Diabetes Care Publish Ahead of Print, published online August 27, 2010

Sexuality Among Middle Age and Older Adults with Diagnosed and Undiagnosed Diabetes: A National, Population-Based Study

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Submitted 19 March 2010 and accepted 13 July 2010.

Additional information for this article can be found in an online appendix at http://care.diabetesjournals.org

Objective: Describe sexual activity, behavior, and problems among middle-age and older adults by diabetes status.

Research Design and Methods: A substudy of 1,993 community-residing adults, ages 57-85, from a cross-sectional, nationally representative sample (N=3005). In-home interviews, observed medications, and HbA1c were used to stratify by diagnosed diabetes, undiagnosed diabetes, or no diabetes. Logistic regression was used to model associations between diabetes conditions and sexual characteristics, separately by gender.

Results: The survey response rate was 75.5%. Over 60% of partnered people with diagnosed diabetes were sexually active. Women with diagnosed diabetes were less likely than men with diagnosed diabetes (AOR 0.28, 95% CI 0.16-0.49) and other women (AOR 0.63, 95% CI 0.45-0.87) to be sexually active. Partnered sexual behaviors did not differ by gender or diabetes status. The prevalence of orgasm problems was similarly elevated among men with diagnosed and undiagnosed diabetes as compared to other men, but erectile difficulties were elevated only among men with diagnosed diabetes (AOR 2.51, 95% CI 1.53 to 4.14). Women with undiagnosed diabetes were less likely to have discussed sex with a physician (11%) than women with diagnosed diabetes (19%), and men with undiagnosed (28%) or diagnosed (47%) diabetes.

Conclusions: Many middle-age and older adults with diabetes are sexually active and engage in similar sexual behaviors as people without diabetes. Women with diabetes were more likely than men to cease all sexual activity. Older women with diabetes are as likely to have sexual problems but are significantly less likely than men to discuss them.

Advances in treatment for diabetes mellitus have prolonged and improved quality of life for many of the approximately 12 million affected people age 60 and older in the US. Clinical guidelines for diabetes care include assessment and treatment of erectile problems in men (1). Sexual problems may be a warning sign of diabetes or a consequence that can lead to depression, treatment inadherence, and strained intimate relationships. In contrast, older women's sexual issues have been largely overlooked in screening for and treating diabetes (1; 2). Failure to recognize and address sexual issues among middle-age and older adults with diabetes may impair quality of life and adaptation to the disease.

Some adults with diabetes maintain sexual relationships throughout their lives (3). Prior studies have focused on the pathophysiological effects of diabetes on male sexual function, primarily erection and sexual desire. The effects of diabetes on women's sexual functioning are poorly understood and likely multifactorial (2). Sexual problems in adults with diabetes have been associated with age, disease duration, and comorbidity (1). The effects of chronic hyperglycemia, degree of diabetes control, or use of glucose-lowering drugs are less clear (4), in part because people with undiagnosed or preclinical diabetes are typically

aggregated with controls in other studies (1). Psychosocial correlates of sexual problems in people with diagnosed diabetes have been found in younger adults. Studies including older adults find associations with depression, (1), vulnerability, lifestyle restrictions due to disease management, (5), and marital conflict (6).

Prior data on sexuality in persons with diabetes have been derived primarily from studies that are small, have not included very old persons or aggregated people 65 years and older, lacked a comparison group, and relied on convenience or other non-generalizable samples (1; 2). Comprehensive, population-based data are needed to further physicians' understanding of the sexual norms and problems of older adults with diagnosed and undiagnosed diabetes. Virtually nothing is known about sexual function among people with undiagnosed diabetes; this information could be relevant for diagnosis, motivation to engage in treatment, and prevention of sexual and non-sexual diabetes-related complications. The National Social Life, Health and Aging Project (NSHAP) provides disease-specific data on the sexual activity, behaviors and problems of middle-aged and older adults affected by diabetes.

METHODS

Study Population and Study Design: NSHAP involved a nationally-representative probability sample of community-dwelling adults ages 57-84 years (at the time of screening), generated from US households screened in 2004, described in detail elsewhere (7). Of 4017 eligible cases in the sample, 3005 (1455 men, 1550 women) were interviewed at home between July 2005 and March 2006, yielding a weighted response rate of 75.5% (unweighted 74.8%). The protocol was approved by the University of Chicago and NORC Institutional Review Boards; all respondents gave written informed consent.

Demographic and Sexuality Data: Details of demographic and sexuality measures have been previously reported (3). Sex was defined as: "any mutually voluntary activity with another person that involves sexual contact, whether or not intercourse or orgasm occurs." Sexually active respondents were asked about the presence of sexual problems selected on the basis of diagnostic and clinical criteria for sexual dysfunction (3). All respondents who had not had sex in the previous 3 months were asked to indicate why from a list of reasons (3). A self-administered questionnaire completed during the in-home interview asked about the frequency of masturbation, defined as "stimulating your genitals (sex organs) for sexual pleasure, not with a sex partner," and ascertained whether orgasm occurred with masturbation. Questions about sexual activity and problems were refused by 2 to 7% of respondents; 12 to 13% declined to answer the questions regarding masturbation.

Diabetes Status Classification: Individuals were classified as having "diagnosed diabetes," regardless of their HbA1c value, if they responded that they had been told by a physician that they had diabetes, or if they were using one or more diabetes medications. To identify individuals with "undiagnosed diabetes," we used an HbA1c cut-point of 6.0% based on the correlation of HbA1c with the traditional fasting glucose criterion in older people. This HbA1c cut-point for identifying undiagnosed diabetes was selected based on a sensitivity/specificity analysis of data from the 1999-2004 U.S.

National Health and Nutrition Examination Survey for people ages 57-85 (8). Comparing varying HbA1c cut-points with diagnosis of diabetes based on fasting glucose levels, an HbA1c cut-point of 6.0% maximized specificity of the assay for detecting undiagnosed diabetes without compromising sensitivity for all cut-points examined between 5.0% and 7.0% (specificity 0.91 for men, 0.91 for women; sensitivity 0.68 for men, 0.69 for women) (Online Appendix Figure 1, available at http://care.diabetesjournals.org).

Individuals who did not have diagnosed diabetes were classified as having "no diabetes" if their HbA1c value was less than 6.0%, and were classified as having "undiagnosed diabetes" if their HbA1c value was 6.0% or higher (Online Appendix Figure 1a). In light of recent changes in international diabetes care guidelines, we also carried out sensitivity analyses using the HbA1c 6.5% cut-point criterion and summarize these in the Discussion section (9; 10).

Details of medication data collection by direct observation and medication classification and coding have been previously described (11). Sixteen percent of all individuals and 26% of those in the analytic sample (17% and 24% weighted, respectively) were taking at least one medication classified as an antidiabetic agent "on a regular schedule, like every day or every week." These agents (and the weighted proportion of individuals in the analytic sample taking them) included: biguanides (13.9%), sulfonylureas (12.5%), thiazolidinediones (7.2%), insulin (5%), antidiabetic combinations (2.6%), meglitinides (0.7%), alpha-glucosidase inhibitors (0.3%), and miscellaneous antidiabetic agents (0.1%). Of all the individuals using one or more diabetes medications, 95.1% also reported a diabetes diagnosis. Of individuals classified as having diagnosed diabetes, 3.9% were classified based on medication data alone.

Measurement of HbA1c: Fingerstick dried blood specimens were sought from a random two-thirds of study respondents (N=2494), with a cooperation rate of 84.4% (N=2105) (Online Appendix Figure 2b). HbA1c was obtained using well-validated dried blood spot methods previously described (12; 13). Adequate specimens were obtained for analysis from 1746 respondents.

Measurement of Other Health Conditions and Physician Communication: Physical health was self-rated using the 5-point "excellent," "very good," "good," "fair," or "poor" scale. Co-morbidities were assessed using the Katz modification of the Charlson Index (14) (diabetes excluded), and activities of daily living were assessed using the Katz Activities of Daily Living Scale (15). Respondents were asked whether a medical doctor had ever told them they had any of several common diabetes-related complications (Table 1). Communication with a physician about sexual matters since age 50 was assessed as previously described (3). Depressive symptoms were assessed using the 11-item short form of the CES-D (16), with response options 0-3; a score ≥ 9 was considered indicative of a clinically significant level of depressive symptoms, consistent with a threshold of 16 on the 20-item scale (17).

Data Analysis: The analytic sample consisted of the 1993 participants for whom diabetes status could be determined based on HbA1c, medication data and/or self-report (Online Appendix Figure 2a).

Demographic and clinical characteristics were estimated separately within each of

the three diabetes status groups by gender. Bivariate associations with diabetes status were tested using the Rao and Scott correction to the chi-square test (18) to account for the survey design. Logistic regression was used to model associations between diabetes conditions and sexual activity, behavior, and problems separately by gender.

All models were adjusted for age group (57-64, 65-74 and 75-85 yrs), depressive symptoms (CES-D scores <9 vs. >=9), and the modified Charlson comorbidity index (0, 1-2, and >=3) except for outcomes with too few cases in either outcome category to support a fully adjusted model (19). Education and race were also evaluated as potential confounders of the effect of diabetes status. For outcomes with a small number of cases in either outcome category, confounding effects of each covariate listed above were evaluated separately; unadjusted models are presented for these outcomes unless confounding, defined as a change in the odds ratio of 10% or more, was identified.

All analyses accounted for the survey sampling design through incorporation of sampling strata and clusters, as well as weights that adjusted for differential probability of selection and differential non-response. All reported estimates are weighted. All analyses were performed by means of Stata statistical software, version 10.

RESULTS

Sociodemographic and health characteristics by diabetes status: Table 1 summarizes the demographic and health characteristics of the analytic sample, stratified by diabetes status. Self-rated health and capacity for activities of daily living were consistently lower and the prevalence of several diabetes complications and comorbidities were consistently higher for people with diagnosed diabetes as compared to those with no diabetes, with intermediate results for those with undiagnosed diabetes.

Partnership and sexual activity by diabetes status: Men, regardless of age or diabetes status, were more likely than women to be married or living with a partner (Table 1) and were significantly more likely than women to be currently sexually active (Table 2). Sixty one percent of men (69% of partnered men) and 33% of women (62% of partnered women) with diagnosed diabetes were currently sexually active. Women with diagnosed diabetes were less likely than men with diagnosed diabetes (AOR 0.28, 95% CI 0.16-0.48) and other women (AOR 0.63, 95% CI 0.45-0.87) to be sexually active. Among sexually active people, the majority engaged in sexual activity at least two to three times per month and neither the frequency of sexual activity nor specific partnered sexual behaviors differed by diabetes status or gender.

Sexual behaviors and problems by diabetes status: Among sexually active individuals, partnered sexual behaviors did not differ by gender or diabetes status (Table 2). However, adults with diagnosed diabetes were less likely than others to masturbate (AOR 0.50, 95% CI 0.32-0.78 for women, AOR 0.66, 95% CI 0.44-0.97 for men) and to experience orgasm with masturbation (Table 3).

Sexual problems were ascertained only for individuals who were sexually active in the prior twelve months (Table 3). Men with diagnosed diabetes were more likely than other men to report lack of interest in sex (AOR 1.72, 95% CI 1.12-2.63); among women, interest in sex did not differ by diabetes status. The prevalence of orgasm problems (inability to climax,

climaxing too quickly) were similarly elevated among men with diagnosed and undiagnosed diabetes as compared to men without diabetes, but erectile difficulties were elevated only among men with a diabetes diagnosis (AOR 2.52, 95% CI 1.53-4.14).

Among all individuals who had not been sexually active for three months or longer, men with diagnosed diabetes were more likely than all other groups (men and women) to report that they had not had sex due to their own physical health problems (60.9%, versus 34.5% for men with undiagnosed diabetes and 39.4% for men with no diabetes, $p<.001$; 16.2% of women with diabetes versus 8.5% with undiagnosed diabetes and 9.2% with no diabetes). Among women, the common reasons for sexual inactivity were similar between those with diagnosed and no diabetes, but women with undiagnosed diabetes were more likely to report lack of interest as a reason for sexual inactivity (54.5% for undiagnosed diabetes versus 44.9% for diagnosed diabetes and 38.0% for no diabetes, $p<.05$).

Communication with a physician about sexual issues by diabetes status: Men with diagnosed diabetes were more than twice as likely (46.8%) as women with diagnosed diabetes (18.8%) to discuss sex with a physician, as compared to 28.0% of men and only 11.3% of women with undiagnosed diabetes (Online Appendices Figures 3a-b). Among those who had discussed sexual matters with a physician, 16.7% of men overall (10.0% of men with diagnosed diabetes) compared to 30.5% of women overall (28.4% of women with diagnosed diabetes) reported that the physician initiated the conversation. About a third of sexually active men and women with sexual problems reported avoiding sex because of problems (Table 3); this did not vary by diabetes status.

DISCUSSION

Our findings, based on nationally representative U.S. data, indicate that two thirds of men and about a third of women ages 57-85 years with diabetes were sexually active. While diabetes was associated with a higher rate of sexual inactivity, those who were active participated in partnered sexual behaviors and activity at a rate similar to those without diabetes. As a group, the majority of people with diabetes were married or living with a partner, although women with diabetes were more likely to be alone. Sexually active adults with diabetes had a similar prevalence of sexual problems, and women were more likely than men to avoid sex due to these problems. Yet fewer than one in five women with diagnosed diabetes as compared to nearly half of men had discussed sex with a physician. Individuals with undiagnosed diabetes, particularly women, were even less likely than others to have discussed sex with a physician.

This study combines self-report measures, medication and biological measures from a population-based probability sample to stratify individuals as having diagnosed, undiagnosed or no diabetes. There is not yet full agreement about using HbA1c to diagnose diabetes in older adults (9; 10; 20), but our strategy generated estimated prevalences of diagnosed and undiagnosed diabetes comparable to 2005-06 US population estimates using fasting plasma glucose and/or oral glucose tolerance testing for community-residing individuals ages 60 years and older (among those with HbA1c results, 20.5% (95% CI = 17.5-24%) of 901 women and 25% (21- 29%) of 843 men had diagnosed diabetes,

while 19% (16-22%) of women and 22% (19-25%) of men had undiagnosed diabetes) (21). Repetition of the analyses shown here using a 6.5% glycosylated hemoglobin threshold for diabetes classification in this population yielded few qualitative differences in the outcomes of interest, but did result in a far smaller undiagnosed diabetes group in the undiagnosed diabetes (4.7% in women and 5.6% in men) than found by classification based on traditional diagnostic criteria. Using either threshold, as a group, individuals with undiagnosed diabetes are different from those with diagnosed diabetes in two important ways. Those with undiagnosed diabetes appeared to be earlier in the course of the disease. Second, undiagnosed diabetes is a pathophysiological state that lacks the psychological burden and/or social stigma associated with having diagnosed diabetes (5).

The etiology of sexual problems associated with undiagnosed diabetes (controlling for other physical and psychological factors known to be associated with sexual problems) might reflect a predominant physiological mechanism whereas the etiology of sexual problems associated with diagnosed diabetes might be more likely to have an additional, diabetes-specific psychosocial component. While cross-sectional data cannot determine the causal direction of such relationships, understanding sexuality of individuals with undiagnosed as compared to those with diagnosed and no diabetes can shed light on the pathological mechanisms and the natural history of both diabetes and sexual dysfunction in later life.

In this study, aside from the expected higher prevalence of erectile dysfunction in men with diagnosed diabetes (55%) (1), the prevalence of many sexual problems did not differ significantly according to diabetes status. Dropout from sexual activity may partly explain the lack of a diabetes association with sexual problems, especially in women. This is suggested by the significantly higher prevalence of sexual inactivity among women with diagnosed diabetes as compared to men and a greater lack of interest in sex among sexually inactive women with diabetes as compared to those without. Furthermore, women with diabetes (diagnosed and undiagnosed) were nearly half as likely as other women to report masturbating, suggesting a reduction in sexual drive that was independent of partner status and of knowledge of the disease. The prevalence of masturbation was also lower in men with diagnosed or undiagnosed diabetes as compared to men without, but was three times higher than in women with diabetes (45%).

Interestingly, the rate of erectile dysfunction was not markedly elevated in men with undiagnosed diabetes (36% versus 32% in men without diabetes), but inability to experience orgasm was high and comparable to men with diagnosed diabetes (29% versus 16% in men without diabetes). This finding suggests that loss of orgasmic function may not only occur as a consequence of erectile dysfunction as described by others (22), but may actually precede erectile dysfunction, at least as perceived by some men with diabetes. In women, inability to experience orgasm with masturbation was also significantly higher among those with diagnosed diabetes. Physicians who do ask about sexual function tend to engage patients with partners (23) and focus on male erectile issues for which treatment is readily available. Asking about orgasm function

in relation to partnered sex and masturbation and expanding these discussions to include women may assist in prevention of downstream sexual problems, personal and interpersonal distress, and in earlier diagnosis of diabetes in some individuals. Although no pharmacologic treatment is approved to remedy anorgasmia, interventions such as education to inform the patient that anorgasmia is known to occur for a substantial proportion of sexually active people with diabetes, directed masturbation, use of a clitoral pump in women, and discussion of ways to enhance sexual arousal and intimacy can be therapeutic.

Medications are another important iatrogenic etiology of later life sexual problems (24). Glucose-lowering medications are largely thought to improve sexual function by mitigating glycemic-related microvascular damage, as seen in clinical studies of erectile function in men with diabetes (4). The stratification strategy used in our study classifies all individuals taking glucose-lowering medications as having diagnosed diabetes. This would tend to underestimate the association between diagnosed diabetes and sexual function, particularly for the subgroup with uncontrolled diabetes. However, other medications used to treat diabetes, including anti-hypertensives and cholesterol-lowering drugs, may have deleterious effects on sexual function (24). Due to sample size, this study is limited by an inability to account for the effects of other medications in estimating the association between diabetes status and aspects of sexuality. Prospective clinical trials are needed to fully elucidate the effects and interactions of medications on sexual activity and function among middle-age and older adults with diabetes; virtually nothing is documented about the effects of diabetes medications on sexuality in older women.

The prevalence of specific sexual problems was only assessed for those who were sexually active in the prior twelve months, therefore underestimating the prevalence of sexual problems in this population. Next, in addition to the expected differences in population prevalence estimates for undiagnosed diabetes, reanalysis using a glycosylated hemoglobin cut-point criterion of 6.5% results in differences between the groups for some outcomes, in part due to loss of precision in estimates. For example, the rate of erectile dysfunction was still higher in men with undiagnosed diabetes (40.5%) as compared to men without diabetes (32.1%), but the adjusted odds ratio comparing these two groups was no longer significant (0.63, 95% CI 0.25-1.58). No substantive differences were found in diabetes status comparisons along sociodemographic, health, or communication variables. As is the case with virtually all clinical and population-based research on human sexuality, these data were self-reported, although the interview methods are widely accepted as being valid (25). Use of a population-based probability sample adds to prior knowledge (1; 2) about later life diabetes and sexuality by disaggregating people with undiagnosed or preclinical diabetes from those with no diabetes. This study builds on prior work by filling a void of information about older women's sexuality and gender differences in sexuality among middle-age and older adults with diabetes. Further research should be powered to also look at age group comparisons.

CONCLUSION

Many middle-age and older adults with diabetes are sexually active. Sexual problems are common, but infrequently discussed with physicians, especially among women. Physician knowledge about sexuality in relation to diabetes should improve patient education and counseling, as well as the identification of symptoms that could signal undiagnosed, or high risk for, disease. Attention to potentially treatable sexual problems in middle-age and older adults with diabetes should improve quality of life and enhance overall diabetes management.

Author Contributions: All of the authors had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. S.L. developed study concept and design, acquired data, analyzed and interpreted data, drafted the manuscript, obtained funding, provided administrative, technical, or material support and provided overall study supervision. H.T. analyzed and interpreted data, drafted the manuscript, provided critical revision of the manuscript for important intellectual content, and provided statistical analysis. A.G. provided analysis and interpretation of the data, and drafted the manuscript. A.V. provided statistical analysis and interpretation of the data and critical revision of the manuscript for important intellectual content. E.H. provided analysis and interpretation of the data, critical revision of the manuscript for important intellectual content, and lent administrative, technical, or material support. M.D. provided statistical analysis and interpretation of the data and critical revision of the manuscript for important intellectual content. D.Q. provided analysis and interpretation of the data and critical revision of the manuscript for important intellectual content. M.C. provided analysis and interpretation of the data, critical revision of the manuscript for important intellectual content, obtained funding, and provided administrative, technical, or material support.

ACKNOWLEDGMENTS

Financial Disclosures: The authors report no conflicts of interest.

Funding/Support: The National Health, Social Life and Aging Project (NSHAP) is supported by the National Institutes of Health, including the National Institute on Aging, the Office of Research on Women's Health, the Office of AIDS Research, and the Office of Behavioral and Social Sciences Research (5R01AG021487). NSHAP is also supported by NORC, whose staff was responsible for the data collection. Donors of supplies include: Orasure, Sunbeam Corporation, A&D/LifeSource, Wilmer Eye Institute at the Johns Hopkins Bloomberg School of Public Health, Schleicher & Schuell Bioscience, Biomerieux, Roche Diagnostics, Digene Corporation, Richard Williams. The National Institutes of Health, National Institute on Aging University of Chicago – NORC Center on Demography and Economics of Aging Core on Biomarkers in Population-Based Health and Aging Research (5 P30 AG 012857) also supported the effort of Lindau, Qato, and Gomero on this manuscript. Dr. Lindau's effort is also supported by 1K23AG032870-01A1. The National Institute of Diabetes and Digestive and Kidney Diseases Diabetes Research and Training Center (P60 DK20595) supported the efforts of Drs. Chin, Drum, and Huang, and Ms. Tang and Ms. Vable. Dr. Chin is also supported by a Midcareer Investigator Award in Patient-Oriented

Research from the National Institute of Diabetes and Digestive and Kidney Diseases (K24 DK071933). Dr. Huang is supported by a project grant from the National Institute of Diabetes and Digestive and Kidney Diseases (R01 DK081796-01A1). The investigators maintained complete independence from the funding organizations in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, and approval of the manuscript.

Role of the Sponsors: The authors retained full independence in the collection, analysis, interpretation and presentation of these findings.

Additional Contributions: The authors would like to acknowledge research assistance provided by Jessica Schwartz, Katherine Githens, Andreea Mihai and Emily Abramsohn, MPH, employed by Dr. Lindau at the University of Chicago. They contributed technical assistance in preparing the manuscript for publication and editing the bibliographic material.

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Table 1. Characteristics of the Study Population; Weighted Prevalence % (95% Confidence Interval)

Characteristic	Men					Women				
	Overall	Diagnosed diabetes*	Undiagnosed diabetes†	No diabetes‡	P-value	Overall	Diagnosed Diabetes	Undiagnosed Diabetes	No Diabetes	P-value
		(N=340)	(N=202)	(N=425)			(N=325)	(N=183)	(N=518)	
Social and Demographic	% (95% CI)					% (95% CI)				
Age, y					0.33					0.05
57-64	41.9 (38.0-45.8)	41.6 (35.5-48.1)	36.9 (29.0-45.6)	44 (39.6-48.6)		38.6 (34.6-42.7)	38.7 (31.4-46.6)	39 (29.3-49.8)	38.4 (33.8-43.2)	
65-74	36.4 (32.7-40.3)	37 (32.6-41.7)	36.6 (29.0-45.0)	35.9 (31.0-41.1)		37.3 (33.7-41.2)	39.1 (31.9-46.7)	27.4 (20.4-35.6)	39.5 (35.3-43.8)	
75-85	21.8 (19.0-24.8)	21.3 (17.1-26.3)	26.5 (21.2-32.6)	20.1 (16.5-24.2)		24.1 (21.4-27.0)	22.3 (17.8-27.5)	33.6 (26.7-41.3)	22.2 (19.2-25.5)	
Race or ethnic group§					<0.001					<0.001
White	81.1 (75.9-85.3)	74.4 (67.3-80.4)	76.1 (65.5-84.2)	87.7 (82.9-91.3)		80 (74.9-84.3)	68.5 (60.2-75.8)	68.1 (60.1-75.2)	89.9 (85.4-93.1)	
Black	8.8 (6.4-11.9)	15.8 (10.5-23.1)	8.4 (5.9-11.8)	4.1 (2.3-7.0)		10.8 (7.9-14.5)	18.3 (12.7-25.6)	17.3 (11.4-25.4)	4.7 (3.0-7.3)	
Hispanic	7.1 (3.9-12.6)	6.1 (2.6-13.6)	11.8 (5.2-24.5)	5.8 (3.4-9.8)		7.2 (3.9-13.1)	11.5 (5.4-23.0)	9.5 (5.2-16.7)	4.2 (2.2-7.9)	
Other	3.1 (2.0-4.8)	3.7 (1.7-7.9)	3.8 (1.5-9.2)	2.4 (1.0-5.4)		2 (1.0-4.1)	1.7 (0.6-4.9)	5.1 (2.0-12.8)	1.3 (0.5-3.0)	
Marital Status					0.57					0.3
Married	77.5 (73.9-80.7)	78.4 (72.8-83.1)	77.9 (68.8-84.9)	76.7 (71.5-81.2)		52.4 (49.0-55.8)	48.6 (41.7-55.5)	46 (37.3-55.0)	56.4 (50.8-61.9)	
Living with a Partner	2.1 (1.2-3.8)	2.4 (1.0-5.7)	1.5 (0.3-7.0)	2.2 (1.0-4.5)		2.2 (1.1-4.2)	2.8 (0.7-10.0)	0.9 (0.5-1.8)	2.2 (1.1-4.6)	
Separated or Divorced	9.6 (7.8-11.9)	7.6 (4.9-11.5)	9.2 (5.4-15.2)	11.2 (8.2-15.3)		15.3 (13.3-17.7)	17.1 (13.3-21.6)	14.1 (8.7-22.0)	14.8 (11.5-18.9)	
Widowed	8.4 (6.7-10.5)	9.7 (6.5-14.4)	10.3 (5.9-17.3)	6.8 (4.7-9.7)		26.4 (23.4-29.6)	27.2 (21.5-33.8)	33.8 (27.2-41.2)	23.7 (19.9-28.0)	
Never Married	2.3 (1.6-3.5)	1.9 (0.9-4.0)	1.1 (0.3-4.1)	3.1 (1.7-5.6)		3.7 (2.6-5.3)	4.4 (2.4-7.9)	5.1 (2.4-10.6)	2.9 (1.7-5.0)	
Education					0.008					0.04

< high school	17.5 (13.5-22.3)	19.4 (14.0-26.1)	24.5 (15.9-35.9)	13.2 (9.6-18.0)		21.7 (17.8-26.3)	25.3 (18.3-33.9)	25.7 (18.8-33.9)	18.6 (14.6-23.4)	
High school/equiv	24.5 (21.0-28.4)	25.6 (19.7-32.5)	27.3 (20.0-36.2)	22.5 (18.6-27.0)		29.3 (26.0-32.9)	30.8 (25.3-36.9)	34.1 (26.9-42.0)	27.1 (21.9-33.0)	
Voc cert/some college/assoc[‖]	26.3 (22.2-30.9)	30.6 (24.8-37.0)	19.4 (14.3-25.7)	26.2 (20.9-32.2)		32.9 (29.2-36.8)	32.1 (26.1-38.8)	23.8 (16.9-32.5)	36.1 (31.3-41.2)	
Bachelor or more	31.8 (26.3-37.8)	24.5 (15.7-36.0)	28.8 (22.1-36.6)	38.1 (31.4-45.3)		16.1 (13.1-19.5)	11.8 (7.9-17.3)	16.5 (11.1-23.8)	18.2 (14.3-23.0)	
Health Care Utilization										
Insurance[¶]		(N=244)	(N=153)	(N=358)			(N=252)	(N=150)	(N=429)	
Medicare	60.6 (55.0-66.0)	61.2 (52.1-69.5)	62.8 (53.0-71.7)	59.5 (53.4-65.3)	0.77	65.6 (60.9-70.0)	67.9 (59.0-75.6)	69.4 (60.1-77.3)	63.2 (58.4-67.8)	0.33
Medicaid	5.3 (3.4-8.0)	5.5 (3.0-10.1)	5.7 (2.6-12.2)	4.9 (3.3-7.4)	0.88	8 (5.5-11.6)	12.1 (7.4-19.1)	10 (5.3-18.0)	5.3 (3.3-8.6)	0.01
Private Insurance	66.9 (60.8-72.4)	70.1 (61.9-77.2)	66.6 (56.3-75.5)	65 (58.5-71.0)	0.43	62.8 (58.0-67.3)	57.9 (48.9-66.5)	51.8 (41.1-62.4)	68.6 (63.8-73.0)	0.004
Veterans Admin	13.6 (10.7-17.1)	14 (9.0-21.1)	14.2 (9.2-21.4)	13.1 (9.6-17.6)	0.93	2.6 (1.5-4.4)	1.2 (0.4-4.0)	1.1 (0.2-7.8)	3.7 (1.9-7.0)	0.17
Other Program	10.3 (7.7-13.5)	7 (3.6-13.1)	9.7 (5.2-17.3)	12.4 (8.9-17.0)	0.21	13.5 (10.8-16.7)	12.9 (8.9-18.3)	16.1 (10.4-24.0)	12.9 (9.7-17.1)	0.61
Place to go when sick	90.2 (87.3-92.4)	92.6 (88.4-95.4)	85.6 (78.8-90.4)	90.4 (85.7-93.6)	0.11	92.1 (89.9-93.8)	96.7 (93.5-98.3)	87.2 (74.5-94.1)	91.1 (87.8-93.6)	0.06
Times Seen Doctor (past 12 months)		(N=304)	(N=188)	(N=401)	0.002		(N=297)	(N=176)	(N=485)	<0.001
none	8.2 (5.6-11.7)	2.4 (0.8-7.3)	12.4 (7.5-19.8)	10.3 (6.1-16.6)		4.8 (3.5-6.7)	1.9 (0.6-5.3)	7.1 (3.8-12.8)	5.7 (3.9-8.3)	
1-9	75.5 (71.5-79.1)	73.4 (65.4-80.1)	72 (62.6-79.9)	78.3 (72.7-83.0)		75.5 (72.6-78.2)	68.1 (61.5-74.1)	75.9 (68.5-82.1)	79.3 (76.1-82.1)	
>=10	16.3 (13.3-19.9)	24.2 (18.1-31.4)	15.6 (9.4-24.7)	11.5 (8.2-15.8)		19.7 (17.2-22.4)	30.1 (24.6-36.1)	17 (11.6-24.2)	15.1 (12.5-18.0)	
Health Status[#]										
Self-rated physical health					<0.001					<0.001
Poor or fair	28.4 (24.0-33.3)	41.4 (35.8-47.3)	22.3 (15.8-30.5)	21.9 (15.9-29.5)		25.6 (21.4-30.3)	39.8 (31.9-48.2)	23.4 (16.7-31.8)	18.6 (14.3-23.8)	
Good	27.9	30.9	30.9	24.6		32.6	40	32	28.7	

	(24.6-31.4)	(26.4-35.7)	(23.5-39.4)	(20.0-29.8)		(28.9-36.5)	(32.8-47.7)	(26.1-38.6)	(23.4-34.7)	
Very good or excellent	43.7	27.7	46.8	53.5		41.8	20.2	44.6	52.7	
	(39.3-48.1)	(22.7-33.4)	(37.7-56.1)	(46.8-60.1)		(37.8-46.0)	(14.7-27.1)	(37.3-52.0)	(47.0-58.3)	
Self-rated mental health					0.01					0.006
Poor or fair	9.1	13.1	6.4	7.3		12.3	15.6	7.5	12	
	(6.6-12.3)	(9.6-17.7)	(3.3-12.3)	(4.5-11.7)		(9.6-15.6)	(10.9-21.8)	(4.1-13.5)	(9.0-15.9)	
Good	25	26.8	27.8	22.7		26.8	29.3	35	22.9	
	(21.7-28.7)	(22.5-31.5)	(21.9-34.5)	(18.1-28.0)		(23.8-30.0)	(23.7-35.6)	(27.8-43.0)	(19.4-26.8)	
Very good or excellent	65.9	60.1	65.8	70		60.9	55.1	57.5	65.1	
	(61.6-70.0)	(54.6-65.3)	(59.7-71.3)	(63.8-75.6)		(57.0-64.7)	(48.8-61.3)	(49.4-65.2)	(60.0-69.9)	
Comorbid conditions										
Heart attack	16	18.8	14.9	14.5	0.5	8.9	16.4	4	6.4	<0.001
	(13.0-19.6)	(15.3-22.8)	(9.6-22.4)	(9.2-22.2)		(7.2-11.0)	(11.3-23.0)	(2.2-7.2)	(4.4-9.1)	
Heart failure	11.7	17.2	14.7	6.6	<0.001	6.6	14.4	3.4	3.5	<0.001
	(9.5-14.3)	(13.1-22.4)	(10.5-20.2)	(4.5-9.5)		(5.1-8.6)	(10.4-19.6)	(1.7-6.9)	(2.2-5.4)	
Peripheral vascular disease	4.5	7.8	5.9	1.7	<0.001	2.4	3.2	2.9	1.9	0.43
	(3.4-6.1)	(5.5-11.0)	(3.0-11.2)	(0.9-3.3)		(1.6-3.6)	(1.5-6.7)	(1.4-5.9)	(1.0-3.4)	
Stroke	8.7	11.6	8.9	6.5	0.1	7.7	12.1	5.9	5.8	0.04
	(6.7-11.1)	(7.9-16.8)	(5.0-15.3)	(4.4-9.7)		(6.3-9.3)	(8.5-16.9)	(2.7-12.5)	(4.0-8.4)	
Poor kidney function	4.6	7.2	2.7	3.5	0.03	4.4	9.5	3	2	<0.001
	(3.1-6.6)	(4.7-10.9)	(1.3-5.5)	(1.8-6.8)		(3.2-5.9)	(6.5-13.8)	(1.3-7.0)	(1.0-4.1)	
Hypertension	55.7	72.5	49.8	46.5	<0.001	53.8	76.7	57.5	40.3	<0.001
	(51.6-59.7)	(65.6-78.5)	(40.6-58.9)	(40.4-52.7)		(49.9-57.8)	(69.4-82.7)	(47.1-67.4)	(36.3-44.4)	
Poor/fair vision	15.9	19.2	14.9	13.9	0.17	16.9	25.7	17.6	11.9	<0.001
	(12.3-20.2)	(14.2-25.5)	(9.3-23.2)	(9.1-20.6)		(13.8-20.5)	(19.5-33.1)	(11.8-25.5)	(9.0-15.6)	
Modified Charlson Index**					0.004					0.02
0	28.8	20.5	33.8	32.5		24	18.3	27	26.3	
	(25.4-32.3)	(16.7-24.9)	(28.3-39.7)	(26.9-38.5)		(20.7-27.7)	(13.4-24.4)	(18.1-38.2)	(21.5-31.6)	
2-Jan	49.3	49.6	46.9	50.1		50.5	47.6	54.5	50.9	
	(45-53.6)	(44.4-54.8)	(40.0-53.9)	(43.5-56.7)		(46.9-54.1)	(39.9-55.4)	(45.2-63.4)	(46.2-55.6)	
3 or more	21.9	29.9	19.3	17.5		25.5	34.2	18.6	22.9	
	(19.3-24.9)	(24.2-36.3)	(14.1-26.0)	(14.0-21.7)		(22.4-28.7)	(28.5-40.3)	(12.9-26.0)	(19.3-26.9)	
CES-D Index††					0.06					0.36
0-8	80.2	74.5	81.4	83.6		73.7	70.5	72.5	75.7	
	(77.0-83.0)	(67.3-80.5)	(73.9, 87.2)	(78.8, 87.6)		(70.4-76.7)	(65.7-75.8)	(63.4-80.1)	(71.1-79.7)	
>=9	19.8	25.5	18.6	16.4		26.4	29.5	27.5	24.3	

	(17.0-23.0)	(19.5, 32.7)	(12.8, 26.1)	(12.4, 21.2)		(23.3-29.7)	(24.2-35.3)	(19.9-36.6)	(20.3-28.9)	
Katz Activities of Daily Living					0.007					<0.001
0	70	59.5	73.8	75.8		59.4	43.4	63.9	66.7	
	(65.7-74.0)	(51.1-67.4)	(65.3-80.8)	(69.6-81.1)		(55.4-63.3)	(36.9-50.1)	(54.3-72.5)	(62.3-70.8)	
1	13.3	18.8	8.9	11.4		16.4	21	14	14.6	
	(11.0-16.1)	(14.0-24.7)	(5.5-14.0)	(8.9-14.4)		(13.5-19.7)	(15.7-27.4)	(8.5-22.4)	(11.4-18.5)	
2	5.1	7	7	3		7.7	10.7	10.6	5.3	
	(3.7-7.1)	(4.5-10.9)	(3.9-12.4)	(1.7-5.3)		(6.2-9.6)	(7.8-14.6)	(6.2-17.6)	(3.6-7.5)	
>=3	11.5	14.7	10.4	9.8		16.5	24.9	11.5	13.5	
	(9.1-14.5)	(10.6-20.0)	(6.1-17.0)	(5.8-16.0)		(13.9-19.5)	(20.3-30.2)	(7.5-17.4)	(10.4-17.3)	

Abbreviation: CI - confidence interval

[*] Diagnosed Diabetes: self-report or on diabetes medication. HbA1c value was not used as a criterion for classifying individuals as "diagnosed diabetes."

[†] Undiagnosed Diabetes: no self-report or diabetes medication, but have HbA1c>=6.0.

[‡] No Diabetes: no self-report or diabetes medication, and HbA1c<6.0.

[§] Race or ethnic group was determined on the basis of the questions "Do you consider yourself primarily white or Caucasian, black or African American, American Indian, Asian, or something else?" and "Do you consider yourself Hispanic or Latino?" Six respondents who reported being both Hispanic and black or African American were included in the black group.

[‖] Vocational certification, some college level training, or associates degree.

[¶] Insurance types not mutually exclusive.

[#] Health Status was self-reported in response to the question, "Would you say your health is excellent, very good, good, fair, or poor?" Specific comorbid conditions were also self-reported in response to the question, "Has a medical doctor ever told you that you have any of the following conditions?" with the option to choose all that apply.

[**] The Katz modification of the Charlson Index was used to assess co-morbidities. Conditions included myocardial infarction, congestive heart failure, peripheral vascular disease, connective tissue disease, ulcer disease, chronic pulmonary disease, cerebrovascular disease, dementia, liver disease, and renal disease. Diabetes was excluded (16).

[††] The 11-item Iowa short form of the Center for Epidemiological Studies-Depression (CES-D) scale was used to assess depressive symptoms (18).

Table 2. Sexual Activity and Behavior in Older Men and Women Stratified by Diabetes Status

Characteristic	Respondents No.	Total (Overall)	Diagnosed Diabetes	Undiagnosed Diabetes	No Diabetes	Undiagnosed vs. Diagnosed Diabetes	No Diabetes vs. Diagnosed Diabetes
		Weighted % (95% CI)				Adjusted OR* (95 % CI)	
Sexual activity with a partner (In previous 12 months)							
Men	926	67.8 (62.8-72.4)	61.3 (52.4-69.5)	68.5 (60.7-75.4)	71.9 (66.3-76.8)‖	1.34 (0.82-2.18)	1.38 (0.90-2.11)
Women	998	41.2 (37.1-45.5)	33.4 (27.4-40.0)	41 (31.5-51.3)	45.5 (39.1-52.0)‖	1.56 (0.85-2.85)	1.68 (1.18-2.38)#
Frequency (≥ 2-3 times per month)‡							
Men	562	64.1 (59.4-68.6)	59.8 (52.6-66.6)	66.4 (55.2-75.9)	65.6 (57.9-72.6)	1.26 (0.74-2.16)	1.21 (0.75-1.94)
Women	321	63.6 (56.6-70.0)	65.6 (49.8-78.5)	63.8 (49.3-76.2)	62.8 (53.3-71.4)	0.98 (0.35-2.73)	0.91 (0.41-2.01)
Vaginal intercourse (Usually or always)‡							
Men	567	84.5 (80.1-88.1)	79.8 (72.4-85.7)	83.8 (71.5-91.5)	87.5 (82.8-91.0)	1.32 (0.59-2.96)	1.74 (0.98-3.08)
Women†	323	85.5 (80.0-89.7)	82.9 (69.0-91.4)	87.9 (77.0-94.1)	85.8 (78.7-90.8)	1.5 (0.49-4.57)	1.25 (0.50-3.08)
Performed oral sex (Usually or always)‡							
Men†	557	13.7 (9.4-19.4)	10.5 (5.8-18.3)	8.2 (3.8-16.9)	17.6 (10.6-27.9)	0.76 (0.25-2.32)	1.82 (0.79-4.21)
Women†	314	10.5 (5.4-19.2)	7.3 (2.5-19.3)	16.7 (5.4-41.2)	10 (4.7-19.8)	2.55 (0.41-16.03)	1.41 (0.37-5.43)
Received oral sex (Usually or always)‡							
Men†	552	14.8 (10.2-20.8)	13.7 (8.3-21.8)	10.2 (4.9-19.9)	17.2 (10.1-27.9)	0.71 (0.26-2.00)	1.31 (0.59-2.87)
Women†	315	9.5 (6.0-14.7)	5.5 (1.5-17.7)	6.1 (0.8-35.6)	12 (8.0-17.7)	1.11 (0.10-12.69)	2.35 (0.60-9.18)
Sexual touching¶ (Usually or always)‡							
Men†	581	92.1 (89.2-94.3)	92.7 (87.5-95.9)	89.8 (78.9-95.4)	92.7 (88.1-95.6)	0.69 (0.23-2.10)	0.99 (0.41-2.43)

Women[†]	331	87.6 (82.7-91.3)	89.0 (80.5-94.0)	77.1 (59.7-88.4)	90.0 (84.0-93.9)	0.42 (0.15-1.17)	1.11 (0.49-2.54)
Masturbation (In previous 12 months)[§]							
Men	850	53.4 (48.7-58.0)	46.5 (39.9-53.3)	47.6 (39.5-55.7)	60.5 (53.0-67.5)[‖]	1.11 (0.70-1.77)	1.74 (1.13-2.68)[#]
Women	862	22.5 (19.1-26.3)	14.9 (10.9-19.9)	15.1 (9.1-24.1)	28.9 (23.9-34.6)[‖]	1.05 (0.53-2.08)	2.33 (1.50-3.63)[#]

Abbreviation: CI, confidence interval; OR, odds ratio

[*] All odds ratios are adjusted for age group, comorbidities, and depression unless otherwise noted.

[†] Unadjusted model was used due to small number of cases.

[‡] Respondents were asked about this activity or behavior if they reported having sex in the previous 12 months

[§] This question was asked of all respondents by means of a self-administered questionnaire.

[‖] Association with diabetes status significant at $p<0.05$

[¶] Kissing, hugging, caressing, or other ways of sexual touching

[#] Odds ratio significant at $p<0.05$

Table 3. Sexual Problems Associated with Diabetes Conditions in Sexually Active Men and Women[‖] (Estimated Population Prevalence (95% Confidence Interval)

Characteristic	Respondents No.	Total (Overall) Weighted % (95% CI)	Diagnosed Diabetes Weighted % (95% CI)	Undiagnosed Diabetes Weighted % (95% CI)	No Diabetes Weighted % (95% CI)	Undiagnosed vs. Diagnosed Diabetes adjusted OR[*] (95 % CI)	No Diabetes vs. Diagnosed Diabetes adjusted OR[*] (95 % CI)
Lack of interest in sex							
Men	580	28.3 (24.2-32.8)	37.6 (30.3-45.6)	23.9 (16.0-34.1)	24.8 (19.4-31.1)[#]	0.57 (0.30-1.07)	0.59 (0.38-0.91)[††]
Women	326	47.6 (40.1-55.2)	44.3 (30.6-58.9)	54.7 (39.0-69.6)	46.9 (37.6-56.3)	1.47 (0.66-3.30)	1.13 (0.55-2.32)
Inability to climax							
Men	568	21.4 (17.8-25.5)	26.1 (18.3-35.8)	28.5 (20.9-37.5)	15.9 (11.6-21.4)[#]	1.16 (0.57-2.36)	0.55 (0.31-0.99)[††]
Women	308	37.3 (31.7-43.2)	43.6 (31.5-56.5)	26.3 (16.2-39.7)	37.9 (31.1-45.2)	0.43 (0.19-0.98)	0.8 (0.41-1.54)
Climaxing too quickly							
Men	565	29 (24.4-34.1)	36.3 (26.0-48.0)	34 (23.0-47.1)	22.9 (18.0-28.6)	0.92 (0.49-1.74)	0.53 (0.29-0.96)[††]
Women[†]	313	7.8 (4.9-12.2)	13.1 (6.1-25.9)	7.8 (2.5-21.4)	5.8 (3.2-10.2)	0.56 (0.13-2.40)	0.41 (0.15-1.10)
Pain during intercourse							
Men[†]	580	3.9 (2.5-6.1)	4.4 (2.2-8.6)	4.7 (1.7-12.8)	3.3 (1.6-7.0)	1.09 (0.30-3.95)	0.76 (0.25-2.32)
Women[†]	326	17.4 (13.1-22.8)	15.7 (8.9-26.2)	17 (6.7-36.8)	18.2 (12.0-26.6)	1.1 (0.29-4.25)	1.2 (0.58-2.47)
Sex not pleasurable							
Men[†]	578	6.2 (4.4-8.7)	6.7 (3.8-11.5)	5.7 (3.3-9.5)	6.2 (3.6-10.5)	0.84 (0.39-1.83)	0.92 (0.39-2.19)
Women[†]	323	24 (18.7-30.3)	23.6 (13.6-37.8)	18.7 (9.7-33.1)	25.7 (18.6-34.3)	0.75 (0.26-2.16)	1.12 (0.50-2.50)
Anxiety about performance							
Men	575	26.5 (22.6-30.8)	31.3 (23.6-40.2)	28.6 (20.7-38.0)	23 (18.4-28.3)	0.87 (0.49-1.55)	0.66 (0.42-1.04)
Women[†]	322	10.9 (8.0-14.5)	11.2 (5.7-20.9)	7.7 (2.6-20.5)	11.6 (8.0-16.6)	0.66 (0.17-2.58)	1.04 (0.44-2.47)
Difficulty achieving or maintaining an erection							

Men	577	39.2 (33.8-44.8)	55.3 (43.2-66.8)	35.6 (25.8-46.9)	31.5 (25.6-38.0)[#]	0.45 (0.24-0.82)[††]	0.38 (0.22-0.66)[††]
Difficulty with lubrication							
Women	321	41.9 (35.4-48.6)	43.5 (32.1-55.6)	46.7 (30.5-63.7)	39.9 (31.9-48.4)	1.28 (0.53-3.09)	0.94 (0.51-1.75)
Avoidance of sex because of sexual problems[‖,¶]							
Men	383	27.9 (22.4-34.2)	27.7 (19.3-38.1)	23.8 (14.2-37.1)	30.1 (22.5-38.9)	0.86 (0.36-2.05)	1.14 (0.60-2.15)
Women[†]	243	35.1 (27.3-43.9)	32.2 (19.7-47.8)	39.2 (21.7-59.9)	35 (27.5-43.3)	1.36 (0.48-3.86)	1.13 (0.60-2.15)
Inability to experience orgasm with masturbation (Never/ Rarely/Sometimes)[**]							
Men[‡]	425	15.7 (12.4-19.7)	21.1 (14.4-29.9)	9 (4.0-18.9)	14.9 (10.3-20.9)	0.31 (0.11-0.88)[††]	0.66 (0.31-1.40)
Women[§]	218	33.6 (27.2-40.6)	48.9 (36.7-61.2)	24.3 (13.0-40.7)	30.2 (22.8-38.7)	0.34 (0.13-0.89)[††]	0.71 (0.33-1.52)

Abbreviation: CI, confidence interval; OR, odds ratio

[*] All odds ratios are adjusted for age group, comorbidities, and depression unless otherwise noted.

[†] Unadjusted model was used due to due to small number of cases.

[‡] Model adjusted for age group and race.

[§] Model adjusted for Charlson index and race.

[‖] Respondents were asked about this activity or behavior if they reported having sex in the previous 12 months

[¶] This question was asked only of respondents who reported at least one sexual problem.

[#] Association with diabetes status significant at $p<0.05$

[**] This question was asked of all respondents by means of a self-administered questionnaire. Answer options included: never, rarely, and sometimes. It was asked of everyone who reported masturbation, not exclusively those who were sexually active.

[††] Odds ratio significant at $p<0.05$