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Trends in Undiagnosed Diabetes Mellitus Among United States Adults: Cross-Sectional Analyses from NHANES 2011-2020

Kartik Gupta
Henry Ford Health, kgupta4@hfhs.org

Liyan Obeidat
Henry Ford Health, lobeida1@hfhs.org

Tanya S. Kakar
Henry Ford Health, tkakar1@hfhs.org

Raef A. Fadel
Henry Ford Health, RFADEL2@hfhs.org

Mahmoud Al Rifai

See next page for additional authors

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Authors

Kartik Gupta, Liyan Obeidat, Tanya S. Kakar, Raef A. Fadel, Mahmoud Al Rifai, Layla A. Abushamat, and Salim S. Virani

Dimitrios Patoulias, MD[a]
Christodoulos Papadopoulos, MD, PhD[b]
George Kassimis, MD, PhD[c]
Nikolaos Fragakis, MD, PhD[b]
Michael Doumas, MD, PhD[ad]

[a] Second Propaedeutic Department of Internal Medicine, Aristotle University of Thessaloniki, General Hospital "Hippokration", Greece
[b] Third Department of Cardiology, Aristotle University of Thessaloniki, General Hospital "Hippokration", Greece
[c] Second Department of Cardiology, Aristotle University of Thessaloniki, General Hospital "Hippokration", Greece
[d] Veterans Affairs Medical Center, George Washington University, Washington, District of Columbia

10 April 2022

1. Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, Lear SA, Ndumele CE, Neeland IJ, Sanders P, St-Onge MP, American Heart Association Council on Lifestyle and Cardiometabolic Health; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; Council on Epidemiology and Prevention; and Stroke Council. Obesity and cardiovascular disease: a scientific statement from the American Heart Association. *Circulation* 2021;143:e984–e1010.
2. Ortega FB, Lavie CJ, Blair SN. Obesity and cardiovascular disease. *Circ Res* 2016;118:1752–1770.
3. Riaz H, Khan MS, Siddiqi TJ, Usman MS, Shah N, Goyal A, Khan SS, Mookadam F, Krasuski RA, Ahmed H. Association between obesity and cardiovascular outcomes: a systematic review and meta-analysis of Mendelian randomization studies. *JAMA Netw Open* 2018;1:e183788.
4. Patoulias D, Papadopoulos C, Kassimis G, Karagiannis A, Doumas M. Updated meta-analysis of cardiovascular outcome trials evaluating cardiovascular efficacy of glucagon-like Peptide-1 receptor agonists. *Am J Cardiol* 2021;159:143–146.
5. Husain M, Birkenfeld AL, Donsmark M, Dungan K, Eliaschewitz FG, Franco DR, Jeppesen OK, Lingvay I, Mosenzon O, Pedersen SD, Tack CJ, Thomsen M, Vilsbøll T, Warren ML, Bain SC. PIONEER 6 Investigators. Oral semaglutide and cardiovascular outcomes in patients with type 2 diabetes. *N Engl J Med* 2019;381:841–851.
6. Marso SP, Bain SC, Consoli A, Eliaschewitz FG, Jódar E, Leiter LA, Lingvay I, Rosenstock J, Seufert J, Warren ML, Woo V, Hansen O, Holst AG, Pettersson J, Vilsbøll T. SUSTAIN-6 Investigators. Semaglutide and cardiovascular outcomes in patients with type 2 diabetes. *N Engl J Med* 2016;375:1834–1844.
7. Aaseth J, Ellefsen S, Alehagen U, Sundfør TM, Alexander J. Diets and drugs for weight loss and health in obesity - an update. *Biomed Pharmacother* 2021;140:111789.
8. Wilding JPH, Batterham RL, Calanna S, Davies M, Van Gaal LF, Lingvay I, McGowan BM, Rosenstock J, Tran MTD, Wadden TA, Wharton S, Yokote K, Zeuthen N, Kushner RF. STEP 1 Study Group. Once-weekly semaglutide in adults with overweight or obesity. *N Engl J Med* 2021;384:989.
9. Davies M, Færch L, Jeppesen OK, Pakseresht A, Pedersen SD, Perreault L, Rosenstock J, Shimomura I, Viljoen A, Wadden TA, Lingvay I, STEP 2 Study Group. Semaglutide 2•4 mg once a week in adults with overweight or obesity, and type 2 diabetes (STEP 2): a randomised, double-blind, double-dummy, placebo-controlled, phase 3 trial. *Lancet* 2021;397(10278):971–984.
10. Wadden TA, Bailey TS, Billings LK, Davies M, Frias JP, Koroleva A, Lingvay I, O'Neil PM, Rubino DM, Skovgaard D, Wallenstein SOR, Garvey WT. STEP 3 Investigators. Effect of subcutaneous semaglutide vs placebo as an adjunct to intensive behavioral therapy on body weight in adults with overweight or obesity: the STEP 3 randomized clinical trial. *JAMA* 2021;325:1403–1413.
11. Rubino D, Abrahamsson N, Davies M, Hesse D, Greenway FL, Jensen C, Lingvay I, Mosenzon O, Rosenstock J, Rubio MA, Rudofsky G, Tadayon S, Wadden TA, Dicker D, STEP 4 Investigators. Effect of continued weekly subcutaneous semaglutide vs placebo on weight loss maintenance in adults With overweight or obesity: the STEP 4 randomized clinical trial. *JAMA* 2021;325:1414–1425.

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Trends in Undiagnosed Diabetes Mellitus Among United States Adults: Cross-Sectional Analyses from NHANES 2011−2020

Early detection and management of diabetes mellitus (DM) will help achieve the World Health Organization Global Action Plan target of a 25% relative reduction in premature mortality because of non-communicable diseases.[1] Currently, there are limited data on the prevalence and racial disparities in undiagnosed DM in the United States after 2016. We sought to address this knowledge gap.

We used data from 4 cycles of the National Health and Nutrition Examination Survey (NHANES): 2011−2012, 2013−2014, 2015−2016, and 2017-March 2020 for nonpregnant adults aged ≥20 years.[2] Data collection for the 2019−2020 cycle was halted in March 2020 because of the COVID-19 pandemic and was reported together with the 2017−2018 cycle. Race and ethnicity were self-reported (Supplementary Table 1).

Diagnosed DM was defined as an affirmative response to ever being told by a doctor that the respondent has DM. Undiagnosed DM was defined as glycated hemoglobin (HbA1c) ≥6.5% (≥48 mmol/mol) and fasting plasma glucose (FPG) ≥126 mg/100 ml (≥7.0 mmol/L) in the same blood sample in participants without diagnosed DM. This definition using confirmatory testing by 2 different tests has been recommended by the American Diabetes Association guidelines.[3] This differs from the liberal criteria used by the Centers for Disease Control and Prevention definition, where participants with either elevated HbA1c or FPG are classified as having DM.[4] There was no change in the assay method for measuring HbA1c and FPG during the study period. Total DM prevalence was calculated using diagnosed and undiagnosed DM.

Analyses were weighted using 2-year sampling weights for the fasting blood sample for NHANES 2011−2012 till 2015−2016, and equivalent fasting weight for NHANES 2017-March 2020. All analyses were performed in Stata/SE version 15.1 (StataCorp, College Station, Texas).

Of 11,367 participants eligible for this study, the median age was 51 years (interquartile range 36, 64), 51.3% were women, and 22.4% were self-reported non-Hispanic (NH) Black (Supplementary Figure 1). The age-adjusted prevalence of total and diagnosed DM increased significantly from 2011−2012 to 2017−2020 (Figure 1). There was no change in the prevalence of undiagnosed DM (1.4%, 1.3%, 1.4%, and 1.6%, respectively, average biannual relative percentage change 7.0%, 95% confidence interval [CI] −5.7 to 21.4, p = 0.147, Figure 1). The prevalence of undiagnosed DM using liberal criteria (HbA1c ≥6.5% or FPG ≥126 mg/100 ml) was 3.8%, 3.4%, 4.8%, and 4.2%, respectively.

In those with undiagnosed DM, 60.9 ± 3.8% and 36.4 ± 3.9% participants had HbA1c ≥7.0% and ≥8.0%, respectively (Figure 1). Gender and racial distribution are given in Supplementary Figure 2 and Supplementary Figure 3, respectively. From 2017−2020, NH Asian participants had the highest prevalence of undiagnosed DM (3.7 ± 1.4, p−for subgroup difference = 0.026, Supplementary Figure 2). In these NH Asian participants, 80.1 ± 6.1% and 40.3 ± 5.9% participants had HbA1c ≥7.0% and ≥8.0%, respectively (Figure 1).

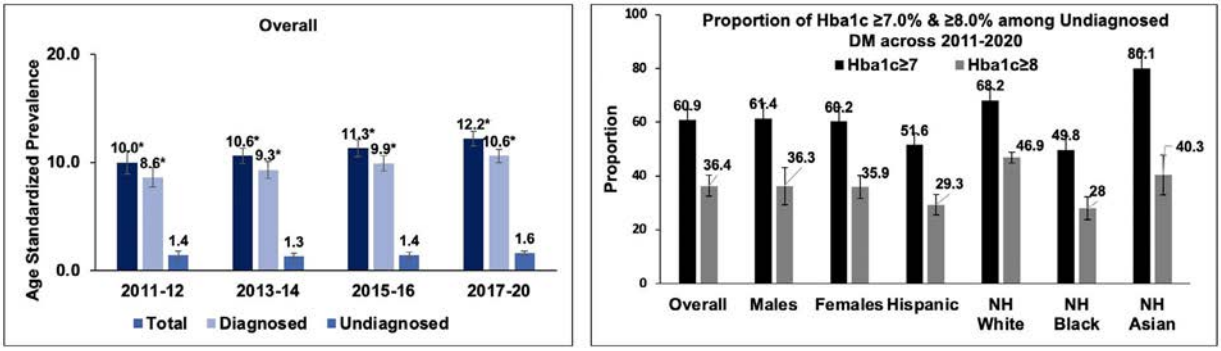

Figure 1. Bar graph showing age standardized prevalence and standard error of total (dark blue), diagnosed (purple), and undiagnosed diabetes (HbA1c ≥ 6.5% and FPG ≥ 126 mg/dL, light blue) in each survey cycle (Panel A). Proportion of participants with undiagnosed diabetes and HbA1c ≥ 7.0% (black bar) and ≥ 8.0% (gray bar). *p for biannual percent change <0.05.

To our knowledge, this is the first report on the prevalence of undiagnosed DM in the United States after 2016 using confirmatory testing. NH Asian participants are at a higher risk of undiagnosed DM. The lower prevalence in our study versus the Centers for Disease Control and Prevention data available online is because of confirmatory testing and sample weighting in our analyses.[4] We feel this reflects the disease burden more accurately.[5] Our study has limitations inherent to survey-based data.

Disclosures

The authors have no conflicts of interest to declare.

Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amjcard.2022.04.032.

Kartik Gupta, MD[a]
Liyan Obeidat, MD[a]
Tanya Singh Kakar, MD[b]
Raef Ali Fadel, DO[a]
Mahmoud Al Rifai, MD, MPH[c]
Layla A. Abushamat, MD, MPH[c]
Salim S. Virani, MD, PhD[cde]

[a] Department of Medicine, Henry Ford Hospital, Detroit, Michigan
[b] Division of Hospital Medicine, Henry Ford Hospital, Detroit, Michigan
[c] Section of Cardiology and Cardiovascular Research, Department of Medicine, Baylor College of Medicine, Houston, Texas
[d] Health Policy, Quality & Informatics Program, Health Services Research and Development Center for Innovations in Quality, Effectiveness, and Safety (IQuESt), Michael E. DeBakey Veterans Affairs Medical Center, Houston, Texas
[e] Section of Cardiology, Michael E. DeBakey Veterans Affairs Medical Center, Houston, Texas

9 April 2022

1. World Health Organization. *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020*. Geneva: World Health Organization; 2013. https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R10-en.pdf?ua=1. Accessed 12 Mar 2022.
2. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. National health and nutrition examination survey: plan and operations; 1999–2010. Available at: https://www.cdc.gov/nchs/data/series/sr_01/sr01_056.pdf. Accessed 7 May 2020.
3. American Diabetes Association. 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2021. *Diabetes Care* 2021;44(1):S15–S33. Suppl .
4. Selvin E, Wang D, Lee AK, Bergenstal RM, Coresh J. Identifying trends in undiagnosed diabetes in U.S. adults by using a confirmatory definition: a cross-sectional study. *Ann Intern Med* 2017;167:769–776.
5. *Centers for Disease Control and Prevention. National Diabetes Statistics Report 2020.* Atlanta, Georgia: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services; 2020.

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Meta-Analysis Addressing the Efficacy and Safety of Antiplatelet Agents in Patients With COVID-19

The COVID-19 pandemic has led to more than 6 million deaths worldwide since its initial outbreak in China in December 2019. Patients with COVID-19, especially those being critically ill and admitted to the hospital, feature an increased risk for thrombotic complications involving both the arterial and venous systems.[1–3] Therefore, it has been speculated whether antithrombotic treatment could lead to improved outcomes in patients with COVID-19. A former meta-analysis of observational studies demonstrated a nonsignificant effect of aspirin on COVID-19–related death,[4] whereas other meta-analyses had contradictory results.[5] Therefore, it remains unknown whether antiplatelet agents, in general, could improve the clinical status and disease course of patients with COVID-19. Because we recently welcomed the results of randomized controlled trials, we sought to determine the efficacy and safety of antiplatelet agents in COVID-19, evaluating the most surrogate outcomes.

We searched PubMed and Cochrane Library databases for randomized controlled trials enrolling adult patients with COVID-19 assigned either to an antiplatelet agent (any of them) plus standard of care compared with standard of care alone. We excluded observational studies and studies performed in the pediatric population if any.

We set as the primary efficacy outcome the effect of antiplatelet agents compared with control on the risk for COVID-19 death. We assessed the following secondary outcomes: major thrombosis and major bleeding.

Two independent reviewers (DP and CP) extracted the data of interest from the eligible trials using a pilot-tested data extraction form.

As we assessed only dichotomous variables, differences were calculated with the use of risk ratio (RR), with 95% confidence interval (CI), after implementation of the Mantel-Haenszel random effects formula. Statistical heterogeneity in studies was assessed using I^2 statistics. All analyses were performed at the 0.05 significance level and were undertaken with Review Manager (RevMan)