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Glycemic Control and Absenteeism among Individuals with Diabetes

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Glycemic Control and Absenteeism among Individuals with Diabetes

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The associations between adverse labor market outcomes and diabetes/diabetic complications are well described (1-8). Clinical guidelines have recommended standards for glycemic, lipid, and blood pressure control (9), which are shown to prevent or delay the onset and progression of diabetic complications (10-16). It is possible that control of these symptoms can reduce absenteeism in employed patients. Two studies have examined the relationship between glycemic control and labor market outcomes including absenteeism (17,18) and this paper adds to that literature by examining the cross-sectional associations between absenteeism from work and glycemic, lipid, and blood pressure control among individuals with diabetes.

RESEARCH DESIGN AND METHODS

Patients were identified from administrative data available within a medical group in Southeast Michigan as having diabetes between June 1, 2003 and May 31, 2004 (N=27,407). From these patients, we selected those that were tested for hemoglobin A1c (A1C) during the **prior** 12 months and were aged 30 to 64 years (N=11,324). Next, we drew a random sample of 1,000 patients stratified by glycemic control level (A1C < 7%, 7-7.99%, 8-8.99%, 9-9.99%, ≥ 10%). Several exclusions were made: subjects that had died (n=5), absence of physician from which to obtain permission for patient contacts (n=72), patients' inclusion in other research studies (n=132), physician refusal (n=46), incorrect diagnosis (n=5), and language barrier (n=13). The final sample comprised 727 patients for a telephone survey and had an overall participation rate among eligible subjects of 59% (n=427). The response rate for eligible subjects who were contacted was 81% (n=525).

The primary outcome was hours absent from work for any reason during the 4 weeks prior to the survey and was reported by **218** patients among employed individuals (n = 233). The

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explanatory variables of interest were hemoglobin A1c (A1C), and low-density lipoprotein cholesterol (LDL-C) obtained through the automated laboratory data, and blood pressure (SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure) levels extracted from the medical records using computerized data collection forms. For patients with more than 1 test result during the 12 months before the telephone survey, we used the arithmetic mean value of A1C, LDL-C, and SBP and DBP. We controlled for age, gender, race, education and marital status, comorbidities, body mass index (BMI), years from diagnosis, insulin use, occupation type (white collar, blue collar, and service sector), and usual weekly hours worked.

We estimated a probit model for the probability of having any hours absent from work and a tobit model for hours missed from work using data from employed individuals. The tobit model accounts for 0 values that occur when a significant portion of patients do not report absenteeism (53%). We performed separate analyses for men and women given their differences in workforce participation, job type, and job attachment (19). Respondents with higher A1C values and males were less likely to participate in the survey. Thus, we weighted coefficients from multivariable models by their inverse probabilities of survey participation. We report unweighted results because weighting did not change the results in either magnitude or statistical significance.

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RESULTS

Patients with diabetes in our sample were 53 years old on average, 54% were female, and nearly evenly split between white and African American (49% and 45% respectively). The employment rate (55%) among the study participants was comparable to the estimates in previous published studies of diabetic patients (1,4,7,8). In pairwise comparisons on

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average both men and women with higher A1C levels reported a greater number of hours absent compared to those with lower A1C levels (results not shown), although patients did not differ by glycemic control in terms of employment status, or usual weekly hours worked. For example, relative to employed patients with hemoglobin A1C < 7%, employed men and women with hemoglobin A1C \geq 10% lost an additional 5.4 hours ($p < 0.05$) and 4.4 hours ($p < 0.01$) in the past 4 weeks, respectively.

Table 1 presents 2 models. The first is a probit model predicting the probability of being absent from work one or more days and the second predicts the number of hours absent from work. For ease of interpretation, the probit estimates are translated into derivatives of the probability (e.g., marginal effects) of being absent with respect to the independent variables. The marginal effects (unconditional expected values) as measures of total impact of individual risk factors on hours absent including observations with zero values are also reported for the tobit model, which takes into account that many employees (53%) did not report absenteeism.

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Among men, those with an A1C between 8% and 9%, and those with A1C \geq 10% were more likely to miss work (marginal effect (ME), 32 percentage points (pp); $p < 0.05$; and ME, 35 pp; $p < 0.05$). Men with an A1C between 8% and 9% furthermore lost about 6 hours on average ($p < 0.05$) compared to men with A1C < 7%. Men with an LDL-C \geq 100 were both more likely to miss work (ME, 26 pp; $p < 0.05$) and report greater hours absent (ME, 3.8; $p < 0.10$) relative to men with an LDL-C < 100.

Among women, those with A1C \geq 10% were 62 pp more likely to report any absenteeism ($p < 0.01$). Women with an A1C between 9% and 10%, and women with an A1C \geq 10% lost an additional 7.9 hours ($p < 0.01$) and 10.3 hours ($p < 0.01$), respectively, compared to women with an A1C < 7%.

In other multivariable models, usual weekly hours worked and the difference between weekly hours worked and hours absent per week did not vary by level of any risk factor control (results not shown).

CONCLUSIONS

As the prevalence of diabetes increases (20,21), the number of individuals with diabetes among the working population will rise. With projections that as many as 1 in 3 people born in 2000 will develop diabetes (22), the implications of diabetes on labor market outcomes are enormous for patients, families, employers, and policy makers.

Our study provides a cross-sectional assessment of the potential impact of diabetes control (glycemic, lipid, and blood pressure control) on absenteeism among those with diabetes.

Poor glycemic control, in some cases, was associated with increased absenteeism. Among men, poor lipid control was also associated with absenteeism. Such findings imply that the adverse impact of diabetes on productivity might be partially reduced through improved control of modifiable risk factors.

Four important limitations are noted. First, the cross-sectional assessment of the relationship between diabetes control and absenteeism is not sufficient to estimate causal paths from control of risk factors to work productivity. Multiple measures over time are required for causal interpretations. Second, the study lacked information on medications taken for hyperglycemia, hypertension, and hyperlipidemia. Therefore, we were not able to account for treatment effects of these medications on outcomes. **Third, a dose-response relationship**

between glycemic control categories and absenteeism (e.g., increasing absenteeism with increasing hemoglobin A1C categories) was not observed. Fourth, usual weekly hours

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worked or the difference between usual weekly hours worked and hours absent per week did not vary by level of any risk factor control; thus, our findings should be cautiously interpreted

Given that access to health care is usually obtained through employer provided health insurance plans in the United States, and given that employers search for ways to control health care costs, documenting potential economic gains in the work place (e.g., reduced absenteeism) from improved clinical control of diabetes may encourage employers, health plans, and policymakers to further their attempts to improve the quality of care delivered to patients with diabetes. The returns from preventing productivity losses might substantially offset some costs of implementing such programs.

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Table 1. Multivariate Models for Probability of Any Absenteeism, and Hours Absent in the Past 4 Weeks

	Any Hours Absent		Hours Absent	
	Male (n = 110)	Female (108)	Male (n=110)	Female (108)
A1c (%) (< 7)				
7-7.99	-0.04 (-0.37-0.28)	-0.08 (-0.43-0.27)	1.40 (-3.81-6.62)	2.86 (-2.38-8.11)
8-8.99	0.32 (0.04-0.61)*	-0.04 (-0.38-0.31)	5.96 (-0.24-12.16) [§]	2.04 (-2.52-6.61)
9-9.99	0.24 (-0.10-0.58)	0.27 (-0.09-0.64)	3.80 (-3.49-11.09)	7.90 (0.96-14.84)*
≥ 10	0.35 (0.08-0.62)*	0.62 (0.45-0.79) [†]	4.73 (-1.58-11.03)	10.26 (1.92-18.60)*
LDL-C (mg/dl) (< 100)				
≥ 100	0.26 (0.01-0.52)*	0.13 (-0.20-0.45)	3.80 (-0.65-8.24) [§]	0.38 (-3.03-3.79)
Blood Pressure Control (mm of Hg) (Both SBP < 130 and DPP < 80)				
Either SBP ≥ 130	-0.04 (-0.30-0.22)	-0.18 (-0.44-0.07)	0.59 (-2.81-3.99)	-1.85 (-4.62-0.92)

Any Hours Absent		Hours Absent	
Male (n = 110)	Female (108)	Male (n=110)	Female (108)
or DBP ≥ 80			

Partial derivatives of probability of any absenteeism from a probit model (marginal effects) and **partial derivatives of hours absent from a tobit model (marginal effects: unconditional expected values)** with respect to independent variables are reported with standard errors of marginal effects in parentheses. The derivatives are computed as the difference in probabilities and the difference in hours **at the observed censoring rate** as the dummy variable takes on the values zero and one, with the other variables at the sample means. All models include the following covariates: Age, race/ethnicity, education, marital status, Charlson comorbidity score, years from diagnosis, insulin usage, BMI, occupational categories, and usual weekly hours worked.

* $p < 0.05$, † $p < 0.01$, § $p < 0.10$