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Healthcare Access and Diabetes Detection among U.S. Adults: Evidence from NHANES

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Abstract. Diabetes remains a major public health problem in the United States, yet some adults who meet laboratory criteria have not received a diagnosis. Because screening usually occurs through contact with the healthcare system, insurance coverage and a usual source of care may influence whether diabetes is detected. This study examines healthcare access and diabetes detection among U.S. adults using the National Health and Nutrition Examination Survey (NHANES), August 2021-August 2023. The primary analysis classified diabetes using self-reported diagnosis and hemoglobin A1c and applied the NHANES phlebotomy weight, strata, and primary sampling units. Among 949 adults with diabetes in the complete-case regression sample, 149 were undiagnosed. After adjustment for age, sex, education, and body mass index, uninsured adults had 3.43 times higher adjusted odds of undiagnosed diabetes than insured adults (95% CI, 1.54-7.61; p = .006). Adults without a usual source of care had 2.75-fold higher adjusted odds than those who had one (95% CI, 1.28-5.92; p = .015). A fasting-subsample sensitivity analysis produced a similar insurance association. These findings indicate that limited healthcare access is associated with missed diabetes detection, although the cross-sectional design does not establish causation.

Keywords: Diabetes detection, Undiagnosed diabetes, Healthcare access, NHANES, Logistic regression

1. Introduction

Diabetes is a chronic condition that can contribute to cardiovascular disease, kidney disease, vision loss, and other serious complications when it is not detected and managed. Recent national estimates indicate that 15.8% of U.S. adults had total diabetes during August 2021-August 2023, including 4.5% with undiagnosed diabetes [1]. The continued presence of undiagnosed disease matters because adults may live with elevated glucose for years before symptoms lead them to seek care. Timely testing can therefore create an opportunity for earlier treatment and risk reduction [2].

Detection is not determined by biological risk alone. Screening requires access to clinicians and laboratory services. Adults without insurance, without a usual source of care, or facing cost barriers may have fewer opportunities for preventive testing. The U.S. Preventive Services Task Force recommends screening adults aged 35-70 years who have overweight or obesity [3], while the American Diabetes Association also supports risk-based testing and recognizes A1c and plasma

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glucose as appropriate tests [4]. However, recommendations cannot close detection gaps when people cannot reach or afford care.

The main question is whether adults with poorer access to healthcare are more likely to have undiagnosed diabetes. The analysis combines recent NHANES questionnaire and laboratory files, describes the sample, and estimates survey-weighted logistic models that account for the complex sample design. Because NHANES is cross-sectional, the results are interpreted as associations rather than evidence of causation.

2. Healthcare access and diabetes detection

2.1. Why access may influence diagnosis

Healthcare access refers to the timely use of appropriate health services. For diabetes detection, access has several connected dimensions. Insurance can reduce the direct cost of visits and laboratory tests. A usual source of care can create continuity, allowing clinicians to recognize risk factors and recommend screening. Recent visits increase the opportunity for testing, while cost-related delay can interrupt this pathway. These measures are not interchangeable: an insured adult may still lack a regular clinician, and a person with a usual place for care may still postpone a visit because of cost.

Previous NHANES research suggests that contact with the healthcare system affects whether diabetes is detected. Zhang and colleagues found that limited healthcare access was associated with a higher likelihood that diabetes remained undiagnosed [5]. Using six NHANES cycles, Mahoney and colleagues reported lower adjusted odds of undiagnosed diabetes among adults with private insurance than among adults without insurance [6]. Insurance is only one part of the explanation, but these findings show that opportunities to receive routine care are related to whether diabetes has already been diagnosed.

2.2. Demographic and socioeconomic differences

Access operates alongside age, body weight, race and ethnicity, education, and income. Fang and colleagues found that undiagnosed diabetes was more common among older adults, adults with obesity, racial and ethnic minority groups, and people without healthcare access [7]. Hsueh and colleagues also reported elevated odds of undiagnosed diabetes among immigrant and racial or ethnic minority adults even after accounting for insurance [8]. These findings justify adjustment for demographic and socioeconomic variables. They also caution against interpreting insurance as a complete measure of access and against using race and ethnicity as biological explanations for structural disparities in care.

3. Data and study design

3.1. Data source and study population

This study uses the public-use NHANES August 2021-August 2023 files, the first release based entirely on data collected after the pandemic-related suspension [9]. NHANES combines interviews, examinations, and laboratory measurements in a complex probability sample of the U.S. civilian, noninstitutionalized population. Relevant files include demographics and sample weights, the diabetes questionnaire, health insurance, hospital utilization and access to care, body measures, glycohemoglobin, and fasting glucose.

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The target population is adults aged 20 years or older. Pregnant participants are excluded because gestational diabetes is conceptually different from diabetes in the general adult population. Records missing the outcome, primary access measures, or required survey-design variables are excluded from the corresponding complete-case model. Because fasting glucose is available only for an examination subsample, analyses involving that measure must use the appropriate subsample weight rather than the full interview weight [10].

3.2. Outcome, exposures, and covariates

Diagnosed diabetes was defined as a self-report that a doctor or health professional had told the participant that they had diabetes. IIn the primary analysis, undiagnosed diabetes was defined as the absence of self-reported diagnosis combined with an HbA1c level of at least 6.5%. This threshold follows current ADA diagnostic criteria [4]. A sensitivity analysis broadened the laboratory definition to A1c of at least 6.5% or fasting plasma glucose of at least 126 mg/dL and used the fasting-subsample weight. A single NHANES measurement is appropriate for epidemiologic classification, although clinical diagnosis normally requires confirmation in the absence of unequivocal hyperglycemia.

Primary exposures were health insurance coverage and whether the participant had a usual place for healthcare. The August 2021-August 2023 public-use access questionnaire does not include a general cost-barrier item, so presentation measure was not carried into the final weighted models. Models were adjusted for age, sex, educational attainment, and body mass index. This parsimonious set was chosen before modeling to preserve design degrees of freedom and avoid overfitting. Table 1 summarizes the final analytic variables.

Table 1. Study variables and analytic roles

Role	Variables	Measurement
Outcome	Diabetes detection	Diagnosed vs. undiagnosed among adults with diabetes
Exposures	Insurance coverage; usual source of care	NHANES questionnaire responses
Covariates	Age; sex; education; BMI	Demographic and examination files

Note. BMI = body mass index.

4. Results and statistical analysis

4.1. Descriptive findings

The cleaned presentation file contained 7,768 adults. As shown in Figure 1, 6,519 were classified as having no diabetes, 1,070 as diagnosed, and 179 as undiagnosed. Among the 1,249 diabetes cases in that unweighted descriptive sample, 14.3% were undiagnosed. The survey-weighted A1c analysis estimated 14.0% total diabetes (95% CI, 12.6%-15.5%), including 11.8% diagnosed and 2.3% undiagnosed diabetes. The figure is retained to connect the paper with the presentation, while the weighted estimates provide the population-level results.

For comparison, NCHS estimated weighted national prevalence at 15.8% for total diabetes, 11.3% for diagnosed diabetes, and 4.5% for undiagnosed diabetes during the same period [1]. These

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national estimates are not directly comparable with the unweighted counts in Figure 1, but they provide an important population benchmark.

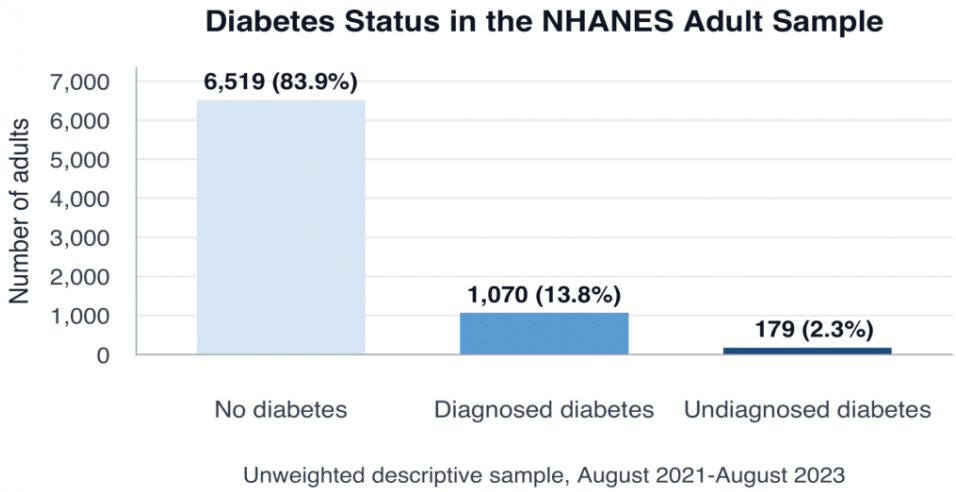

Figure 1. Diabetes classification in the cleaned NHANES adult sample before restricting regression analyses to adults with diabetes (n = 7,768)

Note. Counts are unweighted descriptive counts reproduced from the project presentation; population estimates use NHANES survey weights.

Weighted descriptive estimates showed marked access gaps. Undiagnosed diabetes accounted for 15.0% of diabetes cases among insured adults and 37.5% among uninsured adults. The corresponding estimates were 15.3% among adults with a usual source of care and 33.4% among those without one. Table 2 presents the adjusted survey-weighted models and the principal fasting-subsample sensitivity result.

Table 2. Survey-weighted logistic regression results for undiagnosed diabetes among adults with diabetes

Access indicator	Weighted %: better access	Weighted %: limited access	Adjusted OR (95% CI)
Health insurance	Insured: 15.0%	Uninsured: 37.5%	3.43 (1.54-7.61)
Usual source of care	Has usual place: 15.3%	No usual place: 33.4%	2.75 (1.28-5.92)
Sensitivity: insurance	A1c or fasting glucose	Fasting subsample	4.69 (1.42-15.45)

Note. Percentages are survey-weighted. Primary models used A1c classification and the NHANES phlebotomy weight (n = 949; 149 undiagnosed events), with separate models for each access exposure. ORs compare limited access with better access and adjust for age, sex, education, and BMI. Insurance p = .006; usual source of care p = .015. The sensitivity model used A1c or fasting glucose with the fasting-subsample weight (n = 551; 155 undiagnosed events); insurance p = .016. Complete-case exclusion accounts for the smaller regression samples.

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4.2. Regression strategy and interpretation

The regression sample was restricted to participants classified as having diabetes. The binary dependent variable equaled 1 for undiagnosed diabetes and 0 for diagnosed diabetes. Separate models were fitted for lack of insurance and lack of a usual source of care, with adjustment for age, sex, education, and body mass index. All models incorporated NHANES strata, primary sampling units, and the appropriate laboratory weight. Results are reported as odds ratios with 95% confidence intervals.

In the primary complete-case sample (n = 949; 149 undiagnosed events), lack of insurance was associated with higher adjusted odds of undiagnosed diabetes (OR, 3.43; 95% CI, 1.54-7.61; p = .006). Lack of a usual source of care was also associated with higher odds (OR, 2.75; 95% CI, 1.28-5.92; p = .015). In the fasting subsample, the association for lack of insurance remained (OR, 4.69; 95% CI, 1.42-15.45; p = .016), while the estimate for no usual source of care was imprecise and not statistically significant (OR, 2.72; 95% CI, 0.70-10.54; p = .130). The wider sensitivity intervals reflect the smaller subsample. These associations do not demonstrate that gaining insurance or establishing a usual source of care would by itself cause diagnosis.

5. Public health implications

The survey-weighted results identify healthcare access as an important correlate of diabetes detection. Uninsured adults and adults without a usual source of care had substantially higher adjusted odds of remaining undiagnosed. The consistency of the insurance association in the fasting-subsample analysis strengthens this interpretation, although the wide confidence intervals call for caution about its exact magnitude. The findings support efforts to connect underserved adults with routine primary care and evidence-based screening through community health centers, mobile services, and other low-cost settings. They also suggest that insurance expansion alone may be insufficient when adults still lack a regular point of care.

6. Conclusion

This study examined whether healthcare access was associated with diabetes detection among U.S. adults using NHANES August 2021-August 2023. In the weighted primary analysis, uninsured adults had more than three times the adjusted odds of undiagnosed diabetes, and adults without a usual source of care had nearly three times the odds. The insurance association persisted when fasting plasma glucose was added in a smaller subsample. Together, the results are consistent with a detection pathway in which regular contact with the healthcare system creates opportunities for testing and diagnosis.

The findings should be interpreted as associations, not as proof that lack of access caused diabetes to remain undiagnosed. Even so, the magnitude and consistency of the estimates indicate that screening initiatives should pay particular attention to uninsured adults and people who do not have a regular place for care.

Several limitations remain. NHANES is cross-sectional, so temporal order and causation cannot be established. Diagnosis history and access measures are self-reported, and a single laboratory measurement may misclassify some participants. Fasting glucose was available only for a smaller subsample, producing wide confidence intervals, and complete-case analysis may introduce selection bias. The public-use questionnaire for this cycle also did not support a final cost-barrier exposure. Nonetheless, the use of cycle-specific weights and design variables provides nationally

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interpretable estimates and shows that barriers to routine care are closely connected with missed diabetes detection.

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