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Brief Report

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Prevalence of and Sociodemographic Disparities in Influenza Vaccination Among Adults With Diabetes in the United States

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Abbreviations: ACIP, Advisory Committee on Immunization Practices; CDC, Centers for Disease Control and Prevention; CI, confidence interval; DM, diabetes mellitus; MEPS, Medical Expenditure Panel Survey; NHIS, National Health Interview Survey; OR, odds ratio.

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Abstract

National estimates describing the overall prevalence of and disparities in influenza vaccination among patients with diabetes mellitus (DM) in United States are not well described. Therefore, we analyzed the prevalence of influenza vaccination among adults with DM, overall and by sociodemographic characteristics, using the Medical Expenditure Panel Survey database from 2008 to 2016. Associations between sociodemographic factors and lack of vaccination were examined using adjusted logistic regression. Among adults with DM, 36% lacked influenza vaccination. Independent predictors of lacking influenza vaccination included age 18 to 39 years (odds ratio [OR] 2.54; 95% confidence interval [CI], 2.14-3.00), Black race/ethnicity (OR 1.29; 95% CI, 1.14-1.46), uninsured status (OR 1.88; 95% CI, 1.59-2.21), and no usual source of care (OR 1.61; 95% CI, 1.39-1.85). Nearly

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64% individuals with ≥ 4 higher-risk sociodemographic characteristics lacked influenza vaccination (OR 3.50; 95% CI 2.79-4.39). One-third of adults with DM in the United States lack influenza vaccination, with younger age, Black race, and lower socioeconomic status serving as strong predictors. These findings highlight the continued need for focused public health interventions to increase vaccine coverage and utilization among disadvantaged communities.

Key Words: diabetes, disparities, influenza, prevention, vaccination

The Centers for Disease Control and Prevention (CDC) has estimated that 959 000 hospitalizations and 79 400 deaths from influenza infection occurred in the United States during the 2017-2018 season [1]. There is substantial evidence that those with diabetes mellitus (DM) face serious adverse consequences from influenza infection, including increased likelihood of hospital admission for acute cardiovascular and respiratory diseases and all-cause mortality [2-5].

Therefore, the Advisory Committee on Immunization Practices (ACIP) and American Diabetes Association recommend seasonal influenza vaccination for patients with DM irrespective of age [6]. To date, national estimates of influenza vaccination among individuals with DM in the United States are not well described. In the current study, among a nationally representative sample of adults with DM, we report estimates of influenza vaccination, characterizing sociodemographic groups, both individually and in combination, who were at particularly high risk of lacking vaccination.

1. Research Design and Methods

Data source

We included adults ≥18 years with DM using pooled Medical Expenditure Panel Survey (MEPS) data from 2008–2016. MEPS is administered by the Agency for Healthcare Research and Quality and provides comprehensive national data on health care utilization, expenditures, and insurance coverage for the US civilian noninstitutionalized population [7]. A new panel of households, consisting of 5 rounds of surveys spanning 2 years, are enrolled on a continual basis every year. They represent a subsample of households that participated in the National Health Interview Survey (NHIS) 6 months to 1 year earlier. For NHIS participant recruitment, the sampling design follows an area probability framework that enables representative sampling of households and noninstitutional group quarters where clusters of addresses are defined within each state. Since MEPS data are de-identified and publicly available, it was exempt from purview of the institutional review board committee.

Study variables

Adults with DM were identified using self-reported and/or ICD-9/10 diagnosis codes of diabetes mellitus, both type 1 and 2. Individuals were ascertained to have had influenza vaccination if they answered yes to having received the vaccination in the 12 months prior to survey completion. Other covariates in the study included age (18-39, 40-64, and ≥65years), sex, ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Hispanic), family income (as a proportion of federal poverty limit; high/middle-income [≥200%] and low-income [<200%]), insurance status (insured and uninsured), education level (≥ some college education and ≤ high school), and presence/absence of usual source of care.

Statistical analysis

We used the person-level sampling weights which were obtained after adjusting for nonresponse, age, sex, and ethnicity (based on population estimates from the US Census Bureau) to obtain nationally representative results. We compared the survey-weighted proportions of influenza vaccination across different sociodemographic characteristics using Rao-Scott χ^2 analysis. We assessed the association of sociodemographic characteristics with influenza vaccination using multivariable survey-specific logistic regression adjusting for covariates and known confounders (listed in Table 1 as footnote) and reported the adjusted odds ratios (OR) with 95% confidence intervals (CI). To analyze the cumulative associations between these characteristics and influenza vaccination, we developed a composite model of increasing number of high-risk sociodemographic characteristics including the following 6 variables: (i) 18 to 39 years of age, (ii) non-Hispanic Black race/ethnicity, (iii) uninsured status, (iv) lack of usual source of care, (v) low-income level, and (vi) low education level (i.e., ≤high school). All analyses were performed using Stata version 14.0 (StataCorp, College Station, TX).

Table 1. Weighted Prevalence and Odds Ratios Representing Lack of Influenza Vaccination by Participant Characteristics Among Adults With Diabetes Mellitus in the United States

	Weighted Prevalence	Estimated US Population	OR* (95% CI)
Total Population	35.6 (34.4, 36.8)	8 643 242	N/A
Age Category			
≥ 65 years	24.1 (22.6, 25.6)	2 486 029	Reference
40-64 years	42.5 (41.0, 44.1)	5 173 199	1.94 (1.75, 2.15)
18-39 years	54.7 (51.5, 57.9)	984 014	2.54 (2.14, 3.00)
Sex			
Female	35.0 (33.6, 36.4)	4 346 815	Reference
Male	36.2 (34.6, 37.8)	4 296 427	1.05 (0.96, 1.15)
Race/Ethnicity			
Non-Hispanic White	32.9 (31.2, 34.6)	4 933 720	Reference
Non-Hispanic Black	43.2 (40.9, 45.4)	1 581 587	1.29 (1.14, 1.46)
Non-Hispanic Asian	33.0 (29.3, 36.8)	394 958	0.81 (0.67, 0.98)
Hispanic	39.6 (37.7, 41.4)	1 451 433	0.89 (0.79, 1.02)
Family Income			
Middle/High-Income	34.4 (33.0, 35.9)	5 286 096	Reference
Low-Income	37.6 (36.1, 39.1)	3 357 146	1.10 (1.01, 1.20)
Insurance Status			
Insured	33.6 (32.3, 34.9)	7 556 343	Reference
Uninsured	60.6 (56.9, 64.4)	1 086 899	1.88 (1.59, 2.21)
Education Level			
Some College or Higher	33.7 (31.9, 35.5)	3 678 436	Reference
HS/GED or Less than HS	37.2 (35.7, 38.7)	4 903 713	1.19 (1.06, 1.33)
Usual Source of Care			
Yes	34.0 (32.8, 35.3)	941 359	Reference
No	55.5 (52.4, 58.6)	7 633 547	1.61 (1.39, 1.85)
Region			
Northeast	32.7 (29.2, 36.1)	1 376 978	Reference
Midwest	34.7 (32.4, 36.9)	1 811 918	1.06 (0.87, 1.28)
South	37.5 (35.4, 39.6)	3 714 647	1.10 (0.92, 1.31)
West	35.2 (33.2, 37.3)	1 739 698	1.03 (0.86, 1.24)

Results reported as % (95% confidence interval).

Abbreviations: ASCVD, atherosclerotic cardiovascular disease; CRF, cardiovascular risk factor; GED, general equivalency diploma; HS, high school; US, United States.

* Model adjusted for age, sex, race/ethnicity, family income, insurance status, education, geographic region, usual source of care, cardiovascular risk factors, and comorbidities

2. Results

Nearly 11% of adults in MEPS (n = 25 396) had DM, corresponding to 24.9 million US adults annually. Overall, 35.6% (95% CI, 34.4%-36.8%) of total patients with DM, representing about 8.6 million adults, did not receive influenza vaccination in the previous 12 months. In adjusted analyses, the odds of missing influenza vaccination were highest in adults of age 18 to 39 years (OR 2.54; 95 % CI, 2.14-3.00), non-Hispanic Black population (OR 1.29; 95 % CI, 1.14-1.46), adults lacking insurance coverage (OR 1.88; 95 % CI, 1.59-2.21), those with no usual source of care (OR 1.61; 95 % CI, 1.39-1.85), adults with a low income (OR 1.10; 95 % CI, 1.01-1.20), and those with a completed level of education equal to or less than high school diploma (OR 1.19; 95 % CI, 1.06-1.33). There was no difference in receipt of vaccination based on gender or geographic location (Table 1).

On further analysis of the association of these characteristics (referred to here as *high-risk characteristics*) with influenza vaccination, when compared with the reference group without any high-risk characteristic (non-Hispanic White individuals, of ≥ 65 years of age, with middle to high family income, with health insurance, with usual source of care, and higher education level), those with 1 (34%), 2 (38%), 3 (48%), and ≥4 (64%) high-risk characteristics had a stepwise increase in the prevalence of lacking influenza vaccination (Fig. 1). Adjusting for sex, geographic region, cardiovascular risk factors, and comorbidities, we found that adults with ≥4

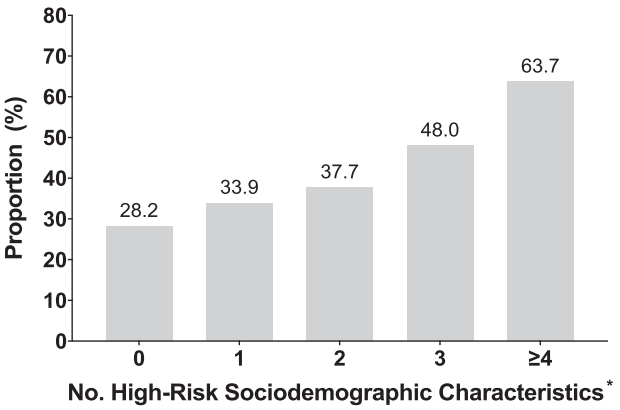

Figure 1. Weighted proportions for lack of influenza vaccination among individuals with diabetes mellitus by number of high-risk sociodemographic characteristics, from Medical Expenditure Panel Survey, 2008-2016. * High-risk sociodemographic characteristics include younger age, non-Hispanic Black race/ethnicity, lack of insurance coverage, no usual source of care, low-income, and lower level of completed education.

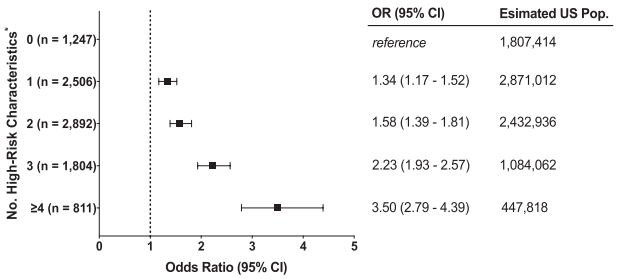

Figure 2. National estimates and odds ratios of lacking influenza vaccination among adults with diabetes and high-risk sociodemographic characteristics. * High-risk sociodemographic characteristics include younger age, non-Hispanic Black race/ethnicity, lack of insurance coverage, no usual source of care, low-income, and lower level of completed education.

high-risk characteristics had 3.5-fold higher odds (OR 3.50; 95% CI, 2.79-4.39) of lacking vaccination when compared with individuals without any high-risk characteristic (Fig. 2).

3. Discussion

We assessed differences in influenza vaccination in various sociodemographic groups in a nationally representative sample of US adults with DM. More than one-third of adults with DM aged ≥18 years did not receive influenza vaccination in the prior 12 months, translating to nearly 9 million individuals. Furthermore, vaccination rates were significantly lower in certain groups including younger adults (18-64 years), non-Hispanic Black adults, individuals without insurance, those from low-income families, and individuals lacking access to usual care, vaccination disparities similar to those reported in the general population [8, 9]. Adults with a greater number of the above-mentioned characteristics were found to have lower rates of influenza vaccination, with nearly two-thirds (64%) of those with 4 or more of these sociodemographic characteristics lacking influenza vaccination. These insights will be critical for health systems and policy makers to develop targeted interventions for these missed opportunities to promote timely vaccination. These findings are particularly relevant in the current COVID-19 pandemic, given the risk of adverse outcomes in patients with comorbid DM and/or co-infection with influenza.

Limitations of our study include the cross-sectional nature of the MEPS data, which limits the determination of causal relationships and the potential recall bias associated with self-reported influenza vaccination information in this database, which may underestimate or overestimate the true prevalence of influenza vaccination. However, the overall high quality of the MEPS data, its representativeness of the US population, the comprehensive adjustment for potential confounders conducted in the regression analyses, and the large sample size lend credibility to our report and make these results valuable for economic and health-policy making.

In conclusion, nearly one-third of U.S. adults with DM lacked influenza vaccination, with disproportionately higher rates among vulnerable sociodemographic groups. These results underscore the importance of focused public health interventions to address these underlying factors to improve influenza vaccination rates and limit downstream preventable adverse outcomes in patients with DM.

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All authors reviewed and approved the final version of the article submitted for publication. K.N. initiated the study.

K.N. is the guarantor of this work and, as such, 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.

Additional Information

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