

Self-reported Neighborhood Safety and Nonadherence to Treatment Regimens Among Patients with Type 2 Diabetes

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BACKGROUND: Few studies have explored the association between neighborhood characteristics and adherence to diabetes self-management behaviors, and none have examined the influence of neighborhood safety on adherence to treatment regimens among patients with diabetes.

OBJECTIVE: To assess whether neighborhood safety is associated with self-reports of technical quality of care and with nonadherence to diabetes treatment regimens.

DESIGN: A cross-sectional analysis of a population-based sample of California adults responding to the 2007 California Health Interview Survey. Multivariable logistic regression models were used to examine the association of self-reported neighborhood safety with technical quality of care and treatment nonadherence, adjusted for sociodemographic characteristics, barriers to access to care, and health status.

PARTICIPANTS: Adults with type 2 diabetes currently receiving medical treatment.

MAIN MEASURES: Patient-reported neighborhood safety, performance of recommended processes of care by provider, treatment nonadherence (patient delays in filling prescriptions and obtaining needed medical care).

KEY RESULTS: Self-reported neighborhood safety was not associated with process measures of technical quality of care, but was associated with treatment nonadherence. Specifically, compared to those who report living in a safe neighborhood, a higher proportion of patients living in unsafe neighborhoods reported delays in filling a prescription for any reason (21.9% vs. 12.8%, aOR=1.69, 95%CI 1.19, 2.40) and delays in filling a prescription due to cost (12.2% vs. 6.8%, aOR=1.63, 95%CI 1.02, 2.62).

CONCLUSIONS: Contextual factors, such as neighborhood safety, may contribute to treatment nonadherence in daily life, even when the technical quality of care delivered in the clinic is not diminished.

KEY WORDS: diabetes; adherence to treatment regimens; neighborhood safety.

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INTRODUCTION

Deep socioeconomic disparities in diabetes outcomes have been widely documented.¹⁻³ Although income, education, communication barriers, insurance status and access to quality medical care are important contributors to these disparities, much of the observed variation in glycemic control remains unexplained by these factors.^{4,5} This suggests that, even among individuals who have access to medical care, contextual influences—i.e. aspects of an individual's social and environmental life context that fall outside of the health care setting—may contribute to perpetuating health disparities.^{1,6-10} Given the widely-reported associations between contextual influences, particularly neighborhood characteristics^{6,11-13}, and health behaviors in general, it is plausible that unfavorable contextual influences promote poor diabetes outcomes by creating barriers to patient adherence to diabetes self-management regimens.

Neighborhood characteristics have been shown to affect the health and well-being of individuals independent of those individuals' own socioeconomic status.¹⁴⁻²⁰ Individuals who live in neighborhoods perceived to be unsafe, for example, report lower levels of physical activity²¹, higher rates of smoking^{22,23}, and greater levels of obesity¹² compared to individuals living in neighborhoods perceived to be safe, even after accounting for individual-level markers of socioeconomic status, such as household income. Such "neighborhood effects" on health may be particularly pronounced among individuals with type 2 diabetes, which requires consistent adherence to management regimens that are often challenging and complex.

In a widely cited review of the literature¹, processes of care and individual health behaviors were posited as important proximal mechanisms linking individual-level and contextual measures of socioeconomic position to poor health outcomes in people with diabetes. Although numerous studies have demonstrated an association between neighborhood characteristics and health behaviors and health outcomes, few have explored these asso-

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ciations specifically among individuals with type 2 diabetes^{22,24} or examined the association between neighborhood factors and processes of care^{25,26}, and none have examined the influence of neighborhood safety on nonadherence to treatment regimens among patients with diabetes. Therefore, in the present study, we examined the degree to which perceived neighborhood safety is differentially associated with the processes of care received during the medical visit, and with nonadherence to diabetes treatment regimens in daily life in a population-based sample of patients with type 2 diabetes who are currently receiving medical care. We hypothesized that, for patients currently being treated for diabetes, unfavorable neighborhood environments (those with low perceived safety) would not be associated with recommended process measures of quality of diabetes care in the clinic setting (annual A1c test, dilated eye exam and foot exam), but would be associated with poorer adherence to diabetes management regimens in daily life (delays in filling prescriptions and in obtaining needed medical care).

METHODS

Procedure

All data were obtained from the 2007 California Health Interview Survey (CHIS), a random-digit dial telephone survey of California households representative of the state's noninstitutionalized population.²⁷⁻²⁹

Sample

The data set used for this study comes from the CHIS Public Use File 2007. Data were collected from one randomly-selected adult per household between July 2005 and April 2006, resulting in a sample of 43,020 adults. The sample was weighted to account for the complex sample design and to be representative of California's population in terms of age, sex, race and ethnicity, and rural and urban residence.²⁷ The analytic sample for this study (N=3401) was restricted to adults with type 2 diabetes, who reported seeing a doctor in the past year and reported that they are currently taking medications for diabetes.

Measures

Processes of Care. Patient reports of performance by their provider of three processes of care recommended by the National Committee on Quality Assurance (NCQA) Diabetes Recognition Program³⁰—an annual blood test for hemoglobin A1c, a dilated eye exam and a foot exam—were available in the dataset and were coded as “1” if the process was performed at least once in the prior year or “0” if the process was not performed in the past year.

Nonadherence to Treatment Regimens Four measures of treatment nonadherence were assessed from patient

responses. *Delayed filling prescription for any reason* was assessed from responses to the question: “During the past 12 months, did you either delay or not get a medicine that a doctor prescribed for you?” *Delayed filling a prescription due to cost* was assessed from the question “Was cost or lack of insurance a reason why you delayed or did not get the prescription?”, which was only asked of patients reporting a delay in filling prescription for any reason. *Delayed obtaining needed medical care for any reason* was assessed from the question “During the past 12 months, did you delay or not get any other medical care you felt you needed—such as seeing a doctor, a specialist or other health professional?” *Delayed obtaining needed medical care due to cost* was assessed from the following question, only asked of respondents who reported a delay in needed medical care for any reason: “Was cost or lack of insurance a reason why you delayed or did not get the care you felt you needed?” Based on the responses to these items, each of the four nonadherence variables was coded dichotomously (“1” if a delay was reported, “0” if no delay was reported).

Neighborhood Safety. Neighborhood safety was assessed from a single item asking “Do you feel safe in your neighborhood all of the time, most of the time, some of the time, or none of the time?” Because very few respondents (6.0%) indicated feeling safe “some of the time” or “none of the time”, neighborhood safety was scored as a dichotomous variable to maximize cell sizes for analysis. Respondents who reported feeling safe in their neighborhood less than all the time were classified as living in an unsafe neighborhood and coded as “1” and those who felt safe all the time were coded as “0”.

Covariates. To assess the unique contribution of each independent variable to the variance explained in the outcomes, models were adjusted for covariates hypothesized to be associated with disease management behavior. These covariates were assessed from self-reported items of the survey and included demographic characteristics (age, sex, education, race/ethnicity, nativity, income); factors related to access to care (insurance status, number of visits to the doctor in the previous year, and access to an automobile); and health status variables (duration of diabetes, general health condition and nonspecific psychological distress assessed using the Kessler 6 (K6) Scale).³¹ Urbanicity (living in an urban versus rural setting) was assessed in the CHIS using population density at the zip code level for all respondents.

Statistical Analyses

All analyses were performed using SAS Callable SUDAAN Release 10.0.1 (Research Triangle Institute, Research Triangle Park, NC) to account for the complex sampling design of the CHIS and to obtain proper variance estimations. Bivariate comparisons were conducted using independent samples t-tests for continuous variables (with means and standard errors reported) and chi squared tests for dichotomous variables (with proportions reported). The association between neighborhood safety and each outcome was assessed using logistic regression models adjusted for the following patient-level covariates: age, sex, education, race/ethnicity, nativity,

income, urbanicity, insurance status, number of visits to the doctor, access to an automobile, duration of diabetes, general health condition and psychological distress.

RESULTS

Characteristics of this sample of diabetes patients currently receiving medical care are presented in Table 1. Compared to respondents living in safe neighborhoods, more respondents living in unsafe neighborhoods were female, were black, and were born in the U.S. They had lower average household income, more frequently lived in urban settings, and had less access to cars, poorer general health status and more psychological distress (all $p < 0.05$).

Processes of Care. Perceived neighborhood safety was not found to be associated with the performance of an annual A1c test, a dilated eye exam or a foot exam (see Table 2) in models adjusting for sociodemographic characteristics, barriers to access to care, and health status.

Nonadherence to Treatment Regimens. Neighborhood safety was found to be associated with nonadherence to diabetes self-management regimens (Table 3), in models adjusting for the same

Table 1. Sample Characteristics*

	Perceived neighborhood safety		P
	Safe	Unsafe	
	N=2182	N=1219	
Age (years [SE])	60.0 [0.6]	59.3 [0.7]	0.45
Gender (% Female)	44.3	52.9	0.006
Education, High school or greater (%)	73.9	79.7	0.07
Race/Ethnicity (%)			0.04
Non-Hispanic white	43.5	45.7	
Latino	22.0	19.4	
Black	7.7	11.7	
Asian/Pacific Islander	11.4	12.6	
American Indian	2.3	1.5	
Other/Multiple Race	13.1	9.1	
US Born (%)	63.2	72.6	0.01
Household income (proportion of Federal Poverty Line [SE])	4.0 [0.1]	3.4 [0.1]	0.002
Lives in urban setting (%)	86.0	89.9	0.01
Uninsured at any point during year (%)	13.3	9.3	0.17
No regular access to a car (%)	8.9	13.2	0.05
Years with Diabetes	10.4 [0.4]	10.0 [0.4]	0.49
General health status (higher is better)	2.5 [0.3]	2.3 [0.4]	<0.001
Serious Psychological Distress (K6)	3.6 [0.2]	5.0 [0.2]	<0.001

*Results are weighted to be representative of the California population and to account for complex survey design effects in the calculation of proportions, means and standard errors. Reported values are not adjusted for covariates. Group comparisons made using independent samples t-tests for continuous variables (with means and standard errors reported) and chi squared tests for dichotomous variables (with proportions reported).

Table 2. Association Between Perceived Neighborhood Safety and Performance of Recommended Processes of Care in Logistic Regression Models

	Perceived neighborhood safety			P
	Safe	Unsafe	aOR	
	N=2182	N=1219	(95% CI)	
Had A1c test in past year (%)	91.2	93.5	1.20 (0.72,2.00)	0.49
Had dilated eye exam in past year (%)	76.7	72.8	0.84 (0.60,1.17)	0.30
Had foot exam in past year (%)	74.3	70.9	0.81 (0.61, 1.06)	0.13

*Results are weighted to be representative of the California population and to account for complex survey design effects in the calculation of proportions. Reported proportions are not adjusted for covariates. Adjusted odds ratios (aOR) are adjusted for age, sex, education, race/ethnicity, nativity, income, urbanicity, insurance status, number of visits to the doctor, access to an automobile, duration of diabetes, general health condition and psychological distress

covariates. A higher proportion of respondents living in unsafe neighborhoods reported delaying filling a prescription for any reason (21.9% versus 12.8%, respectively; aOR=1.69, 95%CI 1.19, 2.40, $p = 0.004$) and delaying filling a prescription due to cost (12.2% vs. 6.8%; aOR=1.63, 95%CI 1.0 2.2,62, $p = 0.043$) compared to those who report feeling safe in their neighborhood. The crude rate of delaying obtaining needed medical care for any reason was greater in patients living in unsafe neighborhoods, (18.5% vs. 11.7%, unadjusted OR=1.71, 95%CI 1.17, 2.48, $p = 0.006$), but in the adjusted model, this association was attenuated to a non-significant trend (aOR= 1.43 95%CI 0.96, 2.11, $p = 0.075$).

DISCUSSION

In this population-based sample of diabetic Californians currently receiving medical care, perceived neighborhood safety was not associated with patient reports of performance

Table 3. Association Between Perceived Neighborhood Safety and Nonadherence to Diabetes Treatment Regimens in Logistic Regression Models*

	Perceived neighborhood safety			P
	Safe	Unsafe	aOR	
	N=2182	N=1219	(95% CI)	
Delayed filling prescription for any reason (%)	12.8	21.9	1.69 (1.19, 2.40)	0.004
due to cost (%)	6.8	12.2	1.63 (1.02, 2.62)	0.043
Delayed obtaining needed medical care for any reason (%)	11.7	18.5	1.43 (0.96, 2.11)	0.075
due to cost (%)	5.3	9.2	1.32 (0.79,2.22)	0.288

*Results are weighted to be representative of the California population and to account for complex survey design effects. Reported percentages are not adjusted for covariates. Adjusted odds ratios (aOR) are adjusted for age, sex, education, race/ethnicity, nativity, income, urbanicity, insurance status, number of visits to the doctor, access to an automobile, duration of diabetes, general health condition and psychological distress

of recommended processes of care, but was associated with treatment nonadherence beyond what was explained by individual socioeconomic status, barriers to access to care, and self-reported health.

The higher rate of delays in filling prescriptions observed in respondents living in unsafe neighborhoods has not been previously demonstrated in the literature, but is consistent with other work linking neighborhood safety to general health behaviors²¹⁻²³ and a study linking neighborhood-level socioeconomic disadvantage with adherence to CPAP therapy for obstructive sleep apnea.³² In the current study, approximately half of the respondents who reported delays in filling prescriptions and obtaining needed care cited cost as the reason for the delay. This suggests that perceived safety and adherence may be linked by mechanisms other than financial pressures alone. Other mechanisms by which an unfavorable neighborhood environment may impact health behaviors have been proposed, including a lack of access to health-promoting resources, accumulated stress brought on by the presence of hazards in the neighborhood environment, and prevailing attitudes that de-emphasize the importance of health and health behaviors.^{1,12,16-19}

Because the association between neighborhood safety and adherence persisted after adjustment for multiple potential barriers to accessing a pharmacy and paying for prescriptions, including income, insurance status, and access to transportation, the lower adherence observed in unsafe neighborhoods is likely attributable to factors in addition to access and finances. It has been suggested that an accumulation of exposures to multiple unhealthy contextual factors may explain the deleterious health effects of unhealthy neighborhoods.^{1,16,33,34} Although the models presented in the current study were adjusted for serious psychological distress, the fact that neighborhood safety was measured using a subjective, individual-level measure suggests that respondents rating their neighborhoods as unsafe are not only living in an unfavorable setting, but are perceiving neighborhood problems and being affected by them. The accumulated burden of these problems may diminish the importance of filling prescriptions or obtaining needed medical treatment promptly in light of competing demands.

The findings of the current study highlight the importance of addressing factors outside of the health care domain that may contribute to nonadherence to recommended diabetes management behaviors in disadvantaged populations. Although contextual influences have a considerable impact on the success or failure of a diabetes self-management regimen, they are seldom adequately discussed and incorporated into the treatment plan during the medical visit.³⁵ For this reason, patients who receive medical care that meets guidelines for technical quality (i.e. receiving appropriate laboratory tests and examinations), and are put on clinically appropriate medication regimens during the medical visit, may not succeed in diabetes self-management in their daily life context.^{36,37} Therefore, in addition to ongoing efforts to improve access and quality of care, better tailoring of diabetes self-management regimens through increased integration of the health care system with the community³⁸⁻⁴⁰, improved doctor-patient communication about barriers to adherence^{41,42}, and greater involvement of self-management support resources such as nurse educators and health coaches^{9,43} may promote improved adherence and outcomes in the face of challenging contextual influences.

Some limitations of the study should be considered when interpreting the findings. First, although data from CHIS are

weighted to be representative of the socioeconomically and racially/ethnically diverse population of California, regional variations in culture, context and available resources may limit the generalizability of findings to other settings. Second, because the measures of nonadherence available in CHIS do not assess several important forms of medication nonadherence, such as skipping doses and changing or discontinuing medications, and rely on patient self-report, they may underestimate the amount of nonadherence actually occurring in the sample.⁴⁴ Third, because no neighborhood-level data were available for respondents to the survey, neighborhood characteristics were assessed with individual-level self-report measures. Although support for the findings presented in the study may be strengthened by using a multi-level data collection methodology, self-reported measures of neighborhood problems have been shown to be significantly related to neighborhood-level measures of socioeconomic status after adjustment for individual-level deprivation.³³ Furthermore, models in the current study were adjusted for individual-level socioeconomic status, barriers to access to care and self-reported health to isolate the independent associations between respondent ratings of neighborhood safety and the outcomes reported.

The findings presented add to a growing literature linking contextual influences to health behaviors and outcomes. Patients living in unsafe neighborhoods may exhibit increased nonadherence to treatment regimens in daily life, even though the technical quality of care delivered in the clinic is not diminished. For those disadvantaged patients who, in spite of persistent barriers to access quality care, are able to see a doctor, interventions to improve tailoring of self-management regimens in response to contextual influences may help improve adherence and outcomes.

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REFERENCES

1. **Brown AF, Ettner SL, Piette J, et al.** Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature. *Epidemiol Rev.* 2004;26(1):63-77.
2. **McBean AM, Huang Z, Virnig BA, Lurie N, Musgrave D.** Racial variation in the control of diabetes among elderly medicare managed care beneficiaries. *Diabetes Care.* 2003;26(12):3250-6.
3. **Peek ME, Cargill A, Huang ES.** Diabetes health disparities: a systematic review of health care interventions. *Med Care Res Rev.* 2007;64(5 Suppl):101S-56.
4. **Harris MI.** Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. *Diabetes Care.* 2001;24(3):454-9.
5. **Heisler M, Faul J, Hayward R, Langa K, Blaum C, Weir D.** Mechanisms for racial and ethnic disparities in glycemic control in middle-aged and older Americans in the health and retirement study. *Arch Intern Med.* 2007;167:1853-60.
6. **Brown AF, Ang A, Pebley AR.** The relationship between neighborhood characteristics and self-rated health for adults with chronic conditions. *Am J Public Health.* 2007;97(5):926-32.

7. **Karter AJ, Ferrara A, Liu JY, Moffet HH, Ackerson LM, Selby JV.** Ethnic disparities in diabetic complications in an insured population. *JAMA.* 2002;287(19):2519–27.
8. **Morenoff JD, Lynch JW.** What makes a place healthy? Neighborhood influences on racial/ethnic disparities in health over the life course. In: **Anderson NB, Bulatao RA, Cohen B, eds.** *Critical Perspectives on Racial and Ethnic Differences in Health in Late Life.* Washington (DC): National Academies Press; 2004.
9. **Moskowitz D, Bodenheimer T.** Moving from evidence-based medicine to evidence-based health. *J Gen Intern Med.* 2011;1–3.
10. **Trinacty C, Adams A, Soumerai S, et al.** Racial differences in long-term self-monitoring practice among newly drug-treated diabetes patients in an HMO. *J Gen Intern Med.* 2007;22:1506–13.
11. **Diez Roux AV, Merkin SS, Arnett D, et al.** Neighborhood of residence and incidence of coronary heart disease. *N Engl J Med.* 2001;345(2):99–106.
12. **Fish JS, Ettner S, Ang A, Brown AF.** Association of perceived neighborhood safety on body mass index. *Am J Public Health.* 2010;100(11):2296–303.
13. **Frank LD, Kerr J, Sallis JF, Miles R, Chapman J.** A hierarchy of sociodemographic and environmental correlates of walking and obesity. *Prev Med.* 2008;47(2):172–8.
14. **Dubowitz T, Heron M, Basurto-Davila R, Bird CE, Lurie N, Escarce JJ.** Racial/ethnic differences in US health behaviors: a decomposition analysis. *Am J Health Behav.* 2011;35(3):290–304.
15. **Nelson K, Taylor L, Lurie N, Escarce J, McFarland L, Fihn SD.** Neighborhood environment and health status and mortality among veterans. *J Gen Intern Med.* 2011.
16. **Odgers CL, Moffitt TE, Tach LM, et al.** The protective effects of neighborhood collective efficacy on British children growing up in deprivation: a developmental analysis. *Dev Psychol.* 2009;45(4):942–57.
17. **Pickett KE, Pearl M.** Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *J Epidemiol Commun Health.* 2001;55(2):111–22.
18. **Ross CE, Mirowsky J.** Neighborhood disadvantage, disorder, and health. *J Health Soc Behav.* 2001;42(3):258–76.
19. **Sampson RJ.** The neighborhood context of well-being. *Perspect Biol Med.* 2003;46(3 Suppl):S53–64.
20. **Sampson RJ, Raudenbush SW, Earls F.** Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science.* 1997;277(5328):918–24.
21. **Bennett GG, McNeill LH, Wolin KY, Duncan DT, Puleo E, Emmons KM.** Safe to walk? Neighborhood safety and physical activity among public housing residents. *PLoS Med.* 2007;4(10):e306.
22. **Gary TL, Safford MM, Gerzoff RB, et al.** Perception of neighborhood problems, health behaviors, and diabetes outcomes among adults with diabetes in managed care: the Translating Research Into Action for Diabetes (TRIAD) study. *Diabetes Care.* 2008;31(2):273–8.
23. **Kendzor D, Businelle M, Mazas C, et al.** Pathways between socioeconomic status and modifiable risk factors among African American smokers. *J Behav Med.* 2009;32(6):545–57.
24. **Horowitz CR, Colson KA, Hebert PL, Lancaster K.** Barriers to buying healthy foods for people with diabetes: evidence of environmental disparities. *Am J Public Health.* 2004;94(9):1549–54.
25. **Edwards R, Burns J, McElduff P, Young R, New J.** Variations in process and outcomes of diabetes care by socio-economic status in Salford, UK. *Diabetologia.* 2003;46(6):750–9.
26. **Kelly WF, Mahmood R, Kelly MJ, Turner S, Elliott K.** Influence of social deprivation on illness in diabetic patients. *BMJ.* 1993;307(6912):1115–6.
27. **California Health Interview Survey.** CHIS 2007 Methodology Report 1—Sample Design. 2009; Available at: <http://www.chis.ucla.edu/methodology.html>. Accessed April 15, 2011.
28. **California Health Interview Survey.** CHIS 2007 Methodology Report 2—Data Processing Procedures. 2009; Available at: <http://www.chis.ucla.edu/methodology.html>. Accessed April 15, 2011.
29. **California Health Interview Survey.** CHIS 2007 Methodology Report 3—Response Rates. 2009; Available at: <http://www.chis.ucla.edu/methodology.html>. Accessed April 15, 2011.
30. **National Committee for Quality Assurance.** Diabetes Recognition Program. 2009; <http://www.ncqa.org/tabid/1023/Default.aspx>.
31. **Kessler RC, Andrews G, Colpe LJ, et al.** Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med.* 2002;32:959–76.
32. **Platt A, Field S, Asch D, et al.** Neighborhood of residence is associated with daily adherence to CPAP therapy. *Sleep.* 2009;32(6):799–806.
33. **Steptoe A, Feldman P.** Neighborhood problems as sources of chronic stress: development of a measure of neighborhood problems, and associations with socioeconomic status and health. *Ann Behav Med.* 2001;23(3):177–85.
34. **Taylor SE, Repetti RL, Seeman T.** Health psychology: what is an unhealthy environment and how does it get under the skin? *Annu Rev Psychol.* 1997;48(1):411–47.
35. **Weiner SJ, Schwartz A, Weaver F, et al.** Contextual errors and failures in individualizing patient care: a multicenter study. *Ann Intern Med.* 2010;153(2):69–75.
36. **Haskard-Zolnieriek KB, DiMatteo MR.** Physician communication and patient adherence to treatment: a meta-analysis. *Med Care.* 2009;826–834.
37. **Piette JD, Heisler M, Horne R, Caleb AG.** A conceptually based approach to understanding chronically ill patients' responses to medication cost pressures. *Soc Sci Med.* 2006;62(4):846–57.
38. **Greenfield S, Kaplan S, Ware JE Jr.** Expanding patient involvement in care. Effects on patient outcomes. *Ann Intern Med.* 1985;102(4):520–8.
39. **Cramer JS, Sibley RF, Bartlett DP, Kahn LS, Loffredo L.** An adaptation of the diabetes prevention program for use with high-risk, minority patients with type 2 diabetes. *Diabetes Educ.* 2007;33(3):503–8.
40. **Mayer-Davis EJ, D'Antonio AM, Smith SM, et al.** Pounds off with empowerment (POWER): a clinical trial of weight management strategies for black and white adults with diabetes who live in medically underserved rural communities. *Am J Public Health.* 2004;94(10):1736–42.
41. **Piette JD, Heisler M, Krein S, Kerr EA.** The role of patient-physician trust in moderating medication nonadherence due to cost pressures. *Arch Intern Med.* 2005;165(15):1749–55.
42. **Piette JD, Heisler M, Wagner TH.** Cost-related medication underuse: do patients with chronic illnesses tell their doctors? *Arch Intern Med.* 2004;164(16):1749–55.
43. **Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM.** Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. *Diabetes Care.* 2002;25(7):1159–71.
44. **DiMatteo M.** Variations in patients' adherence to medical recommendations: a quantitative review of 50 years of research. *Med Care.* 2004;42(3):200–9.