

Obesity and Undiagnosed Diabetes in the United States

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Objective: To study whether obese persons, who are at higher risk for diabetes and for disparities in care, are more likely to have undiagnosed diabetes.

Methods: Analysis of 5514 adult participants in the 1999-2004 National Health and Nutrition Examination Survey.

Results: Of the 9.8% (weighted sample) of participants who had diabetes based on fasting glucose levels and self-reported diagnosis, 28.1% were undiagnosed (estimated 5.2 million). The proportion undiagnosed was not significantly different among normal weight (22.2%), overweight (32.5%), or obese adults (27.4%). Nevertheless, obese adults comprise more than half the undiagnosed diabetes cases (2.7 million). Relative to normal weight adults, the adjusted odds ratio for having undiagnosed diabetes was 1.50 (0.73 – 3.08) in overweight and 1.37 (0.72 – 2.63) in obese adults.

Conclusions: Despite their higher underlying risk of diabetes and widespread clinical recognition of this higher risk, obese adults are no more likely to have their diabetes diagnosed than thinner adults.

The rise in obesity, has led to a comparable rise in Type 2 diabetes, a major cause of death, morbidity, and disability.¹⁻² National guidelines differ, however, on whether screening asymptomatic persons is recommended.^{3, 4} The American Diabetes Association (ADA) advocates screening adults aged 45 years and older, whereas the U.S. Preventive Services Task Force found insufficient evidence to recommend mass screening.^{3, 4} Lack of uniform screening guidelines and potential delays in diagnosing diabetes is of particular concern in populations who are obese, not only because of their high risk for developing diabetes but also because evidence suggests that persons who are obese experience healthcare disparities including delays in receiving preventive care.⁵ We examined whether BMI category is the likelihood of having undiagnosed diabetes among US adults.

RESEARCH DESIGN AND METHODS

We used data from the 1999-2004 National Health and Nutrition Examination Survey (NHANES).⁶ Participants were interviewed about sociodemographic and medical data, including whether a doctor had diagnosed them with diabetes, age at diagnosis, and whether they were taking medications for diabetes. Physical and laboratory examination included measured height and weight, and fasting blood plasma glucose in half the sample; our study included all adults ≥ 20 years with fasting plasma glucose.

We calculated body mass index (BMI) from measured height and weight and classified participants as normal weight (BMI 18.5-24.9 kg/m²), overweight (BMI 25.0-29.9 kg/m²), and obese (BMI 30 kg/m² and higher). We excluded underweight (BMI <18.5 kg/m²) participants and women who were pregnant.

Participants were defined as having evidence of diabetes if a doctor told them they had diabetes or if their fasting glucose was ≥ 126 mg/dl based on ADA criteria.⁷ We classified participants with diabetes as diagnosed if they were aware of their condition.

We compared the prevalence and diagnosis of diabetes across BMI categories using chi-square tests. We developed multivariable models to examine the association between BMI and undiagnosed diabetes adjusting for relevant confounders (see Table). NHANES does not distinguish Type 2 (“adult onset”) diabetes from Type 1 diabetes; therefore, we repeated our primary analyses excluding participants diagnosed before age 30 who were on insulin. We weighted analyses to reflect US population estimates and used SUDAAN to derive appropriate standard errors.

RESULTS

Of 5514 adults, 658 or 9.8% demonstrated evidence of diabetes, representing an estimated 18.6 million U.S. adults; of these, 28.1% (estimated 5.2 million) were undiagnosed.

Obese adults had a higher prevalence of diabetes than overweight or normal weight adults, $p < 0.001$ (see Table.) The proportion of those undiagnosed was comparable between obese 27.4 % (99 out of 327) overweight adults 32.5% (68 out of 225), and normal weight adults 22.2% (32 out of 106), $p = 0.32$. Obese adults comprised an estimated 2.7 million of the 5.2 million adults with undiagnosed diabetes; overweight and normal adults comprise 1.8 million and 0.7 million, respectively.

The table also presents adjusted odds ratios for having undiagnosed diabetes by BMI category. Among those with diagnosed diabetes, adults with higher BMI were not less likely to have undiagnosed diabetes.

DISCUSSION

Despite widespread recognition that obesity is a strong risk factor for diabetes, we found that obese adults were no more likely to have their diabetes diagnosed than thinner adults. Obese adults account for 2.7 million cases or more than half of the 5.2 million cases of undiagnosed diabetes each year.

Our findings complement results by Gregg, examining trends in diagnosed and undiagnosed diabetes by weight category.⁸ While that study did not specifically compare the likelihood of having undiagnosed disease across different BMI groups, Gregg found that adults with moderate to severe obesity had the largest relative decline in the ratio of undiagnosed to diagnosed disease.

That adults with higher BMI were no more likely to have their diabetes diagnosed is somewhat unexpected given the widespread recognition of obesity's predilection towards diabetes. One reason may be that a disproportionate number of normal weight adults identified with diabetes have Type I diabetes, which often produces symptoms earlier in the disease course. Delays in diagnosis in overweight and obese adults who are at higher risk of Type 2 diabetes may reflect delays in experiencing, recognizing, and presenting symptoms of diabetes in a timely way. Competing health concerns, social stigma, and health system bias, however, may also contribute to this phenomenon.^{9,10}

Furthermore, because some guidelines do not recommend systematic screening, clinicians may place lower priority on screening for diabetes in favor of more established preventive measures. Given the higher risk of diabetes, lack of systematic screening has greater implications for obese adults. Even though obese adults comprise only a third of the general population, they comprise more than 50% of U.S. adults with undiagnosed diabetes. Studies suggest that

routine screening for diabetes is highly cost-effective.¹¹ However, whether pharmacologic treatment of early Type 2 diabetes yields benefits that are outweighed by the potential risks of screening and early diagnosis is unclear. Nevertheless, timely diagnosis may lead to indirect benefits especially among those with overweight and obesity in motivating their efforts to control weight and enact lifestyle changes such as improving diet and exercise, which have been shown to reduce the risk of developing diabetes.¹² Future studies are needed to examine the public health impact of screening strategies that incorporate a nuanced consideration for overweight and obesity.

Our study has limitations. Formal diagnosis was based on self-report. Standardized BMI cutpoints tend to underestimate risks of higher weight in Asians.¹³ In addition, our sample size, particularly among normal weight adults with evidence of diabetes, was relatively modest; it is possible that we were underpowered to detect meaningful differences in the likelihood of having undiagnosed diabetes across different BMI groups.

In summary, obese adults are no more likely to have their diabetes diagnosed than normal weight or overweight adults. Because of their higher disease risk, obese adults account for more than half of those with undiagnosed diabetes. Clinicians and policy-makers may want to consider the underlying risk of diabetes associated with body weight in making decisions about whom to screen for diabetes.

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Table. Body mass index (BMI), diabetes prevalence, and the likelihood of having undiagnosed diabetes in US adults*

BMI, kg/m ²	Overall sample, n=5514	Sample w/ diabetes	% Undiagnosed in sample w/ diabetes, n=658	Odds Ratio (OR) of having undiagnosed diabetes among those with diabetes,	
				Age, sex, race adjusted OR	Fully adjusted OR***
18.5–24.9	34.2%	4.9%	22.2%	1.00	1.00
25.0–29.9	35.0%	8.5%	32.5%	1.60 (0.78-3.29)	1.50 (0.73 – 3.08)
≥ 30.0	30.8%	16.8%	27.4%	1.29 (0.65-2.57)	1.37 (0.72 – 2.63)

* All percents are weighted to reflect US population estimates.

**Estimates represent the weighted prevalence of diabetes in the population by BMI category; 658 of 5514 adults had evidence of diabetes (both diagnosed and undiagnosed).

***Results are among those with evidence of diabetes (both diagnosed and undiagnosed) and are adjusted for age, sex, race/ethnicity, education, health insurance, usual source of healthcare, and number of healthcare visits in previous year. When adults who used insulin and who were younger than age 30 at diagnosis were excluded, the odds ratio was 1.20 (0.55-2.60) for overweight and 1.21 (0.58-2.50) for obese adults.