

Public Health Practice and Diabetes—What More Can Be Done to Halt the Epidemic?

a report by

Ann Albright, PhD, RD

Director, Division of Diabetes Translation, Centers for Disease Control and Prevention (CDC)

DOI: 10.17925/USE.2008.04.2.16

As diabetes prevalence and incidence continue to grow at unprecedented rates,¹ addressing diabetes as a public health problem is more important than ever before. Treating diabetes as a public problem means understanding and appreciating that it affects not only individuals but also families, communities, and society. In order to halt or substantially slow the diabetes epidemic, we need to take action in each of these arenas. The Ecological Model of Health Behavior (see *Figure 1*) provides a framework for understanding the multiple levels of influence on health behavior.² The further you move from the individual to societal interventions, the more complex and multifactorial the approaches become, the longer it can take to achieve change, and the more difficult it is to evaluate, but the impact is more far-reaching.

While much of the work in improving diabetes outcomes has focused on clinical care, there is growing recognition that improving diabetes prevention and control also requires public health approaches that are complementary to what can be achieved in clinical care.^{3,4} Glasgow et al.⁵ defined a public health approach to diabetes as “a broad, multidisciplinary perspective that is concerned with improving outcomes in all people who have (or are at risk for) diabetes, with attention to equity and the most efficient use of resources in ways that enhance patient and community quality of life.” For people with diabetes, medical concerns are not the only factors that need to be managed: lifestyle, family, psychosocial, cultural, and economic matters also warrant attention. For people at high risk for developing type 2 diabetes (often referred to as pre-diabetes), the non-medical factors are even more important. Reducing the diabetes epidemic will require that the healthcare delivery ‘system’ and the public health network interconnect (see *Figure 2*). The healthcare delivery system takes the lead in diagnosis and disease care, while the public health network picks up the baton in health protection, promotion, prevention, and preparation. There is a wide area in which the healthcare delivery system and the public health network should work hand-in-hand.



Ann Albright, PhD, RD, is Director of the Division of Diabetes Translation at the Centers for Disease Control and Prevention (CDC), where she leads a team dedicated to eliminating the preventable burden of diabetes through leadership, research, programs, and policies that translate research into practice. She is published in the areas of exercise, nutrition, diabetic nephropathy, improving diabetes care delivery, and public health practice. Dr Albright served as the Senior Health Policy Advisor in the Office of the United States Surgeon General and is Immediate Past President of the American Diabetes Association (ADA).

E: aga6@cdc.gov

Improving Personal and Population-based Health Services

Monitoring the nation’s health through surveillance data is a major public health function. In addition to monitoring prevalence (number of cases at a given point in time) and incidence (number of new cases in a given period of time) of diabetes, surveillance data provide important information on preventive care practices. Using the National Health and Nutrition Examination Survey (NHANES) (1988–1994 and 1999–2002) and the Behavioral Risk Factor Surveillance Survey (1995 and 2002) information for those 18–75 years of age who had reported a diagnosis of diabetes, data were obtained on diabetes processes and outcome measures of care. Although care remains short of current recommendations, annual lipid testing, dilated eye and foot examinations, self-monitoring of blood glucose level, and adoption of aspirin use and pneumococcal and influenza vaccinations have significantly improved. Large improvements in lipid control and some improvements in glycemic control have also occurred, but blood pressure control has not improved.⁵ Another study using NHANES data from 1971 to 2000 examined cardiovascular disease risk factors, including cholesterol, blood pressure, and smoking, among people with diabetes.⁷ The prevalence of high cholesterol, high blood pressure, and smoking declined by 17, 27, and 15%, respectively, during the three decades. Reduction in mean total cholesterol tended to be greater among men than women and in older (60–74 years of age) than younger (20–59 years of age) adults. Improvements in mean blood pressure tended to stop after 1988–1994. Reduction in smoking prevalence was mainly in earlier decades (1970s and 1980s) among men and in the 1990s among women.

A national multicenter study at the Centers for Disease Control and Prevention (CDC)—Translating Research into Action for Diabetes (TRIAD)—was conducted to determine how managed care systems influence the process and outcomes of diabetes care.⁸ The six research centers participating in this study collaborated with 10 health plans and 66 provider groups that care for approximately 180,000 patients with diabetes. The health plans participating in TRIAD include staff model health maintenance organizations, network/independent practice association model health maintenance organizations, point-of-service plans, and preferred provider organizations. They include profit, not-for-profit, Medicare, and Medicaid providers. The study analyzed system-level characteristics and services and patient-level factors. One of the primary findings was that intensity of disease management strongly related to better processes of care (i.e. receiving a glycosylated hemoglobin [HbA_{1c}] or lipid measurement), but not with improved intermediate outcomes (i.e. in HbA_{1c} concentration or lipid level) or level of medication management. This finding reflects improvements in health system factors, but a continued gap between system and patient factors. Among

several other findings, TRIAD also showed that greater out-of-pocket costs (i.e. co-pays or non-coverage) are associated with lower rates of retinal exams, health education, and self-monitoring of blood glucose.⁹

The information on preventive care practices from national surveillance data and from the TRIAD study indicates that we are making improvements in some areas, but more progress is needed. Models such as the Chronic Care Model (CCM) can provide guidance for closing the gap between patient- and system-level outcomes.¹⁰ The CCM includes creating partnerships between health systems and communities. Communities need to be able to provide resources and policies that assist people in participating in healthy practices where they spend most of their time. The health system should provide self-management support, delivery system design, decision support, and clinical information systems that are necessary for improved outcomes. The CCM includes a prepared proactive practice team. A growing body of research has shown that enhanced use of non-physician healthcare providers following treatment algorithms and authority to make independent treatment decisions with physician supervision produces superior outcomes than those achieved with usual physician care.^{11–23} Improved outcomes included HbA_{1c}, fasting glucose, blood pressure, and triglycerides, low-density lipoprotein cholesterol, and total cholesterol levels. In one study,²¹ physicians identified lack of time and other conditions that needed their attention as the primary challenges to carrying out recommended treatment guidelines. In addition, healthcare provider knowledge, communication between patient and provider, and cultural differences between patient and provider have also been identified as barriers to good care. Nurses, dietitians, and pharmacists have specific training in educational strategies, nutrition, and medication management that can help address provider knowledge deficits. It was also suggested that healthcare professionals other than physicians may be able to more effectively communicate with patients because they are more likely to be a part of the local community and to be more aware of the attitudes and beliefs of patients.²¹

An informed, motivated patient is also critical to successful health outcomes and is part of the CCM. One important way to help accomplish this is through participation of community health workers. Community health workers provide a critical bridge between communities and healthcare systems, providing support and reinforcement of skills that help patients become better prepared to meet the demands of living with diabetes.^{24,25} Community health workers are even more likely than healthcare professionals to be considered part of the community and social network of many patient populations. The Institute of Medicine recommends that healthcare systems support the involvement of community health workers to address racial and ethnic disparities in healthcare.²⁶ Norris et al.²⁵ conducted a systematic review on the effectiveness of community health workers in the care of people with diabetes. The roles and responsibilities of community health workers in that review ranged from substantial involvement in patient care to providing assistance in education sessions taught by healthcare providers. Knowledge about diabetes and self-care increased significantly among participants in five of seven studies that reported on this outcome. Positive behavior changes in diet, physical activity, self-monitoring of blood glucose, and other self-care behaviors occurred in seven of the nine studies that evaluated such behaviors. Lipid levels

Figure 1: Ecological Model of Health Behavior

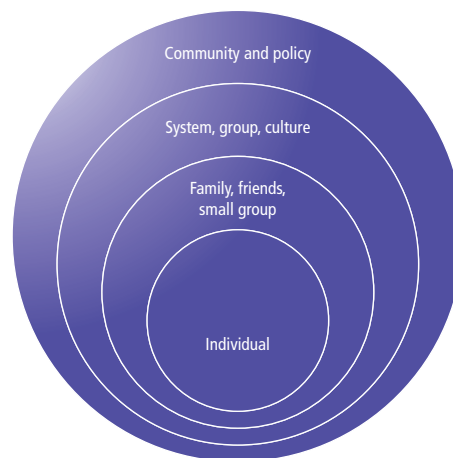
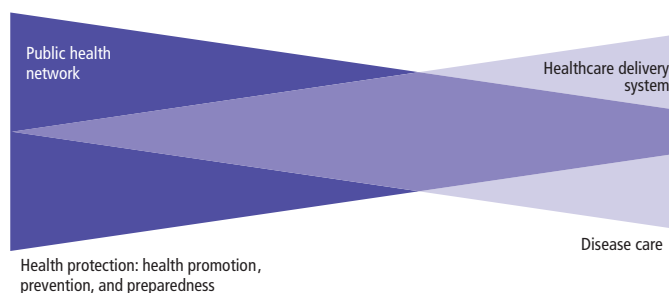


Figure 2: Interdependence of Public Health and Healthcare

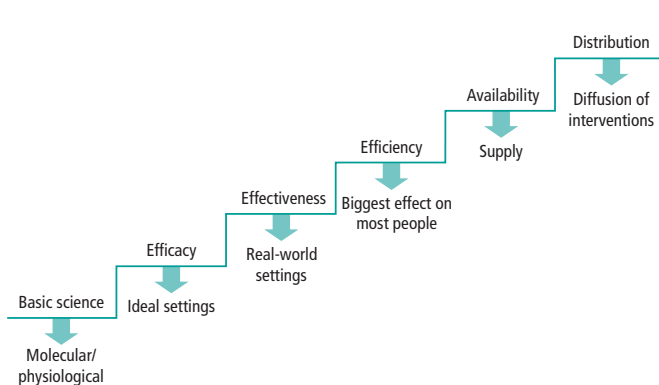


showed improvement in two of five studies and blood pressure decreased in two of four studies in which it was measured. Additional research with community health workers is needed, especially studies with strong designs and ones that identify specific characteristics of successful interventions.

Halting Health Disparities

Significant health disparities continue to exist in diabetes. Stopping the diabetes epidemic involves halting health disparities, which are evident in the number of adults who have diabetes, with American Indians and Pacific Islanders showing the highest prevalence, followed by African-American and Hispanic/Latinos.¹ These disparities persist among youth as well as adults.²⁷ Using National Health Interview Survey data and Markov chain modeling, the CDC projected the lifetime risk for developing diabetes in the US.²⁸ These data estimate that for individuals born in 2000, the lifetime risk for diagnosed diabetes is about one in three for males and two in five for females. The estimated lifetime risk is even higher among minority populations, with Hispanic females having about a one in two risk at birth and a one in three residual risk at 60 years of age. Disparities are also evident in diabetes complications,²⁹ risk factors for cardiovascular disease,⁷ and mortality from diabetes.³⁰ In the CDC TRIAD study, processes of care differed very little by race/ethnicity, but non-white patients had higher HbA_{1c} concentrations and African-Americans had higher systolic blood pressure than whites.³¹ No differences were found between Spanish- and English-speaking Latino patients for processes or outcomes of care.³²

Figure 3: Continuum of Translation



Adequately addressing health disparities will require a focus on the social determinants of health, such as housing, education, and employment.

Addressing Both Primary and Secondary/Tertiary Prevention

The diabetes epidemic is not just about the increasing number of people with the disease; it is also about the serious complications that can result from diabetes. Preventing the devastation that diabetes can cause requires that we address primary prevention (preventing the onset of diabetes) and secondary/tertiary prevention (preventing complications and worsening of complications). It cannot be an either/or proposition, even in a world of limited resources. Surveillance data from the CDC show that age-adjusted prevalence of visual impairment per 100 adults with diabetes in the US between 1997 and 2005 is showing a decline. The trends in the incidence of complications, including cardiovascular disease hospitalization, amputation, and end-stage renal disease, among persons with diabetes from 1980–2003 are showing a decline.³³ Much progress is needed in secondary/tertiary prevention because the human and economic costs of these complications are still too high.^{1,34} When looking at these complication data among the overall population, the trends are increasing, not decreasing, as in the population with diabetes. This is due to the fact that the number of people with diabetes is increasing as a proportion of the overall population. Consequently, primary prevention of diabetes is also a critical factor in halting the epidemic.

Several randomized controlled trials have been performed that demonstrate that type 2 diabetes can be prevented or postponed.^{35–37} The current challenge is taking what was learned in these trials and translating it into practice on a large enough scale to achieve a reduction in incident cases of type 2 diabetes. Emerging research and demonstration projects show that the curriculum tested in the Diabetes Primary Prevention Program trial can be successfully implemented by trained community organization staff (i.e. YMCA).³⁸ They can achieve similar weight-loss results to the research trials for much less money. Multiple prediction models have now shown that a structured lifestyle intervention can result in cost savings within two to three years if the direct costs of the intervention can be reduced to \$250–300 per year.³⁹

Improving Translation

Although there are still many unanswered questions that affect halting the diabetes epidemic, there is a significant body of existing knowledge

that remains to be translated from bench to bedside to community. This gap between evidence-based, efficacious interventions and what actually occurs in practice is significant.^{40,41} The term ‘translation’ is applied to both the type of research that seeks to answer questions that are directly applicable to real-world settings and more broadly to the act of transforming knowledge (i.e. research findings) into action (i.e. healthcare policies and community practices). It is helpful to look at the continuum of translation that moves from basic science to distribution (see Figure 3). Basic biological research is a crucial first step, followed by efficacy trials that seek to understand causal mechanisms and test interventions under ideal conditions. Effectiveness studies are carried out in real-world settings and offer important information about general applicability. The next steps to consider are efficiency, which seeks to identify ways to have the biggest effect on the most people, and then availability, which addresses supply. The final step is distribution, which addresses diffusion of the intervention.

The creation of new knowledge often does not on its own lead to widespread implementation or effects on health.⁴² Government and taxpayers would like to see the benefits of tax dollars invested in health research by moving research into policy, programs, and practices. Knowledge translation can be approached in two ways: end of grant or integrated knowledge translation. In end of grant translation, the researcher develops and implements a plan for making knowledge users aware of the knowledge that had been gained from the project. In integrated translation, researchers and knowledge users work together to shape the research process. Integrated knowledge translation should produce research findings that are more relevant to end users.

Glasgow and Emmons⁴³ described barriers to translation and the kinds of evidence needed to reduce the gap. One set of barriers is the characteristics of the interventions. Interventions that are intensive and very demanding for both staff and participants may prove efficacious, but can lack generalizability and be difficult to apply to a broader population outside of a research setting. To increase translation, it is suggested that more effort be placed on examining the minimal level of intensity that is likely to produce meaningful change and not just the maximum level required. In addition, the interventions may not be easily replicated by others because they are not packaged for easy implementation or there is no information about whether the interventions can be modified in any way. Collecting additional process evaluation data when interventions are being tested may help elucidate what permissible modifications can be made. The other set of translation barriers described by Glasgow and Emmons are the characteristics of the target settings (e.g. schools and community-based health centers), which most often have very limited resources, and the characteristics of the research design (e.g. small unrepresentative samples, failure to address matters important to local concerns). These barriers also influence the generalizability of the findings and make translation difficult.

To overcome some of the barriers it is important to consider the kinds of evidence that are necessary for translating research into practice. As there are many different kinds of evidence and each has its strengths and weaknesses, Glasgow and Emmons recommend integration of different kinds of evidence using mixed methods that combine the strengths of both quantitative and qualitative methods.⁴³ Study designs must incorporate the

principles of complex systems so that systems as a whole can be understood, not just the component parts.⁴⁴ Attention to contextual factors (e.g. personal, social, and economic costs) and connecting the multiple levels of influence that affect a health concern will enhance translation. The community-based participatory research method, where research actively involves community partners in all components of the research study, can enhance study relevance and translation. The contributions of community-based participatory research methods not only occur during the research study and make findings more relevant for implementation, but this form of research can also build community capacity and provide benefits far beyond the duration of the study.

Collaboration and Leadership

Halting the diabetes epidemic is a daunting task, but it must be achieved. Crucial to our success is enhancing collaboration among the many sectors that must be involved in achieving this goal. The job is too large for any one organization or sector to do alone. Collaboration is often assumed and not nurtured. It is helpful to consider that not all the ways we interact are collaborations and partnerships. We may be networking,

which is exchanging information for mutual benefit; co-ordinating, which is identifying and aligning complementary resources; or co-operating, which is altering and sharing resources for a common goal. Collaboration is true synergy to co-create and achieve mutual benefit. Effective collaborations are difficult, if not impossible, without leadership. There are different views on leadership, but reasonable evidence supports the paradigm often referred to as serving leaders⁴⁵ or level 5 leaders.⁴⁶ These leaders create an environment that allows others to excel, and among other things they are a blend of personal humility and professional will. We are in a critical time for diabetes prevention and control, filled with both significant concerns and tremendous opportunity. To realize the opportunities, we must clearly understand that diabetes is a public health problem and that halting the epidemic requires that we treat it as one. ■

Disclaimer

The findings and conclusions in this report are those of the author and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

- Centers for Disease Control and Prevention, *National diabetes fact sheet: general information and national estimates on diabetes in the US, 2007*, Atlanta, Georgia: Department of Health and Human Services, Centers for Disease Control and Prevention, 2008.
- McLeroy KR, Bibeau D, Steckler A, et al., An ecological perspective on health promotion, *Health Educ Quart*, 1998;15: 351–77.
- Vinitoro F, The public health burden of diabetes and reality of limits, *Diabetes Care*, 1998;21:C15–C18.
- Albright A, The public health approach to diabetes, *Am J Nurs*, 2007;107:39–42.
- Glasgow RE, Wagner EH, Kaplan RM, et al., If diabetes is a public health problem, why not treat it as one?, A population-based approach to chronic illness, *Ann Behav Med*, 1999;21:159–70.
- Saadine JB, Cadwell B, Gregg EW, et al., Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002, *Ann Intern Med*, 2006;144:465–74.
- Imperatorre G, Cadwell BL, Geiss L, et al., Thirty-year trends in cardiovascular risk factor levels among US adults with diabetes, *Am J Epidemiol*, 2004;160:531–39.
- Mangione CM, Gerzoff RB, Williamson DF, et al., for the TRIAD Study Group. The association between quality of care and the intensity of diabetes disease management programs, *Ann Intern Med*, 2006;145:107–16.
- Karter AJ, Stevens MR, Herman WH, et al., for the TRIAD Study Group. Out-of-pocket costs and diabetes preventive services: Translating Research Into Action for Diabetes Study Group, *Diabetes Care*, 2003;26:2294–9.
- Institute for Healthcare Improvement, Chronic Care Model. Available at: www.ihc.org/IHI/Topics/ChronicConditions
- Aubert RE, Herman WH, Waters J, et al., Nurse case management to improve glycemic control in diabetic patients in a health maintenance organization. A randomized controlled trial, *Ann Intern Med*, 1998;129:605–12.
- Davidson MB, Effect of nurse-directed diabetes care in a minority population, *Diabetes Care*, 2003;26:2281–7.
- Legorreta LC, Joung IMA, MacKenback JP, et al., Effect of a comprehensive nurse-managed diabetes program: An HMO study, *Am J Manag Care*, 1996;2:1024–30.
- Peters AL, Davidson MB, Application of a diabetes managed care program: The feasibility of using nurses and a computer system to provide effective care, *Diabetes Care*, 1998;21:1037–43.
- Taylor CB, Miller NH, Reilly KR, et al., Evaluation of a nurse care management system to improve outcomes in patients with complicated diabetes, *Diabetes Care*, 2003;26:1058–63.
- Phillis-Tsimikas A, Walker C, Rivard LR, et al., Improvement in diabetes care of underinsured patients enrolled in Project Dulce: community-based, culturally appropriate, nurse management and peer education diabetes care mode, *Diabetes Care*, 2004;27: 110–15.
- The California Medi-Cal T2DM Study Group. Closing the gap: Effect of diabetes case management on glucemic control among low-income ethnic minority populations, *Diabetes Care*, 2004;27: 95–103.
- Fanning EL, Selwyn BJ, Larme AC, DeFronzo RA, Improving efficacy of diabetes management using treatment algorithms in a mainly Hispanic population, *Diabetes Care*, 2004;27:1638–46.
- New JP, Mason JM, Freemantle N, et al., Specialist nurse-led interventions to treat and control hypertension and hyperlipidemia in diabetes (SPLINT): A randomized trial, *Diabetes Care*, 2003;26: 2250–55.
- Rothman RL, Malone R, Bryant B, et al., A randomized trial of a primary care-based disease management program to improve cardiovascular risk factors and glycated hemoglobin levels in patients with diabetes, *Am J Med*, 2005;118:276–84.
- Davidson MB, Castellanos M, Duran P, Karlan V, Effective diabetes care by a registered nurse following treatment algorithms in a minority population, *Am J Manag Care*, 2006;12:226–32.
- Davidson MB, Karlan VJ, Hair TL, Effect of a pharmacist-managed diabetes care program in a free medical clinic, *Am J Med Qual*, 2000;15:137–42.
- Leal S, Glover JJ, Herrier RN, Felix A, Improving quality of care in diabetes through a comprehensive pharmacist-based disease management program, *Diabetes Care*, 2004;27:2983–84.
- Witmer A, Seofor SD, Finocchio L, et al., Community health workers: Integral members of the health care workforce, *Am J Public Health*, 1995;85:1055–58.
- Norris SF, Chowdhury FM, Van Le K, et al., Effectiveness of community health workers in the care of persons with diabetes. *Diabet Med*, 2006;23:544–56.
- Smedley BD, Stith AY, Nelson AR, Institute of Medicine Committee on Understanding and Elimination Racial and Ethnic Disparities in Health Care, *Unequal treatment: Confronting racial and ethnic disparities*, Washington, DC: National Academies Press, 2003.
- SEARCH for Diabetes in Youth Study Group. The burden of diabetes mellitus among U.S. youth: Prevalence estimates from the SEARCH for diabetes in youth study, *Pediatrics*, 2006;118: 1510–18.
- Narayan KMV, Boyle JP, Thompson TJ, et al., Lifetime risk for diabetes mellitus in the United States, *JAMA*, 2003;290:1884–90.
- Burrows NR, Li Y, Williams DE, Racial and ethnic differences in trends of end-stage renal disease: United States, 1995 to 2005, *Adv Chronic Kidney Dis*, 2008;15:147–52.
- Gregg EW, Gu Q, Cheng YJ, et al., Mortality trends in men and women with diabetes, 1971 to 2000, *Ann Intern Med*, 2007;147: 149–55.
- Brown AF, Gregg EW, Stevens MR, et al., Race, ethnicity, socioeconomic position, and quality of care for adults with diabetes enrolled in managed care, *Diabetes Care*, 2005;28: 2864–70.
- Brown AF, Gerzoff RB, Karter AJ, et al., Health behaviors and quality of care among Latinos with diabetes in managed care, *Am J Public Health*, 2003;93:1694–98.
- Centers for Disease Control and Prevention, Division of Diabetes Translation Data and Trends. Available at: apps.nccd.cdc.gov/DDTSTRS/default.aspx
- American Diabetes Association, Economic costs of diabetes in the U.S. in 2007, *Diabetes Care*, 2008;31:596–615.
- Pan XR, Li GW, Hu YH, et al., Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: The Da Qing IGT and Diabetes Study, *Diabetes Care*, 1997;20:537–44.
- Tuomilehto J, Lindstrom J, Eriksson JG, et al., Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance, *N Engl J Med*, 2001;344:1343–50.
- Knowler WC, Barrett-Connor E, Fowler SE, et al., Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin, *N Engl J Med*, 2002;346:393–403.
- Ackermann RT, Finch EA, Brizendine E, et al., Translating the Diabetes Prevention Program into the community: The DEPLOY pilot study, *Am J Prev Med*, 2008;35:357–63.
- Ackermann RT, Marrero DG, Hicks KA, An evaluation of cost sharing to finance a diet and physical activity intervention to prevent diabetes, *Diabetes Care*, 2006;29:1237–41.
- Institute of Medicine Committee on the Quality of Health Care in America, *Crossing the Quality Chasm: A New Health System for the 21st Century*, Washington, DC: National Academies Press, 2001.
- Lenfant C, Clinical research to clinical practice—Lost in translation?, *N Engl J Med*, 2003;349:866–74.
- Canadian Institute of Health Research, About Knowledge Translation. Available at: www.cihr.ca/e/2948.html
- Glasgow RE, Emmons KM, How can we increase translation of research into practice? Types of evidence needed, *Annu Rev Public Health*, 2007;28:413–33.
- Narayan KMV, Benjamin E, Gregg EW, et al., Diabetes translation research: Where are we and where to we want to be?, *Ann Intern Med*, 2004;140:958–63.
- Jennings K, Stahl-Wert J, *The Serving Leader*, San Francisco: Berrett-Koehler Publishers, Inc., 2004
- Collins J, *Good to Great*, New York, NY: HarperCollins, Inc., 2001.