

Problems Paying Out-of-Pocket Medication Costs Among Older Adults With Diabetes

JOHN D. PIETTE, PHD¹
MICHELE HEISLER, MD, MPA¹
TODD H. WAGNER, PHD²

OBJECTIVE — To identify problems faced by older adults with diabetes due to out-of-pocket medication costs.

RESEARCH DESIGN AND METHODS — In this cross-sectional national survey of 875 adults with diabetes treated with hypoglycemic medication, respondents reported whether they had underused prescription medications due to cost pressures or had experienced other financial problems associated with medication costs such as forgoing basic necessities. Respondents also described their interactions with clinicians about medication costs.

RESULTS — A total of 19% of respondents reported cutting back on medication use in the prior year due to cost, 11% reported cutting back on their diabetes medications, and 7% reported cutting back on their diabetes medications at least once per month. Moreover, 28% reported forgoing food or other essentials to pay medication costs, 14% increased their credit card debt, and 10% borrowed money from family or friends to pay for their prescriptions. Medication cost problems were especially common among respondents who were younger, had higher monthly out-of-pocket costs, and had no prescription drug coverage. In general, few respondents, including those reporting medication cost problems, reported that their health care providers had given them information or other assistance to address medication cost pressures.

CONCLUSIONS — Out-of-pocket medication costs pose a significant burden to many adults with diabetes and contribute to decreased treatment adherence. Clinicians should actively identify patients with diabetes who are facing medication cost pressures and assist them by modifying their medication regimens, helping them understand the importance of each prescribed medication, providing information on sources of low-cost drugs, and linking patients with coverage programs.

Diabetes Care 27:384–391, 2004

Most adults with diabetes use insulin or oral hypoglycemics, and taking these medications as prescribed is critical to achieving glycemic

control (1–3). Many patients with diabetes have comorbid illnesses such as hypertension, hyperlipidemia, and depression that also require prescription drug use; as

a result, patients with diabetes have monthly out-of-pocket medication costs that are higher, on average, than patients with most other chronic illnesses (4,5). High out-of-pocket costs can be a significant barrier to adherence to prescription medication regimens. Studies based on claims data (6,7) as well as surveys (8,9) demonstrate that some patients cut back on medication use because of cost pressures, and cost-related medication adherence problems have been linked to serious adverse health events (6,10–14). Moreover, many chronically ill adults who cut back on medications due to cost do not discuss this problem with their clinicians (15). It is unclear, however, whether these problems are common among patients with diabetes and which patients with diabetes are at greatest risk.

In the current study, we examined problems due to medication costs experienced by adults with diabetes as well as their assessments of clinicians' efforts to address their concerns about medication costs. Specifically, we sought to determine 1) the prevalence and risk factors of cost-related underuse of medications among older diabetic adults; 2) the prevalence and correlates of other problems due to out-of-pocket medication costs, such as forgoing basic necessities or increasing debt burden; and 3) the extent to which patients with diabetes discuss problems with medication costs with their clinicians and receive various types of assistance.

RESEARCH DESIGN AND METHODS

Institutional Review Boards at the authors' institutions approved the study protocol. Data were collected by surveys of a nationwide panel of adults living in the U.S. Panel members were recruited by Knowledge Networks (Menlo Park, CA) using random-digit dialing and a sampling frame consisting of the entire U.S. population with assigned telephone numbers. The purpose of the Knowledge Networks panel is to provide researchers from government, academia,

From the ¹Department of Veterans Affairs Center for Practice Management and Outcomes Research and Department of Internal Medicine and Michigan Diabetes Research and Training Center, University of Michigan, Ann Arbor, Michigan; and the ²Department of Veterans Affairs Health Economics Resource Center and Department of Health Research and Policy, Stanford University, Palo Alto, California.

Address correspondence and reprint requests to John D. Piette, PhD, Center for Practice Management and Outcomes Research, VA Ann Arbor Health Care System, P.O. Box 130170, Ann Arbor, MI 48113-0170. E-mail: jpiette@umich.edu.

Received for publication 22 July 2003 and accepted in revised form 13 October 2003.

The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

Abbreviations: AOR, adjusted odds ratio.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

© 2004 by the American Diabetes Association.

and private industry with a large, national sample of adults for whom detailed information about health, economic, and demographic information is known. Panel members complete surveys on a wide range of topics in exchange for WebTV and free monthly Internet access. A strength of the panel is that surveys can be administered rapidly relative to more “traditional” recruitment methods so that study results are available while important national policy issues (e.g., the ongoing debate about prescription drug costs and coverage) are being considered.

At the time of this study, the panel included >40,000 members. Analyses by independent researchers have compared panel members’ characteristics to the U.S. Census Bureau’s Current Population Survey, the National Health Interview Survey, and an independent random-digit dialing sample. On most sociodemographic parameters, key health behaviors (e.g., smoking), and the prevalence of chronic illnesses, panel members’ characteristics have been found to be within a few percentage points of these other national estimates (16,17). Data from surveys of panel members have been used as the basis for several prior studies published in peer-reviewed journals (18–22).

Using sociodemographic and health status information about each panel member, we identified all 5,644 individuals aged ≥ 50 years who reported taking prescription medication for diabetes, depression, heart problems, hypertension, or high cholesterol. For the current analyses, the target population was the subset of these panel members who were taking prescription medication for diabetes ($n = 1,176$). A total of ~ 330 additional panel members with diabetes were ineligible for the current study because they did not report using prescription hypoglycemic medication. After three personalized e-mail requests, 812 of the sampled patients with diabetes completed the on-line informed consent and survey and confirmed using hypoglycemic medication. Compared with nonrespondents, patients with diabetes who completed the survey were somewhat older on average (64 vs. 62 years, $P = 0.02$), more likely to be white (83 vs. 68%, $P < 0.001$), and more likely to have at least some college education (63 vs. 52%, $P = 0.001$). The groups were similar with regard to average income, marital status, and sex (all $P >$

0.40). An additional 63 survey respondents (originally identified based on another index condition) were included in the current study because they reported a diagnosis of diabetes and use of hypoglycemic medication at the time of the survey. As with the overall panel, the subset of respondents with diabetes was sampled to be socioeconomically representative of diabetic patients nationwide.

Survey description and variable creation

Respondents reported whether they used prescription medication for diabetes as well as for 15 other chronic conditions. For each condition, participants were asked, “In the past 12 months, have you ever taken less of [condition] medication than prescribed by your doctor because of the cost?” Respondents who reported cost-related underuse were asked how often they took less of each medication than prescribed. These survey measures of cost-related medication underuse are similar to those used in prior studies (8,9), and the survey was pretested with >100 chronically ill patients before being used in the current study.

Because the clinical significance of adherence problems depends not only on what drugs patients are restricting but also how often, we created four measures of cost-related medication underuse. The first measure identified respondents reporting any cost-related medication underuse during the prior year. The second measure identified individuals who reported underusing one or more of their medications at least once per month. The third measure was diabetes-specific and identified all respondents reporting cost-related underuse associated with one or more of their diabetes medications. Finally, the fourth measure identified individuals experiencing cost-related adherence problems with their diabetes medications at least monthly. The survey did not differentiate between use of insulin and oral hypoglycemic medications.

Respondents were asked about three other types of problems associated with out-of-pocket medication costs: spending less on food, heat, or other basic needs; increasing credit card debt to pay for medications; and borrowing money from family or friends to pay medication costs. We also created an indicator for whether the respondent reported any type of problem due to pressures of medication costs

(i.e., medication underuse, cutting back on basic needs, or increasing debt).

Respondents who reported cost-related medication underuse were asked whether they told a clinician in advance or whether they had ever discussed medication cost problems with their doctors and nurses during the prior year. All respondents reported whether their clinicians provided various types of assistance with potential medication cost problems, such as providing information about coverage programs or recommending a change in medication from a brand to a generic drug.

The sociodemographic variables we examined as possible predictors of problems associated with out-of-pocket medication costs included race, age, sex, education level, and annual household income. We also examined indexes of patients’ medication cost pressures, including total number of prescription medications, total monthly out-of-pocket medication costs, and whether they had prescription drug coverage (any versus none).

Statistical analyses

We used bivariate tabulations and Pearson χ^2 statistics to examine differences across subgroups in the prevalence of problems associated with out-of-pocket medication costs. We then fit multivariate logistic regression models predicting any cost-related medication underuse and any type of cost-related burden as a function of respondents’ sociodemographic characteristics and medication cost pressures. Finally, we used bivariate tables and χ^2 tests to determine whether patients reporting problems with medication costs were more likely than other diabetic patients to receive various forms of assistance from clinicians (e.g., changing medications to generic alternatives). In all analyses, we used poststratification weights to adjust the distribution of respondents to match the distribution of the U.S. population on age, sex, race/ethnicity, education, region, and metropolitan residence, thereby correcting for oversampling and survey nonresponse (23,24). The Bureau of Labor Statistics Current Population Survey for October 2002 provided data on the distribution of the U.S. population (25). All analyses were performed using Stata 8.1 statistical software (Stata, College Station, TX) (26). Statistical tests were two-sided; P values

Table 1—Prevalence of cost-related medication under use

| | Any medication | | | | Diabetes medication | | | |
|------------------------------------|--------------------|---------|------------------|---------|---------------------|---------|------------------|---------|
| | Ever in prior year | | At least 1/month | | Ever in prior year | | At least 1/month | |
| | Percent | P value | Percent | P value | Percent | P value | Percent | P value |
| Total | 19 | | 15 | | 11 | | 7 | |
| Race | | 0.82 | | 0.75 | | 0.65 | | 0.37 |
| White | 19 | | 15 | | 10 | | 7 | |
| Other | 19 | | 16 | | 12 | | 8 | |
| Sex | | 0.01 | | 0.0001 | | 0.38 | | 0.27 |
| Male | 14 | | 9 | | 9 | | 6 | |
| Female | 24 | | 21 | | 12 | | 8 | |
| Annual income | | 0.18 | | 0.08 | | 0.67 | | 0.88 |
| \$60,000+ | 13 | | 11 | | 7 | | 5 | |
| \$40,000–59,999 | 17 | | 13 | | 11 | | 7 | |
| \$20,000–39,999 | 19 | | 14 | | 12 | | 8 | |
| <\$20,000 | 25 | | 22 | | 11 | | 7 | |
| Education | | 1 | | 0.9 | | 0.74 | | 0.6 |
| Some college+ | 19 | | 15 | | 10 | | 6 | |
| High school or less | 19 | | 15 | | 11 | | 8 | |
| Age | | 0.001 | | 0.01 | | 0.0002 | | 0.002 |
| 50–54 years | 32 | | 24 | | 24 | | 17 | |
| 55–64 years | 21 | | 17 | | 10 | | 6 | |
| 65+ years | 13 | | 10 | | 6 | | 5 | |
| Number of prescription medications | | 0.0003 | | 0.0001 | | 0.05 | | 0.008 |
| 1–2 | 9 | | 6 | | 7 | | 2 | |
| 3–6 | 15 | | 12 | | 8 | | 6 | |
| 7+ | 29 | | 24 | | 15 | | 11 | |
| Out-of-pocket prescription cost | | 0.002 | | 0.006 | | 0.05 | | 0.21 |
| \$0–49 | 13 | | 10 | | 7 | | 5 | |
| \$50–99 | 19 | | 14 | | 12 | | 7 | |
| \$100+ | 29 | | 24 | | 15 | | 10 | |
| Prescription drug coverage | | 0.15 | | 0.52 | | 0.19 | | 0.83 |
| None | 24 | | 17 | | 14 | | 7 | |
| Any | 18 | | 15 | | 9 | | 7 | |

All results were adjusted using sampling weights: $n = 875$.

<0.05 were considered statistically significant.

RESULTS

Patient characteristics

A total of 28% of survey respondents were non-white, and 52% were women. A total of 16% were aged 50–54 years, 39% were aged 55–64 years, and 45% were aged ≥ 65 years. The income distribution was as follows: $< \$20,000$ (26%), $\$20,000$ – $\$39,999$ (37%), $\$40,000$ – $\$59,999$ (19%), and $> \$60,000$ (18%). Half of respondents reported taking at least seven prescription medications, and 49% were taking two or more hypoglycemic medications. The most common other medication types were for treatment of hyperten-

sion (71% of respondents); hyperlipidemia (53%); arthritis (29%); heartburn, acid reflux, or irritable bowel syndrome (24%); atherosclerosis (23%); and depression (20%). More than 26% of respondents had monthly out-of-pocket medication costs between \$50 and \$99, and 29% had monthly costs of $\geq \$100$.

Prevalence and correlates of problems associated with medication cost pressures

Overall, 19% of respondents reported using less of one or more of their medications during the prior year due to cost, and 15% reported underusing some medication at least monthly (Table 1). Women were more likely than men to report cost-related medication underuse

(24 vs. 14%, $P = 0.01$) and were more likely to report cutting back on their medication use at least monthly (21 vs. 9%, $P = 0.0001$). Younger respondents were more likely to report cost-related underuse of medications than their older counterparts. The prevalence of cost-related underuse of medications among respondents using seven or more drugs was three times as high as among respondents using one or two drugs (29 vs. 9%), and respondents using seven or more drugs were more than four times as likely to cut back on medication use at least once per month (24 vs. 6%). The prevalence of cost-related adherence problems among respondents reporting out-of-pocket medication costs of at least \$100 per month was more than twice as high as that

Table 2—Prevalence of other problems associated with medication cost pressures

| | Basic needs* | | Increase debt† | | Borrow money‡ | | Any problem§ | |
|------------------------------------|--------------|---------|----------------|---------|---------------|---------|--------------|---------|
| | Percent | P value | Percent | P value | Percent | P value | Percent | P value |
| Total | 28 | | 14 | | 10 | | 36 | |
| Race | | 0.06 | | 0.54 | | 0.02 | | 0.17 |
| White | 25 | | 14 | | 8 | | 34 | |
| Other | 36 | | 16 | | 16 | | 42 | |
| Sex | | 0.003 | | 0.52 | | 0.31 | | 0.004 |
| Male | 21 | | 13 | | 9 | | 29 | |
| Female | 34 | | 15 | | 12 | | 42 | |
| Annual income | | <0.0001 | | 0.84 | | 0.15 | | 0.005 |
| \$60,000+ | 13 | | 12 | | 6 | | 26 | |
| \$40,000–59,999 | 15 | | 13 | | 8 | | 25 | |
| \$20,000–39,999 | 35 | | 16 | | 9 | | 40 | |
| <\$20,000 | 37 | | 14 | | 16 | | 44 | |
| Education | | 0.05 | | 0.73 | | 0.09 | | 0.17 |
| Some college+ | 23 | | 15 | | 7 | | 25 | |
| High school or less | 31 | | 14 | | 12 | | 32 | |
| Age | | 0.24 | | 0.07 | | 0.004 | | 0.03 |
| 50–54 years | 36 | | 23 | | 17 | | 47 | |
| 55–64 years | 25 | | 15 | | 13 | | 38 | |
| 65+ years | 28 | | 11 | | 5 | | 30 | |
| Number of prescription medications | | 0.02 | | 0.002 | | 0.31 | | 0.007 |
| 1–2 | 23 | | 3 | | 9 | | 31 | |
| 3–6 | 22 | | 12 | | 8 | | 31 | |
| 7+ | 36 | | 21 | | 14 | | 47 | |
| Out-of-pocket prescription cost | | <0.0001 | | <0.0001 | | 0.005 | | <0.0001 |
| \$0–49 | 17 | | 6 | | 6 | | 24 | |
| \$50–99 | 33 | | 13 | | 19 | | 39 | |
| \$100+ | 41 | | 24 | | 10 | | 51 | |
| Prescription drug coverage | | 0.004 | | 0.02 | | 0.39 | | 0.005 |
| None | 40 | | 23 | | 12 | | 49 | |
| Any | 24 | | 12 | | 10 | | 32 | |

All results were adjusted using sampling weights. **"In the past 12 months, did you ever spend less on food, heat, or other basic needs so that you would have enough money to pay for your prescription medications?"* †*"In the past 12 months, did you ever increase the amount of credit card debt you carried from month to month because of the cost of your prescription medications?"* ‡*"In the past 12 months, did you ever borrow money from a family member or friend in order to pay for your prescription medications?"* §Any medication underuse, spending less on necessities, increases in credit card debt, or borrowing due to out-of-pocket medication costs. *n* = 875.

among those with monthly costs of ≤\$49 (29 vs. 13%).

A total of 11% of respondents reported cost-related underuse of their diabetes medications during the prior year, and 7% of all respondents reported cutting back on their diabetes medication at least monthly. Compared with respondents aged ≥65 years, those aged 50–54 years were four times as likely to report cost-related underuse of diabetes medications (24 vs. 6%) and more than three times as likely to report cutting back on diabetes medications due to cost at least once per month (17 vs. 5%).

As shown in Table 2, many respondents reported cutting back on basic needs (28%), increasing credit card debt

(14%), and borrowing money from family or friends (10%) to pay for their prescriptions. In bivariate analyses, respondents who reported that they reduced expenditures on basic needs were more likely to be women, to have low income, and to be less educated. More than 20% of individuals using at least seven medications and nearly one in four who had out-of-pocket medication costs of \$100 or more reported increasing their credit card debt to pay for their prescriptions. Respondents reporting no prescription drug coverage were more than twice as likely as those with some coverage to report increasing their credit card debt to pay for their medications (23 vs. 12%, *P* = 0.02).

Controlling for covariates in multi-

variate logistic regression analyses, women were 1.8 times as likely to report cutting back on medication use due to cost problems than men (Table 3, adjusted odds ratio [AOR] 1.8, 95% CI 1.1–3.0). Respondents with annual income <\$20,000 were 2.4 times as likely to report cost-related adherence problems as those with incomes of ≥\$60,000 (95% CI 1.1–5.0). Younger age and higher monthly medication costs were each independently associated with a greater likelihood of cost-related medication underuse. A similar pattern of effects was observed when the outcome included all types of medication cost problems. However, in this model, respondents with no prescription drug coverage were at in-

Table 3—Logistic regression models predicting cost-related medication underuse and any problem associated with out-of-pocket medication costs

| | Prescription medication restriction* | | Any problem† | |
|------------------------------------|--------------------------------------|----------|--------------|---------|
| | AOR | 95% CI | AOR | 95% CI |
| Race | | | | |
| White | 1.1 | 0.6–2.5 | 0.7 | 0.4–1.3 |
| Other | Ref. | | Ref. | |
| Sex | | | | |
| Female | 1.8 | 1.1–3.0 | 1.7 | 1.1–2.6 |
| Male | Ref. | | Ref. | |
| Annual income | | | | |
| <\$20,000 | 2.4 | 1.1–5.0 | 2.3 | 1.2–4.5 |
| \$20,000–39,999 | 1.8 | 0.9–3.7 | 2.1 | 1.2–3.7 |
| \$40,000–59,999 | 1.5 | 0.7–3.0 | 0.9 | 0.5–1.6 |
| \$60,000+ | Ref. | | Ref. | |
| Education | | | | |
| Some college+ | 0.8 | 0.5–1.3 | 0.9 | 0.6–1.4 |
| High school or less | Ref. | | Ref. | |
| Age | | | | |
| 50–54 years | 5.0 | 2.0–10.0 | 2.5 | 1.3–5 |
| 55–64 years | 1.7 | 0.8–3.3 | 1.3 | 0.7–2.5 |
| 65+ years | Ref. | | Ref. | |
| Number of prescription medications | | | | |
| 7+ | 1.6 | 0.6–4.1 | 1.4 | 0.6–3.3 |
| 3–6 | 1.0 | 0.4–2.5 | 0.9 | 0.4–2.0 |
| 1–2 | Ref. | | Ref. | |
| Out-of-pocket prescription cost | | | | |
| \$100+ | 2.8 | 1.5–5.5 | 3.9 | 2.2–6.9 |
| \$50–99 | 2.1 | 1.0–4.3 | 2.9 | 1.6–5.0 |
| \$0–49 | Ref. | | Ref. | |
| Prescription drug coverage | | | | |
| None | 1.4 | 0.8–2.5 | 2.0 | 1.1–3.3 |
| Any | Ref. | | Ref. | |

All results were adjusted using sampling weights. *Any cost-related medication underuse in the prior year; †any medication underuse, spending less on necessities, increases in credit card debt, or borrowing due to out-of-pocket medication costs. *n* = 875.

creased risk relative to those with some coverage (AOR 2.0, 95% CI 1.1–3.3).

Conversations with clinicians about problems paying medication costs

Only 32% of respondents who reported cutting back on medication use due to out-of-pocket costs reported telling a doctor or nurse in advance, and more than one in three (37%) reported never talking with clinicians about their medication cost problem at all. The most common reason that respondents gave for not talking with clinicians about medication cost problems was that clinicians never asked them (reported by 70%). Half (50%) of respondents who did not talk with clinicians

about their cost-related adherence problems stated that they did not think that their health care providers could help them with medication costs, 39% did not think it was important enough to mention, and 35% indicated that they felt embarrassed. A total of 30% of respondents indicated that they felt that there was insufficient time during their visits to raise this issue.

Clinician responses to patients' medication cost pressures

Overall, 59% of respondents reported receiving free medication samples in the prior year, and 44% reported that their clinicians changed one or more of their

medications to a cheaper brand or a generic equivalent. However, only 12% were given information about low-cost medication sources, 11% were given information about financial assistance programs, and 9% had the number of medications in their regimen reduced to lower out-of-pocket costs.

Participants who reported problems due to medication costs were more likely than other patients to report receiving clinician assistance. For example, respondents reporting cost-related medication underuse were more likely than those without such problems to report receiving free samples (77 vs. 55%, *P* = 0.0006), a change in medication to a generic equivalent or cheaper brand (63 vs. 39%, *P* = 0.0001), and information about programs that help patients pay medication costs (22 vs. 9%, *P* = 0.0003). Nevertheless, less than half of patients reporting cost-related adherence problems indicated that a clinician talked with them about which medications they should not skip (42%), few were given information about where to obtain less expensive medications (18%), and individuals reporting cost-related medication underuse were not significantly more likely than other respondents to be asked whether they could afford their medicines (22 vs. 19%, *P* = 0.43).

CONCLUSIONS— We found that many older adults with diabetes underuse their medications because of out-of-pocket costs. The importance of medication adherence among patients with diabetes is well established, and individuals who cut back on medication use due to cost are at increased risk for serious complications. In one prior study, diabetes patients who cut back on their hypoglycemic medication due to cost problems had poorer glycemic control, and those who cut back on other medications due to cost reported more symptoms and poorer health-related quality of life (14). In the current study, we found that the impact of out-of-pocket medication costs extends beyond patients' adherence to medication regimens. Many respondents reported cutting back on basic needs to pay for their medications, and many others incurred credit card debt or borrowed money from family and friends to pay for their medications. These financial consequences of medication cost pressures may also adversely affect the

health and well-being of patients with diabetes, although the magnitude of those effects is unknown.

Many respondents reported cutting back on some of their prescription medications, but not the ones treating their diabetes *per se*. Poor adherence to these concurrent therapies could have a significant impact on patients' diabetes-related outcomes. For example, hypertension management is critically important to prevent macrovascular complications of diabetes (27). Future studies should investigate how diabetic patients taking multiple medications make choices about which ones to forego when facing out-of-pocket medication costs and the implications of those choices for patients' health.

These analyses suggest that large numbers of diabetes patients (i.e., those aged <65 years and not yet eligible for Medicare) will remain at risk for adherence problems even if Medicare prescription drug benefit reforms are enacted. Even with proposed reforms, many patients with diabetes who are eligible for Medicare will incur significant out-of-pocket medication costs and may still be at risk for the adherence problems we observed (28). In the current study, the total number of prescription medications was not an independent predictor of medication cost problems, after controlling for patients' out-of-pocket medication costs. Nevertheless, in practice, these two variables are highly correlated, and the type and number of prescriptions are the drivers of patient medication costs that are most clearly under clinicians' control (5). In the absence of more comprehensive prescription drug coverage, it is critical for clinicians to identify medication regimens for their diabetic patients that carry the lowest possible out-of-pocket costs without compromising treatment effectiveness.

Unfortunately, many diabetic patients with cost-related adherence problems reported that their providers did not assist them with potential problems associated with out-of-pocket medication costs. It is important to note that these data do not necessarily reflect the experience of respondents who had found a viable solution to their medication cost problems after talking with clinicians and, therefore, who did not report cost-related underuse in the survey. Nevertheless, it is clear that diabetic patients with medication cost problems require addi-

tional assistance; improved patient-provider communication may be an important component of an effective strategy to minimize cost as a barrier to medication adherence. High quality patient-provider communication is essential for supporting diabetes self-care (29) and is associated with patients' glycemic control (30). Thus, enhancing patient-provider communication about cost-related adherence problems might improve patients' medication adherence as well as other adherence behaviors.

Some potential clinician responses to medication cost pressures, such as asking patients whether they can afford a new prescription, would be relatively simple to implement and may help providers identify individuals requiring more extensive assistance. Other interventions such as ensuring that all prescribed medications are necessary, substituting generic equivalents for brand therapies, or educating patients about mail-order pharmacies and drug assistance programs may take more effort; unfortunately, primary care providers already face daunting demands on their time (31). Nonphysicians (e.g., social workers, nurses, and clinical pharmacists) with specialized expertise in both pharmacotherapy and strategies for lowering out-of-pocket medication costs may be important adjuncts to patient care teams to assist primary care providers in crafting the best possible regimens in light of patients' financial constraints, health status, and values.

An important finding from this study was that most individuals with low income did not report taking less medication than prescribed due to cost, whereas some who did report cost-related medication underuse had higher incomes. We conclude that diabetic patients' perceptions of the costs and benefits of their treatments may contribute to their rates of underuse, along with the therapy's actual financial burden. As such, diabetes educators and other clinicians may be able to influence patients' behavior even if costs cannot be reduced. Studies suggest that clinicians can improve patients' adherence to medication regimens through open, collaborative discussions (32). Some patients may be more likely to use their medications as prescribed if they receive explicit information about their medications' importance for their long-term health.

Results of this study should be interpreted in light of several possible limitations. Nonwhites and individuals with less education were somewhat less likely to participate in this study, and both of these factors have been found in prior studies to be associated with access problems as well as less effective patient-provider communication. Thus, rates of cost-related adherence problems and the extent to which individuals fail to discuss these issues with their clinicians may have been underestimated. Because the survey was Internet-based, individuals who were less comfortable using technologies such as the worldwide web also could be underrepresented. Such individuals may have lower functional health literacy, a characteristic that has been linked to poorer treatment adherence, patient-provider communication, and outcomes (33). Moreover, it is possible that some respondents reported telling providers about medication cost problems because they believed this response to be more socially desirable. However, prior studies indicate that individuals are less subject to social desirability bias when responding to a computer-based interview than an in-person interview (34–36). Any social desirability bias reflected in these data would suggest that the number of patients who do not discuss medication cost problems with providers is even greater than reported here. Ultimately, the extent to which survey biases such as recall bias or social desirability bias influence the validity of the current data can only be determined through studies that evaluate cost-related adherence problems using other data collection approaches (e.g., pill counts and audiotaped patient-clinician encounters). Other determinants of patients' cost-related underuse (e.g., the cost of medical care for family members) are not reflected in these analyses, and many patients may experience adherence problems for reasons other than medication costs. Finally, it is important to emphasize that people with diabetes who use some medication but not hypoglycemic medication were ineligible for the current study, and their rates of cost-related adherence problems may be different from those reported in this study.

Despite these limitations, this study suggests that medication costs pose significant problems for people with diabetes in the U.S., affecting both their adherence to medication regimens as well

as other aspects of their lives. Moreover, this study suggests that there is substantial room for improvement in clinicians' and health systems' efforts to assist patients with their medication costs. Addressing these issues effectively may improve not only individuals' adherence to treatment regimens but their health outcomes as well.

Acknowledgments—This study was supported by a grant from the Department of Veterans Affairs.

We thank Joanne A. Kimata for editorial assistance.

References

- Schectman JM, Dadkarni MM, Voss JD: The association between diabetes metabolic control and drug adherence in an indigent population. *Diabetes Care* 25: 1015–1021, 2002
- Donnan PT, MacDonald TM, Morris AD: Adherence to prescribed oral hypoglycaemic medication in a population of patients with type 2 diabetes: a retrospective cohort study. *Diabet Med* 19:263–264, 2002
- Mason BJ, Matsuyama JR, Jue SG: Assessment of sulfonylurea adherence and metabolic control. *Diabetes Educ* 21:52–57, 1995
- Rogowsky J, Lillard LA, Kington R: The financial burden of prescription drug use among elderly persons. *Gerontologist* 37: 475–482, 1997
- Dubois RW, Chawla AJ, Neslusan CA, Smith MW, Wade S: Explaining drug spending trends: does perception match reality? *Health Affairs* 19:231–239, 2000
- Soumerai SB, Avorn J, Ross-Degnan D, Gortmaker S: Payment restrictions for prescription drugs under Medicaid: effects on therapy, cost, and equity. *N Engl J Med* 317:550–556, 1987
- Fortess EE, Soumerai SB, McLaughlin TJ, Ross-Degnan D: Utilization of essential medications by vulnerable older people after a drug benefit cap: importance of mental disorders, chronic pain, and practice setting. *J Am Geriatr Soc* 49:793–797, 2001
- Steinman MA, Sands LP, Covinsky KE: Self-restriction of medications due to cost in seniors without prescription coverage. *J Gen Intern Med* 16:793–799, 2001
- Safran DG, Neuman P, Schoen C, Montgomery JE, Li W, Wilson IB, Kitchman MS, Bowen AE, Rogers WH: Prescription drug coverage and seniors: how well are states closing the gap? *Health Affairs Supp Web Exclusives* W253–W268, 2002
- Soumerai SB, Ross-Degnan D, Avorn J, McLaughlin TJ, Choodnovsky I: Effects of Medicaid drug-payment limits on admission to hospitals and nursing homes. *N Engl J Med* 325:1072–1077, 1991
- Soumerai SB, McLaughlin TJ, Ross-Degnan D, Casteris CS, Bollini P: Effects of limiting Medicaid drug-reimbursement benefits on the use of psychotropic agents and acute mental health services by patients with schizophrenia. *N Engl J Med* 331:650–655, 1994
- Tamblyn R, Laprise R, Hanley JA, Abrahamowicz M, Scott S, Mayo N, Hurley J, Grad R, Latimer E, Perreault R, McLeod P, Huang A, Larochelle P, Mallet L: Adverse events associated with prescription drug cost-sharing among poor and elderly persons. *JAMA* 285:421–429, 2001
- Adams AS, Soumerai SB, Ross-Degnan D: The case for a Medicare drug coverage benefit: a critical review of the empirical evidence. *Annu Rev Public Health* 22:49–61, 2001
- Piette JD, Wagner TH, Potter MB, Schillinger D: Health insurance status, medication under-use due to cost and outcomes among diabetes patients in three systems of care. *Med Care*. In press
- Piette JD, Heisler M, Wagner TH: Cost-related medication under-use: do patients with chronic illnesses tell their doctors? *Arch Intern Med*. In press
- A comparison of random digit dialing telephone survey methodology with internet survey methodology as implemented by Knowledge Networks and Harris Interactive [article online], 2001. Available from <http://www.knowledge-networks.com/ganp/reviewer-info.html>. Accessed 9 December 2003
- Baker LC, Bundorf MK, Singer S, Wagner TH: Validity of the Survey of Health and the Internet, and Knowledge Network's panel and sampling [article online], 2003. Stanford, CA, Stanford University, 2003. Available from <http://www.knowledge-networks.com/ganp/reviewer-info.html>. Accessed 9 December 2003
- Schlenger WE, Caddell JM, Ebert L, Jordan BK, Rourke KM, Wilson D, Thalji L, Dennis JM, Fairbank JA, Kulka RA: Psychological reactions to terrorist attacks: findings from the National Study of Americans' Reactions to September 11. *JAMA* 288:581–588, 2002
- Baker L, Wagner TH, Singer S, Bundorf MK: Use of the internet and email for health care information: results from a national survey. *JAMA* 289:2400–2406, 2003
- Lentine DA, Hersey JC, Iannacchione VG, Laird GH, McClamroch K, Thalji L: HIV-related knowledge and stigma—United States, 2000. *Morbidity and Mortality Weekly Report* 49:1062–1064, 2000
- Harris KM: Can high quality overcome consumer resistance to restricted provider access? Evidence from a health plan choice experiment. *Health Serv Res* 37: 551–571, 2002
- Skitka LJ, Mullen E, Griffin T, Hutchinson S, Chamberlin B: Dispositions, scripts, or motivated correction? Understanding ideological differences in explanations for social problems. *J Pers Soc Psychol* 83: 470–487, 2002
- Eltinge JL, Sribnew WM: Some basic concepts for design-based analysis of complex survey data. *Stata Tech Bull Reprints* 6:208–213, 1996
- Korn EL, Graubard BI: *Analysis of Health Surveys*. New York, John Wiley & Sons, 1999
- Bureau of Labor Statistics and the Bureau of the Census. *Current Population Survey Basic Monthly Survey*. Washington, DC, U.S. Dept. of Labor. Available from <http://www.bls.gov/cps/home.htm>. Accessed 15 December 2003
- Stata Corporation: *Stata Release 8.1 User's Manual*. College Station, TX, Stata Corporation, 2003
- Vijan S, Hayward RA: Treatment of hypertension in type 2 diabetes mellitus: blood pressure goals, choice of agents, and setting priorities in diabetes care. *Ann Intern Med* 138:593–602, 2003
- Kennedy J, Erb C: Prescription noncompliance due to cost among adults with disabilities in the United States. *Am J Public Health* 92:1120–1124, 2002
- Heisler M, Bouknight RR, Hayward RA, Smith DM, Kerr EA: The relative importance of physician communication, participatory decision-making, and patient understanding in diabetes self-management. *J Gen Intern Med* 17:243–252, 2002
- Schillinger D, Piette J, Grumbach K, Wang F, Wilson C, Daher C, Leong-Grotz K, Castro C, Bindman AB: Closing the loop: physician communication with diabetic patients who have low health literacy. *Arch Intern Med* 163:83–90, 2003
- Yarnall KS, Pollak KI, Ostbye T, Krause KM, Michener JL: Primary care: is there enough time for prevention? *Am J Public Health* 93:635–641, 2003
- DiMatteo MR: Patient adherence to pharmacotherapy: the importance of effective communication. *Formulary* 30:596–605, 1995
- Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs AMA: Health literacy: report of the Council on Scientific Affairs. *JAMA* 281:552–557, 1999
- Locke SE, Kowaloff HB, Hoff RG, Safran C, Popovsky MA, Cotton DJ, Finkelstein DM, Page PL, Slack WV: Computer-based interview for screening blood donors for risk of HIV transmission. *JAMA* 268: 1505–1506, 1992

35. Koback KA, Reynolds WM, Greist JH: Computer-administered clinical rating scales: a review. *Psychopharmacology* 127: 291–301, 1996
36. Perrine MW, Mundt JC, Searles JS, Lester LS: Validation of daily self-reported alcohol consumption using interactive voice response (IVR) technology. *J Stud Alcohol* 56:487–490, 1995