

UC Irvine

UC Irvine Previously Published Works

Title

The Effects of Financial Pressures on Adherence and Glucose Control Among Racial/Ethnically Diverse Patients with Diabetes

Permalink

<https://escholarship.org/uc/item/6f21h5w8>

Journal

Journal of General Internal Medicine, 27(4)

ISSN

0884-8734

Authors

Ngo-Metzger, Quyen
Sorkin, Dara H
Billimek, John
[et al.](#)

Publication Date

2012-04-01

DOI

10.1007/s11606-011-1910-7

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed



The Effects of Financial Pressures on Adherence and Glucose Control Among Racial/Ethnically Diverse Patients with Diabetes

Quyên Ngo-Metzger, MD, MPH, Dara H. Sorkin, PhD, John Billimek, PhD, Sheldon Greenfield, MD, and Sherrie H. Kaplan, PhD, MPH

Division of General Internal Medicine and Primary Care and Health Policy Research Institute University of California, Irvine, Irvine, CA, USA.

BACKGROUND: The Affordable Care Act is designed to decrease the numbers of uninsured patients in U.S. However, even with insurance, patients who have financial hardships may have difficulty obtaining their medications because of cost issues.

OBJECTIVE: Among patients with type 2 diabetes, to examine the association between patients' self-reported financial pressures on cost-related medication non-adherence and glucose control. Additionally, to examine whether having insurance decrease the financial pressures of diabetes care.

DESIGN AND PARTICIPANTS: Racially/ethnically diverse patients (N=1,361; 249 non-Hispanic whites, 194 Vietnamese, and 533 Mexican American) with type 2 diabetes were recruited from seven outpatient clinics for a cross-sectional, observational study.

KEY RESULTS: Although both Vietnamese and Mexican-American patients reported having low annual incomes, more Mexican Americans reported the presence of financial barriers to getting medical care and perceived financial burden due to their diabetes, compared to whites and Vietnamese ($p < 0.001$). Over half (53.2%) of Mexican Americans reported cost-related non-adherence compared to 27.2% of white and 27.6% of Vietnamese patients ($p < 0.001$). Perceived financial burden was found to be associated with poor glucose control ($HbA1c \geq 8\%$), after adjusting for sociodemographic and health characteristics (aOR=1.70, 95%CI 1.09-2.63), but not when adjusting for non-adherence. Similarly, a significant association between presence of financial barriers and HbA1c (aOR=1.69, 95%CI 1.23-2.32) was attenuated with the inclusion of insurance status in the model. Being uninsured (aOR=1.90, 95%CI 1.13-3.21) and non-adherent (aOR=1.49, 95%CI 1.06-2.08) were each independently associated with HbA1c.

CONCLUSIONS: While having health insurance coverage eliminated some of the financial barriers associated with having diabetes, low-income patients still faced significant financial burdens. Thus, providing health insurance to more individuals is only the first step towards eliminating health disparities. It is important to address medication cost in order to improve medication adherence and glucose control.

KEY WORDS: Affordable Care Act; type 2 diabetes; ethnic groups; race; financial pressure; adherence.

J Gen Intern Med 27(4):432-7

DOI: 10.1007/s11606-011-1910-7

© Society of General Internal Medicine 2011

INTRODUCTION

The number of uninsured Americans, approximately 50.7 million, is at the highest level since the census began collecting this data in 1987.¹ The 2010 Affordable Care Act is designed to address this need, with expected provisions of the law to provide health insurance to 32 million uninsured by 2019.

Having health insurance may alleviate some, though not all, of the financial pressures associated with diabetes, especially among low-income racial/ethnic minorities. Previous studies have found that socioeconomic differences such as insurance status explained a significant portion of the general health disparities that exist among racial/ethnic minorities.^{2,3} Specifically among patients with diabetes, healthcare access and insurance status have been shown to explain some, but not all, of the disparities in glucose control among Latinos.^{4,5} Asian American patients were not included in these studies.

These studies did not focus on the financial barriers that may prevent people from getting medical care. For example, low-income patients may not be able to take time off from work to go to the doctor or afford the co-payment for office visits. Additionally, even in the absence of barriers to obtaining care, having diabetes may bring additional perceived financial burdens to patients and their families who have to balance the cost of obtaining healthcare against competing financial demands, such as paying for food or rent.

When faced with financial hardships, people may alter their behaviors in attempts to save money. For example, in a national survey of older adults with diabetes, 19% reported cutting back on use of their medications because of cost, 20% reported forgoing food and other essentials, 14% increased credit card debt, and 10% borrowed money from family or friends in order to pay for medications.⁶ Previous research has shown that many financial factors contribute to cost-related medication non-adherence (CRMN), including patients' income and out-of-pocket drug cost. However, there has been little research that directly links these financial factors to an intermediate biological outcome such as glucose control, particularly in low-income minority populations.⁴

Received June 9, 2011

Revised September 20, 2011

Accepted September 22, 2011

Published online October 18, 2011

Thus, in the current study, we examined patients' self-reported financial pressures, which included: 1) the presence of *financial barriers* to getting medical care; and 2) the perceived *financial burden* of having diabetes. We hypothesized that these financial pressures, and other financial factors such as income and out-of-pocket medication costs, would be associated with patients' cost-related medication adherence and glucose control, independent of patients' insurance status.

RESEARCH DESIGN AND METHODS

Study Population

Data for the current study came from the Reducing Racial/Ethnic Disparities in Diabetes: The Coached Care (R2D2C2) Project, a 2-year, randomized control trial of patients with type 2 diabetes designed to increase patient participation in medical decision-making. Enrollment occurred from May 2006 through February 2009. Patients were recruited from seven primary care or endocrinology clinics where they received their primary diabetes care. The project received approval from the University of California, Irvine's Institutional Review Board. Patients were consented to the study when they presented to the clinics for their appointments. Patients were eligible for the study if they were ≥ 18 years of age, and spoke English, Spanish, or Vietnamese. Patients who had type 1 diabetes, gestational diabetes, dementia, or another severe life-threatening illness were excluded from the study. Patients who agreed to participate completed an informed consent as well as a Health Insurance Portability and Accountability Act (HIPAA) waiver to obtain consent to review their medical charts. Patients were given a questionnaire to complete, and received a \$20 gift card for their participation. Seventy-six percent of eligible patients who were approached consented to complete the survey and allowed access to their medical record information, laboratory, and administrative data. The sample for the study included 1,361 patients who completed the survey; however we excluded 226 respondents who did not have a hemoglobin A1c (HbA1c) test done within 3 months of survey completion, for a final analytic sample of 1,135 patients.

Measures

Main Dependent and Independent Variables. The main dependent variable was hemoglobin A1c. Patients' A1c levels were measured by the central laboratory at the University of California Irvine Medical Center using the D-10 Hemoglobin Testing System (Bio-Rad Laboratories, Hercules, CA). Poor glucose control was determined as having a hemoglobin A1c $\geq 8\%$, based on the American Diabetes Association and The National Committee for Quality Assurance' definition of poor control.⁷

The main independent variables of interest were: 1) the presence of financial barriers to getting medical care; 2) the perceived financial burden of diabetes; 3) cost-related medication non-adherence; and 4) patients' health insurance status. Other financial characteristics of interest included

patients' annual household income and their out-of-pocket medication cost.

The Presence of Financial Barriers to Medical Care scale was adapted from the Medical Expenditure Panel Survey (MEPS), a national survey conducted by the U.S. Department of Health & Human Services Agency for Healthcare Research and Quality (AHRQ) since 1996 to collect data on the use and cost of health services in the U.S.⁸ The Presence of Financial Barriers to Medical Care Scale consisted of 3 items asking patients "How much of a problem is each of the following when you try to get medical care? a) You cannot afford care; it costs too much; b) The insurance company wouldn't approve or pay for your care; and c) You cannot get time off from daily responsibilities (i.e. work or childcare) to get care. Response categories were on a 5-point scale ranging from "a major problem" to "not a problem at all." Internal consistency reliability of this scale (Cronbach's alpha) was 0.74. The scale was dichotomized between "not much of a problem/ not a problem at all" versus "moderate to major problem."

The Perceived Financial Burden of Diabetes scale was adapted from the PORT Study.⁹ It consisted of a 5-item scale that asked patients "How much of a burden is having diabetes on you and your family in each of the following areas: finances in general; finances due to the cost of medications; finances due to the cost of monitoring supplies; finances due to the cost of healthcare; and finances due to the cost of health insurance because of diabetes." Response categories were on a 6-point scale ranging from "a very large burden" to "not a burden at all." Reliability (Cronbach's alpha) for this scale was 0.95. The scale was dichotomized between "not a burden at all" versus "very small to very large burden."

Cost-related medication non-adherence was adapted from the Cost-related Medication Non-adherence scale.¹⁰ This scale has been widely used among older patients with Medicare in several national studies, including the Medicare Current Beneficiary Survey.^{10,11} Cost-related medication non-adherence was determined by asking patients "During the last 12 months, have you: a) skipped doses of a medicine to make the prescription last longer; b) taken a smaller dose so the prescription would last longer (i.e. by cutting pills in half); c) spent less on food, heat, or other basic needs so that you would have enough money for your medicine; d) decided not to fill a prescription because it was too expensive; and e) not take your medicine because you can't afford them." Cronbach's Alpha for this scale was 0.71. Patients who answered "Yes" to any of these questions were considered to have underused medications because of cost constraints.

The patient's insurance status was accessed using the clinics' administrative database. Patients' insurance status was categorized into the following four groups: commercial insurance, Medicare, Medicaid, or no insurance.

Combined household annual income from all sources was determined by patient survey. Responses were made on a five point scale (0=Less than \$5,000, 1=\$5000-\$9,999, 2=\$10,000-\$14,999, 3=\$15,000-\$19,999, 4=\$20,000-\$59,999, 5=\$60,000 and over). Patients' monthly out-of-pocket cost for medication was determined by asking "In an average month, how much do you pay out of pocket (from your own money) for prescription medication?" Responses were made on a five point scale (1=\$0, 2=\$1-\$25, 3=\$26-\$50, 4=\$51-\$100, 5=over \$100).

Other Covariates. Patients' race/ethnicity, age, and gender were self-reported. The Center for Epidemiological Studies

Depression (CES-D)¹³ was used to assess the presence and severity of depressive symptoms in the last week, using a 4-point scale (0=rarely or none of the time, 3=most of the time). Self-rated health was determined by asking patients to rate their current health on a 5-point scale from excellent (5) to poor (1). Comorbidity was measured using the Total Illness Burden Index (TIBI)¹⁴ a 63-item summary measure of the presence and severity of the patient's diseases and symptoms that has been previously modified to reflect different index conditions. Duration of diabetes was determined by asking patient how long they have had diabetes. Number of medications was assessed by having patients list all of their current medications, and the data was converted as a count of total numbers of medication. Trust in the provider was measured by a 5-item scale based on the Patient Trust in Physician Scale.¹⁵

All survey questions were translated into Spanish and Vietnamese, and then back-translated using standard protocols for linguistic and cultural comparability.¹⁶ Translators were bilingual individuals whose native language was the target language but who were fluent in English.¹⁶ Any discrepancies in translations were resolved by committee. Cognitive testing of the translated surveys were done and results were used in an iterative translation process.¹⁷ The internal consistency reliability of all scales was evaluated in each of the three language groups (English, Spanish, Vietnamese). All scales had acceptable Cronbach alphas greater than 0.70.

Statistical Analyses

The data analysis was done in three phases. First, we examined the demographic, clinical, and financial characteristics of the patients by race/ethnicity. We used analyses of variance (ANOVA) tests to compare differences across the three racial/ethnic groups. Two tailed *P* values less than or equal to 0.05 were considered statistically significant.

Second, using multivariate logistic regression models, we tested whether having: 1) low income; 2) high out-of-pocket medication costs; 3) presence of financial barriers to medical care; 4) perceived financial burden of diabetes; and 5) insurance status, were associated with cost-related medication non-adherence. A priori, we adjusted for race/ethnicity, age, gender, physical and mental health status, number of medications, and trust in the provider because these factors have been shown to affect cost-related medication non-adherence in previous studies.^{12,18-21}

Finally, we conducted multivariable logistic regression models to determine the impact of each of the financial factors of interest (income, out-of-pocket cost, presence of financial barriers to medical care, perceived financial burden of diabetes, and cost-related medication non-adherence) to poor glucose control (HbA1c \geq 8%). We built five models adding groups of variables in a sequential manner, including covariates, financial factors of interest independently, and then the full model. In the final model, we added insurance status to determine whether having health insurance would alleviate the financial pressures of diabetes care. A priori, we included in the adjusted models as covariates other possible predictors of glucose control as mentioned above (including race/ethnicity,

age, gender, depressive symptoms, self-rated health, total illness burden, duration of diabetes, number of medications, and trust in provider).

RESULTS

Table 1 shows the demographic clinical and financial characteristics of the patients by race/ethnicity. Mexican-American patients tended to be younger and female compared to Vietnamese or white patients ($p<0.001$). Although patients had diabetes for approximately 9 years, more Mexican American patients had poor glucose control (45.2% with HbA1c \geq 8%) compared to whites or Vietnamese-Americans (15.6% and 10.0% with HbA1c \geq 8, respectively, $p<0.001$). The annual household income of Mexican and Vietnamese patients was significantly lower compared to whites ($p<0.001$). Mexican Americans also reported having the presence of more financial barriers to getting medical care and more perceived financial burden due to their diabetes, compared to whites and Vietnamese ($p<0.001$). Over half (53.2%) of Mexican Americans reported taking less medication than prescribed because of cost, whereas 27.2% of white and 27.6% Vietnamese patients reported cost-related medication non-adherence ($p<0.001$). A greater proportion of Mexican patients also were uninsured (39.8%), compared to white or Vietnamese patients (2.8% and less than 1%, respectively).

The correlation between each of the multiple measures of patients' financial characteristics is presented in Table 2. Although all of the measures are significantly correlated with each other at $p<0.001$, there is sufficient discrimination between each variable to warrant their separate examination.

Table 3 presents the results of four sequential logistic regression models examining the relationship between indicators of financial pressures and cost-related medication non-adherence. As indicated in Model 4, patients who had low annual income (aOR=0.80 [95% CI 0.71-0.90]), high out-of-pocket medication cost (aOR=1.37 [CI 1.20-2.57]), the presence of financial barriers to medical care (aOR=3.23 [CI 2.32-4.51]), perceived financial burdens related to diabetes (aOR=4.10 [CI 2.46-6.84]), and no health insurance (aOR=1.79 [CI 1.03-3.11]) were more likely to be non-adherent to medications due to cost, adjusting for race/ethnicity, age, gender, depressive symptoms, self-rated health, total illness burden, duration of diabetes, number of medications, and trust in the provider.

Table 4 presents the results of five sequential logistic regression models examining the relationship between hemoglobin A1c and income, out-of-pocket cost, presence of financial barriers to medical care, perceived financial burdens of diabetes, cost-related medication non-adherence, and insurance status. All models were adjusted for noted covariates. As shown in models 2 and 3, the presence of financial barriers to medical care (aOR=1.69 [CI 1.23-2.32]) and the perceived financial burden of diabetes (aOR=1.70 [CI 1.09-2.63]) were independently associated with poor glucose control. As indicated in Model 4, after cost-related medication non-adherence was included in the model (aOR=1.54 [CI

Table 1. Characteristics of Sample by Race / Ethnicity (N=1,135)

	non-Hispanic white (N=249)	Vietnamese American (N=194)	Mexican American (N=533)	P values
Demographic and Clinical Characteristics				
Mean Age (S.D.)	61.0 (10.8) ^a	68.7 (8.9) ^b	55.6 (10.9) ^c	<0.001
Age 55 years and younger, %	30.6	7.0	49.4	
Age 56–64, %	29.0	18.0	28.7	
Age 65–74, %	30.9	49.5	18.3	
Age 75 and older, %	9.4	25.5	3.7	
Gender, % male	57.3 ^a	43.0 ^b	33.0 ^c	<0.001
Hemoglobin A1c ≥ 8, %	15.6 ^a	10.0 ^a	45.2 ^b	<0.001
Depressive symptoms, mean (S.D.)*	10.6 (7.8) ^a	14.3 (7.8) ^b	12.7 (8.1) ^c	<0.001
Self-Rated Health, mean (S.D.)†	3.0 (0.9) ^a	2.6 (0.9) ^b	2.4 (0.8) ^c	<0.001
Total Illness Burden, mean (S.D.)‡	5.0 (3.4)	5.5 (3.5)	4.9 (3.4)	=0.051
Duration of Diabetes, years (S.D.)	8.4 (7.1)	8.9 (7.6)	9.5 (7.3)	=0.084
Number of Medications, count (S.D.)	5.9 (2.7)	5.7 (2.9)	5.5 (2.3)	=0.057
Trust in the Provider, mean (S.D.)§	87.4 (18.6)	90.9 (14.6) ^a	85.5 (20.7) ^b	=0.003
Financial Characteristics				
Annual Income, mean (S.D.)	4.0 (1.5) ^a	1.5 (1.1) ^b	2.0 (1.6) ^c	<0.001
Out-of-Pocket Medication Cost, mean (S.D.)¶	3.6 (1.3) ^a	2.2 (1.0) ^b	2.7 (1.4) ^c	<0.001
Presence of Financial Barriers to Medical Care, %	15.6 ^a	13.5 ^a	50.5 ^b	<0.001
Perceived Financial Burden of Diabetes, %	70.2 ^a	71.0 ^a	86.0 ^b	<0.001
Cost-Related Medication Non-Adherence, %	27.2 ^a	27.6 ^a	53.2 ^b	<0.001
Insurance status,				
Commercial, %	44.1 ^a	2.5 ^b	6.2 ^b	<0.001
Uninsured, %	2.8 ^a	0.5 ^a	39.8 ^b	<0.001
Medicare, %	44.4 ^a	77.0 ^b	28.0 ^c	<0.001
Medicaid, %	8.7 ^a	20.0 ^b	26.0 ^c	<0.001

Note. Superscripts in the same row that are different indicate statistical significant differences between racial/ethnic group, P<0.05

*Range for Center for Epidemiological Studies Depression Scale is 0–33, with higher score denoting more depressive symptoms.

†Range for Self-Rated Health is 1–5, with higher scale denoting better health

‡Range for Total Illness Burden is 0–18, with higher score denoting greater burden from comorbid conditions

§Range for Trust in Provider is 1–100, with higher score denoting more trust

||Range for Household Annual Income was categorized on 6-point scale (0=Less than \$5,000 to 5=\$6,000 and over)

¶Range for Monthly Out-of-Pocket Medication Cost was categorized on 5-point scale (1=\$0 to 5=over \$100)

1.10–2.15]), perceived financial burden was no longer significantly associated with HbA1c (aOR=1.37 [CI 0.87–2.15]), suggesting that the effect of perceived financial burden on glucose control is mediated by medication non-adherence. In model 5, adding insurance status to the model fully attenuated the effect of presence of financial barriers to medical care on glucose control, suggesting that having health insurance alleviates the financial barriers that patients encounter when obtaining medical care. The effect of cost-related medication

non-adherence on glucose control persisted after adjustment for insurance status.

DISCUSSION

To our knowledge, this is one of the first studies⁴ to examine the associations among financial pressures, cost-related medication non-adherence, and glucose control in a large number of low-income White, Latino, and Asian patients with type 2 diabetes. Previous studies of cost-related medication non-adherence have primarily focused on white^{22,23} or African American patients.²⁴

The findings from this study suggest that patients who perceived that they had financial burdens related to diabetes were more likely to be non-adherent to medications because of medication cost. Cost-related medication non-adherence was associated with poorly-controlled diabetes, as indicated by higher HbA1c. This relationship persisted, even after controlling for patients' health insurance status. Having health insurance, however, did mitigate the association between presence of financial barriers to obtaining medical care and patients' glucose control. This finding suggests that having health insurance may offset some of the financial barriers to obtaining medical care and increase patients' access to care. Having access to medical care may in-turn be associated with

Table 2. Correlation Table for Financial Characteristics

	1.	2.	3.	4.	5.	6.
1. Annual income	-	0.41	-0.16	-.10	-.19	-.12
2. Out-of-pocket medication cost		-	0.12	0.14	0.14	0.22
3. Presence of financial barriers to medical care			-	0.31	0.44	0.38
4. Perceived financial burden of diabetes				-	0.33	0.17
5. Cost-related medication non-adherence					-	0.28
6. Uninsured						-

Note. All correlations in table significant at p<0.001

Table 3. The Association Between Indicators of Financial Pressures and Cost-Related Medication Non-Adherence (N=1,135)

	Cost-related medication non-adherence			
	Model 1	Model 2	Model 3	Model 4
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Income	0.74 (0.67-0.83)	0.77 (0.69-0.87)	0.74 (0.67-0.87)	0.80 (0.71-0.90)
Out-of-Pocket Medication Cost	1.58 (1.41-1.78)	1.43 (1.29-1.64)	1.47 (1.31-1.66)	1.37 (1.20-1.57)
Presence of Financial Barriers to Medical Care		4.13 (3.00-5.69)		3.23 (2.32-4.51)
Perceived Financial Burden of Diabetes			5.57 (3.36-9.21)	4.10 (2.46-6.84)
Insurance Status, REF=Commercial Insurance				
Uninsured				1.79 (1.03-3.11)
Medicare				1.11 (0.73-1.70)
Medicaid				1.40 (0.86-2.28)

Note. All analyses included adjustment for race/ethnicity, age, gender, depressive symptoms, self-rated health, total illness burden, duration of diabetes, number of medications, and trust in the provider

improved glucose control. However, cost-related medication non-adherence remains associated with glucose control, independent of insurance status.

Furthermore, this study found that although both Vietnamese and Mexican-American patients reported having low annual incomes, Mexican-American patients reported having more financial barriers to receiving medical care, more perceived financial burden related to their diabetes, and more cost-related medication non-adherence, compared to Vietnamese and non-Hispanic white patients. While the findings suggest that having health insurance may eliminate some of the financial barriers to medical care that patients encounter, thus potentially accounting for improvements in patients' access to care, health insurance coverage by itself may not completely mitigate the perceived financial burdens of diabetes faced by low-income Mexican American patients.

This study has several limitations. First, the study was limited to patients living in one region of the country, and may not be generalizable to other geographic areas. Most of the financial variables, except for patients' insurance status, were based on self-report, and may be subject to social desirability bias. However, social desirability bias would lead to patients *under-reporting* their financial pressures and medication non-adherence, and would unlikely change the results of the study. Furthermore, there is no indication that one racial/ethnic

group would be more susceptible to social desirability bias compared to another group. Recall bias is another limitation that is inherent to self-reported data. However, recall bias should not affect one racial/ethnic group more than another. This study only examined whether patients had different types of health insurance, but did not examine whether patients with health insurance were underinsured (had insurance but had limited coverage). However, we did examine monthly out-of-pocket drug cost, which is one measure of underinsurance. Also, this study did not examine cost-related non-adherence of different types of medications or differences between generic and brand-name medications. These research questions will be the subject for future study. Finally, the study is cross-sectional and thus can only suggest associations and not causality.

This study has several important implications. Medical providers should address patients' financial pressures during office visits. Patients may be reluctant to bring up their financial situation; however, physicians' initiation of the conversation may enhance patient satisfaction and trust. Providers who care for low-income patients also should be aware that financial pressures may result in medication non-adherence and poor glucose control, and have candid conversations regarding strategies to reduce medication costs.

Table 4. The Association Between Indicators of Financial Barriers to Medical Care and Medication Non-Adherence and Hemoglobin A1c (N=1,135)

	Hemoglobin A1c greater or equal to 8				
	Model 1	Model 2	Model 3	Model 4	Model 5
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Income	1.01 (0.91-1.12)	1.03 (0.93-1.15)	1.01 (0.91-1.13)	1.05 (0.94-1.17)	1.09 (0.97-1.22)
Out-of-Pocket Medication Cost	1.12 (1.01-1.25)	1.07 (0.96-1.20)	1.09 (0.98-1.22)	1.03 (0.92-1.16)	1.02 (0.90-1.16)
Presence of Financial Barriers to Medical Care		1.69 (1.23-2.32)		1.42 (1.01-1.99)	1.32 (0.94-1.86)
Perceived Financial Burden of Diabetes			1.70 (1.09-2.63)	1.37 (0.87-2.15)	1.36 (0.86-2.15)
Cost-Related Medication Non-Adherence				1.54 (1.10-2.15)	1.49 (1.06-2.08)
Insurance Status, REF=Commercial Insurance					
Uninsured					1.90 (1.13-3.21)
Medicare					1.00 (0.66-1.52)
Medicaid					1.55 (0.96-2.48)

Note. All analyses included adjustment for race/ethnicity, age, gender, depressive symptoms, self-rated health, total illness burden, duration of diabetes, number of medications, and trust in the provider

On a health system level, it is important to note that increasing health insurance coverage to more Americans may not completely mitigate the financial pressures that diabetic patients face. Health insurance coverage will undoubtedly increase access to medical care and eliminate some of the financial barriers associated with having no health insurance. Many patients, however, especially those who are low-income, may still face significant financial burdens associated with diabetes. Thus, providing health insurance coverage to more individuals is only the first step towards eliminating racial/ethnic health disparities. It is important to find ways to decrease medication cost as a way to improve medication adherence. Decreasing cost-related non-adherence may ultimately result in improved glucose control and possibly decrease diabetes-related mortality.

Acknowledgments: This work was supported by the Robert Wood Johnson Foundation (Generalist Physician Faculty Award #1051084 and Finding Answers: Disparities Research for Change #59758), the NovoNordisk Foundation, and the National Institute of Diabetes, Digestive and Kidney Diseases (R18DK69846 and K01DK078939). All authors have no relevant conflict of interest to disclose. Dr. Ngo-Metzger completed this work as an Associate Professor at the University of California, Irvine. The views expressed in this publication are solely the opinions of the authors and do not necessarily reflect the official policies of the U.S. Department of Health and Human Services (HHS) or the Health Resources and Services Administration (HRSA), nor does mention of the department or agency names imply endorsement by the U.S. Government.

Conflict of interest: None disclosed.

Corresponding Author: Quyen Ngo-Metzger, MD, MPH; Division of General Internal Medicine and Primary Care and Health Policy Research Institute University of California, Irvine, Irvine, CA, USA (e-mail: Qngo-metzger@hrsa.gov).

REFERENCES

- DeNavas-Walt C, Proctor BD, Smith JC. Income, Poverty, and Health Insurance Coverage in the United States: 2009, in Current Population Reports, P60-238, U.S. Census Bureau, Editor. Washington, DC; 2010.
- Kirby J, Taliaferro G, Zuvekas SH. Explaining racial and ethnic disparities in health care. *Medical care*. 2006;44(5):1-64-72.
- Hargraves JL, Hadley J. The contribution of insurance coverage and community resources to reducing racial/ethnic disparities in access to care. *Health Serv Res*. 2003;38(3):809-829.
- Heisler M, et al. 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(17):1853-1860.
- 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.
- Piette JD, Heisler M, Wagner TH. Problems paying out-of-pocket medication costs among older adults with diabetes. *Diabetes Care*. 2004;27(2):384-391.
- National Committee for Quality Assurance. Changes to the Diabetes Recognition Program. 2009; Available from: <http://www.ncqa.org/tabid/1023/Default.aspx>.
- Agency for Healthcare Research and Quality (AHRQ). Medical Expenditure Panel Survey (MEPS) [cited 2010 December 15]; Available from: <http://www.meps.ahrq.gov/mepsweb/>.
- Greenfield S, et al. The uses of outcomes research for medical effectiveness, quality of care, and reimbursement in type II diabetes. *Diabetes Care*. 1994;17(Suppl 1):32-9.
- Soumerai SB. Cost-related medication nonadherence among elderly and disabled Medicare beneficiaries: a national survey 1 year before the Medicare drug benefit. *Arch Intern Med*. 2006;166(17):1829-35.
- Safran DG, et al. Prescription drug coverage and seniors: findings from a 2003 national survey. *Health Aff (Millwood)*. 2005, Suppl Web Exclusives, p. W5-152-W5-166.
- Wilson IB, et al. Cost-related skipping of medications and other treatments among Medicare beneficiaries between 1998 and 2000. Results of a national study. *J Gen Intern Med*. 2005;20(8):715-20.
- Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1(3):385-401.
- Greenfield S. Development and testing of a new measure of case mix for use in office practice. *Med Care*. 1995;33(4):AS47-55.
- Thom DH, et al. Further validation and reliability testing of the Trust in Physician Scale. The Stanford Trust Study Physicians. *Med Care*. 1999;37(5):510-7.
- Bullinger M, et al. Translating health status questionnaires and evaluating their quality: the IQOLA Project approach. International quality of life assessment. *J Clin Epidemiol*. 1998;51(11):913-23.
- Fowler FJ. *Improving Survey Questions: Design and Evaluation*. Newbury Park: Sage Publications; 1995.
- Briesacher BA, Gurwitz JH, Soumerai SB. Patients at-risk for cost-related medication nonadherence: a review of the literature. *J Gen Intern Med*. 2007;22(6):864-71.
- Piette JD, et al. The role of patient-physician trust in moderating medication nonadherence due to cost pressures. *Arch Intern Med*. 2005;165(15):1749-1755.
- Kurlander JE, et al. Cost-related nonadherence to medications among patients with diabetes and chronic pain: factors beyond finances. *Diabetes Care*. 2009;32(12):2143-8.
- Tseng CW, et al. Race/ethnicity and economic differences in cost-related medication underuse among insured adults with diabetes: the translating research into action for diabetes study. *Diabetes Care*. 2008;31(2):261-6.
- Piette JD, Heisler M, Wagner TH. Medication characteristics beyond cost alone influence decisions to underuse pharmacotherapy in response to financial pressures. *J Clin Epidemiol*. 2006;59(7):739-46.
- Wagner TH, Heisler M, Piette JD. Prescription drug co-payments and cost-related medication underuse. *Health Econ Policy Law*. 2008;3(Pt 1):51-67.
- Piette JD, et al. Beliefs about prescription medications among patients with diabetes: variation across racial groups and influences on cost-related medication underuse. *J Health Care Poor Underserved*. 2010;21(1):349-61.