptomatic chronic conditions focuses on improving patients' symptom profile, functioning and quality of life, and may also delay or prevent poor long-term outcomes. Treatment for asymptomatic chronic conditions focuses almost exclusively on preventing downstream adverse events and early mortality.*

- Symptomatic
  - Depression, rheumatoid arthritis, gastroesophageal reflux disease, angina
- Asymptomatic
  - Hypertension, hyperlipidemia, moderately poor glycemic control

**Figure 2**—Typologies of comorbid chronic conditions.

their HIV infection (39). For patients with diabetes and HIV, attention to cardiovascular disorders may be as important as attention to their immune system impairment, but HIV may dominate the attention of both patients and their clinicians (particularly HIV specialists).

**Concordant versus discordant comorbidities.** Some conditions (e.g., diabetes and hypertension) are “concordant” because they represent parts of the same overall pathophysiologic risk profile and are more likely to be the focus of the same disease management plan. In contrast, unrelated or “discordant” conditions (e.g., diabetes and irritable bowel syndrome) are not directly related in either their pathogenesis or management and do not share an underlying predisposing factor (40). Because there is limited time to address all patient needs, diabetic patients may receive lower quality medical care for discordant conditions. For example, Redelmeier et al. (40) showed that women with diabetes were less likely than others to be prescribed hormone replace-

ment therapy. Diabetes guidelines often make specific recommendations for concordant conditions but are silent with respect to discordant health problems (41).

Although the concept of concordance is attractive, not all studies have found that discordant conditions are associated with poorer diabetes care. Desai et al. (42) found that patients with diabetes and comorbid mental disorders were as likely as other diabetic patients to receive foot inspections, retinal exams, and A1C tests. In a more recent study, Dixon et al. (43) found that diabetic patients with schizophrenia actually had better glycemic control than those without serious mental illness (adjusted mean A1C of 7.7 vs. 9.0%). These studies suggest that the impact of comorbidities on diabetes management may have less to do with concordance than with their influence on patients' exposure to health system supports. Even discordant conditions may increase the overall number of outpatient contacts and, as a result, opportunities for

diabetes-related health monitoring and counseling may be greater.

**Symptomatic versus asymptomatic chronic comorbidities.** Many clinicians assume that managing bothersome symptoms is of greater concern for patients with diabetes than managing underlying risk factors such as hyperglycemia. However, we know very little about how people with diabetes and their clinicians emphasize management of symptomatic conditions such as back pain versus asymptomatic chronic diseases. Recent studies of cost-related medication adherence problems suggest that patients are often less likely to forego treatment for conditions such as diabetes and hypertension than treatments aimed mainly at symptom relief (e.g., analgesics) (44–47). Studies of medication adherence across drug classes often classify treatments for asymptomatic conditions with preventable acute consequences as essential treatments, while drugs such as analgesics and muscle relaxants are considered nonessential or discretionary (48). This nomenclature suggests that (at least among some researchers), life-extending treatments are sometimes more highly valued than treatments that improve patients' functioning.

**Unanswered questions about the characteristics of comorbid conditions.** The typologies in Fig. 2 represent possible ways of classifying comorbid conditions, but there has been almost no research on whether one of these approaches (or another approach not described here) provides the most useful information to clinicians and researchers. The concept of concordance with diabetes care deserves further consideration, but researchers need to tease out the negative effects of discordant disease management from the positive impacts associated with increasing patients' overall health system use. Studies of the quality of care for diabetic patients with serious mental illness provide a fascinating counterpoint to our expectations and demonstrate that we have much to learn about the ways in which diabetes and comorbidities interact. One might expect that conditions associated with more frequent visits would have a stronger positive association with diabetes care processes when systems are in place to identify patients for needed diabetes services regardless of their reason for seeking care. Research comparing diabetes treatment quality among patients with serious mental illness in health care systems that vary in their resources for

chronic illness care would shed light on this intriguing question. Finally, we need to understand the ways in which the characteristics of comorbid conditions affect diabetic patients' willingness and ability to manage self-care tasks. Qualitative studies may be particularly useful to glean from patients themselves how they make sense of their health care needs and what characteristics of their health conditions matter to them most.

### Setting treatment priorities

Although diabetic patients with comorbid chronic illnesses may receive more care overall, there are limits on the resources available for managing patients' multiple health care needs. Clinicians and patients often must set priorities and focus on specific health care goals, while attending less to other clinical problems.

**Clinician priorities.** Given intensive time constraints, clinicians often must make decisions about where to focus treatment priorities during outpatient encounters (11,49,50). For patients with diabetes and comorbidities, it may be unrealistic to address all health problems all of the time. Unfortunately, physicians receive no explicit education or training in how to prioritize care given a patient's comorbidities and risk factors. Hofer et al. (51) examined physicians' diabetes care goals and found that many identified blood pressure control as a relatively low priority, in contrast to clinical trial evidence. Another review suggests that blood pressure control may be "the most important factor in preventing adverse outcomes for type 2 diabetic patients" but did not take into account the management of comorbidities such as chronic pain that may be high on patients' agenda (52). Given the complex task of prioritizing treatment goals within diabetes care itself (e.g., balancing blood pressure versus glycemic control), prioritizing targets across multiple chronic conditions remains a daunting challenge. Too often, visit-specific goals are determined only by patients' chief complaints, and clinicians' attention frequently is driven by defined quality indicators rather than patients' overall needs (51,53). A more rational approach to setting both short- and long-term treatment priorities is clearly needed.

**Patient priorities.** Patients juggling multiple chronic conditions also must set priorities for their health and self-care, although the basis for those decisions is unclear. Diabetes patients' knowledge of

hypertension risk is limited, (54,55) and many patients do not identify blood pressure management as one of their primary health goals (56,57). While the process through which patients derive priorities is murky, we do know that diabetic patients and their clinicians often disagree about what their top priorities are. In a study of diabetic patients and their physicians, only 63% of pairs agreed that glycemic control was one of their top priorities, and only 38% of pairs agreed that medication taking was one of their most important treatment strategies (56).

**Unanswered questions about priority setting.** For patients with diabetes and comorbid conditions, priority setting is unavoidable. The only choice is whether to set those priorities explicitly and rationally, or (as often occurs) based on unclear or even random criteria. We need to know more about how clinicians prioritize diabetes management goals relative to the management of comorbid illnesses, including how health systems affect these choices, the stability of these decisions over time, and the ways in which patients' multiple providers either share goals or work at cross-purposes. A few studies suggest strategies for clinical priority setting that may help providers maximize population-level outcomes (58–60). Health system interventions designed to use these strategies to assist diabetes care providers in identifying rational treatment priorities would be valuable. However, priority setting is not solely a rational exercise, and more discussion is needed about the values that ought to drive these decisions. To what extent should patients determine their own treatment priorities? Do impacts on patients' current quality of life matter more or less than potential downstream consequences? What about the effect of treatment prioritization on the cost of care to people with diabetes? What about the cost to their health plan or society as a whole? Balancing these often conflicting values is by no means easy and remains a critical area for further study.

We know almost nothing about how diabetic patients rate the importance of their diabetes-specific self-management behaviors, treatments, and outcomes relative to those of comorbid conditions such as chronic pain or depression. Patients' priorities may vary substantially over the life course or based on factors such as their sociocultural context, financial resources, or social supports. Understanding patients' priorities and the ways

they are derived may provide insight into their adherence to diabetes self-management tasks and the impact of diabetes-focused interventions.

### Improving health systems for multimorbid diabetic patients

Health care systems need to be redesigned to meet the needs of patients with chronic conditions such as diabetes (61–64), and some leaders in the field have begun to discuss health system features that are important to improve care for patients with complex multimorbidity (37,65–67). Comorbid conditions and their treatments often interact, and it is critical that treatment be coordinated by a single provider or provider team with an understanding of the patient's many challenges. Care managers and clinical pharmacists can aid in coordinating activities within a patient's complex medical care regimen (68–70). Patients must play a central role in coordinating their own care and need appropriate resources to do so. Information technology, including e-mail and automated telephone calls, can facilitate communication between patients and providers between outpatient encounters and circumvent the time constraints on communication during office visits (71).

**Unanswered questions about health system changes.** Researchers have tested many of the care management components mentioned above in quality improvement interventions focused on specific diseases. The current challenge is to test these elements in the context of improving the overall quality of care for diabetic patients with a variety of coexisting conditions. For patients with multiple health problems, treatment plans may vary based on goals negotiated between them and their clinicians (56). Health system changes that foster such collaborative goal setting may be important to foster clinician trust and patients' adherence to treatment plans (56,72,73). Unfortunately, few research methods are available to measure treatment success when patients vary in their management goals. Rather, standard research models often require that interventions to improve diabetes care focus on a single, measurable end point, such as A1C. Goal attainment scaling is one strategy for evaluating health system changes for multimorbid diabetic patients that takes their variable treatment priorities and abilities into account (74–76). Despite recent attention in geriatrics, nursing, and other fields, no published studies have examined the use

of goal attainment scaling as a means for evaluating the success of interventions among diabetic patients with multiple, variable health care needs.

Indicators used to monitor the quality of diabetes care typically focus on technical treatment processes such as monitoring and control of hyperglycemia. However, for patients with diabetes and concurrent chronic diseases, it may be impossible and even inappropriate to maximize all processes and physiological control outcomes at the same time. More sophisticated quality measures are required that take a broader view of patients' clinical needs. For example, measures could incorporate importance weights that reflect either the likelihood of benefit or patient preferences. How best to develop such weights or the impact of these measures on patients' care are both currently unstudied. Measures that assess providers' willingness to discuss treatment options and provide self-management support may more fully capture the quality of multimorbid patients' care. Such measures also may provide better incentives to provide these patients with coordinated, patient-centered services rather than to focus narrowly on quality indicators that may have less impact on patients' overall health. The Patient Assessment of Chronic Illness Care is one recent example of the types of patient-centered measures that may move the science in this area forward (77).

## Conclusions

Clinicians and researchers have established evidence-based guidelines for diabetes care, and most recognize the need to reorganize health systems to better serve diabetic patients. Despite these advances, many health system changes have focused only narrowly on diabetes management or the management of other chronic diseases such as hypertension or depression. People with diabetes often struggle with these comorbid conditions simultaneously and frequently have other health problems as well. We are just beginning to define strategies for addressing the challenges presented by this complexity. Essential research remains to be done on how to best organize care for diabetic patients with comorbid conditions to maximize clinical outcomes and quality of life, including research on how to help patients and clinicians set management priorities and on how to evaluate the quality of care these patients receive. As the proportion of diabetic patients with multi-

morbidity continues to rise, the challenge of integrating their care is one that we cannot afford to ignore.

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## References

1. Druss BG, Marcus SC, Olfson M, Taniguchi T, Elinson L, Pincus HA: Comparing the national economic burden of five chronic conditions. *Health Aff (Millwood)* 20:233–241, 2001
2. Wolff JL, Starfield B, Anderson G: Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. *Arch Intern Med* 162:2269–2276, 2002
3. Maddigan SL, Feeny DH, Johnson JA: Health-related quality of life deficits associated with diabetes and comorbidities in a Canadian National Population Health Survey. *Qual Life Res* 14:1311–1320, 2005
4. Jha AK, Perlin JB, Kizer KW, Dudley RA: Effect of the transformation of the Veterans Affairs Health Care System on the quality of care. *N Engl J Med* 348:2218–2227, 2003
5. Wilson C, Gilliland S, Cullen T, Moore K, Roubideaux Y, Valdez L, Vanderwagen W, Acton K: Diabetes outcomes in the Indian health system during the era of the Special Diabetes Program for Indians and the Government Performance and Results Act. *Am J Public Health* 95:1518–1522, 2005
6. McClain MR, Wennberg DE, Sherwin RW, Steinmann WC, Rice JC: Trends in the diabetes quality improvement project measures in Maine from 1994–1999. *Diabetes Care* 26:597–601, 2003
7. Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A: Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)* 20:64–78, 2001
8. Eurich DT, Majumdar SR, Tsuyuki RT, Johnson JA: Reduced mortality associated with the use of ACE inhibitors in patients with type 2 diabetes. *Diabetes Care* 27:1330–1334, 2004
9. Maciejewski ML, Maynard C: Diabetes-related utilization and costs for inpatient and outpatient services in the Veterans Administration. *Diabetes Care* 27 (Suppl. 2):B69–B73, 2004
10. Tierney EF, Cadwell BL, Engelgau MM, Shireley L, Parsons SL, Moum K, Geiss LS: Declining mortality rate among people with diabetes in North Dakota, 1997–2002. *Diabetes Care* 27:2723–2725, 2004
11. Yarnall KS, Pollak KI, Ostbye T, Krause KM, Michener JL: Primary care: is there enough time for prevention? *Am J Public Health* 93:635–641, 2003
12. Stange KC, Woolf SH, Gjelteme K: One minute for prevention: the power of leveraging to fulfill the promise of health behavior counseling. *Am J Prev Med* 22:320–323, 2002
13. Koseoff J, Kahn KL, Rogers WH, Reinsch EJ, Sherwood MJ, Rubenstein LV, Draper D, Roth CP, Chew C, Brook RH: Prospective payment system and impairment at discharge: the 'quicker-and-sicker' story revisited. *JAMA* 264:1980–1983, 1990
14. Grembowski D, Paschane D, Diehr P, Katon W, Martin D, Patrick DL: Managed care, physician job satisfaction, and the quality of primary care. *J Gen Intern Med* 20:271–277, 2005
15. Murray A, Montgomery JE, Chang H, Rogers WH, Inui T, Safran DG: Doctor discontent: a comparison of physician satisfaction in different delivery system settings, 1986 and 1997. *J Gen Intern Med* 16:452–459, 2001
16. Dugdale DC, Epstein R, Pantilat SZ: Time and the patient-physician relationship (Review). *J Gen Intern Med* 14 (Suppl. 1):S34–S40, 1999
17. Ciechanowski PS, Katon WJ, Russo JE: Depression and diabetes: impact of depressive symptoms on adherence, function, and costs. *Arch Intern Med* 160:3278–3285, 2000
18. Krein SL, Heisler M, Piette JD, Makki F, Kerr EA: The effect of chronic pain on diabetes patients' self-management. *Diabetes Care* 28:65–70, 2005
19. Schoenberg NE, Drungle SC: Barriers to non-insulin dependent diabetes mellitus (NIDDM) self-care practices among older women. *J Aging Health* 13:443–466, 2001
20. Ware JE: *SF-36 Health Survey: Manual and Interpretation Guide*. Boston, Massachusetts, The Health Institute, New England Medical Center, 1993
21. Glasgow RE, Dryfoos J, Ruggiero L, Chobanian L, Eakin E: Quality of life and associated characteristics in a large sample of adults with diabetes. *Diabetes Care* 20:562–567, 1997
22. Jaen CR, Stange KC, Nutting PA: Competing demands of primary care: a model for the delivery of clinical preventive services (Review). *J Fam Pract* 38:166–171, 1994
23. Chernof BA, Sherman SE, Lanto AB, Lee ML, Yano EM, Rubenstein LV: Health habit counseling amidst competing de-

- mands: effects of patient health habits and visit characteristics. *Med Care* 37:738–747, 1999
24. Safford MM, Russell L, Dong-Churl S, Roman S, Pogach L: How much time do patients with diabetes spend on self-care? *J Am Board Fam Pract* 18:262–270, 2005
  25. Russell LB, Suh DC, Safford MA: Time requirements for diabetes self-management: too much for many? *J Fam Pract* 54:52–56, 2005
  26. Bayliss EA, Steiner JF, Fernald DH, Crane LA, Main DS: Descriptions of barriers to self-care by persons with comorbid chronic diseases. *Ann Fam Med* 1:15–21, 2003
  27. Hitchcock P, Frueh C, Larne AC, Pugh JA: Collaborative care needs and preferences of primary care patients with multimorbidity. *Health Expect* 8:54–63, 2005
  28. Rogowsky J, Lillard LA, Kington R: The financial burden of prescription drug use among elderly persons. *Gerontologist* 37:475–482, 1997
  29. Dubois RW, Chawla AL, Neslusan CA, Smith MW, Wade S: Explaining drug spending trends: does perception match reality? *Health Aff (Millwood)* 19:231–239, 2000
  30. Karter AJ, Stevens MR, Herman WH, Ettner S, Marrero DG, Safford MM, Engelgau MM, Curb JD, Brown AF, the Translating Research Into Action for Diabetes Study Group: Out-of-pocket costs and diabetes preventive services: the Translating Research into Action for Diabetes (TRIAD) Study. *Diabetes Care* 26:2294–2299, 2003
  31. Piette JD, Heisler M, Wagner TH: Problems paying out-of-pocket medication costs among older adults with diabetes. *Diabetes Care* 27:384–391, 2004
  32. Piette JD, Wagner TH, Potter MB, Schillinger D: Health insurance status, cost-related medication underuse, and outcomes among diabetes patients in three systems of care. *Med Care* 42:102–109, 2004
  33. Heisler M, Wagner T, Piette JD: Patient strategies to cope with high prescription medication costs: who is cutting back on necessities, increasing debt, or underusing medications? *J Behav Med* 28:43–51, 2005
  34. Bodenheimer T, Wagner EH, Grumbach K: Improving primary care for patients with chronic illness. *JAMA* 288:1775–1779, 2002
  35. Piette JD, Richardson C, Valenstein M: Addressing the needs of patients with multiple chronic illnesses: the case of diabetes and depression. *Am J Manag Care* 10:152–162, 2004
  36. Katon WJ, Von Korff M, Lin EH, Simon G, Ludman E, Russo J, Ciechanowski P, Walker E, Bush T: The Pathways Study: a randomized trial of collaborative care in patients with diabetes and depression. *Arch Gen Psychiatry* 61:1042–1049, 2004
  37. Starfield B, Lemke KW, Bernhardt T, Folds SS, Forrest CB, Weiner JP: Comorbidity: implications for the importance of primary care in ‘case’ management. *Ann Fam Med* 1:8–14, 2003
  38. Fultz NH, Ofstedal MB, Herzog AR, Wallace RB: Additive and interactive effects of comorbid physical and mental conditions on functional health. *J Aging Health* 15:465–481, 2003
  39. Betz ME, Gebo KA, Barber E, Sklar P, Fleishman JA, Reilly ED, Christopher Mathews W, HIV Research Network: Patterns of diagnoses and hospital admissions in a multi-state cohort of HIV-positive adults in 2001. *Medical Care* 43 (Suppl. 9):III3–III14, 2005
  40. Redelmeier DA, Tan SH, Booth GL: The treatment of unrelated disorders in patients with chronic medical diseases. *N Engl J Med* 338:1516–1520, 1998
  41. Boyd CM, Darer J, Boulton C, Fried LP, Boulton L, Wu AW: Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. *JAMA* 294:716–724, 2005
  42. Desai MM, Rosenheck RA, Druss BG, Perlin JB: Mental disorders and quality of diabetes care in the veterans health administration. *Am J Psychiatry* 159:1584–1590, 2002
  43. Dixon LB, Kreyenbuhl JA, Dickerson FB, Donner TW, Brown CH, Wohlheiter K, Postrado L, Goldberg RW, Fang L, Marano C, Messias E: A comparison of type 2 diabetes outcomes among persons with and without severe mental illnesses. *Psychiatr Serv* 55:892–900, 2004
  44. Piette JD, Heisler M, Horne R, Alexander GC: A conceptually based approach to understanding chronically ill patients’ responses to medication cost pressures. *Soc Sci Med* 2005
  45. Martin BC, McMillan JA: The impact of implementing a more restrictive prescription limit on Medicaid recipients. *Med Care* 34:686–701, 1996
  46. Stuart B, Grana J: Ability to pay and the decision to medicate. *Med Care* 36:202–211, 1998
  47. Harris BL, Stergachis A, Ried LD: The effect of drug co-payments on utilization and cost of pharmaceuticals in a health maintenance organization. *Med Care* 28:907–917, 1990
  48. Soumerai SB, McLaughlin TJ, Ross-Degnan D: Utilization of essential medications by vulnerable older people after a drug benefit cap: importance of mental disorders, chronic pain, and practice setting. *J Am Geriatr Soc* 49:793–797, 2001
  49. Townsend A, Hunt K, Wyke S: Managing multiple morbidity in mid-life: a qualitative study of attitudes to drug use. *BMJ* 327:837, 2003
  50. Ostbye T, Yarnall KS, Krause KM, Pollak KI, Gradison M, Michener JL: Is there time for management of patients with chronic diseases in primary care? *Ann Fam Med* 3:209–214, 2005
  51. Hofer TP, Zemencuk JK, Hayward RA: When there is too much to do: how practicing physicians prioritize among recommended interventions. *J Gen Intern Med* 19:646–653, 2004
  52. Vijan S, Hayward RA: Treatment of hypertension in type 2 diabetes mellitus: blood pressure goals, choice of agents, and setting priorities in diabetes care. *Ann Intern Med* 138:593–602, 2003
  53. Asch SM, McGlynn EA, Hogan MM, Hayward RA, Shekelle P, Rubenstein L, Keesey J, Adams J, Kerr EA: Comparison of quality of care for patients in the Veterans Health Administration and patients in a national sample. *Ann Intern Med* 141:938–945, 2004
  54. Hedner T, Hansson L, Jern S: Is hypertension a risk factor for cancer? *Blood Press* 6:132–133, 1997
  55. Egan BM, Lackland DT, Cutler NE: Awareness, knowledge, and attitudes of older americans about high blood pressure: implications for health care policy, education, and research. *Arch Intern Med* 163:681–687, 2003
  56. Heisler M, Vijan S, Anderson RM, Ubel PA, Bernstein SJ, Hofer TP: When do patients and their physicians agree on diabetes treatment goals and strategies, and what difference does it make? *J Gen Intern Med* 18:893–902, 2003
  57. Moser M: No surprises in blood pressure awareness study findings: we can do a better job. *Arch Intern Med* 163:654–656, 2003
  58. Granata AV, Hillman AL: Competing practice guidelines: using cost-effectiveness analysis to make optimal decisions. *Ann Intern Med* 128:56–63, 1998
  59. Coffield AB, Maciosek MV, McGinnis JM, Harris JR, Caldwell MB, Teutsch SM, Atkins D, Richland JH, Haddix A: Priorities among recommended clinical preventive services. *Am J Prev Med* 21:1–9, 2001
  60. Maciosek MV, Coffield AB, McGinnis JM, Harris JR, Caldwell MB, Teutsch SM, Atkins D, Richland JH, Haddix A: Methods for priority setting among clinical preventive services. *Am J Prev Med* 21:10–19, 2001
  61. Von Korff M, Gruman J, Schaefer J, Curry SJ, Wagner EH: Collaborative management of chronic illness. *Ann Intern Med* 127:1097–1102, 1997
  62. Vladeck BC: You can’t get there from here: obstacles to improving care of the chronically ill. *Health Aff (Millwood)* 20:175–179, 2001
  63. Bodenheimer T, Wagner EH, Grumbach K: Improving primary care for patients with chronic illness: the chronic care model, part 2. *JAMA* 288:1909–1914, 2002
  64. Committee on Quality of Health Care in

- America: Institute of Medicine. In *Crossing the Quality Chasm*. Washington, DC, National Academy Press, 2001
65. Grumbach K: Chronic illness, comorbidities, and the need for medical generalism. *Ann Fam Med* 1:4–7, 2003
  66. Casalino LP: Disease management and the organization of physician practice. *JAMA* 293:485–488, 2005
  67. DeBusk RF, West JA, Miller NH, Taylor CB: Chronic disease management: treating the patient with disease(s) vs treating disease(s) in the patient. *Arch Intern Med* 159:2739–2742, 1999
  68. Weingarten SR, Henning JM, Badamgarav E, Knight K, Hasselblad V, Gano A Jr, Ofman JJ: Interventions used in disease management programs for patients with chronic illness—which ones work? Meta-analysis of published reports. *Br Med J* 325:925–932, 2002
  69. Kneight K, Badamgarav E, Henning JM, Hasselblad V, Gano AD Jr, Ofman JJ, Weingarten SR: A systematic review of diabetes disease management programs. *Am J Manag Care* 11:242–250, 2005
  70. Tsai AC, Morton SC, Mangione CM, Kessler EB: A meta-analysis of interventions to improve care for chronic illnesses. *Am J Manag Care* 11:478–488, 2005
  71. Glasgow RE, Bull SS, Piette JD, Steiner JF: Interactive behavior change technology: a partial solution to the competing demands of primary care. *Am J Prev Med* 27:80–87, 2004
  72. Von Korff M, Gruman J, Schaefer J, Curry SJ, Wagner EH: Collaborative management of chronic illness. *Ann Intern Med* 127:1097–1102, 1997
  73. Olivarius NF, Beck-Nielsen H, Andreasen AH, Horder M, Pedersen PA: Randomized controlled trial of structured personal care of type 2 diabetes mellitus. *Br Med J* 323:970–975, 2001
  74. Rockwood K, Howlett S, Stadnyk K, Carver D, Powell C, Stolee P: Responsiveness of goal attainment scaling in a randomized controlled trial of comprehensive geriatric assessment. *J Clin Epidemiol* 56:736–743, 2003
  75. Becker H, Stuijbergen A, Rogers S, Timmerman G: Goal attainment scaling to measure individual change in intervention studies. *Nurs Res* 49:176–180, 2000
  76. Fisher K, Hardie RJ: Goal attainment scaling in evaluating a multidisciplinary pain management programme. *Clin Rehabil* 16:871–877, 2002
  77. Glasgow RE, Wagner EH, Schaefer J, Mahoney LD, Reid RJ, Greene SM: Development and validation of the Patient Assessment of Chronic Illness Care (PACIC). *Med Care* 43:436–444, 2005