

Structural Inequities in Seasonal Influenza Vaccination Rates

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Abstract

Background

Influenza immunization is a highly effective method of reducing illness, hospitalization and mortality from this disease. However, influenza vaccination rates in the U.S. remain below public health targets.

Methods

We analyzed correlates of influenza vaccination rates using the 2019 Behavioral Risk Factor Surveillance System (BRFSS) in the year 2020. Our analysis compared influenza vaccination as the outcome of interest with the variables age, sex, race, education, income, geographic location, health insurance status, access to primary care, and history of delaying care due to cost.

Results

Our results showed that several persistent structural inequities predict influenza vaccination, within and across racial and ethnic groups, including geographic location, health insurance status, regular access to primary care, and the need to delay medical care due to cost.

Conclusion

With the impending rollout of a COVID-19 vaccine, it is important for physicians and policymakers to recognize and eliminate structural racism and inequities in U.S. influenza vaccination rates so that future vaccination campaigns are not impeded by these barriers to immunization.

Background

The Centers for Disease Control and Prevention (CDC) estimates that in the 2018-2019 United States influenza season, an estimated 35.5 million individuals were sick with influenza, resulting in 490,600 hospitalization and 34,200 deaths.¹ Immunization against influenza is an excellent low-cost, safe, and effective way to reduce influenza morbidity and mortality. Unfortunately, influenza immunization rates are below public health targets throughout the U.S. population, and reflect persistent structural inequities that reduce the likelihood that Black, American Indian and Alaska Native, Latina/o, Asian groups, and populations of low socioeconomic status receive the influenza vaccine.²

Past literature has highlighted the impact of factors such as insurance coverage,³ accessibility of flu vaccine,⁴ education level,^{5,6} income,⁶ employment status,⁵ housing segregation,⁷ and rurality on influenza immunization rates in the U.S.⁸ The persistence of these associations with vaccination rates, reflect structural inequities and structural racism that should be addressed to reduce inequities in influenza mortality.

This paper details our analysis of data from the 2019 Behavioral Risk Factor Surveillance System (BRFSS) survey to quantify the structural factors associated with racial and ethnic differences in U.S. influenza vaccination rates. We describe structural factors that show the greatest impact on racial and ethnic differences in influenza vaccination, so that strategies can be implemented to address upstream factors that contribute to vaccination inequities. Vaccination access is an important—but frequently underemphasized—part of the broader conversation of healthcare access as a social determinant of health. With the projected rollout of a vaccine against SARS-CoV-2—the virus that causes COVID-19—it is instructive to understand influenza vaccination prevalence and the structural factors that impact vaccination rates so that these inequities can be addressed during the distribution of the COVID-19 vaccine.

Methods

Data

We used data from the 2019 BRFSS.⁹ The BRFSS is an annual state-administered surveillance survey which asks about health conditions and behaviors. Raking weights are used to produce population estimates that adjust for survey non-coverage, non-response, and the probability of being sampled given the geographic location, age, race, and sex of the participant.¹⁰

Variables

Our outcome of interest was influenza vaccination in the past 12 months which was assessed via the survey question, “During the past 12 months, have you had either a flu vaccine that was sprayed into your nose or injected into your arm?”

Age and sex were assessed via survey questions. Race/ethnicity was self-reported into the following categories: non-Hispanic White (NH-White), non-Hispanic Black (NH-Black), Hispanic, other race, Asian, American Indian/Alaska Native, multiracial, and Native Hawaiian/other Pacific Islander. Education level was assessed from the following question, “What is the highest grade or year of school you have completed?”. Income was assessed via the question, “Is your annual income from all sources: less than \$10,000, or \$10,000 to less than \$15,000, or \$15,000 to less than \$20,000, or \$20,000 to less than \$25,000, or \$25,000 to less than \$35,000, or \$35,000 to less than \$50,000, or \$50,000 to less than \$75,000, or \$75,000 or more.” Health insurance status was determined from the question, “Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service?”. We used the follow survey question to determine if someone has a primary care doctor, “Do you have one person you think of as your personal doctor or health care provider?”. Delayed care due to cost was determined using the survey question, “Was there a time in the last 12 months when you needed to see a doctor but could not because of cost?”

We examined geographic data by state divisions defined by the US Census. We restricted our analysis to participants who answered the influenza vaccination question and had complete data for covariates (N = 302,537). We calculated weighted median, interquartile range for continuous covariates and N, weighted percentage for categorical covariates by if they received the influenza vaccine. All analysis was completed in SAS-callable SUDAAN version 11.0.3 in the year 2020.

Results

Participants who received the influenza vaccine were more likely to be older (54 years old, compared to 42 years old not vaccinated), and female (46.5% female vaccinated compared to 39.5% male vaccinated). Asian (44.1%) and NH-White (46.5%) race/ethnicity groups had a higher percentage of their population receive the influenza vaccine compared to NH-Black (36.7%), Hispanic (33.9%), American Indian/Alaska native (36.6%), and Native Hawaiian / Other Pacific Islander groups (37.9%). Influenza vaccination prevalence was higher in individuals with at least a college degree (52.9%) compared to those with less than a high school education (34.4%) and higher in individuals with an annual income of \$75,000 or more (47.8%) compared to those with an annual income less than \$25,000 (38.1%). Participants in New England had the highest prevalence of the population vaccinated (50.1%) compared to the West South-Central division which had the lowest (40.5%) (Table 1).

Figure 1 contains the weighted prevalence of influenza vaccination for structural factors. Individuals who have health insurance (46.3%), have a primary care doctor (48.9%), or do not have delayed care due to cost (45.2%) had higher prevalence of influenza vaccination compared to those who did not (18.8%, 22.7% and 28.4%, respectively). In Figure 2 we see similar trends of the weighted prevalence of influenza vaccination for structural factors by race/ethnicity. For NH-White, NH-Black, Hispanic, Asian, and American Indian/Alaska Native individuals, those who have health insurance, have a primary care doctor, or do not have delayed care due to cost had higher prevalence of influenza vaccination compared to those who did not. For Native Hawaiian/other Pacific Islanders, those who have health insurance or have a primary care doctor had a higher prevalence of influenza vaccination compared to those who did not.

For weighted logistic regression models predicting influenza vaccination (Table 2), after adjusting for covariates, older participants were more likely to receive the influenza vaccine [OR: 1.02 (1.02-1.02)]. Males [OR: 0.81 (0.79-0.84)] were less likely to receive the influenza vaccine compared to females. NH-Black individuals [OR: 0.77 (0.73-0.81)], and American Indian/Alaska Natives [OR: 0.80 (0.70, 0.92)] were less likely to receive the influenza vaccine compared to NH-White individuals. Individuals without health insurance [OR: 0.51 (0.47-0.55)], without a primary care doctor [OR: 0.50 (0.48-0.52)] or had delayed medical care due to cost [OR: 0.75 (0.71-0.79)] were less likely to receive the influenza vaccine. Individuals with less than high school education [OR: 0.61 (0.57-0.66)] were less likely to receive the influenza vaccine compared to those with a college degree or more. The lowest income group, less than \$25,000 [OR: 1.00 (0.96-1.05)], was not significantly less likely to receive the influenza vaccine than the highest income group, \$75,000 and more. All the divisions except for the Middle Atlantic and West North

Central were less likely to receive the influenza vaccine compared to individuals in the New England division.

When stratifying models for NH-White individuals, males [OR: 0.82 (0.79, 0.84)], those with less than a high school education [OR: 0.46 (0.42, 0.50)], with less than \$25,000 annual income [OR: 0.95 (0.91, 0.99)], without a primary care doctor [OR: 0.46 (0.44, 0.49)], without health insurance [OR: 0.40 (0.37, 0.43)], or had delayed medical care due to cost [OR: 0.77 (0.72, 0.81)] were less likely to receive the influenza vaccine (Table 3). For NH-Black individuals, males [OR: 0.87 (0.79, 0.97)], those with less than a high school education [OR: 0.77 (0.63, 0.95)], without a primary care doctor [OR: 0.52 (0.45, 0.61)], and without health insurance [OR: 0.59 (0.48, 0.73)] were less likely to receive the influenza vaccine (Table 4). For Hispanic individuals, males [OR: 0.77 (0.69, 0.86)], those with less than a high school education [OR: 0.82 (0.69, 0.97)], without a primary care doctor [OR: 0.54 (0.48, 0.62)], without health insurance [OR: 0.57 (0.49, 0.66)], or had delayed medical care due to cost [OR: 0.68 (0.59, 0.78)] were less likely to receive the influenza vaccine (Table 5). For Asian individuals, those without a primary care doctor [OR: 0.53 (0.41, 0.69)], and without health insurance [OR: 0.61 (0.40, 0.93)] were less likely to receive the influenza vaccine (Table 6). For American Indian/Alaska Natives models, males [OR: 0.72 (0.55, 0.93)], those without a primary care doctor [OR: 0.56 (0.42, 0.73)], and without health insurance [OR: 0.46 (0.30, 0.71)] were less likely to receive the influenza vaccine (Table 7). For Native Hawaiian/other Pacific Islander individuals, those without a primary care doctor [OR: 0.23 (0.12, 0.45)] were less likely to receive the influenza vaccine (Table 8).

Discussion

This analysis illustrates the many structural and associated demographic factors that contribute to seasonal influenza vaccination rates. The clear racial and ethnic disparities are of particular concern amidst the larger context of persistent health inequities among minority groups.¹¹

Structural factors matter when it comes to influenza vaccination rates. Those with less consistent interaction with the healthcare system overall, as determined by the lack of a primary care doctor, no health insurance, and a history of delaying care due to cost, are also less likely to receive the flu vaccine. These healthcare access factors are further connected to income status, as those in lower income brackets are likewise less likely to receive the flu vaccine.

A limitation of these data is that the BRFSS does not have information on attitudes towards influenza vaccination, including concern about side effects,⁶ low perception of risk regarding influenza infection, perceived ineffectiveness of the vaccine,⁵ and distrust of physicians,⁶ which have been described as contributors to vaccine hesitancy and the persistence of racial and ethnic care disparities. Strategies that have demonstrated success in responding to the complex issue of vaccine hesitancy and increased influenza vaccine uptake indicate the importance of multi-component interventions.¹² When patients have access to a primary care clinician, an emphasis on conversations with healthcare clinicians about the health benefit and importance of influenza vaccination, with acknowledgments of concerns and side

effects helps to increase uptake while also fostering trust between patients and healthcare providers, which is of particular benefit to African American and Latino populations.¹³ Linguistically-relevant, dialogue-based interventions used along with lowering out-of-pocket cost, standing orders, reminder systems for provider and client, community vaccine programs and other community-based interventions all have proven to increase vaccine uptake.¹⁴ As an additional limitation, understanding racial and ethnic differences in vaccination can be complicated by important heterogeneity within racial or ethnic subgroups, for example, in the heterogenous subgroups classified as Asian, which can mask differences within subgroups and lead to unaddressed structural inequities in these groups.

Conclusion

There are multiple persistent structural inequities related to accessing care and paying for care that influence influenza vaccination rates for Black, indigenous, low-income populations and other groups in the United States. Several strategies to mitigate these structural factors have been successful in past efforts to increase vaccination rates, though more fundamental efforts to increase access to care and address financial barriers to care are needed. Policy efforts to advance multi-system approaches to increasing vaccination rates will have important implications as the U.S. faces the impending rollout of the COVID-19 vaccine.

Abbreviations

CDC – Centers for Disease Control and Prevention

BRFSS – Behavioral Risk Factor Surveillance System

COVID-19 – Coronavirus disease 2019

Declarations

Ethics approval and consent to participate:

Not applicable

Consent for publication:

Not applicable

Availability of data and materials:

The dataset used for this analysis is available for public access from the Behavioral Risk Factor Surveillance System: https://www.cdc.gov/brfss/annual_data/annual_2019.html

Competing interests:

The authors declare that they have no competing interests.

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Author contributions:

LB, MJO, and CRC conceived and designed the analysis. LB, MJO, AN, and CRC contributed to the analysis. LB and MJO performed the statistical analysis. LB, MJO, and CRC wrote the manuscript. All authors read and approved the final manuscript.

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Not applicable.

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Tables

Due to technical limitations, tables are only available as a download in the Supplemental Files section.

Figures

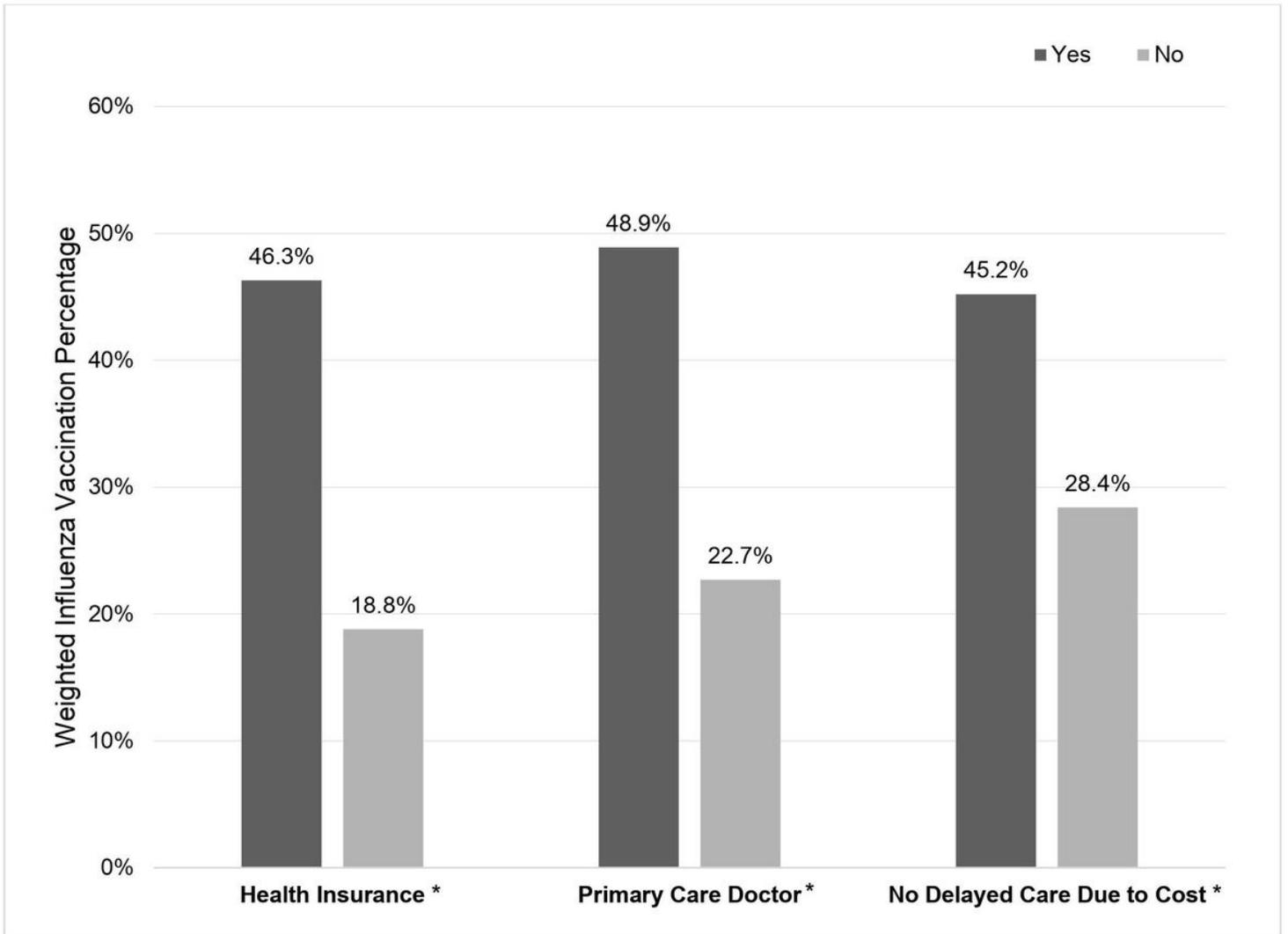


Figure 1

Impact of Structural Factors on Influenza Vaccination Notes: * P<0.001

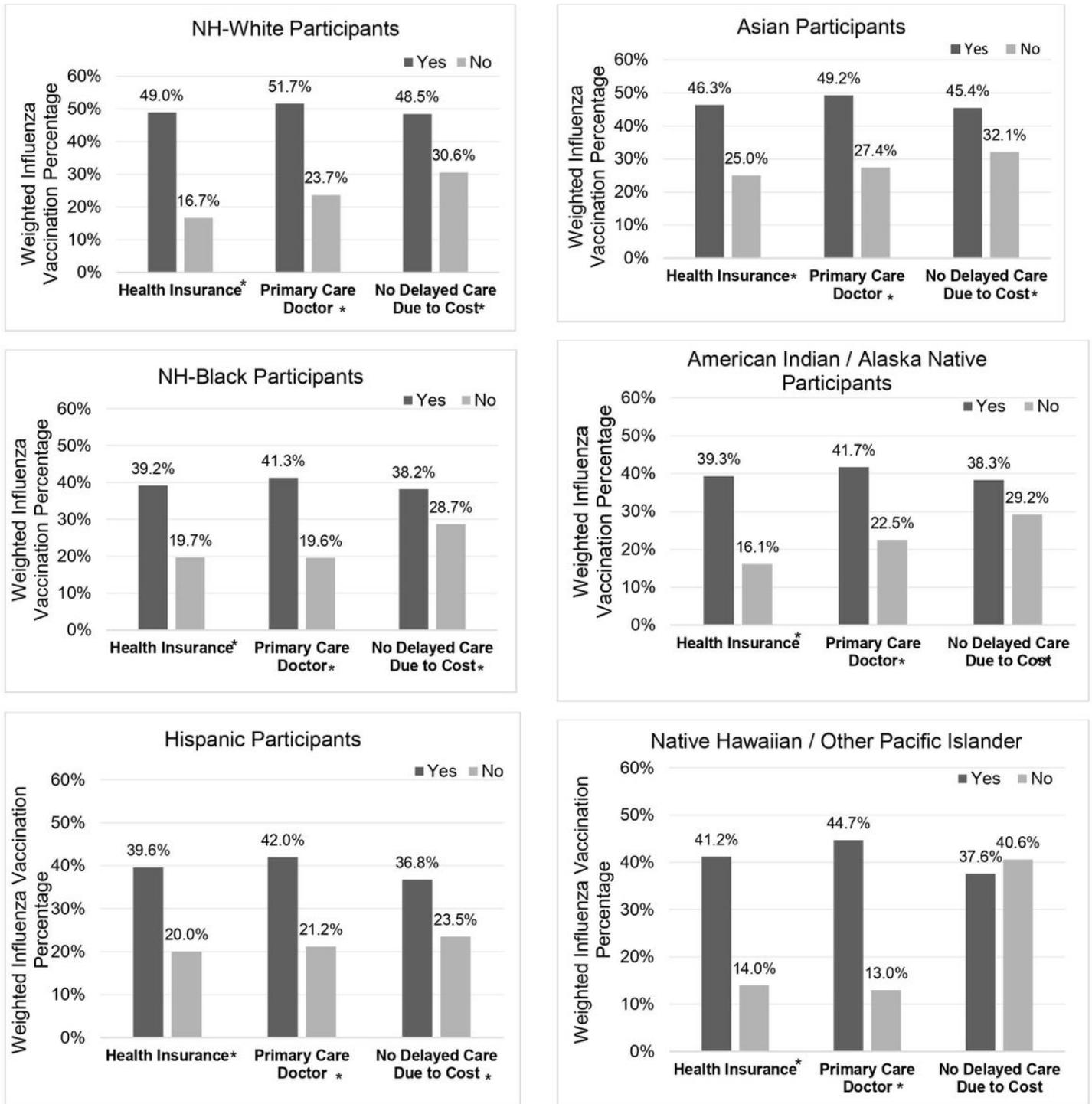


Figure 2

Impact of Structural Factors on Influenza Vaccination by Race/Ethnicity Notes: * P<0.001, ** P<0.05

Supplementary Files

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- [Table.docx](#)