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RESEARCH ARTICLE

Factors Associated With Influenza Vaccination in a National Veteran Cohort

Alissa S. Chen, MD,[1] Melissa M. Farmer, PhD,[2] Ling Han, MD, PhD, MS,[3] Tessa Runels, MPH,[3] Brett Bade, MD,[4] Kristina Crothers, MD,[5,6] Lori A. Bastian, MD, MPH,[1,3] Isabel S. Bazan, MD,[7] Bevanne A. Bean-Mayberry, MD, MHS,[2,8] Cynthia A. Brandt, MD, MPH,[3,9,10] Kathleen M. Akgün, MD, MS[3,7]

Introduction: Only 53% of American adults receive influenza vaccination, and disparities in vaccination exist among particular racial and ethnic groups. This study determines how race, ethnicity, sex, and rurality are associated with influenza vaccination adherence in a national Veteran Health Affairs Administration cohort.

Methods: The authors examined differences in documented influenza vaccinations for the 2019−2020 influenza season among Veteran Health Affairs Administration patients in a retrospective cohort study using Veteran Health Affairs Administration administrative electronic health record data. The author used logistic regression to model receipt of influenza vaccination in association with race, ethnicity, sex, and rurality while controlling for clinical diagnoses, demographics, and ambulatory care utilization. The authors also stratified the models by sex and rurality.

Results: Among 5,943,918 veterans, 48.6% received influenza vaccination. Unadjusted comparisons showed that those who were vaccinated were more likely to be White, to be of male sex, and to be older. Similar proportions of unvaccinated and unvaccinated veterans were from rural settings. In adjusted models, Black race was most strongly associated with decreased vaccination (AOR=0.69; 95% CI=0.69, 0.70), and American Indian/Alaskan Native race also had reduced odds of vaccination (AOR=0.94; 95% CI=0.92, 0.95) compared with White race. Female veterans had increased odds of vaccination (AOR=1.20; 95% CI=1.19, 1.20) compared with men. Rurality (AOR=0.97; 95% CI=0.96, 0.97) was associated with a small decreased odds of vaccination compared with urban. In stratified models, Black veterans were less likely to receive influenza vaccination regardless of sex and rurality than White veterans. American Indian/Alaska Native female veterans had equal odds of vaccination as White female veterans, whereas American Indian/Alaska Native male veterans had reduced odds of vaccination compared with White male veterans.

From the [1]Section of General Medicine, Department of Medicine, Yale University School of Medicine, New Haven, Connecticut; [2]Center for Study of Healthcare Innovation, Implementation, and Policy (CSHIIP), VA Greater Los Angeles Healthcare System, Los Angeles, California; [3]Pain Research, Informatics, Multimorbidities, and Education (PRIME) Center, VA Connecticut Healthcare System, West Haven, Connecticut; [4]Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York; [5]VA Puget Sound, Seattle, Washington; [6]Division of Pulmonary, Critical Care and Sleep Medicine, University of Washington, Seattle, Washington; [7]Pulmonary, Critical Care, & Sleep Medicine, Yale University School of Medicine, New Haven, Connecticut; [8]Department of Medicine, David Geffen School of Medicine, University of California, Los Angeles, Los Angeles, California; [9]Department of Emergency Medicine, Yale University School of Medicine, New Haven, Connecticut; and [10]Section of Biomedical Informatics and Data Science, Yale University School of Medicine, New Haven, Connecticut

Address correspondence to: Alissa S. Chen, MD, MPH, Department of Medicine, Yale University School of Medicine, 333 Cedar Street, New Haven CT 06510. E-mail: Alissa.chen@yale.edu.

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Conclusions: During the 2019−2020 influenza season, Black and American Indian/Alaskan Native veterans had lower odds of vaccination. Despite the Veteran Health Affairs Administration's universal approach to healthcare, racial disparities still exist in preventive care.

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INTRODUCTION

Influenza causes tens of millions of infections in the U.S. per year. The most vulnerable populations, including older people, nursing home residents, and patients with chronic conditions, are the most susceptible to severe disease.[1,2] Vaccination protects from severe disease, especially in those with chronic illnesses and older adults, and is recommended for all by the Advisory Committee on Immunization Practices.[3] Despite the broad recommendation for vaccination, only 53% of adults received influenza vaccination in the 2019−2020 influenza season.[4,5]

Disparities in influenza vaccination exist. National surveys have shown that Black and Hispanic Americans are less likely to receive influenza vaccination.[6,7] Black patients report more financial and logistical barriers to vaccination than their White counterparts[8] and identify financial concerns and access limitations to vaccination, even when the vaccine is free.[9] In addition, the intersection between race, ethnicity, and demographic factors (e.g., sex and rurality) may impact vaccination. For instance, among people aged ≥50 years, rural White patients were less likely to get vaccinated than urban White patients, but Black patients had lower vaccination odds regardless of rurality.[10] Although nonveteran women have been found to have higher rates of influenza vaccination than nonveteran men,[7,11,12] a prior study found that older women veterans were less likely to receive influenza vaccination than veteran men.[13] Subgroup analyses by sex are needed to understand which groups are more at risk for disparities in vaccination.

The Veteran's Health Administration (VHA) is the largest integrated healthcare system in the U.S.[14] The VHA theoretically functions as an equal access system for eligible, enrolled veterans. The objective of this study was to examine whether there are disparities in the receipt of influenza vaccination in terms of race, ethnicity, sex, and rurality at the VHA for the 2020 influenza year. The authors also analyzed the intersection between race and ethnicity with sex and rurality for receipt of influenza vaccination in stratified analyses. These data among VHA users allow us to identify what is known about the disparities in influenza vaccination, among a population with equal access to health care, minimizing the likelihood of financial barriers to vaccination.

METHODS

Study Population

The authors performed a retrospective national observational study of influenza vaccination among veterans who utilized the VHA predominantly for their health care, defined as any patient seen at any VHA facility with at least 1 outpatient visit during the 2019 calendar year. Patients and variables were identified using the VHA Corporate Data Warehouse (CDW), which contains electronic health record (EHR) clinical and administrative data on patients receiving care at the VHA.[15] Data were first obtained from CDW in July 2021. Data were updated prior to finalizing analyses and last obtained in May 2024. The study was permitted by the IRB at the Veteran's Affairs Connecticut Healthcare System. A waiver of informed consent was granted.

Measures

The dependent variable was receipt of influenza vaccination during the 2019−2020 influenza season (defined as September 1, 2019 to August 31, 2020). Influenza vaccination was ascertained by either VHA facility administration care site or patient report of vaccination outside of the VHA, both of which are documented in the EHR and available in CDW. The independent variables of interest were race, ethnicity, sex, and rurality. Race and ethnicity were determined by patient self-report and included in mutually exclusive categories (race: White, Black, Asian, Pacific Islander, American Indian/Alaskan Native, multiple races, unknown; ethnicity: Hispanic or non-Hispanic). Sex was defined as female or male from CDW. Rural/highly rural and urban were determined using patients' 2019 home address and ZIP code and defined on the basis of rural−urban commuting area codes.[16] Rural and highly rural were combined owing to small number of veterans in highly rural settings.

The authors also included demographic, clinical, and ambulatory care utilization covariates that may impact influenza vaccination. Demographics included age, marital status, geographic region, and percentage service-connected disability determined by VHA-assessed disability due to military service. Age and marital status were included because they have been shown in studies outside the VHA to be associated with influenza vaccination.[7] Geographic region was added to control for location-specific practice patterns, which has been shown to be significant in coronavirus disease 2019 (COVID-19) vaccination (Appendix Table 1, available online).[17] Service connection status and percentage given are driven by Veterans Affairs Veterans Benefits Association approval and potential compensation or pension for conditions and injuries related to military experiences, which could impact healthcare utilization. Higher ratings (>50%) or priority are associated with full access to Veterans Affairs health services without regard to income or ability owing to their service exposures and resultant disability.[18] The authors restricted clinical factors to covariates that impact severity of influenza infection.[2] Clinical variables as described by the International Classification of Disease, Ninth Revision and the ICD-10 included chronic pulmonary disease (including asthma, bronchiectasis, chronic obstructive pulmonary disease, interstitial lung disease, pulmonary hypertension, acute and chronic respiratory failure), cardiac disease (including acute myocardial infarction, heart failure, unstable angina), hypertension, diabetes, alcohol use disorder, and HIV (Appendix Materials, available online). All clinical variables were identified using a validated methodology of ≥2 outpatient or 1 inpatient visit, with the condition coded in the year prior to immunization date or September 1, 2019, for those unvaccinated.[19] Tobacco use (never, former, or current) was obtained through VHA health factors. Ambulatory care utilization variables included the number of primary care visits and the number of mental health visits in the year prior to vaccination or year prior to September 1, 2019, for those unvaccinated.

Statistical Analysis

The authors used chi-square tests to compare patient groups by influenza vaccination. The authors used Wilcoxon-ranked sum tests to compare the number of primary care visits and mental health visits between those who were vaccinated and unvaccinated. The authors first performed a logistic regression to model the receipt of vaccination in terms of race, ethnicity, sex, and rurality, while controlling for patient demographics, clinical factors, and ambulatory care utilization. For AORs corresponding to primary care and mental health visits, the OR represents the odds of vaccination with every additional primary care or mental health visit. To further understand how associations between race and ethnicity and vaccination are modified by sex and rurality, the authors tested interactions (all p<0.001) between race and rurality, race and sex, ethnicity and rurality, and ethnicity and sex in the adjusted model. To facilitate clinical interpretations of the heterogeneity of vaccination, the authors further stratified the final adjusted logistic model by rurality and sex to derive AOR (95% CI) for race and ethnicity among respective subgroups. All analyses were conducted in SAS, Version 9.4 (SAS Institute, Cary, NC). A p-value <0.05 was used to indicate statistical significance.

RESULTS

The analytic sample included 5,943,918 veterans, and 527,730 (9%) were female. Overall, 48.6% of veterans received influenza vaccination. Unadjusted comparisons showed that veterans who were vaccinated more often identified as White (75.7%) and male (92%). A total of 60% of those vaccinated were aged <65 years compared with 43% of those unvaccinated. Similar proportions of those who were vaccinated and not vaccinated identified as Hispanic. A similar percentage of veterans were from highly rural or rural settings regardless of vaccination status (35% vaccinated vs 34% unvaccinated) (Table 1). Median number of primary care visits was 1 (IQR=1−3) for unvaccinated and 3.0 (IQR=2−4) for vaccinated (Wilcoxon-ranked sum test p<0.001). Median number of mental health visits was 0 (IQR=0−1) unvaccinated and 0 (IQR=0−2) for unvaccinated (Wilcoxon-ranked sum test p<0.001).

In the adjusted model for the full cohort, Black race was associated with decreased odds of influenza vaccination compared with White race (AOR=0.69; 95% CI=0.69, 0.70) (Table 2). American Indian/Alaska Native race, multiple races, and unknown race were also associated with decreased odds for vaccination (American Indian/Alaska Native: AOR=0.94; 9%% CI=0.92, 0.95; multiple races: AOR=0.92; 95% CI=0.90, 0.94; unknown: AOR=0.86; 95% CI=0.86, 0.87) compared with White race. Asian race had higher odds of vaccination than White race (AOR=1.35; 95% CI=1.33, 1.37). Hispanic ethnicity was associated with higher odds of vaccination than non-Hispanic ethnicity (AOR=1.09; 95% CI=1.08, 1.09). Female sex had higher odds of vaccination than male (AOR=1.20; 95% CI=1.19, 1.20). Rurality was associated with decreased odds for vaccination compared with urban (AOR=0.97; 95% CI=0.96, 0.97). All regions had lower odds of vaccination than the North Atlantic region.

In a logistic regression model including interaction terms between race and rurality, race and sex, ethnicity and rurality, and ethnicity and sex showed significant interactions between all groups (p<0.001 for all). Models

Table 1. Characteristics of Veterans Based on Receipt of Influenza Vaccination

Variable	Did not receive flu vaccine, *n* (%)	Received flu vaccine, *n* (%)	All, *n* (%)
All	3,053,551 (51)	2,890,367 (49)	5,943,918 (100)
Sex			
Female	293,117 (10)	234,613 (8)	527,730 (9)
Male	2,760,434 (90)	2,655,754 (92)	5,416,188 (91)
Age, years			
<40	547,555 (18)	237,190 (8)	784,745 (13)
40–55	625,068 (20)	393,677 (14)	1,018,745 (17)
56–65	548,199 (18)	513,670 (18)	1,061,869 (18)
66–75	772,640 (25)	1,073,652 (37)	1,846,292 (31)
>75	560,089 (18)	672,178 (23)	1,232,267 (21)
Race			
White	2,152,462 (71)	2,189,170 (76)	4,341,632 (73)
Black	596,468 (20)	450,482 (16)	1,046,950 (18)
Asian	31,983 (1)	33,142 (1)	65,125 (1)
American Indian/Alaska Native	25,188 (1)	21,683(1)	46,871 (1)
Pacific Islander	24,382 (1)	23,902 (1)	48,284 (1)
Multiple races	29,487 (1)	24,241 (1)	53,728 (1)
Unknown	193,581 (6)	147,747 (5)	341,328 (6)
Ethnicity			
Non-Hispanic	2,847,003 (93)	2,696,271 (93)	5,543,274 (93)
Hispanic	206,548 (7)	194,096 (7)	400,644 (7)
Rurality			
Highly rural	39,549 (1)	38,135 (1)	77,684 (1)
Rural	993,282 (33)	988,480 (34)	1,981,762 (33)
Urban	2,020,720 (66)	1,863,752 (64)	3,884,472 (65)
Geographic region			
North Atlantic	641,949 (21)	666,692 (23)	1,308,641 (22)
Continental	566,163 (19)	517,827 (18)	1,083,990 (18)
Midwest	633,223 (21)	629,930 (22)	1,263,153 (21)
Pacific	569,307 (19)	475,244 (16)	1,044,551 (18)
Southeast	642,909 (21)	600,674 (21)	1,243,583 (21)
Marital status			
Married	1,611,139 (53)	1,724,656 (60)	3,335,795 (56)
Unmarried	1,442,412 (47)	1,165,711 (40)	2,608,123 (44)
Smoking status			
Nonsmoker	1,073,704 (35)	996,259 (34)	2,069,963 (35)
Smoker	1,074,793 (35)	795,250 (28)	1,870,043 (31)
Former smoker	905,054 (30)	1,098,858 (38)	2,003,912 (34)
Not service connected	1,192,466 (39)	1,068,556 (37)	2,261,022 (38)
Service connected	1,861,085 (61)	1,821,811 (63)	3,682,896 (62)
Chronic conditions			
Alcohol use disorder	164,098 (5)	159,233 (6)	323,331 (5)
Diabetes	500,334 (16)	867,848 (30)	1,368,182 (23)
Cardiac disease	95,269 (3)	164,836 (6)	260,105 (4)
HIV	8,757 (0)	19,252 (1)	28,009 (0)
Chronic pulmonary disease	236,138 (8)	418,810 (14)	654,948 (11)

Note: All comparisons were significant at $p<0.001$ with chi-square test.

stratified by sex and adjusted for age, rurality, clinical conditions, and ambulatory care utilization showed similar AORs for female and male veterans, with the exception of American Indian/Alaska Native race (Table 3). Both Black female veterans and Black male veterans had decreased odds of influenza vaccination

Table 2. Factors Associated With Receipt of Influenza Vaccination in Adjusted Logistic Regression Model (N=5,943,918)

Variable	AOR	95% CI
Female sex	1.20	1.19, 1.20
Age, years (ref <40)		
40–55	1.17	1.16, 1.17
56–65	1.53	1.52, 1.54
66–75	1.97	1.96, 1.98
>75	1.85	1.84, 1.87
Race (ref White)		
Black	0.69	0.69, 0.70
Asian	1.35	1.33, 1.37
Pacific Islander	1.01	0.99, 1.03
American Indian/Alaska Native	0.94	0.92, 0.95
Multiple races	0.92	0.90, 0.94
Unknown	0.86	0.86, 0.87
Hispanic (ref non-Hispanic)	1.09	1.08, 1.09
Rural (ref urban)	0.97	0.96, 0.97
Geographic region (ref North Atlantic)		
Continental	0.90	0.89, 0.90
Midwest	0.94	0.94, 0.95
Pacific	0.82	0.81, 0.82
Southeast	0.88	0.87, 0.88
Unmarried (ref married)	0.84	0.84, 0.85
Service connected (ref not service connected)	1.20	1.20, 1.20
Alcohol use disorder	1.04	1.03, 1.04
Smoking (ref nonsmoker)		
Current smoker	0.78	0.78, 0.78
Former smoker	1.07	1.07, 1.08
Diabetes	1.27	1.27, 1.28
HIV	3.53	3.44, 3.62
Hypertension	1.74	1.73, 1.75
Chronic pulmonary diseases	1.32	1.31, 1.33
Cardiovascular diseases	0.80	0.79, 0.81
Mental health visits	1.00	1.00, 1.00
Primary care visits	1.19	1.19, 1.19

compared with their White counterparts (Black female: AOR=0.68; 95% CI=0.67, 0.69; Black male: AOR=0.70; 95% CI=0.70, 0.70). American Indian/Alaska Native female veterans' vaccination receipt was not different from those of White female veterans (AOR=1.00; 95% CI=0.95, 1.06), but American Indian/Alaska Native male veterans had decreased odds of vaccination (AOR=0.92; 95% CI=0.91, 0.94) compared with White male veterans. Multiple-race veterans and unknown-race veterans had lower odds of influenza vaccination than White veterans in both males and females. Hispanic female veterans and Hispanic male veterans had odds of influenza vaccination similar to those of non-Hispanic veterans.

Table 3. Adjusted Odds of Influenza Vaccination by Race and Ethnicity Stratified by Sex

Variable	Female, *n*=527,730, AOR (95% CI)	Male, *n*=5,416,188, AOR (95% CI)
Race (ref White)		
Black	0.68 (0.67, 0.69)	0.70 (0.70, 0.70)
Asian	1.33 (1.27, 1.39)	1.35 (1.32, 1.37)
Pacific Islander	0.97 (0.92, 1.03)	1.02 (1.00, 1.04)
American Indian/Alaskan Native	1.00 (0.95, 1.06)	0.92 (0.91, 0.94)
Multiple races	0.88 (0.84, 0.92)	0.92 (0.91, 0.94)
Unknown	0.82 (0.80, 0.84)	0.87 (0.86, 0.87)
Hispanic (ref non-Hispanic)	1.10 (1.08, 1.13)	1.08 (1.07, 1.09)
Rural (ref urban)	0.96 (0.94, 0.97)	0.97 (0.96, 0.97)

Note: Model adjusted for additional covariates, including age, marital status, geographic region, service connectedness, smoking, comorbidities, number of primary care visits, and number of mental health visits.

In models stratified by rurality (Table 4), there were some notable differences between rural and urban veterans. Among rural veterans, Black veterans continued to have lower odds of vaccination receipt (AOR=0.77; 95% CI=0.76, 0.78) than White veterans. Among urban veterans, Black veterans also had lower odds of vaccination (AOR=0.68; 95% CI=0.67, 0.68) than White veterans, with decreased odds compared with the rural model. Rural and urban American Indian/Alaska Native veterans had decreased odds of influenza vaccination similar to those of White rural and urban veterans. Rural Hispanic veterans had increased odds of vaccination

Table 4. Adjusted Odds of Influenza Vaccination by Race and Ethnicity Stratified by Rurality

Variable	Urban, *n*=3,884,472, AOR (95% CI)	Rural, *n*=2,059,446, AOR (95% CI)
Female sex	1.19 (1.18, 1.20)	1.20 (1.19, 1.22)
Race (base White)		
Black	0.68 (0.67, 0.68)	0.77 (0.76, 0.78)
Asian	1.33 (1.31, 1.35)	1.28 (1.22, 1.35)
Pacific Islander	1.01 (0.99, 1.04)	0.98 (0.94, 1.02)
American Indian/Alaskan Native	0.94 (0.92, 0.97)	0.94 (0.91, 0.97)
Multiple races	0.90 (0.88, 0.92)	0.95 (0.92, 0.98)
Unknown	0.83 (0.83, 0.84)	0.91 (0.90, 0.92)
Hispanic (base non-Hispanic)	1.06 (1.05, 1.07)	1.18 (1.16, 1.20)

Note: Model adjusted for additional covariates, including age, marital status, geographic region, service connectedness, smoking, comorbidities, number of primary care visits, and number of mental health visits.

(AOR=1.18; 95% CI=1.16, 1.20) compared with rural non-Hispanic veterans, and a similar association was found with urban Hispanic veterans (AOR=1.06; 95% CI=1.05, 1.07) as with rural Hispanic veterans.

DISCUSSION

This large, retrospective study of veterans shows that influenza vaccine disparities persist among Black, American Indian/Alaska Native, and rural veterans. This VHA dataset reflects care from the largest integrated health system in the U.S., which provides equitable access to care to veterans nationally,[14] wherein barriers to care should be minimal. The study findings suggest that despite ostensibly equitable access to care, disparities persist for influenza vaccination among veterans using VHA.

This study adds to the growing body of evidence that Black and American Indian/Alaska Native patients are less likely to receive influenza vaccination.[7,11] In this study, Black and American Indian/Alaska Native veterans were less likely to be vaccinated, even in models stratified by rurality. This association was modified by sex for American Indian/Alaska Native individuals. Male American Indian/Alaska Native veterans had decreased odds for vaccination, whereas there was no difference in the odds of vaccination among female American Indian/Alaska Native veterans compared with those among White veterans. In the model stratified by sex, Black females had the lowest relative odds for vaccination. This finding for Black female veterans is notable because the overall model indicates that female veterans are more likely to receive influenza vaccine than males. Despite disparities in vaccination being seen in some groups, Asian and Hispanic veterans had higher odds of vaccination, which is consistent with studies outside of the VHA.[12] These large retrospective EHR data conflict with an analysis of national survey data from veterans and nonveterans, where there were no racial or ethnic disparities in influenza vaccination among veterans.[20] The prior analysis of national survey data included a smaller sample size of veterans and is subject to recall bias, which may explain these differences.

The authors have shown that racial disparities persist in the receipt of vaccination, even across different subgroups and in an environment with more equitable health care access. Although these differences are likely multifactorial, such racial differences may point to structural racism, defined as “having differential levels of access, based on race, to society goods, services, and opportunities.”[21] In this case, differential levels of access may prevent the equitable uptake of influenza vaccination.

Such structural racism can prevent patients from accessing health care owing to their mistrust of a historically racist system or lack of education on the need for preventive care. Mistrust in the health care system that was historically racist has been shown in prior studies. In a qualitative study regarding vaccine hesitancy, Black participants described general mistrust of the medical establishment stemming from historical mistreatment (e.g., Tuskegee experiments).[9] Another recent qualitative study with Black patients confirmed this mistrust and also found that instances of personal mistreatment by the medical system led to COVID-19 vaccine hesitancy.[22] Notably, structural racism was historically explicit for U.S. military members; for instance, basic training and military units were separated by race during World Wars I and II, and desegregation of the military only occurred by executive order in 1948.[23] Although such policies have evolved, the U.S. military still openly struggles with discrimination on the basis of race.[24] Such a service experience could impact how Black veterans view the care they obtain from the VHA.

In addition to historical mistreatment affecting healthcare engagement, predominantly Black patients have been disadvantaged in social, financial, and educational attainment that impacts their knowledge of the need for influenza vaccination.[21] Multiple surveys have found that Black patients had less knowledge of the recommendation for an influenza vaccination.[25,26] In a survey of veterans in 2003−2004, White patients were less likely to need a reminder to get their influenza vaccination than Black and American Indian/Alaska Native patients who relied on their healthcare team to remind them.[25] Therefore, because of the long history of racism in health care and the differential education of the need for vaccination by racial group, there may be pernicious and complex factors that prevent certain racial groups from receiving guideline-directed preventive care even in a universal healthcare system.

More recent findings in COVID-19 vaccination contrast with these data and may be indicators of progress. In a national sample of veterans' uptake of the first COVID-19 vaccination at the VHA, Black veterans had higher odds of vaccination than White patients.[17] Rural Black, urban Black, and urban Hispanic veterans all were more likely to be vaccinated than their White counterparts. The combination of this study's influenza data (just prior to the pandemic) and more recent COVID-19 vaccination studies suggest that more recent vaccination strategies reduce pre-existing vaccination disparities for those who identify as Black. The authors state that the COVID-19 vaccination strategy at the VHA hinged on leveraging the connections between veterans and their primary care providers. Using the VHA EHR, patients who had not obtained COVID-19 vaccination received communications regarding the vaccine. Thus, utilizing trusted relationships that veterans have with their primary care providers may be among the strategies to improve vaccination and reduce differential receipt of other vaccines such as influenza. Notably, the odds of COVID-19 vaccination for American Indian/Alaska Native patients were still lower than the odds of vaccination of White patients, so this vaccination strategy does not necessarily reduce disparities for all groups equally.

This study also found that rural veterans were less likely to receive influenza vaccination than urban veterans. Veterans in geographic regions outside the North Atlantic also had lower odds of vaccination. Rural veterans are known to have more difficulty with access to care than urban veterans.[27] The VHA expanded outpatient care to veterans through the creation of Community-Based Outpatient Clinics, and about 39% of these clinics are in rural areas. Leveraging the care received at Community-Based Outpatient Clinics may improve vaccination of rural veterans because these clinics are physically closer to a rural veteran's home. In addition, the VHA has a large home-based primary care practice that serves over 50,000 veterans, with the majority of practices in rural areas.[28] Home-based primary care practices have also been shown to have much higher influenza rates than the general population both in and outside the VHA, making it a potentially powerful tool to promote and support vaccination efforts for rural veterans.[29,30] It is notable that the odds of vaccination for rural Black veterans were not markedly worse than for urban Black veterans. This finding differs from research outside of the VHA where rural Black patients had lower odds of vaccination than urban Black patients,[10] suggesting that care from the VHA may provide better access to rural patients than the healthcare system outside of VHA. It may also be possible that urbanicity may be a factor associated with lower vaccination for Black veterans.

This study has multiple implications for care within and outside the VHA. First, 51.4% of veterans did not receive the influenza vaccination during the year of study. Therefore, more can be done to improve influenza vaccination for all veterans. Second, Black and American Indian/Alaska Native race was associated with lower odds of influenza vaccination. A strategy similar to the COVID-19 vaccination approach that utilized the relationship patients had with their primary care providers may be beneficial in reducing this disparity for Black patients, but this may not carry benefit for American Indian/Alaska Native patients. Third, patients who live in rural settings are less likely to be vaccinated, although rurality did modify the disparity between American Indian/Alaska Native and White patients. Leveraging VHA programs, including Community-Based Outpatient Clinics, home-based primary care, and care in the community for those living in rural communities, may assist with improving these rates. Fourth, the findings point to the possible influence of structural racism on influenza vaccination of Black and American Indian/Alaska Native veterans. Given these findings, more specific questions and research approaches (e.g., qualitative, mixed methods) may be needed that allow the understanding of why these groups are less likely to receive vaccination. Such research should consider environmental, system, and provider—patient factors in the VHA system.

Limitations

This study has several limitations. Vaccination receipt outside of the VHA is incompletely documented in the EHR, so the study results may underestimate true vaccination receipt. Influenza vaccination documentation in the EHR has been found to vary in other populations from 83.8% to 87%.[31,32] The authors would expect a similar percentage or higher at the VHA because most veterans utilize the VHA primarily for their care.[33] Veterans who visited the VHA only outside of influenza season may have not self-reported vaccines obtained outside the VHA. However, the prevalence of vaccination for those who visited the VHA during influenza season versus those who visited outside influenza season was very similar (data not otherwise shown), so this is likely minimal. Owing to the use of VHA administrative data, this study used self-identified race and ethnicity, which is only one means of capturing the evolving and complex identities that people may carry.[34] Some racial groups reflect the combination of diverse groups (e.g., multiple races and unknown race), and results should be interpreted with caution. Finally, this study only analyzed data for veterans, so results may not be generalizable to other populations.

The strengths of this study include its large, national sample size and VHA's single, integrated health system access for all veterans. This study provides a look at how race, ethnicity, sex, and rurality impact vaccination, apart from the influence of barriers to healthcare access. This study also explores the variation in receipt of vaccine across different subgroups within race and ethnicity to understand gaps in preventive care.

CONCLUSIONS

During the 2019—2020 influenza season, Black and American Indian/Alaska Native race veterans and veterans living in rural areas were less likely to receive influenza vaccination. Stratified comparisons showed that disparities are not experienced evenly by rural versus urban residence nor between male and female veterans. Strategies that reduced health disparities in COVID-19 vaccination at the VHA may be useful to mitigate disparities in annual influenza vaccination. Specific subgroups experiencing more severe gaps in care may benefit from tailored prevention approaches (e.g., Black urban veterans, American Indian/Alaska Native male veterans).

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CREDIT AUTHOR STATEMENT

Alissa S. Chen: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. Melissa M. Farmer: Conceptualization, Methodology, Writing – review & editing. Ling Han: Methodology, Formal analysis, Writing – review & editing. Tessa Runels: Methodology, Formal analysis, Data curation, Writing – review & editing. Brett Bade: Conceptualization, Writing – review & editing. Kristina Crothers: Conceptualization, Writing – review & editing. Lori A. Bastian: Conceptualization, Writing – review & editing, Funding acquisition. Isabel S. Bazan: Conceptualization, Writing – review & editing. Bevanne A. Bean-Mayberry: Conceptualization, Writing – review & editing. Cynthia A. Brandt: Conceptualization, Data curation, Writing – review & editing. Kathleen M. Akgün: Conceptualization, Methodology, Writing – review & editing, Supervision.

SUPPLEMENTARY MATERIALS

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