



Spouse's Diabetes Status and Incidence of Depression and Anxiety: An 18-Year Prospective Study

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OBJECTIVE

We investigated the risk of depression and anxiety in people whose spouse did or did not have diabetes. We also examined associations between depression and anxiety and severity of spouse's diabetes.

RESEARCH DESIGN AND METHODS

We analyzed prospective self-reported data about diagnosed depression/anxiety and diabetes in cohabiting couples in the national Panel Study of Income Dynamics (PSID) during 1999–2017 ($n = 13,500, 128,833$ person-years of follow-up, median follow-up 8.1 years). We used Poisson models to estimate incidence and incidence rate ratios (IRRs) of depression/anxiety, according to spouse's diabetes status overall and by severity of diabetes.

RESULTS

Age-, sex-, and race-adjusted incidence of depression/anxiety was 8.0/1,000 person-years (95% CI 6.5, 9.6) among those whose spouse had diabetes and 6.5/1,000 person-years (95% CI 6.0, 6.9) among those whose spouse did not have diabetes. Those whose spouse had diabetes had higher risk of depression/anxiety (IRR 1.24 [95% CI 1.01, 1.53]). Those whose spouse had diabetes-related limitations in daily activities (IRR 1.89 [95% CI 1.35, 2.67]) and diabetes combined with other chronic conditions (IRR 2.34 [95% CI 1.78, 3.09]) were more likely to develop depression/anxiety, while those whose spouse had diabetes with no limitations or additional chronic conditions had incidence of depression/anxiety similar to that of subjects whose spouses did not have diabetes.

CONCLUSIONS

People living with a spouse with diabetes are at higher risk of developing depression/anxiety than people whose spouse does not have diabetes; this risk is driven by the severity of the spouse's diabetes. Strategies to address the impacts of diabetes on families need to be devised and tested.

Diabetes is a progressive condition that often entails escalating health problems (1), reductions in mobility (2), and increasing needs for health care and assistance with daily activities. This care is often provided or supported by spouses and other family members (3,4). In fact, in people with diabetes, support and care from family are associated with better care and delayed increase in morbidity (3,5–9). The positive

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outcomes among those with family support may be in part due to lowering distress related to diabetes (10). As such, the American Diabetes Association encourages involving family in diabetes management (11,12). However, for people supporting a family member with diabetes, providing this support may come with costs for their own well-being. Cross-sectional studies show that, in the U.S., adults with a spouse with type 2 diabetes have depression and anxiety scores as high as or higher than those of the person with diabetes (13). Further, people living with a family member with diabetes reported that they had diabetes-related distress and that undertaking care responsibilities decreased their quality of life (14); >60% of people with a family member with diabetes were occasionally worried about the person having hypoglycemia (15).

The risk of developing depression in adults living with a spouse who has diabetes is not known. Longitudinal studies have found that people whose spouses have colon, lung, or prostate cancer have higher risks of psychiatric diagnoses (16) and that those whose spouses have breast cancer have higher risk of depression compared with people with a spouse without cancer (17). A cancer diagnosis can have short-term severe consequences and may be an acute shock for families, which could exert higher levels of psychological stress than a diagnosis of diabetes. However, diabetes is a slowly progressing lifelong chronic condition. Severe complications and increasing care demands can take years to emerge (18), and family members may not experience a psychological toll until those complications and care demands reach a high level. Thus, cross-sectional studies have shown that, for family members, perceived severity of the diabetes is associated with diabetes distress (19).

Using a prospective study of U.S. households, we investigated the risk of diagnosed psychological problems, specifically a composite of depression and/or anxiety, in adults whose spouse has diabetes. Given the slowly but often severe progression of diabetes, we also investigated the excess risk of depression/anxiety associated with diabetes-related limitations in daily activities,

associated with combination of diabetes with other chronic conditions, and by duration of living with a spouse with diabetes.

RESEARCH DESIGN AND METHODS

Data

We analyzed data from the Panel Study of Income Dynamics (PSID), a longitudinal U.S. national study. PSID is a dynamic household cohort started in 1968. Individuals enter the cohort through birth or marriage into a PSID household and exit through death or divorce. Data are collected with telephone interviews. Since 1999, PSID has biennially collected data from the head of household about himself/herself and a cohabiting partner/spouse about various conditions, illnesses, and disorders, including psychological problems and diabetes (20).

Of 80,666 people who ever lived in a household in the PSID cohort, 40,477 lived in a PSID household between 1999 and 2017, and 22,662 were head of the household or cohabiting partner/spouse and interviewed about depression/anxiety and diabetes. Of these, 18,240 lived with a spouse at one or more time points between 1999 and 2017. Eighty-six had missing data of depression/anxiety. To calculate incidence, we retained those with at least two records of depression/anxiety ($n = 15,391$). Respondents with depression/anxiety at first record were not eligible for the incidence analyses ($n = 1,781$). Lastly, we excluded people with missing information about the spouse's diabetes status ($n = 28$), date of birth ($n = 7$), or relevant covariates ($n = 75$). The resulting analytical sample consisted of 13,500 adults without depression/anxiety at study entrance who had two or more health reports with depression/anxiety status (median records 7, median follow-up 11.9 person-years, total follow-up 151,279 person-years) (Supplementary Fig. 1).

Variables

Depression/Anxiety

In PSID, household heads are asked whether they or their cohabiting partner have been told by a doctor that they have a series of health conditions. For psychological problems, the question is, "Has a doctor ever told you that you have or had any of the following—

emotional, nervous, or psychiatric problems?" If the answer is yes, the type of problem is specified, with depression and anxiety being two of the options. We only included those reporting being told by a doctor that they had depression and/or anxiety (<0.5% had other psychiatric disorders).

Incidence of depression/anxiety was the main outcome. We calculated incidence as the number of new cases per 1,000 person-years. We calculated person-years at risk from the date of the first record when the respondent was first asked about depression/anxiety and had reported none. End of person-years at risk was the age (date) the respondent was diagnosed with depression/anxiety or the date of the last record with no depression/anxiety. If date of diagnosis was missing, we used the midpoint between the last record without the condition and the record where the person first reported the condition.

Diabetes Status

The main exposure was the spouse's diabetes status. A spouse was coded as having diabetes if the respondent or her/his spouse answered yes to the question, "Has a doctor ever told you that you have diabetes or high blood glucose?" Respondents are also asked about how old they or their partners were when they were told they had the specific conditions. We considered diabetes as irreversible starting at the age (date) the spouse was diagnosed or, if this information was missing, the midpoint between the last record where diabetes was reported not present and the record where the spouse first reported having diabetes.

Over time, diabetes often progresses, causing changing treatment requirements and complications. Therefore, we performed three additional analyses where we modeled the incidence of depression/anxiety according to 1) whether the spouse reported being limited by diabetes in doing daily activities, 2) whether the spouse had one or more other chronic conditions (heart disease, heart attack, stroke, cancer, or depression/anxiety), and 3) an indicator for whether the duration of exposure to the spouse's diabetes was "new" versus "long-term." In PSID, the category "diabetes with limitations" can be answered as "A lot," "Somewhat," "Just a

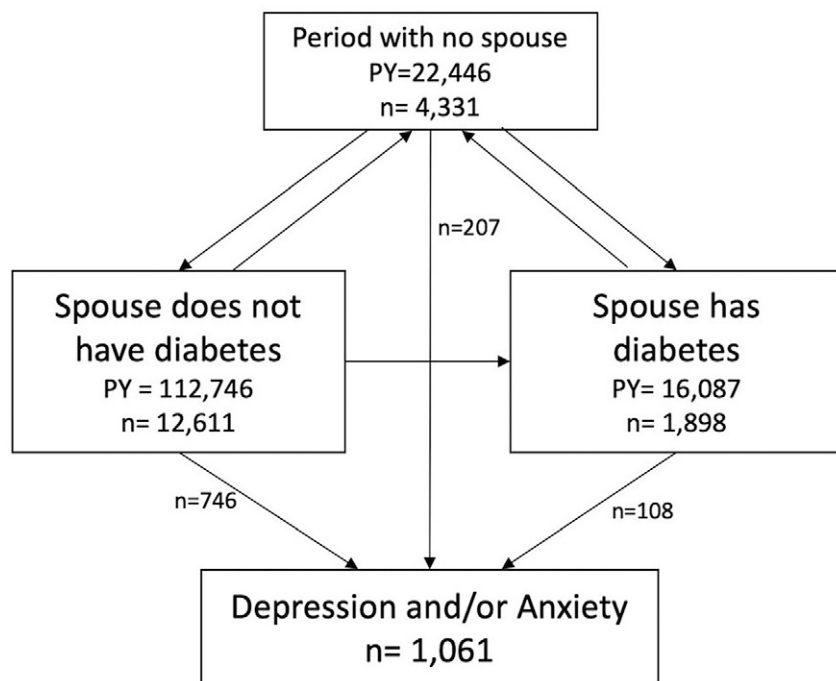


Figure 1—Flow diagram of the participants' relationship stages and transitions during the study period. The flow diagram shows the number of study participants in each type of relationship (living with spouse without diabetes, living with spouse with diabetes, living without a spouse), person-years of follow-up, and number of events (first-time occurrence of depression/anxiety) during follow-up. In each box is shown numbers of individuals who during the study period spent time in this type of relationship and person-years of follow-up for the people in this type of relationship. People could enter the study in any of the three types of relationships and could change status during the study according to how their life evolved. Therefore, during the study period, one individual could contribute follow-up time to all three boxes according to their individual history of relationships. If a person developed depression/anxiety, the event was counted as an outcome for the exposure state of the individual at that point in time. PY, person-years.

little," or "Not at all." We coded those answering "A lot" or "Somewhat" as having diabetes limiting daily activities, and the variable was categorized as follows: no spouse with diabetes, spouse has diabetes but reporting no related limitations, and spouse has diabetes and is experiencing some or a lot of diabetes-related limitations in daily activities. "Diabetes in combination with other chronic conditions" was defined as no spouse with diabetes, spouse has no diabetes but has one or more other chronic conditions, spouse has diabetes and none of the included chronic conditions, and spouse has diabetes and one or more other chronic conditions. "Duration of living with spouse with diabetes" was categorized as no spouse with diabetes, living with spouse with diabetes at study entry (prevalent diabetes), or living with or moving in with a spouse who develops diabetes (incident diabetes).

Covariates

We included sociodemographic variables shown to be associated with depression and anxiety: age, sex, race/ethnicity, and household poverty status (21,22). Poverty was based on household income and number of people living in the household and dichotomized according to the poverty threshold from the U.S. Census Bureau (23). We also included the person's own diabetes status. Age, poverty, and the person's own diabetes status were modeled as time-dependent variables.

Data Analyses

We estimated incidence rates of depression/anxiety using Poisson models. Poisson models can model count processes (the number of depression/anxiety events) while considering the exposure unit (person-time of follow-up) and account for both time-varying exposures and covariates (24). Spouse's diabetes

was considered a time-varying exposure: to assign follow-up time and outcomes to the appropriate exposure status, we allowed spouse's diabetes status to change over the 20 years of observation in the analysis (Fig. 1). For example, a woman may enter the study with no exposure to spouse's diabetes, but her exposure status changes when her husband is diagnosed with diabetes in the 10th year of follow-up. This woman may again become unexposed to spouse's diabetes if she separates from her partner in the 15th year of follow-up. For the denominator of the incidence rate calculation, the time spent living with a spouse without diabetes was treated as follow-up years in which the individual was not exposed to spouse's diabetes, while time spent with a spouse with diabetes was treated as follow-up years in which the individual was exposed to spouse's diabetes. For the numerator of the incidence rate calculation, each depression/anxiety event was counted according to spouse's diabetes status at the time the depression/anxiety event was reported. In the analyses of incidence of depression/anxiety, we excluded events and follow-up time occurring when people lived alone given that our exposure of interest was spouse's diabetes status. Follow-up time and exposure status were split into 2-year time bands, corresponding to the PSID data rounds.

We tested associations between spouse's diabetes status and the incidence of depression/anxiety by calculating incidence rate ratios (IRRs). Adjustments were made in three steps: the first adjustment level consisted of age, sex, and race/ethnicity of the person (model 1). In model 2, we additionally adjusted for the person's own diabetes status. In model 3, we adjusted for household poverty. Finally, we tested for interactions between sex and diabetes exposure, justifying additional models with stratification by sex.

All incidence rates are presented as cases per 1,000 person-years. All incidence rates and IRRs are presented with 95% CIs. All statistical analyses were performed with use of Stata SE software, version 15.1.

Data and Resource Availability

The data sets analyzed during the current study are available from the PSID website. PSID data are freely available

for registered users at the PSID website (<https://psidonline.isr.umich.edu>).

RESULTS

Table 1 summarizes the characteristics of study participants stratified as those who at any time between 1999 and 2017 lived with a spouse with diabetes and those who at no time during the same period lived with a spouse with diabetes. Compared with those who did not live with a spouse with diabetes, those who lived with a spouse with diabetes were older at study entry (age 44.3 vs. 35.9 years, respectively), a higher proportion had diabetes themselves (11.6% vs. 5.1%) or developed diabetes during the follow-up period (14.8% vs. 7.7%), and a higher proportion had a spouse who had or developed other chronic conditions (28.6% vs. 13.3% and 34.3% vs. 16.1%).

Incidence of Depression and Anxiety

Of the 151,279 person-years of follow-up, 128,833 person-years were spent living with a spouse (median 8.1 years [25th percentile 4.0, 75th percentile

14.4]). During follow-up 1,061 people developed depression/anxiety, 854 while they lived with a spouse and 207 during a time when they lived alone (Fig. 1). The crude incidence of new depression/anxiety among those living with a spouse was 6.6/1,000 person-years (95% CI 6.2, 7.1). Sex-specific incidence of depression/anxiety among those living with a spouse (age and race adjusted) was 7.6 per 1,000 person-years (95% CI 7.0, 8.3) among women and 5.7 per 1,000 person-years (95% CI 5.1, 6.3) among men.

Spouse's Diabetes Status and Incidence of Depression and Anxiety

The age-, sex-, and race-adjusted incidence of depression/anxiety was 8.0 per 1,000 person-years (95% CI 6.5, 9.6) among adults with a spouse who had diabetes and 6.5 per 1,000 person-years (95% CI 6.0, 6.9) for adults with a spouse without diabetes. Having a spouse with diabetes was associated with 24% higher incidence of depression/anxiety (IRR 1.24 [95% CI 1.01, 1.53]). Adjusting for the person's own diabetes status attenuated the relative risk of depression/

anxiety to IRR 1.19 (95% CI 0.97, 1.47), while adjusting for poverty attenuated the relative risk to IRR 1.21 (95% CI 0.98, 1.49) (Table 2).

Compared with adults living with a spouse without diabetes, those living with a spouse with diabetes that limited daily activities had an 89% higher incidence of depression/anxiety (IRR 1.89 [95% CI 1.35, 2.67]). The risk was similar for those living with a spouse with diabetes that did not limit the spouse's daily activities (IRR 1.07 [95% CI 0.84, 1.36]). The association was robust across models with adjustment for the adult's own diabetes status and household poverty status (Table 2).

In comparison with adults living with a spouse who had neither diabetes nor other chronic conditions, the incidence of depression/anxiety was higher for those living with a spouse who had diabetes plus other chronic conditions (IRR 2.34 [95% CI 1.78, 3.09]) and those living with a spouse who did not have diabetes but who had other chronic conditions (IRR 2.18 [95% CI 1.85, 2.58]). Adults living with

Table 1—Characteristics of the study participants by exposure to spouse diabetes status

	Never exposed to spouse with diabetes, <i>n</i> = 11,602	Exposed to spouse with diabetes, <i>n</i> = 1,898	<i>P</i>
Study entry individual characteristics			
Sex (women), %	48.6 (0.5)	50.8 (1.1)	0.078
Age (years), mean	35.9 (0.1)	44.3 (0.3)	<0.001
Race/ethnicity, %			<0.001
White	67.3 (0.4)	59.4 (1.1)	
Black	26.6 (0.4)	32.4 (1.1)	
Other	6.1 (0.2)	8.2 (0.6)	
Lives in household with income below the poverty threshold†, %	8.2 (0.3)	8.3 (0.6)	0.912
Person has diabetes herself/himself, %	5.1 (0.2)	11.6 (0.7)	<0.001
Person has other chronic conditions herself/himself, %	8.9 (0.3)	16.8 (0.9)	<0.001
Follow-up individual characteristics			
Records of psychological problems (<i>n</i>), median (p25, p75)	7 (4, 10)	9 (6, 10)	<0.001
Follow-up time (years), median (p25, p75)‡	10.5 (5.1, 17.9)	12.9 (8.1, 18.1)	<0.001
Develops diabetes, %	7.7 (0.3)	14.8 (0.9)	<0.001
Develops other chronic conditions, %	10.2 (0.3)	17.2 (0.9)	<0.001
Relationship and spouse's characteristics			
Lives with spouse at study entry, %	83.6 (0.3)	90.5 (0.7)	<0.001
>1 spouse during follow-up, %	6.4 (0.2)	7.2 (0.6)	0.187
Spouse has diabetes at study entry§, %	NA	43.7 (1.1)	NA
Spouse develops diabetes during follow-up, %	NA	56.3 (1.1)	NA
Time exposed to spouse having diabetes, median (p25, p75)	NA	7.9 (3.9, 13.0)	NA
Spouse has other chronic condition(s) at study entry¶, %	13.3 (0.3)	28.6 (1.1)	<0.001
Spouse develops other chronic condition(s) during follow-up¶, %	16.1 (0.4)	34.3 (1.3)	<0.001

Data are % (SE) or mean (SE) unless otherwise indicated. p25, 25th percentile; p75, 75th percentile. †Poverty was based on household income and number of people living in the household and dichotomized according to the poverty threshold from the U.S. Census Bureau. ‡Follow-up time only included time living with a spouse. §Of the 1,898 ever living with a spouse with diabetes, 1,717 lived with a spouse at baseline and, of these, 830 had a spouse who had diabetes at baseline. ¶One or more of the following conditions: heart diseases, heart attack, stroke, cancer, or psychological problems. NA, not applicable as these people never lived with a spouse with diabetes.

a spouse who had diabetes but no other chronic conditions had a risk of depression/anxiety similar to that of adults living with a spouse who had neither diabetes nor other chronic conditions (IRR 1.09 [95% CI 0.81, 1.47]). Again the association was robust across models with adjustment for the person's own diabetes status and household poverty status (Table 2).

In comparison with adults living with a spouse who within the study period never had diabetes, those who at the study entry lived with a spouse who had prevalent diabetes had a higher risk of developing depression/anxiety (IRR 1.33 [95% CI 1.01, 1.75]), while those living with a spouse who developed incident diabetes or moving in with a spouse with diabetes did not have an increased risk of depression/anxiety (IRR 1.16 [95% CI 0.87, 1.55]).

As an additional consideration, we examined whether the associations between spouse's diabetes status and incidence of depression/anxiety were independent of the person's own health status; including other chronic conditions (heart disease, heart attack, stroke, cancer) in the models

did not attenuate or suppress the associations (Supplementary Table 1).

Sex-Specific Associations Between Spouses' Diabetes Status and Incidence of Depression and Anxiety
 For women, the age- and race-adjusted incidence rates of depression/anxiety were not statistically different for women living with a husband with diabetes compared with women living with a husband without diabetes (8.3 per 1,000 person-years [95% CI 6.0, 10.6] vs. 7.7 per 1,000 person-years [95% CI 7.0, 8.5]) (Fig. 2). In comparison with women whose husbands did not have diabetes, incidence of depression/anxiety was higher if the husband's diabetes limited his daily activities (IRR 1.71 [95% CI 1.05, 2.76]). Compared with women whose husband had neither diabetes nor other chronic conditions, women living with a husband who had diabetes had a similar risk of depression/anxiety (IRR 0.83 [95% CI 0.53, 1.28]), while women with a husband with other chronic conditions, or diabetes and other chronic conditions, had a 81% and 106% higher relative risk of depression/anxiety, respectively (IRR 1.81 [95% CI 1.42, 2.32] and 2.06 [95% CI 1.39, 3.05]). The duration of living with a

husband with diabetes (prevalent or incident diabetes) was not associated with a higher risk of depression/anxiety.

In men, the age- and race-adjusted incidence of depression/anxiety was 8.1 per 1,000 person-years (95% CI 5.9, 10.2) for those living with a wife with diabetes compared with 5.3 per 1,000 person-years (95% CI 4.7, 5.9) among those with a wife without diabetes (Fig. 2). Compared with men living with a wife who did not have diabetes, men living with a wife who had diabetes had a 52% higher relative risk of depression/anxiety (IRR 1.52 [95% CI 1.14, 2.03]) and 220% higher relative risk if the wife's diabetes limited her daily activities (IRR 2.20 [95% CI 1.36, 3.57]). Compared with men whose wife had neither diabetes nor other chronic conditions, men with a wife with diabetes had a 57% higher relative risk of depression/anxiety (IRR 1.57 [95% CI 1.04, 2.37]), while men with a wife with other chronic conditions, or diabetes and other chronic conditions, had a 172% and 192% higher relative risk of depression/anxiety, respectively (IRR 2.72 [95% CI 2.16, 3.43] and 2.92 [95% CI 1.97, 4.33]). Compared with men living with a wife who no diabetes, men with a wife who had prevalent diabetes had an 86% higher relative risk (IRR 1.72 [95% CI

Table 2—Incidence of depression or anxiety according to spouse's diabetes status over the period 1999–2017

	Person-years of follow-up	Cases (n)	Incidence rate per 1,000 person-years	IRR (95% CI), adjustment level 1	IRR (95% CI), adjustment level 2	IRR (95% CI), adjustment level 3
Spouse's diabetes status						
Spouse without diabetes	112,746	746	6.5 (6.0, 6.9)	Ref	Ref	Ref
Spouse has diabetes	16,087	108	8.0 (6.5, 9.6)	1.24 (1.01, 1.53)	1.19 (0.97, 1.47)	1.21 (0.98, 1.49)
Diabetes with limitations						
No diabetes	112,746	746	6.5 (6.0, 6.9)	Ref	Ref	Ref
Diabetes without limitations	12,175	72	6.9 (5.3, 8.5)	1.07 (0.84, 1.36)	1.03 (0.80, 1.31)	1.05 (0.82, 1.34)
Diabetes with limitations	3,912	36	12.3 (8.2, 16.3)	1.89 (1.35, 2.67)	1.77 (1.26, 2.50)	1.77 (1.26, 2.49)
Diabetes and comorbidities						
No diabetes, no other conditions	91,428	533	5.4 (5.0, 5.9)	Ref	Ref	Ref
No diabetes but other conditions	21,317	213	11.9 (10.2, 13.5)	2.18 (1.85, 2.58)	2.16 (1.83, 2.55)	2.14 (1.81, 2.53)
Diabetes, no other conditions	9,562	48	6.0 (4.3, 7.7)	1.09 (0.81, 1.47)	1.05 (0.78, 1.42)	1.07 (0.79, 1.44)
Diabetes and other conditions	6,525	60	12.8 (9.4, 16.1)	2.34 (1.78, 3.09)	2.23 (1.69, 2.64)	2.23 (1.69, 2.95)
Duration†						
Spouse has no diabetes	112,746	746	6.5 (6.0, 6.9)	Ref	Ref	Ref
Prevalent diabetes	8,176	57	8.6 (6.3, 10.9)	1.33 (1.01, 1.75)	1.27 (0.96, 1.67)	1.28 (0.97, 1.68)
Incident diabetes	7,911	51	7.5 (5.4, 9.6)	1.16 (0.87, 1.55)	1.11 (0.84, 1.48)	1.14 (0.85, 1.52)

Incidence is calculated as the incidence rate of new cases per 1,000 person-years of follow-up with adjustment for age and sex. Adjustment level 1: age, sex, race/ethnicity. Adjustment level 2: age, sex, race/ethnicity, own diabetes status. Adjustment level 3: age, sex, race/ethnicity, household poverty status. Ref, reference. †Duration of spouse's diabetes: prevalent diabetes is defined as living with a spouse with diabetes at study entry; incident diabetes is defined as living with or moving in with a spouse who developed diabetes.

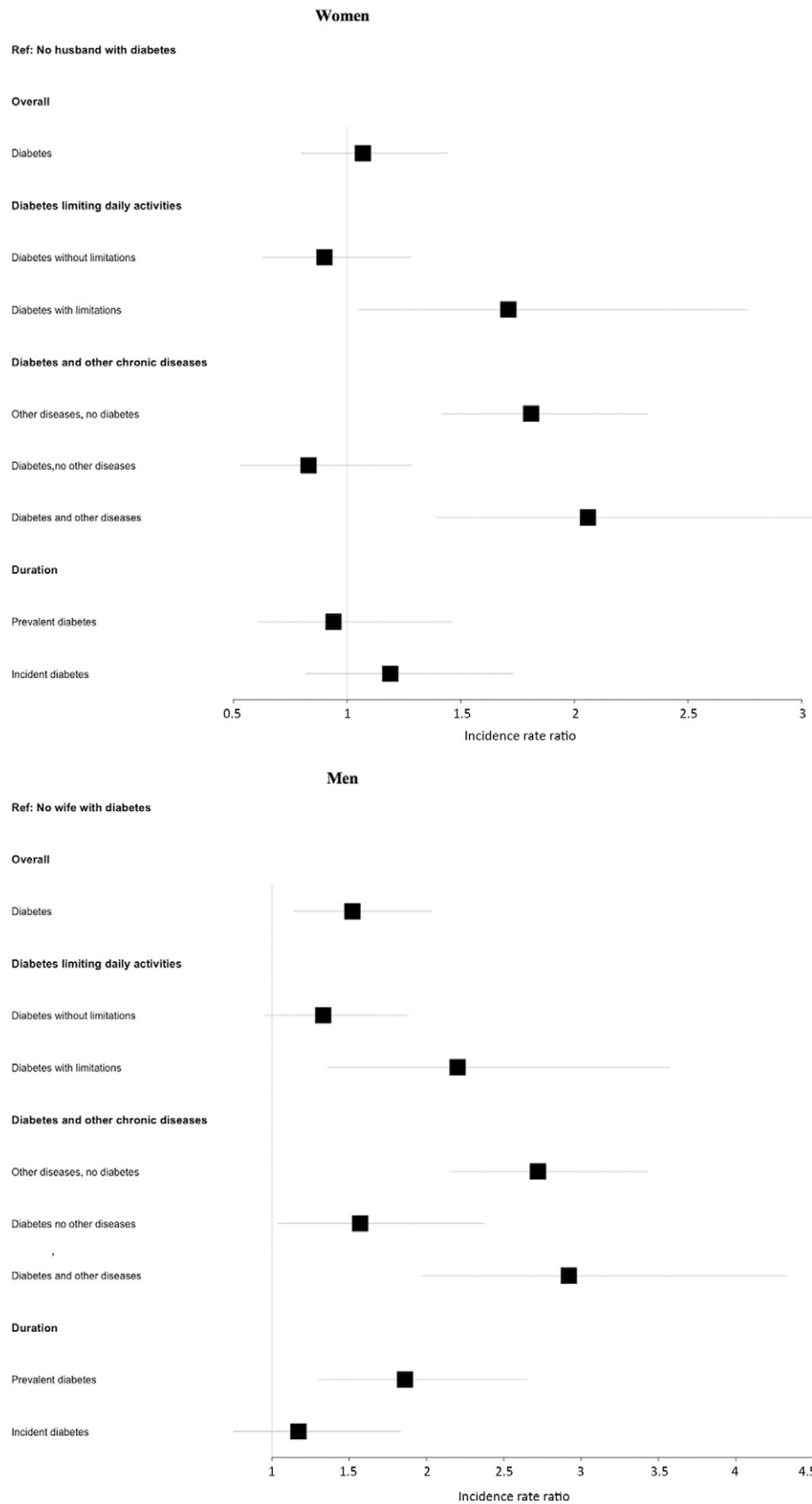


Figure 2—IRR of developing depression and/or anxiety according to spouse’s diabetes status, with stratification by sex. Shown are the IRRs of depression or anxiety in women and men with a husband or wife with diabetes in comparison with those whose husband or wife does not have diabetes, with stratification by sex and adjustment for age and race. Ref, reference.

1.30, 2.65]), while men with a wife with incident diabetes were not at higher risk (IRR 1.17 [95% CI 0.75, 1.83]).

CONCLUSIONS

To understand the implications on psychological well-being of living with a spouse who has diabetes, we analyzed data from a national prospective cohort followed over 18 years. Living with a spouse who had diabetes was associated with an increased risk of diagnosed depression and/or anxiety. This association was robust to adjustment for the person's own diabetes status and household poverty status, which are important risk factors for depression/anxiety and potential confounders of the association between spousal diabetes and one's risk of psychological problems. We found that the higher risk of depression/anxiety was driven by severity of diabetes. Of note, adults living with a spouse who had diabetes limiting daily activities, diabetes in combination with other chronic conditions, or longer exposure to a spouse's diabetes had the highest risk of subsequent depression/anxiety. The association of living with a spouse with diabetes and depression/anxiety was stronger in men than women.

Living with a spouse with diabetes was associated with an increased risk of depression/anxiety, especially when diabetes limited the spouse's daily activities or the spouse had other chronic conditions in addition to diabetes. In contrast, those whose spouse had diabetes but did not experience limitations or had no additional chronic conditions did not have higher risk of depression/anxiety. Adults with shorter exposure to spouse's diabetes (i.e., those whose spouses experienced incident diabetes or moved in with a spouse who already had diabetes) were not at higher risk of depression/anxiety. These results imply that adults are not prone to depression/anxiety in the early stages of a spouse's diabetes or in the early phase of living with a spouse's diabetes; however, depression/anxiety may emerge once diabetes progresses to severe symptoms and comorbidities or when time lived with a spouse with diabetes increases. Consistent with our hypothesis and findings, this may be because depression and/or anxiety results from the care demands and resulting stress

at advanced stages of diabetes. Indeed, a prior cross-sectional study showed that the perceived severity of a spouse's diabetes was associated with increased distress (14). Qualitative studies have reported that living with a spouse who has diabetes entails living with an uncertain future (25), and seeing the deteriorating health in one's spouse causes sorrow (26). In terms of care demands, the hours of informal care received by people with diabetes increases with greater medication demands (27). Further, family members responsible for tasks related to diabetes care, such as cooking healthy meals and accompanying the patient to doctor appointments, reported lower quality of life and perceived diabetes as a larger burden than family members not involved in the diabetes care (14). We cannot differentiate whether the stronger associations between the development of depression/anxiety and more severe manifestations of diabetes in one's spouse are due to worries related to diabetes, exhaustion due to the caregiver tasks of living with a chronically ill spouse, or a combination. Indeed, we found that adults living with spouses diagnosed with other chronic conditions also had higher risk of depression/anxiety.

We found stronger associations between living with a spouse with diabetes and development of depression/anxiety among men than among women. This is partly explained by the observation that men with a spouse without diabetes had lower risk of psychological problems than women with a spouse without diabetes (5.3 vs. 7.7 cases per 1,000 person-years, respectively [Supplementary Table 2]), which is in line with studies of depression in men and women in general (21,22). In contrast, with restriction to adults living with a spouse who had diabetes, the risk of depression/anxiety was similar for men and women (7.1 vs. 6.9 cases per 1,000 person-years [Supplementary Table 2]). Thus, compared with men, women have higher levels of depression in general, while having a spouse with diabetes may add less additional stress for women than for men. This may be explained by women in general being more commonly involved in caretaking of family members (28), while for men having to care for a spouse with diabetes may be unusual and therefore extra stressful. Stressful life events are

associated with a higher risk of depression in men than women (29).

Our findings suggest that the increased risk of depression/anxiety for those with a spouse with diabetes is similar to the increased depression risk for those who have diabetes themselves (15–24% higher risk than for people without diabetes according to prior research [30,31]).

Studies of people who have a spouse with cancer have an 8–216% higher risk of depression, depending on severity of depression investigated and the spouse's type of cancer, in comparison with those with a spouse without cancer (16,17). These increased risks are in line with our findings, though the data do not distinguish by severity of the depression/anxiety (20).

This study contributes with a longitudinal analysis of developing depression/anxiety as an outcome of the spouse's diabetes status. It also provides information on the implications of a spouse's diabetes with differing levels of severity and duration. The findings are robust to adjustment for known risk factors and determinants, such as a person's own health status and household poverty status. This study also has limitations. All diagnoses of diabetes, depression, and anxiety were self-reported. Self-reported diabetes is highly sensitive and specific (32). Self-reported depression and anxiety are commonly used in large population-based studies (33), though self-report has not been extensively validated against medical records. A small study ($n = 104$, response rate 24%) conducted up to 4 years after the participant had self-reported a clinical depression diagnosis validated 74% of the self-reported depression cases against a clinician-conducted test (34). Though the unconfirmed 26% of cases could be due to people having reversed or improved their condition, our study may overreport depression/anxiety. On the other hand, stigma around depression and anxiety may have led to underreporting of these conditions (35). In addition, by PSID study design, only one spouse per household was interviewed, which may introduce further errors in capturing incident occurrences of depression/anxiety (outcome) and diabetes (exposure). In PSID, the diabetes questions include whether the person has been told that they have high blood

glucose or diabetes, which could include prediabetes. High blood glucose such as prediabetes may not be perceived to be as serious as diabetes, which could have contributed to the difference in risk between those with a spouse with diabetes only and those with a spouse with diabetes limiting daily activities or in combination with other chronic conditions. PSID also does not distinguish between type 1 and type 2 diabetes, but both types of diabetes can progress to severe comorbidities and complications addressed as limiting daily activities and other chronic conditions (36). Finally, depression and anxiety were combined in the analyses. Though they are distinct conditions, both are influenced by living in stressful environments (37), which we hypothesized living with a spouse with diabetes may amount to.

In conclusion, living with a spouse who has diabetes increases the risk for developing depression and/or anxiety, more acutely experienced by men than by women. More severe or long-standing diabetes in the spouse was associated with higher magnitude of relative risk of depression/anxiety. In fact, the association of a spouse's diabetes status with depression/anxiety is comparable with the associations reported with one's own diabetes status (30,31). These findings have implications for both research and practice. For practice, family support has long been praised as a key to successful management of diabetes. Yet, our results suggest caregiver stress as a mechanism leading to psychological problems in people with a spouse with diabetes. Thus, clinicians should be attentive to the psychosocial burden to others in the home when treating a person with diabetes, and diabetes associations and guideline committees need to recognize caregiver stress in their guidelines. Future research and interventions should 1) investigate the effectiveness of integrating screening and treatment of depression/anxiety in caregivers such as spouses into diabetes care and 2) investigate how family members can support the person with diabetes without compromising their own psychological well-being.

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