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Costs and Beliefs: Understanding Individual- and Neighborhood-Level Correlates of Medication Nonadherence Among Mexican Americans With Type 2 Diabetes

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Abstract

Objective—High rates of medication nonadherence observed in disadvantaged populations are often attributed to socioeconomic factors. Little is known, however, about how a person's neighborhood environment may contribute to nonadherence beyond what can be explained by a lack of individual resources to pay for medications. This study considered the reasons patients reported for deviating from their medication regimens to understand how individual-level and neighborhood-level indicators of socioeconomic status (SES) may each influence adherence behavior.

Method—Cross-sectional data were collected between 2006 and 2011 from a sample of Mexican American patients with type 2 diabetes (N = 749) treated at university-affiliated clinics in Southern California. Measures included individual-level SES (years of education, health insurance type, and household income), neighborhood deprivation, and medication nonadherence (for reasons related to cost and reasons related to beliefs about medications). Neighborhood deprivation was assessed using the Neighborhood Socioeconomic Status Index (Dubowitz et al., 2011), a validated aggregate of census tract-level indicators linked to each participant's home address.

Results—Results from multilevel logistic regression models revealed that individual-level SES was associated with nonadherence related to cost (annual household income < $20,000 vs. > $40,000, p = .001; Medicare vs. commercial health insurance, p < .001), whereas neighborhood deprivation was associated with nonadherence related to beliefs about medications (p = .011).

Conclusion—Findings from this study suggest that an individual's lack of resources may contribute to nonadherence related to cost, whereas elements of the broader social environment may promote nonadherence related to negative beliefs about medications.

Keywords

diabetes; medication adherence; neighborhood characteristics; socioeconomic status; Mexican Americans

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Nonadherence to medication regimens is a major contributor to suboptimal health outcomes (Egede et al., 2013), especially for low-income patients (Fischer et al., 2011). Mexican Americans with diabetes represent a particularly vulnerable population, exhibiting higher rates of nonadherence than non-Hispanic Whites (Yang et al., 2009).

Although nonadherence in disadvantaged patient populations is largely attributed to an inability to pay for medications, expanding health coverage for low-income patients has had disappointing results (Baicker et al., 2013). In addition to a lack of resources to pay for medications, unfavorable beliefs about medications also may contribute to nonadherence (e.g., Fisher, Fisher, Amico, & Harman, 2006). Patients who believe their medications have unpleasant side effects or are ineffective, for example, often skip doses or discontinue medications, even if they can afford them (Voils et al., 2012). Interventions that go beyond reducing out-of-pocket costs and also address beliefs about medications may be the most likely to improve adherence (Bandura, 2004).

Variation in diabetes-related behaviors and outcomes cannot fully be explained by individual-level characteristics alone (Brown et al., 2004). Living in lower socioeconomic status (SES) neighborhoods is associated with poorer health behaviors and outcomes (e.g., Dubowitz et al., 2011; Ludwig et al., 2012), even after accounting for individual-level characteristics. Few studies (Billimek & Sorkin, 2012; Platt et al., 2009) have investigated the link between neighborhood characteristics and nonadherence to a provider-prescribed medication regimen.

The present study, therefore, examined the degree to which individual SES and neighborhood deprivation are each associated with medication nonadherence for two distinct reasons—nonadherence related to costs and nonadherence related to beliefs about medications—in a sample of low-income Mexican American patients with diabetes.

Method

Participants and Procedure

Data for this study came from a 2-year randomized controlled trial of patients with type 2 diabetes (Kaplan, Billimek, Sorkin, Ngo-Metzger, & Greenfield, 2013), which received institutional review board approval. The analytic sample for this study included participants whose residential address was known (N = 749 complete cases, 509 women and 240 men, out of 782 enrolled participants).

Adult patients with type 2 diabetes currently receiving care from one of seven university-affiliated primary care and endocrinology clinics in Southern California were recruited. Data were collected from February 2006 through August 2011. Of the eligible patients approached, 76% consented to complete the baseline survey and allowed access to their medical records. Patients were offered a $20 gift card upon completion of the survey.

Measures

Individual-level characteristics—Education level (less than a high school degree vs. a high school degree or greater), annual household income (less than $20,000, between $20,000 and $39,999, and $40,000 or greater), age, gender, nativity (U.S.-born vs. foreign-born), survey-administration method (self-administered vs. assisted by someone else) and duration of diabetes were assessed from patient questionnaires. Insurance status (uninsured, commercial, Medicare, Medicaid) and preferred language were assessed from patients' medical records (see Table 1).

Neighborhood deprivation—Neighborhood deprivation was assessed using the Neighborhood Socioeconomic Status Index (NSES; Dubowitz et al., 2011) with census tracts serving as proxies for neighborhoods. NSES is a composite of six indicators obtained from the American Community Survey (ACS; U.S. Census Bureau, 2009), 2005–2009 5-year summary files for each tract: (a) percent of adults 25 years and over with less than a high school education; (b) percent of unemployed males; (c) percent of households with income below poverty level in the past year; (d) percent of households receiving public assistance; (e) percent of households with children that are headed by an unmarried female; and (f) median household income in the past year (in 2009 inflation-adjusted dollars). Each indicator was transformed to a z score ($M = 0$, $SD = 1$) such that values greater than zero reflected SES greater than the average of all tracts in the sampling area. The NSES score was computed as the mean of these six z scores. Neighborhood deprivation scores were linked to individual patients by their addresses of residence using geographic information systems software (ArcGIS Desktop 10, ESRI, Redlands, CA). Tracts were categorized into subgroups based on the quartile into which its NSES value fell among all the tracts in the sampling area (lowest quartile, second quartile, and upper half).

Medication nonadherence—Medication nonadherence for two different reasons was assessed using items adapted from published measures (Safran et al., 2005). *Medication nonadherence related to cost* was assessed from five items asking how frequently respondents deviated from their prescribed regimen due to its monetary costs (e.g., "During the past 12 months, have you skipped doses of a medicine to make the prescription last longer?" 1 = *no, never,* 2 = *yes, sometimes,* 3 = *yes, often*). *Medication nonadherence related to beliefs* was assessed from six items asking how frequently respondents deviated from the regimen due to their beliefs about their medications, including beliefs related to experiences with the medications (such as side effects; e.g., "I sometimes don't take my medicines because they are unpleasant to take." 1 = *none of the time*, 5 = *all of the time*") and self-assessed need (such as believing the medication is not necessary; e.g., "During the past 12 months, have you decided not to fill a prescription because you didn't think you needed the medicine?" 1 = *no, never*, 2 = *yes, sometimes,* 3 = *yes, often*).

Data Analysis

All analyses were performed using SAS software version 9.3 (SAS Institute, Cary, NC). Patient characteristics were compared across NSES subgroups using chi-squared tests for categorical variables and one-way ANOVA for continuous variables. The association between individual- and neighborhood-level SES and the two types of medication

nonadherence was examined using two-level logistic regression models. We entered neighborhood deprivation (living in a neighborhood in the lowest NSES quartile) as a level-2 covariate, and two individual-level indicators of ability to pay (health insurance type and household annual income) and seven sociodemographic covariates (age, gender, education, years with diabetes, nativity, preferred language, and method of survey administration) as level-1 covariates.

Because a large proportion of participants (21%) did not report income, we applied multiple imputation to include all available data in the models presented, assuming that the data were missing at random (MAR). The MAR assumption allows the probability of a missing observation to be related to characteristics of the participants (e.g., women being less likely than men to report income), provided that the pattern of missing data is unrelated to the true values of missing observations (e.g., high earners are no more or less likely than low earners to report income; see Allison, 2001). Missing data on all model covariates were imputed using PROC MI applying the Markov-chain Monte Carlo algorithm to generate 10 completed datasets (Allison, 2001). The models were then run on all 10 datasets with results integrated into a single set of estimates using PROC MIANALYZE.

Results

As shown in Table 1, participants in lower versus higher NSES neighborhoods were more likely to have less than a high school diploma ($p = .001$), to have been born outside the U.S ($p < .001$), to prefer Spanish language ($p < .001$), to have been assisted by someone else to complete the survey ($p < .001$), to report lower household income ($p < .001$), and to be uninsured or have health coverage through Medicaid ($p < .001$). Higher rates of medication nonadherence in lower NSES neighborhoods were observed (non-adherence related to cost, $p = .047$; nonadherence related to beliefs about medications, $p = .046$).

In multilevel logistic regression analyses (see Table 2), nonadherence related to cost was associated with individual-level characteristics (having health coverage through Medicare, adjusted odds ratio (aOR) = 0.37, 95% CI [0.23, 0.60], $p < .001$; annual household income < $20,000, aOR = 3.74, 95% CI [1.76, 7.93], $p = .001$; and income $20,000 to $40,000, aOR = 3.25, 95% CI [1.45, 7.30], $p = .004$), but not with neighborhood deprivation. Nonadherence related to beliefs about the medication regimen was not associated with individual-level characteristics, but was associated with neighborhood deprivation (aOR = 1.64, 95% CI [1.12, 2.39], $p = .011$).

Discussion

In a sample of Mexican American patients with type 2 diabetes, nonadherence related to cost was associated with individual-level measures of SES (income and insurance type), but not with neighborhood deprivation. Conversely, nonadherence related to beliefs about the medications was associated with neighborhood deprivation, but not with individual-level SES. This suggests that high rates of nonadherence among low-SES patients may involve more than a lack of individual resources, and may be compounded by elements of their neighborhood environments. Independent of their own SES or access to health insurance,

patients who live in the most disadvantaged neighborhoods were the most likely to report nonadherence related to their beliefs about the medication—a problem not likely to be resolved by simply reducing costs.

One limitation of this study is its cross-sectional nature, which does not allow for an examination of causal associations between variables. Second, the multiple imputation methods employed to address missing data may produce biased estimates if the missing-at-random assumption is violated. Third, nonadherence is measured solely by patient report, which may underestimate nonadherence, but has the advantage of capturing useful insights about reasons for nonadherence (Voils et al., 2012). In addition, lacking data on respondents' household size prevented us from reporting income relative to the poverty line. Because neighborhood deprivation is highly correlated with its racial/ethnic composition, it is difficult to disentangle the direct impact of these two neighborhood characteristics. At least one study, however, suggests that neighborhood SES may be a more important contributor to health than racial/ethnic composition (Ludwig et al., 2012). Finally, given the disproportionate number of women in this study, the extent to which our findings generalize to men is unclear.

This study is among the first to suggest that neighborhood and individual factors may contribute to different reasons for medication nonadherence among low-SES Mexican American patients with diabetes. Although the specific mechanisms for this association require further investigation, this study adds to a growing body of evidence that patients' life circumstances and social environment may influence their beliefs and preferences regarding medication regimens, and, thus, may contribute to disparities in medication adherence. Alongside efforts to reduce out-of-pocket medication costs, efforts to reduce nonadherence should include training physicians and empowering patients to communicate more effectively about beliefs and preferences regarding medications, and engaging patients' communities and social networks to promote more positive medication-related beliefs.

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References

Allison, PD. Missing data. Sage; Thousand Oaks, CA: 2001.

Baicker K, Taubman SL, Allen HL, Bernstein M, Gruber JH, Newhouse JP, … Finkelstein AN. The Oregon experiment: Effects of Medicaid on clinical outcomes. New England Journal of Medicine. 2013; 368:1713–1722. DOI: 10.1056/NEJMsa1212321 [PubMed: 23635051]

Bandura A. Health promotion by social cognitive means. Health Education & Behavior. 2004; 31:143–164. DOI: 10.1177/1090198104263660 [PubMed: 15090118]

Billimek J, Sorkin DH. Self-reported neighborhood safety and nonadherence to treatment regimens among patients with Type 2 diabetes. Journal of General Internal Medicine. 2012; 27:292–296. DOI: 10.1007/s11606-011-1882-7 [PubMed: 21935749]

Brown AF, Ettner SL, Piette J, Weinberger M, Gregg E, Shapiro MF, … Beckles GL. Socioeconomic position and health among persons with diabetes mellitus: A conceptual framework and review of the literature. Epidemiologic Reviews. 2004; 26:63–77. DOI: 10.1093/epirev/mxh002 [PubMed: 15234948]

Dubowitz T, Heron M, Basurto-Davila R, Bird CE, Lurie N, Escarce JJ. Racial/ethnic differences in US health behaviors: A decomposition analysis. American Journal of Health Behavior. 2011; 35:290–304. DOI: 10.5993/AJHB.35.3.4 [PubMed: 21683019]

Egede LE, Lynch CP, Gebregziabher M, Hunt KJ, Echols C, Gilbert GE, Mauldin PD. Differential impact of longitudinal medication non-adherence on mortality by race/ethnicity among veterans with diabetes. Journal of General Internal Medicine. 2013; 28:208–215. DOI: 10.1007/s11606-012-2200-8 [PubMed: 22948932]

Fischer MA, Choudhry NK, Brill G, Avorn J, Schneeweiss S, Hutchins D, … Shrank WH. Trouble getting started: Predictors of primary medication nonadherence. The American Journal of Medicine. 2011; 124:1081e9–1081.e22. DOI: 10.1016/j.amjmed.2011.05.028

Fisher JD, Fisher WA, Amico KR, Harman JJ. An information-motivation-behavioral skills model of adherence to antiretroviral therapy. Health Psychology. 2006; 25:462–473. DOI: 10.1037/0278-6133.25.4.462 [PubMed: 16846321]

Kaplan SH, Billimek J, Sorkin DH, Ngo-Metzger Q, Greenfield S. Reducing racial/ethnic disparities in diabetes: The Coached Care (R2D2C2) Project. Journal of General Internal Medicine. 2013; doi: 10.1007/s11606-013-2452-y

Ludwig J, Duncan GJ, Gennetian LA, Katz LF, Kessler RC, Kling JR, Sanbonmatsu L. Neighborhood effects on the long-term well-being of low-income adults. Science. 2012; 337:1505–1510. DOI: 10.1126/science.1224648 [PubMed: 22997331]

Platt AB, Field SH, Asch DA, Chen Z, Patel NP, Gupta R, … Kuna ST. Neighborhood of residence is associated with daily adherence to CPAP therapy. Sleep: Journal of Sleep and Sleep Disorders Research. 2009; 32:799–806.

Safran DG, Neuman P, Schoen C, Kitchman MS, Wilson IB, Cooper B, … Rogers WH. Prescription drug coverage and seniors: Findings from a 2003 national survey. Health Affairs. 2005; 24:w152–w166. DOI: 10.1377/hlthaff.w5.152

U.S. Census Bureau. American Community Survey 2005–2009 5-Year Summary File. 2009. [Data file]. Retrieved from http://dataferrett.census.gov/

Voils CI, Maciejewski ML, Hoyle RH, Reeve BB, Gallagher P, Bryson CL, Yancy WS. Initial validation of a self-report measure of the extent of and reasons for medication nonadherence. Medical Care. 2012; 50:1013–1019. DOI: 10.1097/MLR.0b013e318269e121 [PubMed: 22922431]

Yang Y, Thumula V, Pace PF, Banahan BF 3rd, Wilkin NE, Lobb WB. Predictors of medication nonadherence among patients with diabetes in Medicare Part D programs: A retrospective cohort study. Clinical therapeutics. 2009; 31:2178–2188. DOI: 10.1016/j.clinthera.2009.10.002 [PubMed: 19922889]

Table 1

Participant Characteristics by Neighborhood Socioeconomic Status Index Quartile ($N = 749$)

	Neighborhood SES score			
Demographic	**Lowest quartile *n* = 188**	**2nd quartile *n* = 432**	**Upper half *n* = 129**	***p***
Age, mean (*SD*)	54.9 (10.0)	55.8 (11.1)	55.7 (11.0)	.604
Gender, % female	70.7	66.4	69.0	.550
Years with diabetes, mean (*SD*)	10.1 (7.6)	9.7 (7.6)	9.4 (6.7)	.672
Education level, % less than high school	82.9	79.7	65.3	.001
Nativity, % born outside U.S.	93.5	85.9	73.2	<.001
Preferred language, % reporting Spanish	93.6	85.4	68.2	<.001
Method of survey administration, % assisted by someone else	62.6	54.5	44.0	<.001
Annual household income, %				<.001
$0–19,999	80.5	77.5	59.6	
$20,000–39,999	16.8	17.8	17.3	
$40,000–59,999	1.3	2.7	5.8	
$60,000 or greater	1.3	2.1	17.3	
Health insurance type, %				<.001
Uninsured	40.4	35.6	32.6	
Medicare	14.4	17.1	16.3	
Medicaid	29.8	33.3	20.9	
Medicare + Medicaid combined	12.2	9.7	12.4	
Commercial	3.2	4.2	17.8	
Reported medication nonadherence, %				
Due to cost	55.2	54.2	42.4	.047
Due to beliefs about medications	58.1	47.4	46.5	.046

Table 2

The Association of Individual-Level and Neighborhood-Level Characteristics and Medication Nonadherence (N = 749)

	Nonadherence related to cost of medications		Nonadherence related to beliefs about medications	
Model covariates	**aOR (95% CI)**	***p***	**aOR (95% CI)**	***p***
Individual-level measure of ability to pay				
Health insurance type (reference: commercial/private)				
Uninsured/self-pay	1.13 (0.61, 2.10)	.688	1.07 (0.58, 1.97)	.840
Medicaid	0.64 (0.38, 1.09)	.101	1.05 (0.62, 1.76)	.868
Medicare	0.37 (0.23, 0.60)	<.001	0.89 (0.55, 1.44)	.646
Household annual income (reference: $40,000+)				
Less than $20,000	3.74 (1.76, 7.93)	.001	1.12 (0.53, 2.35)	.771
$20,000–40,000	3.25 (1.45, 7.30)	.004	0.80 (0.35, 1.83)	.596
Neighborhood deprivation				
Neighborhood socioeconomic status (reference: greater than lowest quartile)	1.13 (0.78, 1.64)	.516	1.64 (1.12, 2.39)	.011

Note. aOR = adjusted odds ratio. Results are from multilevel logistic regression models adjusting for age, gender, education, years with diabetes, nativity, preferred language, and method of survey administration.