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Performance of a Random Glucose Case-Finding Strategy to Detect Undiagnosed Diabetes

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Abstract

Introduction—Random glucose <200 mg/dL is associated with undiagnosed diabetes but not included in screening guidelines. This study describes a case-finding approach using non-diagnostic random glucose values to identify individuals in need of diabetes testing and compares its performance to current screening guidelines.

Methods—In 2015, cross-sectional data from non-fasting adults without diagnosed diabetes or prediabetes (N=7,161) in the 2007–2012 National Health and Nutrition Examination Surveys were analyzed. Random glucose and survey data were used to assemble the random glucose, American Diabetes Association (ADA), and U.S. Preventive Services Task Force (USPSTF) screening strategies and predict diabetes using hemoglobin A1c criteria.

Results—Using random glucose ≥ 100 mg/dL to select individuals for diabetes testing was 81.6% (95% CI=74.9%, 88.4%) sensitive, 78% (95% CI=76.6%, 79.5%) specific and had an area under the receiver operating curve (AROC) of 0.80 (95% CI=0.78, 0.83) to detect undiagnosed diabetes. Overall performance of ADA (AROC=0.59, 95% CI=0.58, 0.60), 2008 USPSTF (AROC=0.62, 95% CI=0.59, 0.65), and 2015 USPSTF (AROC=0.64, 95% CI=0.61, 0.67) guidelines was similar. The random glucose strategy correctly identified one case of undiagnosed diabetes for every 14 people screened, which was more efficient than ADA (number needed to screen, 35), 2008 USPSTF (44), and 2015 USPSTF (32) guidelines.

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Conclusions—Using random glucose ≥ 100 mg/dL to identify individuals in need of diabetes screening is highly sensitive and specific, performing better than current screening guidelines. Case-finding strategies informed by random glucose data may improve diabetes detection. Further evaluation of this strategy's effectiveness in real-world clinical practice is needed.

INTRODUCTION

In spite of diabetes screening guidelines, nearly 30% of adults with Type 2 diabetes and 90% of adults with prediabetes in the U.S. remain undiagnosed, and only half of those eligible for guideline-indicated screening complete diabetes testing.^{1–4} The American Diabetes Association (ADA),⁵ 2008 U.S. Preventive Services Task Force (USPSTF),⁶ and 2015 USPSTF⁷ screening guidelines recommend targeting diabetes screening to high-risk individuals when they present for clinical care. However, each guideline defines risk differently, which impacts clinicians' ability to identify individuals in need of screening.

The ADA guideline⁵ considers individuals at risk for diabetes if they are aged ≥ 45 years or <45 years with a BMI ≥ 25 kg/m² (≥ 23 kg/m² in Asians) with additional diabetes risk factors including non-white race, hypertension, dyslipidemia, cardiovascular disease, family history of diabetes, polycystic ovarian syndrome, physical inactivity, and history of gestational diabetes. The 2008 USPSTF guideline⁶ recommended screening only for individuals with hypertension. The current 2015 USPSTF guideline⁷ recommends diabetes screening for individuals aged 40–70 years with a BMI ≥ 25 kg/m².

Non-diagnostic random glucose elevations are more strongly associated with undiagnosed diabetes than traditional diabetes risk factors^{8,9} and may provide an early warning sign of glycemic dysregulation. Although random glucose values ≥ 200 mg/dL in the presence of hyperglycemic symptoms are considered diagnostic for diabetes, recommendations for interpreting values <200 mg/dL are lacking.⁵ Even though clinicians may consider random glucose a “screening test” for diabetes in clinical practice,¹¹ it is not a guideline-recommended screening test.^{5,7} However, it is routinely measured in clinical practice and available in electronic medical records (EMRs).^{10,11} Thus, utilization of existing random glucose data may help identify individuals in need of diabetes screening. This study utilizes nationally representative data from the National Health and Nutrition Examination Survey (NHANES) to examine the ability of random glucose values to identify individuals in need of diabetes screening. This study describes the performance of a random glucose case-finding strategy to identify cases of undiagnosed diabetes and dysglycemia and compares its effectiveness with the ADA, 2008 USPSTF, and 2015 USPSTF diabetes screening guidelines.

METHODS

Merged data from 2007–2012 NHANES—a stratified, multistage health and risk factor study representative of the non-institutionalized U.S. population—were analyzed. NHANES performed in-person interviews, standardized examinations, and laboratory testing.¹² NHANES design, survey instruments, and data collection protocols are described

elsewhere.¹³ This study was approved by the IRB at the University of Texas Southwestern Medical Center.

Study Population

Non-pregnant participants aged 18 years without diagnosed diabetes or prediabetes who completed both the interview and clinical examination were included. Participants with known diabetes ($n=1,003$) were excluded if they responded *yes* when asked: *Other than during pregnancy, have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?* Participants with known prediabetes ($n=322$) were excluded if they responded *yes* to the question: *Have you ever been told by a doctor or other health professional that you have any of the following: prediabetes, impaired fasting glucose, impaired glucose tolerance, borderline diabetes, or that your blood sugar is higher than normal but not high enough to be called diabetes or sugar diabetes?* Participants with both a hemoglobin A1c (HbA1c) and random serum glucose available were included. NHANES randomly assigned participants to fast for the morning examination. Fasting participants ($n=2,628$) who had nothing to eat or drink except water for 9 hours were excluded because random glucose was not available in NHANES. Non-fasting participants in the morning examination were included.

Measures

Participants were classified by glycemic status using HbA1c as the criterion standard. The oral glucose tolerance test and fasting glucose were not used to define diabetes, as fasting participants were excluded from the study because random glucose was not available in NHANES. Participants with an HbA1c $<5.7\%$ had normal glycemic status. Participants with HbA1c $\geq 6.5\%$ who did not report diagnosed diabetes were considered to have undiagnosed diabetes. Those with an HbA1c $\geq 5.7\%$ who did not report diagnosed diabetes or prediabetes were considered to have undiagnosed dysglycemia.

Patient characteristics and risk factors were obtained from NHANES interviews and examinations. BMI was calculated from measured height and weight. Participants self-reporting hypertension, high cholesterol, and heart disease, defined as coronary artery disease, heart attack, or stroke, were considered to have the condition. Participants reporting <150 minutes of physical activity per week were classified as physically inactive using ADA-endorsed activity goals from the Diabetes Prevention Program.^{14,15} Polycystic ovarian syndrome was not available in NHANES. Participants were classified as meeting ADA⁵ or USPSTF^{6,7} screening criteria using available risk factors. The 2008 USPSTF guideline, which requires sustained elevations of blood pressure, was based on diagnosed hypertension rather than measured blood pressure because NHANES only measures blood pressure on a single day. Random serum glucose values were utilized in the glucose risk assessment strategy. The random glucose and HbA1c measure specifications and calibrations are reported elsewhere.¹³

Statistical Analysis

Means or percentages of participant characteristics by screening strategy are reported. The SAS, version 9.3 PROC SURVEYFREQ procedure was used to account for sample weights

and complex survey design. The sensitivity and specificity to detect diabetes and dysglycemia was calculated for each strategy. All HbA1c values were analyzed without corrections as recommended by the National Center for Health Statistics.¹⁶ The performance of each strategy was evaluated using logistic regression with diabetes or dysglycemia as the outcome. The area under the receiver operating curve (AROC) was used as the index of effectiveness. An AROC of 1.0 indicates perfect discrimination and 0.5 indicates chance discrimination. Ninety-five percent CIs were calculated using bootstrap methodology with replacement for 500 cycles. The sensitivity, specificity, and AROC of different random glucose cut points were examined to select the cut point that maximized AROC. AROCs were compared using the SAS, version 9.3 ROCONTRAST procedure for dependent samples.¹⁷

To estimate the real-world implications of implementing strategies with different sensitivity and specificity trade-offs, the number needed to screen (NNTS), which represents the number of people screened to accurately identify one case of undiagnosed disease without error, was calculated. The NNTS was defined as $1/(\text{proportion correctly diagnosed} - \text{proportion incorrectly diagnosed})$.¹⁸ Analyses were conducted in 2015 using SAS, version 9.3. Two-sided p -values <0.05 were considered statistically significant.

RESULTS

A total of 7,161 NHANES participants met study criteria. The prevalence of undiagnosed diabetes (2.3%) and dysglycemia (25.3%) was similar to other studies using HbA1c as the gold standard diagnostic test.^{19,20} Participant characteristics are shown in Table 1. The multi-risk factor ADA guideline recommended screening for 78% (74.4 million) of non-pregnant U.S. adults without diabetes. The 2008 and 2015 USPSTF guidelines recommended screening for 24% (22.8 million) and 34% (32.8 million), respectively. Using a random glucose ≥ 100 mg/dL as an indicator of diabetes risk would recommend screening for 23% (22.4 million) of U.S. adults in the sample. In general, individuals satisfying the USPSTF guidelines were older, had a higher prevalence of cardiovascular risk factors, and were more likely to report being screened for diabetes than those meeting the multifactorial ADA guideline. Those meeting the random glucose ≥ 100 mg/dL criteria were generally similar to those meeting the ADA guideline.

The ADA guideline had near-perfect sensitivity (99.2%) to detect undiagnosed diabetes, but specificity was low (23%), resulting in a 78% false positive rate. The 2008 USPSTF guideline was highly specific (76.7%) but had low sensitivity (41.9%). The 2015 USPSTF screening guideline had higher sensitivity (65%) but lower specificity (67%) than the 2008 guideline. No difference in the performance of the 2008 USPSTF and ADA guidelines ($p=0.34$) to detect undiagnosed diabetes was observed. The 2015 USPSTF guideline was significantly better at detecting undiagnosed diabetes than the ADA screening guideline (AROC, 0.64 vs 0.59; $p<0.001$) (Table 2).

As a strategy to identify those in need of diabetes testing, the random glucose strategy was highly effective at discriminating undiagnosed diabetes (AROC=0.88, 95% CI=0.86, 0.91) (Figure 1). As an indicator of diabetes risk, lower random glucose cut points had higher

sensitivity and higher cut points had greater specificity to detect undiagnosed diabetes. A random glucose cut point 100 mg/dL was selected to identify those in need of formal diabetes screening because it achieved a balance of sensitivity (81.6%, 95% CI=74.9%, 88.4%) and specificity (78.0%, 95% CI=76.6%, 79.5%) to detect undiagnosed diabetes.

As a case-finding strategy, a single random glucose 100 mg/dL had the highest AROC of any examined strategy (0.80, 95% CI=0.78, 0.83) and performed better than the ADA, 2008 USPSTF, and 2015 USPSTF screening guidelines to detect undiagnosed diabetes (Table 2) ($p<0.001$ for all). Adding random glucose 100 mg/dL as a criterion to ADA screening guidelines did not change overall performance ($p=0.42$). Adding random glucose 100 mg/dL to the 2008 and 2015 USPSTF screening guidelines improved performance ($p<0.001$ for both), but the random glucose 100 mg/dL strategy still performed better by AROC criteria (Table 2). The random glucose strategy was the most efficient approach to identify individuals in need of diabetes screening with an NNTS of 14 to detect one case of undiagnosed diabetes, compared with the ADA guideline (NNTS=35), 2008 USPSTF guideline (NNTS=44), and 2015 USPSTF guideline (NNTS=32).

The ADA screening guideline had high sensitivity (96%) and low specificity (29%) to detect undiagnosed dysglycemia. Conversely, the 2008 USPSTF screening guideline had higher specificity (81%) and lower sensitivity (38%). The 2015 USPSTF guideline was 50% sensitive and 71% specific (Table 2). As a continuous measure, the AROC for a single random glucose was 0.68 (95% CI=0.66, 0.69) (Figure 1). Using a random glucose 100 mg/dL to identify individuals in need of screening had an AROC of 0.61 (95% CI=0.60, 0.62) with a sensitivity of 38.8% (95% CI=35.7%, 42.0%) and a specificity of 81.9% (95% CI=80.4%, 83.4%) (Table 2). No differences in AROC were observed between the ADA, 2008 USPSTF, 2015 USPSTF, and random glucose 100 mg/dL strategies (Table 2). Adding random glucose 100 mg/dL to the 2008 and 2015 USPSTF screening guidelines improved the performance of both guidelines and provided a better strategy to identify individuals for dysglycemia screening than either the ADA screening guideline or the random glucose strategy.

DISCUSSION

Using nationally representative NHANES data, this study demonstrates that a single random glucose 100 mg/dL can identify people in need of diabetes screening, is highly sensitive and specific for detecting undiagnosed diabetes, and performs better than ADA and USPSTF guidelines by AROC criteria. As a case-finding strategy, random glucose would recommend screening half as many people as the ADA and USPSTF guidelines to correctly identify one case of undiagnosed diabetes. These findings suggest that random glucose values, which are commonly available in EMRs, could provide a novel strategy to efficiently target case-finding strategies in clinical practice. However, further studies using historic random glucose values available in the EMR are needed to determine the effectiveness of this approach in real-world clinical practice.

Random glucose elevations provide an early warning sign of glycemic dysregulation and a measurable physiologic marker of diabetes risk. A single random glucose 100 mg/dL is

more strongly associated with undiagnosed diabetes than traditional diabetes risk factors.⁸ Normally, glucose homeostasis is a tightly regulated function of insulin sensitivity and production²¹ that maintains glucose concentrations in a narrow range.²² However, as patients transition from normal glucose metabolism to prediabetes and diabetes, glucose values and glycemic variability increase.²¹ This results in modest random glucose elevations that can provide an early indicator of dysglycemia well before values exceed the diabetes diagnostic threshold of 200 mg/dL.⁵

Random glucose can identify high-risk individuals in need of formal diabetes screening better than current screening guidelines. Using random glucose from a nationally representative sample, this study found a higher overall AROC (0.88) and a higher sensitivity and specificity for a random glucose ≥ 100 mg/dL to detect undiagnosed diabetes by HbA1c criteria than a similar, single-site study using the glucose tolerance test as the criterion standard.²³ Simulation studies suggest that using random glucose to target diabetes screening achieves a good case yield while minimizing unnecessary screening tests and cost.²⁴

To develop more-efficient screening strategies, practical risk assessments that are both sensitive and specific are needed.²⁵ The sensitivity and specificity estimates for the ADA and 2008 USPSTF guidelines in this study were similar to others.^{3,4,26} Both the random glucose strategy and 2015 USPSTF guideline balanced sensitivity and specificity, but using random glucose alone to assess diabetes risk was better at discriminating undiagnosed diabetes. Although adding random glucose ≥ 100 mg/dL as a criterion to the 2008 and 2015 USPSTF guidelines improved AROC, the random glucose strategy remained superior at discriminating undiagnosed diabetes.

As a strategy to identify individuals at risk for dysglycemia, the ADA, USPSTF, and random glucose strategies performed similarly, but poorly. Sensitivity of the random glucose strategy is low because glucose variability is decreased in the early stages of glycemic dysregulation.²¹ Thus, using a single random glucose to target screening may miss patients with dysglycemia. Adding random glucose as a criterion in the 2008 and 2015 USPSTF screening guidelines performed best at detecting dysglycemia, although overall performance was modest. This suggests that a combination of clinical diabetes risk factors and random glucose may perform better than either approach alone to detect dysglycemia; however, further research is needed to optimize dysglycemia risk assessments.

These findings have important policy implications for healthcare costs. Even though diabetes screening poses minimal risk,²⁷ it has not been shown to improve mortality and there is ongoing debate whether targeting screening to high-risk individuals or universal screening is the best approach.^{28,29} Currently, the Affordable Care Act reimburses for screening services graded A or B by the USPSTF. The 2015 USPSTF guideline expands screening eligibility from 24% of the U.S. population (2008 guideline) to 34% of the U.S. population in this sample. To detect dysglycemia, the sensitivity and specificity of the 2015 USPSTF guideline in this study are similar to estimates using EMR data from opportunistic screening in clinical practice; however, the proportion of the population identified for screening differs owing to the prevalence of risk factors in the study population.³⁰ The high sensitivity, low specificity

ADA guideline recommends screening for 78% of the study population; however, the majority of screening tests are negative.

This study suggests three alternate case-finding strategies to identify individuals for testing. The most sensitive, specific, and efficient strategy would be to test all individuals with a single, most recent random glucose ≥ 100 mg/dL. This strategy would correctly identify one case of undiagnosed diabetes for every 14 people screened—an approach more than twice as efficient as the ADA and 2015 USPSTF guidelines and three times more efficient than the 2008 USPSTF guideline. Alternatively, adding a single, most recent random glucose ≥ 100 mg/dL as a criterion to the 2008 and 2015 USPSTF screening guidelines would identify one case of undiagnosed diabetes for every 20 and 24 people screened, respectively, which is still more efficient than current clinical guidelines.

Although the use of nationally representative data is a strength of this study, the findings require further study to determine their effectiveness in real-world clinical practice. Not all patients engaged in clinical care have a random glucose available. However, more than 70% of patients in clinical practice have random glucose results available in the EMR.^{11,26} Although random glucose accounts for 95% of glucose testing in clinical practice, the results are underutilized and largely ignored because they are obtained as routine components of standard chemistry panels ordered for reasons other than diabetes screening.¹⁰ This large repository of existing random glucose values may help inform diabetes risk assessments and identify individuals in need of gold standard diabetes screening tests. Rather than rely on individual clinicians to assess diabetes risk, programming clinical decision support to utilize random glucose data that have already been collected and stored in the EMR may improve screening rates and detection of undiagnosed diabetes.^{3,31,32} This approach could also be used to manage the health of a clinical population by identifying those at highest risk and performing outreach screening for those with elevated glucose values.

Limitations

This study has several strengths. It utilizes a large, nationally representative data set to generate estimates representative of the U.S. population and utilized HbA1c as the gold standard diabetes test, which enhances the translation of the findings to real-world practice. However, several limitations are worth noting. First, analyses use a single HbA1c for diabetes testing. In clinical practice, the HbA1c would be repeated to confirm the diagnosis. Second, findings may modestly underestimate ADA guideline performance because not all criteria were available in NHANES. However, the most common risk factors were included. Third, glycemic status was defined using HbA1c alone because fasting NHANES participants did not have random glucose available. Thus, study findings only apply to those screened with HbA1c, which underestimates the true burden of undiagnosed disease.¹⁹ However, sensitivity and specificity estimates using HbA1c in this study are similar to those using a combination of HbA1c and fasting glucose as the gold standard.³ Fourth, performance of the random glucose case-finding strategy in a real-world clinical setting may differ because not all patients will have random glucose available and random glucose values may be influenced by acute illness. Additionally, this strategy may miss high-risk patients that are uninsured, underinsured, or have limited access to care.

CONCLUSIONS

A single random glucose 100 mg/dL is highly sensitive and specific for identifying individuals in need of diabetes screening and is better at detecting cases of undiagnosed diabetes by AROC criteria than ADA and USPSTF screening guidelines. More-efficient risk assessment and case identification strategies are needed to improve the detection of diabetes and prediabetes at both the patient and population levels. Further studies using real-world clinical data are needed to determine if random glucose values collected for purposes other than diabetes screening can be utilized in diabetes risk assessment and case identification strategies.

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MB participated in the design, analysis, data interpretation, and drafting of the manuscript. LX participated in analysis, data interpretation, and manuscript revision. IL participated in the data interpretation and manuscript revision. EH participated in the design, analysis, data interpretation, and manuscript revision. MB had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Figure 1.

Performance of a single random blood glucose to identify undiagnosed cases of diabetes and dysglycemia.

Notes: Random blood glucose cut-points in mg/dL are indicated on the Receiver Operating Characteristic Curve. Diabetes defined as HbA_{1C} ≥ 6.5%. Dysglycemia defined as HbA_{1C} ≥ 5.7%.

Diagonal 45-degree line indicates an uninformative test. Area under the receiver operating curve (AOC) (95% CI) to detect undiagnosed diabetes = 0.88 (0.86–0.91).

AOC (95% CI) to detect undiagnosed dysglycemia = 0.68 (0.66–0.69).

Characteristics of Individuals Eligible for Diabetes Testing According to Different Screening Strategies

Table 1

Characteristics	All participants (N=7,161)	ADA criteria ^a (N=5,859)	2008 USPSTF criteria ^b (N=1,961)	2015 USPSTF criteria ^c (N=2,377)	RBG 100 mg/dL (N=1,838)
Mean age (±SE), y	44.7 ± 0.5	49.2 ± 0.5	57.0 ± 0.5	52.7 ± 0.2	50.4 ± 0.7
Female (±SE), %	50.8 ± 0.6	52.5 ± 0.7	51.0 ± 1.5	47.1 ± 1.3	48.5 ± 1.7
Race/ethnicity (±SE), %					
Non-Hispanic white	69.7 ± 2.3	66.7 ± 2.4	73.1 ± 2.6	72.4 ± 2.4	68.7 ± 2.9
Non-Hispanic black	10.2 ± 1.0	11.5 ± 1.2	12.5 ± 1.5	10.5 ± 1.2	8.9 ± 1.0
Mexican American	7.9 ± 1.1	8.9 ± 1.2	5.2 ± 0.9	7.3 ± 1.1	8.6 ± 1.4
Other Hispanic	5.4 ± 0.8	5.9 ± 0.9	4.2 ± 0.9	5.1 ± 0.9	5.3 ± 1.0
Other	6.8 ± 0.7	7.0 ± 0.8	5.0 ± 0.8	4.7 ± 0.7	8.6 ± 1.2
BMI (±SE), % ^d	28.0 ± 0.1	29.0 ± 0.1	30.0 ± 0.2	31.0 ± 0.2	29.3 ± 0.2
Hypertension (±SE), %	23.7 ± 0.9	29.9 ± 1.0	100.0 ± 0.0	34.8 ± 1.3	33.4 ± 1.4
Hyperlipidemia (±SE), %	26.3 ± 0.9	32.4 ± 1.1	48.1 ± 1.6	40.3 ± 1.5	31.6 ± 1.5
Heart disease (±SE), %	4.7 ± 0.4	5.9 ± 0.4	14.0 ± 1.0	5.3 ± 0.6	6.9 ± 0.8
Family history diabetes (±SE), %	31.7 ± 0.9	36.2 ± 0.9	37.2 ± 1.3	38.6 ± 1.5	34.7 ± 1.5
History of GDM or baby > 9 pounds (±SE), %	18.4 ± 1.1	19.7 ± 1.3	20.6 ± 2.2	20.7 ± 2.3	21.7 ± 2.3
Physically inactive (±SE), %	35.1 ± 1.0	45.2 ± 1.0	44.8 ± 1.5	39.3 ± 1.2	40.2 ± 1.5
Screened past 3 years (±SE), %	40.6 ± 0.9	45.3 ± 1.0	58.5 ± 1.4	50.3 ± 1.6	42.7 ± 1.9
Mean RBG (±SE), mg/dL	92.6 ± 0.3	94.7 ± 0.4	97.2 ± 0.5	96.7 ± 0.7	119.7 ± 0.9
Mean HbA _{1c} (±SE), %	5.4 ± 0.01	5.5 ± 0.01	5.6 ± 0.01	5.6 ± 0.02	5.7 ± 0.03

^a ADA Guideline: Screening for all individuals age ≥ 45 years or those with BMI ≥ 25 kg/m² (≥ 23 kg/m² if Asian-American) plus at least one of the following risk factors: family history of diabetes, non-white race, hypertension, high cholesterol, cardiovascular disease, history of gestational diabetes or baby weighing ≥ 9 pounds, physical inactivity.

^b 2008 USPSTF Guideline: Screening for all individuals with diagnosed hypertension.

^c 2015 USPSTF Guideline: Screening for all individuals age 40–70 with a BMI ≥ 25 kg/m²

^d BMI data missing for 88 participants

ADA, American Diabetes Association; GDM, gestational diabetes; HbA_{1c}, hemoglobin A_{1c}; RBG, random serum blood glucose; USPSTF, U.S. Preventive Services Task Force

Table 2

Test Characteristics and Performance of Screening Strategies to Identify Individuals With Undiagnosed Diabetes and Dysglycemia

Screening strategy	Sensitivity, % (95% CI)	Specificity, % (95% CI)	AROC (95% CI)	NNTS
Identification of diabetes cases, HbA _{1C} 6.5%				
RBG 100 mg/dL	81.6 (74.9–88.4)	78.0 (76.6–79.5)	0.80 (0.78–0.83)	14
ADA ^a	99.2 (98.4–100.0)	23.0 (20.9–25.1)	0.59 (0.58–0.60)	35
2008 USPSTF ^b	41.9 (34.8–48.9)	76.7 (75.0–78.4)	0.62 (0.59–0.65)	44
2015 USPSTF ^c	65.2 (58.4–71.9)	66.5 (64.4–68.5)	0.64 (0.61–0.67)	32
ADA ^a + RBG 100	100.0 (100.0–100.0)	20.1 (18.2–22.0)	0.58 (0.58–0.59)	35
2008 USPSTF ^b + RBG 100	90.7 (86.2–95.3)	61.9 (60.1–63.7)	0.76 (0.74–0.77)	20
2015 USPSTF ^c + RBG 100	93.5 (89.6–97.3)	53.7 (51.5–55.9)	0.73 (0.72–0.75)	24
Identification of dysglycemia, HbA _{1C} 5.7%				
RBG 100 mg/dL	38.8 (35.7–42.0)	81.9 (80.4–83.4)	0.61 (0.60–0.62)	5
ADA ^a	96.0 (94.8–97.3)	28.8 (26.1–31.4)	0.61 (0.60–0.61)	4
2008 USPSTF ^b	38.4 (35.9–40.9)	81.2 (79.5–83.0)	0.60 (0.59–0.62)	5
2015 USPSTF ^c	50.2 (47.4–53.0)	71.2 (69.0–73.4)	0.61 (0.60–0.62)	6
ADA ^a + RBG 100	97.1 (95.9–98.3)	25.3 (22.8–27.8)	0.60 (0.59–0.60)	4
2008 USPSTF ^b + RBG 100	60.5 (57.6–63.4)	67.9 (66.0–69.8)	0.65 (0.64–0.66)	5
2015 USPSTF ^c + RBG 100	68.9 (66.4–71.4)	59.9 (57.4–62.5)	0.65 (0.64–0.66)	5

Notes: Prevalence of undiagnosed diabetes by HbA_{1C} criteria in the weighted study population 2.3%. Prevalence of undiagnosed dysglycemia by HbA_{1C} criteria in the weighted study population 25.3%.

^aADA Guideline: Screening for all individuals age ≥45 years or those with BMI ≥25 kg/m² (≥23 kg/m² if Asian-American) plus at least one of the following risk factors: family history of diabetes, non-white race, hypertension, high cholesterol, cardiovascular disease, history of gestational diabetes or baby weighing >9 pounds, physical inactivity.

^b2008 USPSTF Guideline: Screening for all individuals with diagnosed hypertension.

^c2015 USPSTF Guideline: Screening for all individuals 40–70 with BMI ≥25 kg/m²

ADA, American Diabetes Association screening guideline; AROC, area under receiver operator curve; NNTS, number needed to screen; RBG, random serum blood glucose; USPSTF, U.S. Preventive Services Task Force screening guideline