


# A Review of Racial and Ethnic Disparities in Immunizations for Elderly Adults

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## Abstract

Vaccine preventable diseases are responsible for a substantial degree of morbidity in the United States as over 18 million annual cases of vaccine preventable disease occur in the U.S. annually. The morbidity due to vaccine preventable disease is disproportionately borne by adults as over 99% of the deaths due to vaccine preventable diseases occur within adults, and national data indicates that there are racial disparities in the receipt of vaccines intended for elderly adults. A literature review was conducted by using the PubMed database to identify research articles that contained information on the vaccination rates among minority populations for selected vaccines intended for use in elderly populations including those for herpes zoster, tetanus, diphtheria, pertussis, hepatitis A, and hepatitis B. A total of 22 articles were identified, 8 of which focused on tetanus related vaccines, 2 of which focused on hepatitis related vaccines, and 12 of which focused on herpes zoster. The findings indicate that the magnitude of the disparity for the receipt of tetanus and herpes related vaccines is not decreasing over time. Elderly patients having a low awareness of vaccines and suboptimal knowledge for when or if they should receive specific vaccines remains a key contributor to suboptimal vaccination rates. There is an urgent need for more intervention-based studies to enhance the uptake of vaccines within elderly populations, particularly among ethnic minorities where culturally sensitive and tailored messages may be of use.

## Keywords

access to care, community health, geriatrics, health literacy, health promotion, pharmacy, efficiency, focus groups

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## Introduction

Vaccines play an invaluable role in preventing morbidity and mortality associated with infectious disease. Vaccination within the United States saves 12 000 lives and prevents 20 million cases of disease annually.<sup>1</sup> While vaccination rates among children routinely exceed 90%, adults have suboptimal vaccination rates and incur more morbidity and mortality from vaccine preventable diseases.<sup>2</sup> Overall, 99% of deaths from vaccine preventable diseases occur within adults,<sup>2</sup> and over 18 million cases of these diseases occur in adults each year with an economic burden of \$9 billion.<sup>3</sup> The most common vaccine preventable disease is influenza, which typically affects more than 16 million adults in the United States annually.<sup>3</sup> Although the annual incidence of influenza is slightly greater among adults younger than 50,<sup>4</sup>

adults over age 50 have far higher mortality rates due to influenza.<sup>5</sup> Non-influenza vaccine preventable diseases such as pneumonia and herpes zoster occur more frequently in elderly adults at least 50 years old and are more likely to lead to fatality in older adults.<sup>6</sup>

Racial and ethnic minorities are disproportionately affected by vaccine preventable diseases. Blacks are nearly

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twice as likely as whites to be hospitalized for influenza,<sup>7,8</sup> and Hispanics are also more likely to be hospitalized for influenza.<sup>7</sup> Blacks and Native Americans are also more likely to be hospitalized for pneumonia compared to whites.<sup>9</sup> Moreover, Blacks hospitalized for pneumonia are more likely to die within the hospital and have a longer length of stay compared to Whites.<sup>10</sup> Numerous social, economic, and geographical determinants contribute to the disproportionate burden of vaccine preventable diseases borne by minority populations. Individuals living in impoverished, crowded conditions, and households headed by females are more likely to be hospitalized for influenza.<sup>7,8</sup> Living in a socioeconomically deprived neighborhood is also a risk factor for higher mortality among those hospitalized for pneumonia.<sup>11</sup> Geographic areas with higher proportions of Blacks such as the Southeastern United States have higher pneumonia related hospitalization and mortality rates in comparison to regions such as the West where there are fewer Blacks.<sup>9,12</sup>

A substantial amount of research has focused on the persistent racial and ethnic disparities in influenza and pneumococcal vaccination rates with most of the evidence focused on African Americans.<sup>13</sup> Among elderly African Americans, prominent reasons for not receiving the influenza vaccine include not having a regular physician, lower income, and lack of private insurance coverage.<sup>14</sup> African Americans also mistrust institutions and systems involved in vaccine development such as pharmaceutical companies and the federal government.<sup>15</sup> Social norms play a role in the decreased uptake of vaccines among African Americans wherein they are less likely to believe their friends and loved ones want them to receive a vaccination.<sup>16</sup> While individuals living in the Southeast United States and metropolitan regions may be less likely to receive the influenza vaccine in general,<sup>17</sup> there are notable differences within regions regarding the receipt of the vaccine among different ethnic groups. For example, within New York City and metropolitan Los Angeles, Blacks are less likely to receive the influenza vaccine in comparison to Hispanics, Chinese, Korean, Filipino, and Vietnamese individuals, although there were no differences of note between these populations with receipt of the pneumococcal vaccine.<sup>18</sup>

In a fashion similar to Blacks, income and lack of private insurance are associated with vaccine related disparities among Hispanics, yet geographical region plays a larger role.<sup>14</sup> This is illustrated by a study in metropolitan Chicago that included Mexican and Puerto Rican respondents that found the percentage of those receiving the pneumococcal vaccine among those at least 65 varied from 18% to 91% based on location.<sup>19</sup> Emerging evidence examines influenza vaccine uptake among groups other than African Americans and Hispanics. For example Arab Americans in California were 10% less likely to receive the influenza vaccine in comparison to whites, yet there were no

appreciable differences after adjusting for health behaviors, sociodemographic variables and acculturation status.<sup>20</sup> National level data indicate that some Asian American subgroups such as Asian Indians and select other Asian groups may actually have higher influenza vaccination rates in comparison to Whites in some instances.<sup>21</sup> Collectively the data indicates that Blacks and Hispanics are the most vulnerable racial and ethnic subgroups with regards to influenza and pneumococcal related vaccine disparities.

There are also racial and ethnic disparities with regards to other vaccines recommended for elderly adults in the U.S such as the (tetanus and diphtheria with acellular pertussis [Tdap], hepatitis A (hep A), hepatitis B (hep B), and herpes zoster vaccines.<sup>22</sup> Ameliorating these disparities would be quite beneficial, as achieving health equity for herpes zoster related vaccination rates in Blacks that are similar to those seen within whites would prevent over 34 000 cases of herpes zoster among the current cohort of elderly Blacks while averting over \$180 million in economic costs.<sup>23</sup> Although the reasons surrounding the disparities seen between majority populations and Blacks regarding influenza and pneumococcal vaccine related disparities have been well studied,<sup>14,24,25,26</sup> the mechanisms underlying the persistent disparities seen among elderly minority and majority populations for other adult vaccinations are less understood. Accordingly, this review was undertaken to evaluate the trends seen in immunization related disparities for elderly adults in the hepatitis, herpes zoster, and Tdap vaccines and elucidate the reasons contributing to these disparities.

## Methods

### Search Strategy

A predetermined protocol was used to search for and identify relevant articles by using the PubMed database. The search strategy was designed to find articles that contained information on minorities and had some means of assessing their vaccination rates and their knowledge, attitudes, and beliefs toward receiving these vaccines. The search was also conducted in a manner to elicit information regarding vaccination among adults within the United States. Further information regarding the search strategy is available in Table 1.

### Inclusion/Exclusion Criteria

The search was restricted to articles written in the English language. Articles were excluded if they did not have any data documenting immunization rates for Tdap, hepatitis A, hepatitis B, or herpes zoster vaccines in a minority population. In order to be included, studies had to have information presented on vaccination rates for elderly minority populations at least 60 years old.

**Table 1.** Description of Search Terms.

S1	“Healthcare disparities” [Mesh] OR “African Americans” [Mesh] OR “Hispanic Americans” [Mesh] OR “Minority groups” [Mesh] OR “Ethnic groups” [Mesh] OR “Minority health” [Mesh] OR “Continental population groups” [Mesh] OR “Health promotion” [Mesh] OR “Health knowledge, attitudes, practice” [Mesh] OR “Health surveys” [Mesh] OR “Health care surveys” [Mesh]
S2	“Mass vaccination” [Mesh] OR “Immunization” [Mesh] OR “Vaccination” [Mesh]
S3	“Middle aged” [Mesh] OR “Aged” [Mesh] OR “Adult” [Mesh]
S4	United States
S5	S1 and S2 and S3 and S4

### Selection of Studies

The titles and abstracts of studies were screened to determine if they were in conformity with the predefined inclusion and exclusion criteria. The full text of articles was retrieved in cases where there was some degree of uncertainty regarding the relevance of an article. Reviewers also scanned the reference section of relevant articles identified during searches. Information that was obtained from the articles was placed into a Microsoft Excel file for data abstraction. The data that was placed in the Excel sheet contained information on the inclusion and exclusion criteria, the study population, location, and the primary findings of the study.

## Results

### Tetanus and TDAP Related Studies

As seen in Table 2, there were 8 studies that documented immunization rates amongst minorities for TDAP from 2000 to 2016.<sup>22,27,28-33</sup> All of these were observational studies. Many of the studies utilized data from the National Health Interview Survey (NHIS) which is conducted on a yearly basis by the CDC to gather nationally representative data about the health status of the United States population. These studies generally demonstrated that Blacks, Hispanics and in many cases Asians received tetanus related vaccines at significantly lower rates than whites.<sup>22,28-30,32,33</sup> Lu et al<sup>27</sup> utilized data from the 2012 NHIS survey to analyze the proportion of minority patients that had received the pertussis vaccine during the previous decade. In unadjusted analysis, whites were found to have higher immunization rates than both Blacks and Hispanics. However in unadjusted analysis, the immunization rate for whites (56.4%) was only significantly higher than that of Blacks (48.7%).

There were 2 studies that explored factors associated with receipt of vaccines containing tetanus. While using national level data, Singleton et al<sup>32</sup> found that Asian/Pacific Islanders and Hispanics at least 65 were less likely to receive the tetanus vaccine compared to Non-Hispanic whites. The study findings also indicated that lower education and income levels were associated with being less likely to receive the tetanus vaccine. A study conducted in

San Francisco demonstrated that Hispanics, Blacks, and Asians at least 65 were actually more likely to receive the tetanus vaccine compared to Whites.<sup>31</sup> Moreover, elderly adults who saw a primary care physician were more likely to receive the vaccine compared to those only visiting a specialty clinic.

### Herpes Zoster Vaccine

Several studies have been conducted that document the immunization rates of herpes zoster in minorities. The majority of these studies employ a cross sectional study design and utilize data from the NHIS.<sup>22,27,28-30,33-35</sup> These studies conclusively demonstrate that Whites consistently have higher immunization rates than Blacks and Hispanics in those at least 60. Recent data indicates that the immunization rate for whites at least age 60 is 32.0% which is significantly higher than the rates seen in Blacks (11.6%) and Hispanics (14.6%) in 2014. These data demonstrate how much the immunization rates have increased since 2008. At that time less than 8% of whites had received the vaccine and less than 3% of Blacks and Hispanics had received the vaccine.<sup>35</sup>

Several of the studies examining disparities in herpes zoster vaccination rates examined additional factors beyond race and ethnicity that may influence immunization rates.<sup>27,34-39</sup> In many cases, after adjusting for gender, marital status, education, employment, insurance status, and age whites were still more likely to be vaccinated than other groups.<sup>27,35,37,38</sup> However, there were some cases where whites were not more likely to be vaccinated after adjusting for other factors.<sup>34,36,39</sup> Data from these studies suggest that the absolute differences observed in immunization rates between whites and minorities may at least in part be explained by knowledge of shingles, awareness of recommendations to receive the vaccine, and receipt of the influenza vaccine.

Quite a few studies demonstrated that Asians also have lower rates of the shingles vaccine than whites as well.<sup>22,28-30,33</sup> There were also analyses that demonstrated that foreign born individuals had lower immunization rates than whites, but these results were not significant after accounting for other factors.<sup>34</sup>

**Table 2. Findings Related to Disparities in Vaccinations Among Adults at Least 60 Years Old.**

Author	Study design	Setting	Racial/ethnic groups included	Proportion of majority populations vaccinated	Proportion of minority populations vaccinated	Additional findings/reasons noted for disparities or not receiving vaccine
<b>Tetanus/Tdap related findings</b>						
Williams et al. <sup>22</sup>	Cross-sectional, NHIS data from 2014	National survey	Whites, Blacks, Hispanics, Asians at least 65 years old	TDaP last 9 years 15.7% (14.1%-17.6%) Tetanus vaccine last 10 years 60.6% (58.9%-62.3%)	TDaP last 9 years Blacks 5.0% (3.6%-7.0%) Hispanics 6.6% (4.5%-9.5%) Asians 15.2% (10.2%-22.1%) Tetanus vaccine last 10 years Blacks 43.1% (39.4%-47.0%) Hispanics 49.1% (44.7%-53.6%) Asians 46.6% (40.2%-53.1%) Tetanus vaccine last 10 years Blacks 44.6% (40.8%-48.4%) Hispanics 44.8% (40.1%-49.6%) Asians 45.8% (39.5%-52.2%)	Authors state there is a lack of awareness regarding the importance and need for vaccination amongst adult populations. Wider ethnic and racial gap in coverage seen in Tdap vaccination. There are multiple missed opportunities and routine assessment needs to be done for adults to make them aware of their vaccination needs.
Lu <sup>27</sup>	Cross-sectional NHIS data from 2012	National survey	Blacks, Hispanics, Asians at least 65 years old	Tetanus vaccine last 10 years 57.7% (55.9%-59.5%)	Tetanus vaccine last 10 years Blacks 44.6% (40.8%-48.4%) Hispanics 44.8% (40.1%-49.6%) Asians 45.8% (39.5%-52.2%)	Populations that have health insurance had an improved vaccination outcome.
Williams et al. <sup>28</sup>	Cross-sectional, NHIS data from 2013	National survey	Blacks, Hispanics, Asians at least 65 years old	TDaP last 8 years 13.0% (11.6%-14.5%) Tetanus vaccine last 10 years 59.6% (57.9-61.3%)	TDaP last 8 years Blacks 6.5% (4.1%-10.2%); Hispanics 7.3% (4.7%-11.2%) Asians 11.1% (6.5%-18.2%) Tetanus vaccine last 10 years Blacks 56.4% (54.9-57.8%) Hispanic 45.3% (40.7%-50.0%) Asian 42.8% (36.3%-49.5%)	There was higher vaccination coverage in adults that have health insurance coverage and better health care access such as having a regular provider.
Williams et al. <sup>23</sup>	Cross-sectional NHIS data from 2012	National survey	Blacks, Hispanics, Asians	Tetanus vaccine last 10 years 57.7% (55.9%-59.5%)	Tetanus vaccine last 10 years Blacks 44.6% (40.8%-48.4%) Hispanic 44.8% (40.1%-49.6%) Asian 45.8% (39.5%-52.2%)	More efforts are needed to education those eligible for vaccines and efforts are needed to enhance vaccination services in medical practices including reminder systems and removal of administrative and monetary hindrances to vaccination in clinical offices
CDC <sup>29</sup>	Cross-sectional NHIS data from 2011	National survey	Blacks, Hispanics, Asians	Tetanus vaccine last 10 years 57.0% (55.2%-58.7%)	Tetanus vaccine last 10 years Blacks 44.4% (40.0%-48.8%) Hispanic 45.1% (40.7%-49.6%) Asian 37.9% (31.1%-45.2%)	Health care providers in general received Tdap vaccines more than non-Health care providers. However, authors claim disparities in health care providers, where White health care providers had higher Tdap coverage when compared to black Health care providers.
CDC <sup>30</sup>	Cross-sectional, NHIS data from 2010	National survey	Blacks, Hispanics, Asians	Tetanus vaccine last 10 years 56.3% (54.2%-58.5%)	Tetanus vaccine last 10 years Blacks 39.7% (35.6%-44.0%) Hispanic 43.8% (39.1%-48.6%) Asian 36.5% (29.2%-44.5%)	About 58.9% of respondents from a number of 7088 respondents who received tetanus vaccination claimed they were not informed of the vaccination type they received. Non-Hispanic White health care personnel had higher Tdap coverage (21.5%), while non-Hispanic black providers (14%) and Hispanic providers (13.8%). Authors comment on a need for increased access to vaccination services; in workplaces, commercial establishments and also using reminder-recall systems.

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**Table 2. (continued)**

Author	Study design	Setting	Racial/ethnic groups included	Proportion of majority populations vaccinated	Proportion of minority populations vaccinated	Additional findings/reasons noted for disparities or not receiving vaccine
<b>Tetanus/TDAP related findings</b>						
Daniels <sup>31</sup>	Cross sectional analysis of data from 1997 to 2000 at specialty and primary care based clinics at the University of San Francisco	Medical record system (STOR) at the UCSF medical centers	Whites, Blacks, Hispanics, Asians, Russians	Tetanus vaccine last 10 years 39% for men and 47% for women	Tetanus vaccine last 10 years Blacks: 57% for men and 59% for women; Hispanics: 56% for men and 66% for women; Asian: 62% for men and 63% for women Russian: 35% for men and 30% for women	Patients that were aged 50 and older and that were seen in primary care settings and patients that are seen in both primary care and specialty practices are more likely to get adequate Tetanus vaccination than patients that were only seen in specialty practices.
Singleton <sup>32</sup>	Cross-sectional; 1995 NHIS data, and BRFS Data from 1993, 1995, and 1997	State-based BRFS & National survey	Whites, Blacks, Hispanics	1995 NHIS data Tetanus vaccine previous 10 years 40.8% ± 2.2%	Blacks 1995 NHIS data 36.9% ± 6.1% Hispanics 1995 NHIS data 28.3% ± 7.1% Asian/Pacific Islander 25.1% ± 13.7%	Adults that had frequent encounters with health-care providers have a higher likelihood of having increased vaccination opportunities. Access to care, patient attitude toward vaccinations, public health adult vaccination programs and physician practice patten from state to state are potential reasons for disparities.
<b>Hepatitis related findings</b>						
Xiong <sup>40</sup>	Cross-sectional analysis of data gathered from surveying adult Laotian immigrants recently immigrant to Minnesota	Minneapolis-Saint Paul, Minnesota	167 Adult Laotian immigrants of which 25 were at least 66 years old	N/A	Among those at least 66 years old, 14.3% received the HBV vaccine	Over all age groups, Not being able to afford the vaccine, don't know where to go to get vaccinated, and limited English were the most frequent responses for barriers to vaccination. There is a need for culturally appropriate health intervention to improve HBV vaccination and screening in this population
Hsur <sup>41</sup>	Quasi-Experimental Pre-Post study amongst Asian Americans in Montgomery County Maryland	Montgomery County, Maryland	807 Asian residents of Montgomery County, MD and 98 of these were at least 66 years old, Asian Indian, Cambodian	N/A	Among those at least 65 years old, 42.9% received the vaccine	Knowledge regarding Hepatitis B and the Hepatitis B vaccination improved after administration of a culturally appropriate educational intervention.
<b>Herpes zoster related findings</b>						
Williams et al. <sup>22</sup>	Cross-sectional, NHIS data from 2014	National survey	Whites, Blacks, Hispanics, Asians	At least 60, 32.0% (30.5%-33.5%)	Blacks at least 60, 11.6% (9.6%-13.8%) Blacks at least 65, 13.5% (11.0%-16.4%) Hispanics at least 60, 14.6% (12.2%-17.5%) Hispanics at least 65, 16.3% (13.2%-20.1%) Asians at least 60, 16.5% (12.9%-20.8%) Asians at least 65, 20.7% (16.3%-26.1%) At least 65, 35.0% (33.3%-36.9%)	Overall, vaccination coverage was lower among adults without health insurance compared with those with health insurance. For influenza, pneumococcal, Tdap, herpes zoster, and HPV vaccination, coverage was 2 to 5 times higher among those with health insurance compared with those without insurance (Table 6). Vaccination coverage among U.S.-born respondents was significantly higher than that of foreign-born respondents Many factors contribute to low adult vaccination rates, including limited awareness among the public about adult vaccinations, vaccine needs assessment often not routinely included in adult patient care, lack of vaccine requirements for adults, complexities in how adult vaccinations are paid for by private and public insurers, the financial risks for providers to stock vaccines and provide vaccination services, limited funding for programs to vaccinate uninsured adults, and acute medical care taking precedence over preventive services.

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Table 2. (continued)

Author	Study design	Setting	Racial/ethnic groups included	Proportion of majority populations vaccinated	Proportion of minority populations vaccinated	Additional findings/reasons noted for disparities or not receiving vaccine
Herpes zoster related findings						
Lu <sup>27</sup>	Cross-sectional, NHIS data from 2012	National survey	Whites, Blacks, Hispanics, Asians	At least 60, 22.8% (21.5%-24.0%) unadjusted At least 60 Adjusted analysis 21.4% (20.2%-22.7%)	All measurements in ethnic groups for those at least 60 Black 8.8% (6.9%-11.2%) Hispanic 8.7% (6.6%-11.4%) Asian 16.9% (13.2%-21.5%) Blacks adjusted 11.4% (8.9%-14.5%) Hispanics adjusted 14.4% (10.6%-19.3%) Asians adjusted 21.0% (15.7%-27.5%)	Adjustments made for gender, marital status, education, employment, health insurance, and other covariates  In multivariate analysis, the odds being vaccinated for blacks (OR: 0.53) and Hispanics (OR: 0.67) was significantly lower than the odds for whites to be vaccinated Reasons for racial disparities: differences in attitudes toward vaccination and preventive care, propensity to seek and accept vaccination, variations in the likelihood that providers recommend vaccination, differences in quality of care received by racial and ethnic populations, and differences in concerns about vaccination, including vaccine safety. Additionally, non-Hispanic black and Hispanic adults are more likely to be uninsured. Our study showed that health insurance had a positive impact on adult vaccination coverage. Studies have shown that awareness of shingles, and HPV vaccines was significantly lower among racial and ethnic minorities compared with non-Hispanic whites
Williams et al. <sup>28</sup>	Cross-sectional, NHIS data from 2013	National survey	Whites, Blacks, Hispanics, Asians	Adjustments made for gender, marital status, education, employment, health insurance and other covariates At least 60, 27.4% (25.8%-29.0%)	Blacks at least 60, 10.7% (8.5%-13.3%) Hispanics at least 60, 9.5% (7.4%-12.1%)  Asians at least 60, 22.6% (18.2%-27.7%)	Shortages of herpes zoster vaccine that might have contributed to lower coverage during the first years after licensure appear to have been resolved in 2012. The cost of herpes zoster vaccine and billing challenges might pose barriers for some patients and providers. Awareness of the need for vaccines for adults is low among the general population, and adult patients largely rely on health care provider recommendations for vaccination
Williams et al. <sup>23</sup>	Cross-sectional, NHIS data from 2012	National survey	Whites, Blacks, Hispanics, Asians	At least 60, 22.8% (21.5%-24.0%)	Blacks at least 60, 8.8% (6.9%-11.2%) Hispanics at least 60, 8.7% (6.6%-11.4%) Asians at least 60, 16.9% (13.2%-21.5%)	

(continued)



**Table 2. (continued)**

Author	Study design	Setting	Racial/ethnic groups included	Proportion of majority populations vaccinated	Proportion of minority populations vaccinated	Additional findings/reasons noted for disparities or not receiving vaccine
<b>Herpes zoster related findings</b>						
Teeter <sup>36</sup>	Cross-sectional, survey administered to patients at 51 pharmacies in Alabama and Florida	Community pharmacies in Alabama and Florida	White, Non-white	At least 60, 28.7%	Non-white at least 60, 14.3%	In unadjusted analysis, whites were significantly more likely to have been vaccinated (OR 2.4); After adjusting for age, Medicare part D coverage, knowledge of shingles, awareness of vaccine recommendation, and recommendation of the vaccine, whites were no longer significantly more likely to be vaccinated (OR: 1.51); Among those that had not been vaccinated, the most common reasons for patients not receiving the vaccine were that they forgot about it or did not know it was needed in the first place  The most frequently provided reasons for being unvaccinated were "haven't gotten around to it/forgot" and "didn't know it was needed"  Lack of patient education, recommendation from healthcare provider
Lu <sup>34</sup>	Cross-sectional, NHIS data from 2012	National survey	Whites, Blacks, Hispanics, Asians, Foreign Born	At least 60, 22.9% (21.6%-24.2%)	U.S. born blacks at least 60, 8.8% (6.8%-11.2%) U.S. born Hispanics at least 60, 16.0% (11.7%-21.7%) Foreign born whites at least 60, 20.1% (14.6%-27.0%)	Foreign born individuals from Mexico, Central America, the Caribbean Islands and Asia all had lower vaccination rates than U.S. born individuals  After adjusting for age, gender marital status, education, and other covariates foreign born individuals had a lower likelihood of being vaccinated (OR: 0.8) but it was not significant  Limited-English proficiency has been reported to be an impediment to accessing health services and health promotion programs  The percentage of uninsured was higher among non-U.S. citizens, recent immigrants, and those with poor/fair English proficiency. Our study findings of lower vaccination coverage for non-citizens, recent immigrants, and those interviewed in a language other than English are not unexpected. These characteristics are closely associated with lower access to care.  Lack of awareness within those populations of U.S. adult immunization recommendations  Limited access to vaccine services
CDC <sup>29</sup>	Cross-sectional, NHIS data from 2011	National survey	Whites, Blacks, Hispanics, Asians	At least 60, 17.6% (16.4%-18.9%)	Blacks at least 60, 7.9% (6.2%-9.9%) Hispanic 8.0% (6.2%-10.2%) Asian 14.0% (10.4%-18.6%)	Presence of financial and administrative barriers to vaccination for all populations After adjusting for age, gender, income, and comorbid conditions, blacks had significantly lower likelihood of developing shingles during the study (Hazard Ratio =0.55)
Langan <sup>37</sup>	Retrospective Cohort using data from Medicare beneficiaries from January 2007 to December 2009	Administrative claims program (Medicare)	Whites, Blacks	At least 65, 2.4%	Blacks at least 65, 0.3%	

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Table 2. (continued)

Author	Study design	Setting	Racial/ethnic groups included	Proportion of majority populations vaccinated	Proportion of minority populations vaccinated	Additional findings/reasons noted for disparities or not receiving vaccine
Herpes zoster related findings						
Joon Lee <sup>38</sup>	Cross-sectional analysis of data from 3 university affiliated clinics in the southeastern part of the United States in 2010	An academic medical center in eastern North Carolina.	Whites, Blacks	At least 60, 14%	At least 60, 2%	After adjusting for age, education, history of shingles, witnessing someone with shingles, clinic site, and influenza vaccine status, whites (OR: 3.4) were significantly more likely to have been vaccinated compared to blacks; the reasons cited most often for obtaining the vaccine amongst those receiving it was it was recommended by a health care provider (48%) or some type of media or ads (32%) The primary reason cited for not getting the vaccine was not having heard about it (70%) Witnessing someone with shingles was associated with a higher rate HZ vaccination compared with people who had never seen others with shingles Patients with $\geq 12$ years of education were 4.6 times more likely to report receiving HZ vaccination Personal history of shingles were more likely to be interested in getting the vaccine Lack of awareness of availability of the vaccine, no recommendation from physician, do not believe they will develop shingles
CDC <sup>30</sup>	Cross-sectional, NHIS data from 2010	National survey	Whites, Blacks, Hispanics, Asians	At least 60, 32.0% (30.5%-33.5%) At least 65, 35.0% (33.3%-36.9%)	Blacks at least 60, 4.5% (3.4%-5.9%) Hispanics at least 60, 4.4% (3.2%-6.2%) Asians at least 60, 12.7% (9.4%-17.0%)	
Lu <sup>35</sup>	Cross-sectional, NHIS data from 2008	National survey	Whites, Blacks, Hispanics	At least 60, 7.6% (6.7%-8.7%)	Blacks at least 60, 2.5% (1.5%-4.1%) Hispanics at least 60, 2.1% (1.2%-3.7%)	After adjusting for several variables including age, marital status, education, employment status, poverty level, region and physician contacts, the proportion of blacks vaccinated (3.8%) was significantly lower than the proportion of whites vaccinated (7.5%)
Lu <sup>39</sup>	Cross sectional, National Immunization Survey data from 2007	National survey	Whites, Blacks, Hispanics	At least 60, 2.0% (1.2%-3.2%)	Blacks at least 60, 2.4% (1.3%-4.6%)	After adjusting for age, gender, education, marital status, insurance, and influenza vaccine status, the odds of blacks receiving the vaccine were 1.7 times greater than the odds for whites to receive the vaccine but this was not a significant difference; Hispanics (OR: 0.8) were less likely to receive the vaccine compared to whites but this difference was not significant; among those that did not receive the vaccine, most people said they would get the vaccine if their physician recommended it, and most individuals had not heard of the vaccine Key reasons reported for not accepting HZ vaccine included "vaccination not needed," "not at risk," and "don't trust in doctors or medicine" Additional reasons cited Lack of patient awareness Lack of physician recommendation



One of the most consistent reasons cited for not being vaccinated for herpes zoster among seniors was a lack of awareness of the vaccine or the fact that the vaccine is recommended for them.<sup>36,38,39</sup> African Americans were less likely to be aware of the vaccine when compared to Whites.<sup>38,39</sup> One reason given for lack of awareness is the lack of recommendations from health care providers, although the majority of the elderly state that if a health care provider had recommended the vaccine, they would have accepted the vaccine.<sup>38,39</sup>

### *Hepatitis A and Hepatitis B*

Two studies evaluated vaccination rates for hepatitis B vaccines in elderly minority patients. Xiong et al<sup>40</sup> conducted an observational study of Laotian immigrants in Minnesota. Out of a cohort of 125 patients, a total of 25 were at least 66 years old, and 2 of these patients (8%) had received the hepatitis B vaccine. The majority of respondents from all ages indicated that they had no knowledge of the vaccine, and the most common barriers to receiving the vaccine were affordability and not knowing where to go to get it. Hsu et al<sup>41</sup> conducted a quasi-experimental pre-post study evaluating the use and knowledge of hepatitis B vaccine in Asian populations of Montgomery County, Maryland. Administration of a culturally appropriate educational intervention to the patients increased their knowledge of hepatitis B and the hepatitis B vaccine.

### **Discussion**

In this review, African Americans, Hispanics, and Asians were consistently demonstrated to have lower immunization rates in comparison to whites for vaccines indicated for elderly adults, many times after adjusting for other important factors. There were some factors which contributed to differences in receipt of the vaccines including senior's awareness of the vaccines,<sup>36,38,39</sup> health care provider recommendations,<sup>36,39,42</sup> and interaction with primary care providers.<sup>31</sup> There were some instances where financial payments presented an obstacle,<sup>40</sup> but this was not a universal occurrence, most likely due to the vaccines being covered by Medicare insurance.

One of the most concerning findings from this study is the realization that the disparities in immunization rates among elderly adults have not decreased in an appreciable manner over time. Recent data indicate there was a 17.5% gap in the national immunization rates between elderly Whites and Blacks for the tetanus vaccine,<sup>22</sup> which was an increase from a gap of less than 5% in national data abstracted from 1995.<sup>32</sup> Likewise, when comparing Blacks and Whites at least 60 years old, there was a disparity of about 5% in herpes zoster immunization rates in 2008,<sup>21</sup> however the disparity had grown to over 20% by 2014.<sup>22</sup>

Few studies incorporated an intervention to reduce the disparities seen in immunization rates, especially with

regards to hepatitis and TDAP related vaccines. However, there is emerging evidence of interventions that have helped to increase vaccination rates for herpes zoster. Many of these studies have been conducted in community pharmacy settings. One study assessed the impact of "personal selling" by community pharmacists for a herpes zoster vaccine wherein the pharmacist's actively promoted the vaccine and sent personalized letters to patients and demonstrated that this intervention had a significant impact on the patient's stated intention to receive the vaccine.<sup>42</sup> Another community pharmacy made use of automated telephone messaging to promote uptake of the and found this strategy significantly increased uptake of herpes zoster vaccines.<sup>43</sup> Another community pharmacy-oriented intervention utilized a personalized letter sent to patients, an informational flyer dispensed with the prescriptions, and a 1-time newspaper advertisement during an intervention month as strategies to increase herpes zoster vaccination rates.<sup>44</sup> The procedures adopted in these community pharmacy settings could conceivably be implemented with similar success in physician's offices, especially those involved in primary care. However, one glaring limitation with these studies is the lack of data regarding the effectiveness of these interventions within ethnic minorities as this information was lacking.

This study has some limitations. Due to the cross-sectional nature of most of the studies, causal inferences are limited. In addition, although this study assumes that African Americans may be a homogenous group, it may in fact be true that they are a heterogenous group with a growing population of first or second generation immigrants. Moreover, although the Hispanics have been treated as a homogenous group in these studies, there are also likely differences in vaccine preferences within this group as well. In addition, there is limited data on the vaccination rates for the vaccines following the first vaccine in a series. In addition, this search was limited to articles conducted in the English language, so this may exclude potentially useful information written in other languages such as Spanish.

Despite the limitations, the data from this study suggest that disparities in immunizations among elderly adults are not decreasing over time. However there are some strategies that could be used to increase vaccination rates among elderly minorities by increasing awareness of vaccines and adopting active strategies to promote the vaccines. Primary care-based physicians are likely to play an integral role in reducing immunization disparities in elderly adults, yet implementation of culturally sensitive messages tailored toward minority populations is indispensable in ameliorating these disparities.

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