Impact of Diabetes on Employment and Income in Manitoba, Canada

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OBJECTIVE — To compare employment and income of working-age (18–64 years) people with and without diabetes.

RESEARCH DESIGN AND METHODS — We conducted a prospective population-based cohort study based in Manitoba, Canada, consisting of 25,554 individuals without diabetes and 608 with diabetes, of whom 242 had a complication of the disease. Adjusted odds ratios (ORs) of employment and income variables were determined.

RESULTS — Diabetic individuals with complications were twice as likely not to be in the labor force (OR 2.07 [95% CI 1.49–2.87]) than nondiabetic individuals. This difference was not evident for diabetic individuals without complications (OR 1.20 [0.93–1.56]). Diabetic individuals without complications had incomes similar to those of nondiabetic individuals. The total income of diabetic individuals with complications was 72% of the income of nondiabetic individuals. When the analysis was limited to only those in the labor force, diabetic workers with complications still had only 85% the employment income of nondiabetic people. Diabetic individuals with complications received 58% more social support income. In a separate analysis of aboriginal individuals, complicated diabetes was not associated with an increased likelihood of not working or a decrease in employment income.

CONCLUSIONS — In general, complications of diabetes and the absence of the disease affect the ability to earn income in Manitoba, Canada. This effect was not identified in the aboriginal population of the province.

Diabetes Care 24:64–68, 2001

An increasing number of individuals are living and working with diabetes (1,2). Diabetes can affect employment and subsequent income opportunities in a number of ways. The most obvious effect occurs when diabetic complications limit an individual's ability to work. Late diabetic complications were the major reason people with type 1 diabetes were less likely to be employed in Sweden (3). Diabetic people in the U.K. were more likely to report difficulties obtaining employment and changing their jobs because of their illness (4). Diabetic people report greater difficulties with shift work than others do (4), a finding consistent with the results of a number of physiological studies (5). Data from Sweden revealed that diabetic people have lower mean disposable incomes and a higher rate of disability pension than either hypertensive or healthy individuals (6). Recent data from the U.S. have shown that diabetic individuals have significantly lower predicted earnings (7).

Diabetes can also affect access to the job market, particularly in jobs designated as safety sensitive. In these situations, some employers may have concerns about job performance issues (8–10). The major issue is the risk of hypoglycemia, particularly in individuals using insulin. Whether diabetic people face employment discrimination varies among countries. Research from New Zealand suggests that they are not likely to encounter discrimination in the workplace (11), whereas that from Japan (12), Australia (13), and the U.S. (14) suggests the opposite. No data, however, could be identified on the employment patterns and income of Canadians with diabetes.

The objectives of this study were as follows: *1*) to compare the labor force participation rate and unemployment rate of diabetic people with and without complications with those of nondiabetic individuals among working-age (18–64 years) Manitobans, *2*) to determine the influence that diabetes and its complications has on an individual's income in a sample of working-age Manitobans, and *3*) to determine whether these patterns were similar in the aboriginal population in the province.

RESEARCH DESIGN AND METHODS

Sources of data

This study is based on a unique research database created through the collaboration of Statistics Canada, the Government of Manitoba, and the University of Manitoba. This database combines longitudinal information on individual encounters with the Manitoba health care system over a 7-year period (1983–1990) with detailed information on social, economic, and occupational characteristics provided by a 5% sample of Manitoba respondents to the Census 2B form in 1986. Of the households in the province, 20% received the 2B form. The head of the household or his or her designate completed the census form on behalf of all individuals in the home.

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Received for publication 18 May 2000 and accepted in revised form 19 September 2000.

Abbreviations: ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*; OR, odds ratio.

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

Table 1—*Characteristics of study participants*

	Without diabetes	With diabetes	Noncomplicated diabetes	Complicated diabetes
n (unweighted)	25,554	608	366	242
n (weighted)	25,624	538.1	342.5	195.6
Mean age (years)	37.9	49.8	48.5	52.2
Male (%)	49.2	51.7	48.5	57.4
Residence (%)				
Winnipeg	58.5	60.7	62.7	57.1
Urban (not Winnipeg)	15.2	13.2	10.7	17.4
Rural	26.3	26.2	26.6	25.5
Education (%)				
None through Grade 9	19.1	32.9	32.6	33.4
Grade 10–12	35.8	36.7	39.6	31.7
Some postsecondary	45.2	30.4	27.8	35.0
Married (%)	67.8	73.1	75.9	68.0
Aboriginal race (%)	3.0	8.1	7.3	9.4

Residents of Manitoba are universally insured for medically necessary health care by a single-payer agency, the Manitoba Health Services Insurance Plan. All computerized records of health care encounters contain unique personal identifiers that permit the creation of longitudinal individual histories of health care utilization (15). All but a small minority of physicians provide services on a fee-for-service basis. As a requirement when physicians submit a service claim for reimbursement, they must provide a single diagnosis most responsible for the patient encounter. With use of the *International Classification of Disease, Ninth Revision, Clinical Modification* (ICD-9-CM), diagnoses are recorded in the computerized medical claims file at the three-digit level (16). Information on hospitalization is also captured by this system with as many as 16 hospital discharge diagnoses recorded on each hospital encounter. In the hospitalization file, diagnoses are coded to the five-digit level in the ICD-9 system.

Responses to the 1986 Census 2B form include information on the level of education attained, sources and amounts of individual and household income, and self-reported occupation, industry, and labor force participation. In addition, sociodemographic variables, such as sex, race, area of residence, and marital status, were collected.

The methodology used to link records in the two data sources and create the study sample has been described previously (17,18).

Identification of diabetic individuals

Diabetic people were identified in the health care utilization records by meeting one of the following validated criteria (1): *1*) an individual who had two physician claims for diabetes (ICD-9 250) in any 2-year period between 1 April 1983 and 2 June 1988 with at least one of these claims being before 3 June 1986, the date of the census; or *2*) an individual hospitalized between 1 April 1983 and 3 June 1986 in which the hospital discharge abstract listed diabetes as a discharge diagnosis.

Of the 44,629 people in the data set, 26,162 were of working age. Of these, 608 were identified as having diabetes. With use of sample weights, the prevalence of diabetes in our population was ~2.1%. Given the age and racial background of our population, this estimate is consistent with other work (1,2). Of the 608 individuals identified with diabetes, 436 were identified only in the medical claims data, 23 only in the hospital claims data, and 149 in both data sets. Thus, ~96% of the cases were identified in the medical claims data. Those identified solely in the hospital claims data had a sex distribution similar to that of those individuals identified by medical claims, but were older.

Diabetic people with complications were identified by meeting one of the following two criteria: *1*) an individual having a hospital discharge abstract listing an end-organ complication of diabetes (ICD-9 250.4–250.9) from 1 April 1983 until the census (3 June 1986); or 2) a diabetic patient with at least two medical claims for a condition likely to be associated with diabetes, as described below, and no hospitalization for this condition that did not list the appropriate diabetic complication. At least one of these medical claims had to be before 3 June 1986.

The likelihood of a diagnosis in the medical claims file identifying individuals with complications due to diabetes was established by reviewing the attributable risk percent for a series of conditions that may be related to this disorder. Attributable risk percentages were calculated for a number of potential diabetic complications, including retinal disorders (ICD-9 362), neuropathy (ICD-9 337 and 357), nephropathy (ICD-9 581 and 583), peripheral vascular disease (ICD-9 443), chronic skin ulcers (ICD-9 707), ischemic heart disease (ICD-9 440–414), cerebrovascular disease (ICD-9 430–438), and lower-limb amputation (complication code 841.0–841.9) using the following formula: rate ratio – 1/rate ratio (19). Conditions in which the lower 95% CI of the rate ratio exceeded 1.0 and the attributable risk percent exceeded 50% were believed to identify complications caused by diabetes. Neuropathy was the only potential complication studied that did not meet these criteria. Of the 608 people with diabetes, 242 were identified as having complications using the above the criteria. Table 1 describes the sociodemographic profile of the individuals with and without diabetes.

Information on the type of diabetes, mode of glycemic control, and level of control are not available in the data set.

Occupational classification

Standard Statistics Canada definitions were used to determine the employment status of labor force participants (20). Individuals who did not live in institutions were either in or out of the labor force. Individuals who were not working and were not actively seeking work were considered not to be in the workforce. This would include homemakers, retired individuals, disabled people, students, and those who choose not to work, because they feel they cannot find a job. The census data do not allow for the identification of individuals within these groups. Those in the labor force were either employed or unemployed. The definition of unemployment requires that the individual be not working and actively seeking work. Self-reported occupation was coded to the four-digit level of the Canadian Standard Occupational Classification (21) system.

To control for social class in the income analysis, the labor force participants were divided into 16 occupational categories as developed by Pineo et al. (22). No occupational category is available for individuals who were unemployed >18 months at the time of the census.

Income classification

Individual income was used in all analyses. Three types of income were identified from the census data for the year 1985: total income, employment income, and social support income. Social support income, a subset of transfer income, was defined to include Canadian Pension Plan income and other government income that included social assistance payments.

Table 2—*Unadjusted labor force participation, unemployment, and percent not working among all Manitobans and aboriginal Manitobans, 1986*

				Diabetes group		
	No	Yes	*P*	Noncomplicated	Complicated	*P*
All Manitobans	25,624	608	—	366	242	—
n (unweighted)						
Labor force	79.7	64.5	0.001	68.0	58.3	0.02
Unemployed	6.8	8.8	0.15	9.9	8.3	0.63
Not working	25.7	41.2	0.001	37.6	47.5	0.01
Aboriginals	2,391	144	—	73	71	—
n (unweighted)						
Labor force	53.5	42.2	0.15	41.9	42.6	0.96
Unemployed	32.6	23.8	0.43	24.3	23.1	0.95
Not working	64.0	67.9	0.60	68.3	67.2	0.94

Data are %, unless otherwise stated.

Racial status

The population of Manitoba is largely Caucasian, with a sizable aboriginal minority. Aboriginal individuals were identified as those reporting to be of Indian, Eskimo, or métis heritage. All other individuals were classified as nonaboriginal.

Analysis

All information was stored in a personal computer. All analyses were performed using the SAS program. Normalized sample weights were used in all analyses. To compare differences in proportions, χ^2 testing was used, and *t* tests were used to analyze continuous variables.

Employment

Logistic regression was used to assess whether diabetic people with or without complications are less likely to be labor force participants or more likely to be unemployed. Potential confounding variables—age, sex, educational status, area of residence, marital status, and aboriginal race—were entered into the analysis. A test for interaction between race and diabetes was also performed. The level of significance was set at 5%.

Income

Tobit regression techniques were used to determine the influence of diabetes on income. This analysis was used because the distribution pattern of income revealed that many individuals had no social support income. Comparisons of results using linear regression and Tobit regression for total and employment income were similar. The effects of age, sex, educational status, area of residence, marital status, and race were controlled for in the analysis of total and social support income. Analysis of employment income was limited to labor force participants. In addition to the previously mentioned potential confounding variables, occupational class, number of weeks worked in 1985, and part-time work were also controlled for in this analysis. Because income is not directly related to age throughout the working period of 18–64 years of age, three groupings—18–29, 30–49, and 50–64 years of age—were identified for analysis. The reported change in income includes 95% CI. The percentage change in income was calculated for the Tobit regressions as described by McDonald and Moffitt (23). The level of significance was set at 5%. *P* values are also reported comparing income for diabetic people with and without complications. Since the development of complications will most likely lead to a decrease in employment income as well as an increase in social support income, one-tailed tests were used in these comparisons.

Ethics

This study was reviewed and accepted by both the University of Manitoba Faculty of Ethics Committee and the Access and Confidentiality Committee of Manitoba Health.

RESULTS — Unadjusted analysis revealed that diabetic individuals had a lower labor market participation rate compared with that of nondiabetic individuals ($P = 0.001$) (Table 2). Much of this difference was in the diabetic group with complications. The pattern of employment among the aboriginal population was different. In general, they had lower rates of labor force participation and higher rates of unemployment than the total population. The diabetic group with complications had a labor market participation profile very similar to that of the diabetic group without complications.

In an analysis controlling for potential confounding variables, diabetic individuals with complications were twice as likely not to be in the labor force (odds ratio [OR] 2.07; [95% CI 1.49–2.87]) than nondiabetic people. This difference was not evident for diabetic individuals without complications (OR 1.20 [0.93–1.56]). Diabetic individuals in the labor force were more likely to be unemployed, although this result bordered on significance (OR 1.45 [0.98–2.15]). Stratification by the presence of diabetic complications revealed ORs for unemployment of 1.69 (0.89–3.21) for diabetic individuals with complications and 1.35 (0.83–2.19) for those without complications. Among the aboriginal population, no differences in the various employment classifications were observed between diabetic individuals with and without complications when compared with nondiabetic individuals. The OR for nonworking diabetic individuals with complications in the aboriginal subgroup was 1.1 (0.39–3.22).

The total income of diabetic individuals was affected only by the presence of complications (Table 3). Diabetic individuals with complications had 72% of the total income of nondiabetic individuals. When the analysis was limited to employment income of labor force participants, diabetic individuals without complications had incomes similar to those of nondiabetic individuals. Diabetic individuals with complications had ~85% of the earned income

Table 3—*Comparison of total income, employment income, and social support income of individuals without diabetes, with noncomplicated diabetes, and with complicated diabetes, 1985*

		Without diabetes		Noncomplicated diabetes		Complicated diabetes		*P*‡
Type of income*	Grouping	*n*	Mean income	*n*	Adjusted % of WD income† (95% CI)	*n*	Adjusted % of WD income† (95% CI)	(complicated vs. noncomplicated)
Total income	18–64 years	25,554	$16,800	366	95.4 (86.9–103.9)	242	72.2 (61.0–83.4)	0.0005
Employment income	18–64 years	19,801	$17,600	239	100.4 (91.6–109.2)	134	85.6 (73.1–98.0)	0.03
	18–29 years	6,841	$11,300	26	130.8 (105.4–156.2)	13	87.7 (49.5–126.0)	0.035
	30–49 years	9,368	$20,600	108	106.7 (94.3–119.0)	49	84.3 (63.7–104.9)	0.035
	50–64 years	3,592	$21,100	105	87.9 (74.1–101.8)	72	89.6 (72.3–106.9)	0.44
	Aboriginal	780	$8,600	25	98.3 (68.3–128.2)	18	123.9 (89.4 −158.4)	0.92
Social support income	18–64 years	25,554	$213	366	105.6 (67.3–143.9)	242	157.7 (114.1–201.3)	0.035

*Income adjusted for age, sex, marital status, aboriginal status, residence, and education with 95% CI. †WD, without diabetes. ‡One-tailed test was used in this analysis. Employment income is also adjusted for weeks worked in 1985, full-time/part-time employment, and job class with 95% CI.

of the labor force participants without diabetes. Younger individuals (i.e., 18–29 years of age), who were more likely to have type 1 diabetes, were noted to have a higher-than-expected employment income. The pattern of employment income did not differ in the aboriginal population based on diabetes status. No interaction was observed between aboriginal status and diabetes in the income analyses.

Some social support income was received by 9.5% of nondiabetic individuals, 16.8% of diabetic individuals without complications, and 25.0% of diabetic individuals with complications ($P < 0.001$). In analysis controlling for potential confounding variables, the ORs for receiving any social support income was 1.3 (0.93–1.74) for diabetic people without complications and 1.7 (1.18–2.49) for diabetic people with complications. In the Tobit regression, diabetic individuals without complications received amounts of social support income similar to those received by nondiabetic people. Diabetic individuals with complications, however, received ~58% additional income from social support sources. Comparisons in the income analysis of the two groups of diabetic people revealed similar findings.

CONCLUSIONS — This analysis reveals different patterns of employment and income for diabetic individuals with and without complications. Diabetic individuals with complications were less likely to be working than individuals in the nondiabetic population. Decreases in employment and total income were observed when compared with nondiabetic people. Diabetic individuals with complications have lower total income than nondiabetic individuals because of a combination of decreased participation in the labor force and lower employment income for those who are working. Although diabetic individuals with complications had an increase in social support income, this did not compensate for their loss in earned income.

The pattern for diabetic individuals without complications was less clear. The ORs on the employment variables, although lower than those for the diabetic individuals with complications, were still elevated compared with the nondiabetic population. The differences bordered on statistical significance. The income analysis revealed no significant differences from the general population. In fact, diabetic individuals who were between 18 and 29 years of age and without complications had higher-than-expected employment incomes. Most of these individuals likely had type 1 diabetes treated with insulin, suggesting that for type 1 diabetic people without complications, their disease does not affect their potential to earn income.

Diabetic individuals with complications were more likely to be out of the labor force, but not clearly more likely to be unemployed than nondiabetic individuals. These findings suggest that once complications ensue, diabetic individuals with complications who leave their jobs may choose to take themselves out of the labor force and not seek other work (24).

We observed a different pattern among the aboriginal population in our cohort. In this group, the baseline rate of not working was much higher than that in the population as a whole. With this background, the presence of complicated diabetes did not appear to have a significant impact on either employment or employment income. This finding suggests that disability related to disease status is only one of a number of factors that influence whether an individual will be working. Individuals who come from disadvantaged populations and succeed in finding employment may have different attributes than those who cannot find work. When faced with disease, these individuals appear to be able to continue to work longer than those who come from more privileged backgrounds. Whether this finding is due to psychosocial variables or to the fact that they may have less financial support than individuals who come form nondisadvantaged populations cannot be determined from our data. We could not identify any race-based income data on diabetic individuals with which we could compare our results. In order for our findings to be confirmed, future studies of the influence of disease on income should attempt to identify separate effects on disadvantaged minority populations.

Our findings on income and labor force participation are similar to those from a case-control study in the U.S. (14) and population-based studies from the U.S. (7) and Sweden (3).

Our study has a number of limitations. People with type 1 and type 2 diabetes could not be distinguished. Although this information would have been useful, its absence would not have limited the interpretation of the results, because both types of diabetes lead to complications. Further,

since concerns regarding shift work and safety-sensitive jobs usually revolve around insulin-induced hypoglycemia, and both types of diabetes may be treated with insulin, lack of this information would not severely influence the employment analyses. The analysis of the aboriginal group was also limited by the relatively small number of people in some of the categories.

Understanding the interaction between the presence of the disease, the presence of complications of the disease, and employment and income is important. This information is useful to ensure that there is no systematic discrimination against people with certain diseases—in this case, diabetes. Once it is established that the complications of the disease are what usually limit employment, this information will be of help in advocating for job modifications, if possible, to increase the employability of people who are ill. The fact that diabetic complications were found to limit employment and income in our cohort is useful information in the area of diabetic education. This information could be used both in career counseling and for those diabetic people who need it, to explain how the complications of this disease may affect their employment and income.

Understanding what motivates people to continue working while ill and what supports sick individuals require to continue working are important topics as our society ages and chronic diseases become more prominent in the working population. The results from our analysis of aboriginal individuals with diabetes suggest that disease variables have different influences on working in different segments of society. Future research is required to determine the nature of these variables.

Acknowledgments — Funding for this research was provided in part by grants from the Canadian Diabetes Association in honor of Rosa Hunt and the National Health Research Development Program, Health Canada. C.M. is a recipient of a Medical Research Council of Canada Scientist award.

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