

# The Effect of Chronic Pain on Diabetes Patients' Self-Management

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**OBJECTIVE** — Many adults experience chronic pain, yet little is known about the consequences of such pain among individuals with diabetes. The purpose of this study was to examine whether and how chronic pain affects diabetes self-management.

**RESEARCH DESIGN AND METHODS** — This is a cross-sectional study of 993 patients with diabetes receiving care through the Department of Veterans Affairs (VA). Data on chronic pain, defined as pain present most of the time for 6 months or more during the past year, and diabetes self-management were collected through a written survey. Multivariable regression techniques were used to examine the association between the presence and severity of chronic pain and difficulty with diabetes self-management, adjusting for sociodemographic and other health characteristics including depression.

**RESULTS** — Approximately 60% of respondents reported chronic pain. Patients with chronic pain had poorer diabetes self-management overall ( $P = 0.002$ ) and more difficulty following a recommended exercise plan (adjusted odds ratio [OR] 3.0 [95% CI 2.1–4.1]) and eating plan (1.6 [1.2–2.1]). Individuals with severe or very severe pain, compared with mild or moderate, reported significantly poorer diabetes self-management ( $P = 0.003$ ), including greater difficulty with taking diabetes medications (2.0 [1.2–3.4]) and exercise (2.5 [1.3–5.0]).

**CONCLUSIONS** — Chronic pain was prevalent in this cohort of patients with diabetes. Even after controlling for general health status and depressive symptoms, chronic pain was a major limiting factor in the performance of self-care behaviors that are important for minimizing diabetes-related complications. Competing demands, such as chronic pain, should be considered when working with patients to develop effective diabetes self-care regimens.

*Diabetes Care* 28:65–70, 2005

There are many effective diabetes treatment and self-management strategies that improve patients' short- and long-term outcomes (1–5). Nonetheless, recommended diabetes management strategies tend to include a complex set of care requirements. While it may be feasible for healthcare providers and patients to follow many of these rec-

ommendations when diabetes is their only consideration, how the presence of other chronic conditions might influence the delivery of recommended diabetes services or a patient's ability to engage in self-care activities is not always taken into account.

Chronic pain is a comorbid condition that could be especially troublesome for

patients with diabetes given its symptomatic manifestation and the accompanying psychological distress and physical disability (6–8). Chronic pain is common in the general population, with an estimated prevalence ranging from 15 to 50% (6,9–12). Pain is a leading reason people seek medical care (13,14) and a primary factor for lost productive time among U.S. workers (7,15). However, aside from its well-documented association with depression (8), little is known about how chronic pain affects individuals with other chronic conditions.

For this exploratory study we used a model of competing demands that describes how patient, provider, and environmental factors compete for attention and thereby affect healthcare delivery (16,17). Although developed primarily in the context of preventive care, because of the complexity associated with the management of chronic illnesses such as diabetes, we believe this model provides a useful framework to examine both the delivery of chronic care services and patient self-management. In particular, we hypothesize that chronic pain could serve as a competing demand that affects patients' participation in recommended diabetes self-care activities.

Previous research supporting this hypothesis includes one study that explored perceived barriers to self-care among individuals with multiple chronic conditions. Respondents in that study reported that symptoms or lifestyle changes necessitated by one condition interfered with self-care for another condition (18). Most individuals also mentioned that the compound effects of taking multiple medications (e.g., schedule and coordination) interfered with their self-care (18). In a second study of older women with diabetes, respondents specifically identified pain and disability as barriers to exercise, driving, and foot care (19).

However, prior studies have not explicitly examined whether chronic pain acts as a competing demand for patients with diabetes or the extent to which chronic pain serves as a barrier to performing recommended diabetes self-management practices. Thus, we asked

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Received for publication 18 June 2004 and accepted in revised form 15 September 2004.

**Abbreviations:** CES-D 10, Center for Epidemiological Studies Short Depression Scale; OLS, ordinary least squares; VA, Veterans Affairs.

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

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the following research questions: 1) What is the association between chronic pain and the performance of recommended diabetes self-management activities? and 2) Among patients reporting pain, is pain severity related to the performance of recommended self-management activities?

## RESEARCH DESIGN AND METHODS

— Data were collected as part of a larger multisite diabetes quality of care study (20,21). Human studies committees at participating Department of Veterans Affairs (VA) medical centers approved the study protocol. A full description of the sample criteria, response rate, and respondent characteristics for this larger study are described elsewhere (21). Briefly, potential study participants included patients with at least one VA nonancillary care outpatient visit between 1 October 1998 and 30 September 1999 at one of five regional VA healthcare systems and who were identified as having diabetes using data (pharmacy, laboratory, and diagnosis) obtained from the automated VA patient record system. Patients who met the initial selection criteria were invited to participate in a baseline computer-assisted telephone interview after verifying that they 1) had diabetes and 2) received most of their diabetes care through one of the participating facilities. We were unable to reach all individuals to verify their eligibility. However, assuming that persons we were unable to contact or could not confirm eligibility had the same rate of eligibility as those contacted and using a calculation endorsed by the Council of American Survey Research Organizations (22), the survey response rate for the overall study sample was 57%.

Data for this research were primarily obtained through a self-administered survey of study participants conducted ~18 months after the initial phone interview. Of 1,359 study participants, 993 (73%) responded to this follow-up survey, which was conducted in March through May of 2003. Analyses of the baseline characteristics of those who responded to the follow-up survey versus those who did not show that respondents were slightly older, more likely to be white, more likely to have a high school or post-high school education, and had better reported health status at baseline.

## Survey description

The survey included several questions to elicit information about the extent to which patients experienced and were affected by chronic pain. Consistent with prior studies (6,9), patients with chronic pain were identified as those who reported having pain that was present most of the time for 6 months or more during the past year. Patients reporting chronic pain were then asked questions about pain severity and the impact of pain on behavior and moods (23). Information about pain location and treatment was also requested from those patients with chronic pain.

Diabetes self-management was assessed by asking patients to indicate their difficulty with and execution of key self-care practices as recommended by their doctor (24). These practices included taking diabetes medication, exercising regularly, following a recommended eating plan, checking their blood glucose level, and checking their feet for wounds or sores. Patients were asked to rate their level of difficulty with each activity on a scale ranging from 1, “so difficult that I couldn’t do it at all,” to 5, “not difficult I got it exactly right.” A “does not apply” option was also provided. These self-management items can be analyzed individually or combined to form a single scale ranging from 0 to 100 (higher scores indicate less difficulty with self-management). In a prior study, higher scores on this scale were found to be associated with better glycemic control and the receipt of recommended diabetes services (24).

Other factors that could affect self-management include general health status, the priority the patient gives to taking care of his or her diabetes, and the presence of depressive symptoms (8,25,26). Information about these factors was also collected as part of the survey. General health status was assessed using the general health question from the SF-36 questionnaire (27). Diabetes care priority was measured using a question that asks patients how much they agree (from 1 = strongly disagree to 6 = strongly agree) with the statement that taking care of their diabetes is not a high priority for them right now. Depressive symptoms were measured using the Center for Epidemiologic Studies Short Depression Scale (CES-D 10), in which a score of 10 or

greater is considered a positive screen for probable depression (28).

Supplemental data, including socio-demographic information and BMI, were obtained as part of the baseline telephone interview, while information about other comorbid conditions was collected through a baseline medical chart review (21). A comorbidity measure was constructed by counting the number of other comorbid conditions from a list of 13 conditions (see Table 1 footnote).

## Study variables

Our primary outcome variables for all analyses included the overall self-management score as well as the five specific self-care items. We examined both the individual items as well as the overall score. Although we did not have specific hypotheses about how pain would affect an individual self-care item, we felt it was important to identify those activities that might be most affected by chronic pain. The self-management score was analyzed as a continuous measure, with a higher score representing better self-management, while the five self-care items were dichotomized, with respondents who indicated the activity was difficult (“but they managed some of the time”) to so difficult (“that they couldn’t do it at all”) coded as having difficulty with the activity or behavior.

The key independent variable for our first set of analyses was the self-reported presence of chronic pain. These analyses were conducted using the entire study sample except for 65 individuals who did not respond to the chronic pain question. A missing response to this item was primarily related to age and education level, with nonresponders being older and less likely to have a high school education compared with responders. Other variables of interest, which were also dichotomous, included the depression screen (i.e., CES-D 10 score  $\geq 10$ ), health status (poor or fair health versus good, very good, or excellent), the presence of other comorbid conditions (one versus none, two or more versus none), and whether diabetes was a patient priority.

The second set of analyses focused only on those patients with chronic pain and the association between pain severity and patient self-management. Severity was assessed using a question that asked about the general amount of bodily pain the patient experienced during the past 4

Table 1—Social, demographic, and health status characteristics of diabetic patients with and without chronic pain

	With chronic pain	Without chronic pain	P value
<i>n</i>	557	371	
Age (years)	64 ± 10	66 ± 10	0.0001
<60	39 (216)	26 (98)	0.0001
60–70	30 (168)	34 (125)	0.26
>70	31 (173)	40 (148)	0.006
Male	96 (537/557)	99 (368/371)	0.008
White	67 (358/538)	71 (257/362)	0.16
Education, high school or greater	83 (444/538)	81 (292/361)	0.53
Annual household income, ≥\$20,000	53 (275/522)	57 (196/345)	0.23
Use insulin	44 (245/556)	36 (132/368)	0.01
No. of comorbid conditions (range 0–13)*	1.3 ± 1.3 (516)	1.3 ± 1.3 (346)	0.73
0	34 (174)	33 (114)	0.81
1	29 (149)	28 (96)	0.72
≥2	37 (193)	39 (136)	0.57
Health status, fair or poor	55 (299/543)	33 (122/368)	0.0001
CES-D 10 score ≥10†	49 (267/547)	20 (72/362)	0.0001
BMI (kg/m <sup>2</sup> )	31.5 ± 6.4	29.5 ± 5.5	0.0001
Taking care of diabetes not a high priority right now (agree vs. neutral or disagree)	20 (108/547)	21 (77/369)	0.68
Amount of pain		NA	
None to moderate	68 (374/548)		
Severe or very severe	32 (174/458)		
Use pain medication	78 (428/552)	NA	

Data are means ± SD or % (*n*). NA, not applicable. \*Number of comorbid conditions based on medical record data and includes 13 conditions: congestive heart failure, dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, hemiplegia, leukemia, lymphoma, liver disease, cancer, renal disease, peripheral vascular disease, cerebrovascular disease, and cardiovascular disease (excluding hypertension or dyslipidemia) (21). †A score ≥10 is considered probable depression (i.e., positive screen).

weeks. For these analyses, the response categories were collapsed and severity analyzed as a dichotomous variable (severe or very severe versus none to moderate). A variable indicating whether the patient used medication to control their pain on a regular or occasional basis was also added for this set of analyses.

### Statistical analyses

We used bivariate analyses ( $\chi^2$  and Student's *t* tests) to examine differences in the sociodemographic characteristics and health status of patients with chronic pain versus those without pain. Multivariable regression techniques were then used to examine the association between the presence of chronic pain and pain severity and patients' reported difficulty with diabetes self-management while adjusting for other potentially influential factors. The overall self-management score was analyzed using ordinary least squares (OLS) regression, and difficulty with each of the individual components was analyzed using logistic regression. We report our results using the unstandardized coefficients

from the OLS models and the adjusted ORs from the logistic models with their 95% CIs. The reported results were adjusted for sociodemographic and health factors including annual household income, education, age, sex, race, insulin use, BMI, and a number of other comorbid conditions. All analyses were conducted using Stata 8.0 (29) statistical software, with the SE adjusted for the clustering of patients by the VA Medical Center.

In our bivariate analyses, we found there was an association between chronic pain and other variables, such as depression and health status. Despite the potential collinearity among these variables, however, we believed for conceptual reasons that it was important to include all of these factors in the analysis. Moreover, the highest correlation among the individual variables was 0.3, and model diagnostics did not reveal any significant problems with including depression and health status, in addition to chronic pain, in the models.

The amount of missing data were gen-

erally 5% or less for most of the variables used in the statistical analysis. However, the amount missing was closer to 7% for three variables (chronic pain, number of comorbid conditions, and income). Consequently, we also analyzed the data using a multiple imputation procedure (30) to examine the potential influence of missing data on our study results. No substantial changes were observed for our key variable of interest, so we present the results of the nonimputed analyses only.

**RESULTS**— Approximately 60% of respondents (557 of 928) reported experiencing pain that was present most of the time for 6 months or more during the past year. The characteristics of patients with chronic pain versus those with no chronic pain are presented in Table 1. In general, patients reporting chronic pain compared with those without chronic pain were younger, included a higher proportion of women, were more likely to be using insulin, and had a higher BMI. A significantly higher percentage of those with chronic pain reported their health was fair

Table 2—Linear and logistic regression results of the effect of chronic pain on diabetes self-management\*

	Self-management		Difficulty taking diabetes medication	Difficulty with exercise	Difficulty following eating plan	Difficulty with foot care	Difficulty with monitoring
	$\beta$ -Coefficient (95% CI)	P					
Chronic pain	-5.0 (-7.8 to -2.2)	0.002	1.7 (0.68-4.5)	3.0 (2.1-4.1)	1.6 (1.2-2.1)	1.2 (0.75-1.9)	1.3 (0.62-2.5)
CES-D 10 score $\geq$ 10	-6.6 (-8.9 to -4.3)	0.000	3.2 (2.1-5.0)	1.3 (0.73-2.4)	1.7 (1.2-2.4)	3.2 (1.9-5.3)	1.2 (0.84-1.8)
Health fair or poor	-3.7 (-6.2 to -1.1)	0.008	0.95 (0.39-2.3)	2.0 (1.3-3.0)	1.2 (0.88-1.7)	0.93 (0.56-1.5)	1.4 (0.95-2.0)
1 comorbid condition vs. none	0.72 (-0.87 to 2.3)	0.350	0.69 (0.25-1.9)	1.4 (1.0-1.8)	1.2 (0.87-1.7)	1.1 (0.57-2.0)	0.74 (0.41-1.3)
$\geq$ 2 comorbid conditions vs. none	-1.5 (-3.5 to 0.41)	0.110	1.7 (1.1-2.7)	2.0 (1.2-3.2)	1.1 (0.80-1.5)	1.7 (1.0-3.0)	0.79 (0.51-1.2)
Diabetes not a priority	-4.9 (-8.1 to -1.8)	0.004	1.8 (0.99-3.3)	1.3 (1.0-1.6)	1.8 (1.2-2.8)	1.5 (0.83-2.7)	1.7 (1.4-2.2)

Data are adjusted OR (95% CI) unless otherwise stated. \*All models were adjusted for the variables listed as well as for annual household income, education, insulin use, age, sex, race, BMI, and clustering by site.

or poor (55 vs. 33%;  $P < 0.001$ ) and had a CES-D 10 score of 10 or greater (49 vs. 20%;  $P < 0.001$ ), indicating the presence of significant depressive symptoms. On the other hand, individuals with chronic pain did not have a greater number of other chronic conditions than those without pain nor were they more likely to indicate that taking care of their diabetes was not a priority.

Among patients with chronic pain, almost one-third indicated that during the past 4 weeks their pain was severe or very severe, and 78% reported using pain medication on either a regular or occasional basis. The most commonly reported pain locations included the back (60%) and hip or knee (60%). In addition, patients indicated that, on average, pain had interfered with their daily activities on 18 of the last 28 days.

### Association between chronic pain and self-management

As shown in Table 2, the presence of chronic pain was significantly associated with poorer overall diabetes self-management ( $P = 0.002$ ), even after adjusting for the presence of depressive symptoms, general health status, number of other comorbid conditions, and priority given to diabetes care. The logistic results suggest that chronic pain was most strongly associated with specific diabetes self-care activities, including greater difficulty with exercise (adjusted OR 3.0 [95% CI 2.1-4.1]) and following a rec-

ommended eating plan (1.6 [1.2-2.1]). The presence of chronic pain did not appear to be a significant barrier to taking diabetes medications, blood glucose monitoring, or checking feet for wounds or sores. In contrast, a positive depression screen was significantly associated with increased difficulty in taking diabetes medications, checking feet, and following a recommended eating plan.

### Association between chronic pain severity and self-management

Among patients with chronic pain, overall self-management was also significantly poorer for those who indicated their pain was severe or very severe compared with those who rated their pain as mild or moderate ( $P = 0.003$ ) (Table 3). Specifically, patients with severe pain reported more difficulty with taking diabetes medications (adjusted OR = 2.0 [95% CI 1.2-3.4]) and with exercise (2.5 [1.3-5.0]). For patients with chronic pain there was also a significant positive association between taking pain medication and reported diabetes self-management ( $P = 0.003$ ). However, while those who reported taking pain medication had better diabetes self-management scores than patients not taking pain medication, their scores were still significantly lower than patients without chronic pain (79 [SD = 17] vs. 72 [15] vs. 67 [16], respectively;  $P < 0.01$ ).

**CONCLUSIONS**— This study suggests that chronic pain is a prevalent condition among patients with diabetes. Furthermore, the presence of comorbid chronic pain and greater pain severity were both associated with poorer overall diabetes self-management and increased difficulty with certain self-care activities, such as exercising on a regular basis. These findings emphasize the importance of considering potential competing demands, such as chronic pain, when developing self-care regimens for patients with diabetes and other chronic health conditions that require high levels of self-management. Although innovative self-management programs for patients with a wide array of chronic conditions and comorbidities are being developed (31,32), a disease-specific focus continues to be the primary method for self-management education. The results from this study indicate that a more broadly focused approach that equips patients with the skills and confidence to manage chronic illnesses in general may be more effective in improving patients' diabetes-related self-care.

Our findings also suggest that treatment of chronic pain (i.e., taking pain medication) may improve diabetes self-management, although, at least in this population, it does not completely eliminate the negative effect of chronic pain on self-management. However, taking pain medication is only a proxy measure. This project did not assess the types of pain

Table 3—Linear and logistic regression results of the effect of pain severity on diabetes self-management\*

	Self-management		Difficulty taking diabetes medication	Difficulty with exercise	Difficulty following eating plan	Difficulty with foot care	Difficulty with monitoring
	$\beta$ -Coefficient (95% CI)	P					
Pain severe or very severe	−5.2 (−8.3 to −2.1)	0.003	2.0 (1.2–3.4)	2.5 (1.3–5.0)	1.2 (0.90–1.7)	1.8 (0.88–3.7)	1.1 (0.63–1.9)
CES-D 10 score $\geq$ 10	−7.0 (−9.5 to −4.5)	0.000	3.3 (1.5–7.3)	1.5 (0.75–2.8)	1.6 (1.2–2.2)	2.8 (1.4–5.6)	1.5 (1.0–2.1)
Health fair or poor	−2.8 (−5.1 to −0.49)	0.021	1.0 (0.39–2.8)	1.5 (0.86–2.5)	1.3 (1.0–1.6)	0.72 (0.34–1.5)	1.4 (0.99–1.9)
1 comorbid condition vs. none	1.7 (−0.62 to 4.1)	0.140	0.57 (0.17–1.9)	1.3 (0.93–1.9)	0.93 (0.56–1.5)	1.0 (0.42–2.6)	0.80 (0.38–1.7)
$\geq$ 2 comorbid conditions vs. none	0.89 (−0.62 to 4.1)	0.470	1.3 (0.77–2.0)	1.9 (1.2–3.1)	0.71 (0.41–1.2)	1.2 (0.47–3.0)	0.82 (0.42–1.6)
Diabetes not priority	−5.0 (−9.4 to −0.67)	0.026	2.3 (1.2–4.5)	1.3 (0.76–2.2)	2.6 (1.4–5.1)	1.3 (0.55–3.2)	1.3 (0.81–2.2)
Take pain medication	5.9 (2.3–9.5)	0.003	0.38 (0.13–1.1)	0.91 (0.65–1.3)	0.44 (0.28–0.68)	0.56 (0.33–0.95)	0.83 (0.43–1.6)

Data are adjusted OR (95% CI) unless otherwise stated. \*All models were adjusted for the variables listed as well as for annual household income, education, insulin use, age, sex, race, BMI, and for clustering by site.

medications being used, other pain control strategies (e.g., acupuncture), or the effectiveness of treatment for chronic pain. Thus, future studies are needed to explicitly address whether, and if so how, better pain control improves the performance of self-care behaviors and perhaps even more importantly diabetes clinical outcomes and patient quality of life.

We also did not assess the potential health consequences of comorbid chronic pain and poorer diabetes self-management. However, in a prior VA diabetes study, a higher score on the same self-management scale was associated with lower A1c levels, with a self-management score of 70 corresponding to a predicted hemoglobin A1c level of 7.7% and a self-management score of 30 corresponding with an A1c level of 8.3% (24). In the current study, as shown above, the self-management scores for patients with chronic pain were substantially lower than those for patients without chronic pain, which suggests the potential for poorer glycemic control among this subgroup of patients. Nonetheless, the effect of chronic pain on the achievement of good glycemic, lipid, and blood pressure control requires additional research.

This study further highlights the often observed link between pain and depression (8) and between chronic pain and poor self-rated health (26). Moreover, it suggests there is an independent association between chronic pain and self-management even after these rela-

tionships are taken into account. Similar to prior research (25), we found that a positive depression screen affects patients' performance of certain activities, such as taking diabetes medications and following an eating plan. On the other hand, our results did not show a significant association between depressive symptoms and exercise, as found in previous work (25), but instead revealed that both the presence of chronic pain and pain severity had a significant effect on patients' reported difficulty with exercising.

There are some study limitations that need to be discussed. First, while we found that the majority of patients with chronic pain reported pain involving back and knees, we did not assess the types of pain conditions affecting our study population. However, the presence of peripheral neuropathy, which may produce pain, was abstracted as part of the baseline medical record review. According to these data, about 19% of the study population had a diagnosis of peripheral neuropathy (21% in the chronic pain group and 16% among those who reported no chronic pain), and thus peripheral neuropathy does not appear to be the only pain condition influencing our study results. Second, the response rate to the initial survey limits the generalizability of these study results. Therefore, it will be important to conduct additional studies with more representative samples to determine whether these results can be

replicated both inside and outside the VA system. Finally, we excluded from our analyses 65 individuals who did not respond to the chronic pain question. To examine whether this decision affected our results, we ran our main analyses first including these individuals in the no chronic pain group and then including them in the chronic pain group. Neither of these approaches produced a substantial change in the results.

In conclusion, the rapidly growing number of individuals with diabetes and the potential for poor outcomes without proper management only serve to heighten the importance of providing optimal diabetes care and improving patient self-management. One possibly significant but generally overlooked aspect of diabetes care is how other chronic conditions, such as chronic pain, might complicate and/or serve as a competing demand in a patient's ability to engage in self-care activities. This study suggests that comorbid chronic pain may be a major limiting factor in the performance of certain self-care behaviors and thereby reinforces the need to proactively address such potential competing demands as we seek to support and improve patients' diabetes self-management.

**Acknowledgments**—This study was supported through grant funding from the Department of Veterans Affairs, Health Services Research and Development Service, SDR 01-

019 and DIB 98-001, and used core support from the Michigan Diabetes Research and Training Center funded by NIH5060 DK20572.

A special thank you goes to Emily Lipp for helping with data management.

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