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Historic Vaccination Patterns Provide Insights for Covid-19 Vaccine Rollout

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MARCH 2021

Introduction

Longstanding barriers to vaccine uptake are likely to affect the success of Covid-19 vaccination efforts. These may include fears that vaccines will cause illness or produce dangerous side effects, insurance-related barriers that affect costs and access to health care providers, a lack of paid leave, a perceived lack of time, and other issues of inconvenient access.[1,2,3,4,5]

Existing barriers to vaccine uptake may be exacerbated in the case of the Covid-19 vaccine due to its novelty, the pandemic related economic crisis, and current racial and economic tensions in the United States. To provide insights as to where additional outreach and education efforts may be needed as the Covid-19 vaccine rollout continues, we examine historic vaccination patterns among adults using data from the 2016-18 National Health Interview Survey (NHIS). We focus on the flu vaccine because it is recommended for all adults regardless of age, and we stratify the population into three risk groups: nonelderly adults (ages 19-64) at low risk of severe disease from Covid-19, nonelderly adults at high risk of severe disease from Covid-19 and elderly adults ages 65 and over who are at high risk due to their age alone. The Centers for Disease Control and Prevention (CDC) recommend prioritizing the elderly and others at risk of severe disease during the vaccine rollout, so we consider how these populations have used vaccines in the past.[6] There is also considerable overlap between risk factors for Covid-19 and the flu, so flu vaccination patterns across Covid-19 health risk groups may also reflect how disease risk is associated with vaccination rates.[7,8]

For each risk group, we examine variation in vaccination rates by gender, race/ethnicity, region, income relative to poverty, insurance coverage and presence of a usual source of care. We also describe the demographic, socioeconomic and health characteristics of the population of higher risk adults who did not receive their flu vaccines. Finally, we consider pneumonia and shingles vaccination rates among the elderly because these vaccines vary in their administration schedules and novelty and may provide different insights into potential barriers to Covid-19 vaccine use.

We find:

- Lower income adults were less likely to be vaccinated than those with higher incomes, and adults in the southern US had the lowest vaccination rates compared to other regions.
- Black and Hispanic adults were less likely to receive a flu vaccine than their white counterparts, and these patterns persisted across most risk and income groups.
- Among the nonelderly Black, Hispanic, Medicaid/CHIP and lower income adult populations, the higher risk group was more likely to receive their flu vaccine than their lower risk counterparts.
- Flu vaccination rates among uninsured adults and those lacking a usual source of care were among the lowest observed, at rates below 20 percent among both the high and low risk nonelderly.

These findings emphasize the need to explicitly consider racial and socioeconomic equity in prioritizing rollout of the Covid-19 vaccine. This will involve addressing access issues by expanding delivery site options and providing assistance with appointment scheduling and other logistics. Enhanced outreach efforts will also be necessary to build trust and encourage vaccinations among hesitant populations. Such efforts may be particularly important as the vaccine rollout extends to the lower risk nonelderly population where racial and economic disparities in flu vaccination rates were wider. Reaching the uninsured and those lacking a usual source of care will likely require ensuring vaccine availability at community health centers, pharmacies, and mass vaccination sites as well as developing outreach and awareness campaigns that rely on sources other than insurers or health care providers.

Background

Three Covid-19 vaccines have been approved in the US as of March 1, 2021, and the CDC has established broad guidelines for prioritizing their rollout.[9] Front-line health care workers and residents of long-term care facilities were the first priority, but even before this phase was complete, many states and localities started vaccinating other essential workers, the elderly, and others at high risk of severe disease from Covid-19.[10] At the end of 2020, the US

had fallen well short of a stated goal to have 20 million people vaccinated, but health departments and providers have started to move past early hurdles and the pace of vaccination exceeded 1.5 million doses administered per day as of late February 2021.[11]

As the rollout continues, other longstanding barriers to vaccine uptake are likely to persist. Racial and ethnic differences in vaccine use are among the most widely reported with numerous studies demonstrating much lower rates of vaccine use among Black and Hispanic populations. Flu vaccination rates for Black (39%), Hispanic (37%), and American Indian/Alaska Native (38%) adults were well below the rate for white adults (49%) in 2018-19 based on data from the Behavioral Risk Factor Surveillance System (BRFSS).[12] Low vaccination rates among Black and Hispanic adults compared to white adults were also evident for pneumonia, shingles, and Hepatitis A and B according to the 2017 NHIS.[13] Important drivers of these patterns include barriers to accessing insurance and health care providers as well as limited trust in the government and the medical establishment among people of color.[14,15,16] This mistrust may be attributed partly to historical atrocities like the Tuskegee experiment but also to current patterns of discrimination.[17,18,19,20]

A strong association between insurance coverage and vaccine use has also been consistently reported, with uninsured individuals much less likely to use vaccines.[21] Estimates from the 2017 NHIS found that both publicly (52.7%) and privately (46.7%) insured adults had much higher flu vaccination rates than adults without insurance (18.9%). Patterns by coverage type varied by age, however. The elderly with public coverage, predominantly Medicare, had higher vaccination rates than their privately insured counterparts. Among the nonelderly, where public coverage is mostly Medicaid/CHIP, those with private coverage were more likely to receive their vaccines.[22] Other factors commonly associated with low levels of vaccine use include male gender and lower incomes and educational attainment. There is also wide variation in vaccine use across states, but vaccination rates in southern states tend to be lower than those in the northeast.[23]

The expedited approval and novelty of the Covid-19 vaccine creates considerable uncertainty and may enhance existing vaccine related fears, and the job and income losses associated with the pandemic may exacerbate other access barriers. For example, 60 percent of adults surveyed in January 2021 said they did not know when and 55 percent said they did not know where people like them would get the Covid-19 vaccine, and these rates were higher for people of color and those with low incomes.[24] In addition, about one-third of Black and Latino adults surveyed did not feel that vaccine distribution was taking the needs of their racial and ethnic groups into account. According to another survey, Black adults were the most likely to report that they would probably or definitely not get a coronavirus vaccine, at 49 percent, compared to 34 percent for white adults and 32 percent for Hispanic/Latinx adults.[25]

With demand for a Covid-19 vaccine far exceeding supply, most states and localities have turned to online scheduling systems to allocate limited appointments. This creates barriers for those without reliable internet access, including adults with lower incomes and those in rural areas, as well as for elderly and disabled adults who may be less tech savvy or encounter sites that cannot accommodate adaptive technology.[26,27] Finally, the Pfizer and Moderna Covid-19 vaccines require two doses several weeks apart which presents additional challenges in ensuring that individuals get fully vaccinated. An analysis of shingles vaccination patterns among Medicare beneficiaries found that beneficiaries of color were less likely to receive the second shot.[28]

Data and Methods

We use publicly available data from the NHIS obtained via IPUMS-Health Surveys.[29] The NHIS is the primary source of data on the nation's health and provides nationally representative estimates of health care access, use and affordability among the civilian noninstitutionalized population. Much of the information on detailed health care usage, including vaccinations, is collected for only one adult per family on the sample adult questionnaire, so our analysis is limited to these sample adults and weighted using appropriate survey weights. We pool data from the 2016-18 surveys to provide sufficient sample size to examine our subpopulations of interest.

We first stratify the adult population into three risk groups: nonelderly adults (ages 19-64) at low risk of severe disease from Covid-19 (n=29,733), nonelderly adults at high risk of severe disease from Covid-19 (n=28,793), and elderly adults ages 65 and over (n=23,154).[30] The elderly are at high risk of severe disease due to their age alone, and we define high risk for the nonelderly based on CDC guidelines and available NHIS measures to include adults with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers.[31]

The flu vaccine is recommended annually for all adults and we measure self-reported receipt in the past 12 months. We also measure whether elderly adults have ever received a pneumonia vaccine or a shingles vaccine. The pneumonia vaccine is recommended for adults ages 65 and over, and while there are two versions and people can receive both, a single dose of the Pneumovax/PPSV23 vaccine is considered sufficient for most elderly adults. The shingles vaccine is recommended for adults ages 50 and over who have had, or are unsure if they have had, chicken pox and is currently given in a two-shot series. We limit our analysis of the shingles vaccine to those ages 65 and over.

For each risk group, we consider the vaccination rate overall and by gender, race (non-Hispanic American Indian/Alaska Native (AI/AN), Asian, Black, and white), Hispanic ethnicity, Census region, income (above and below 250 percent of the federal poverty level (FPL)), insurance coverage (employer, Medicaid/CHIP, Medicare and other public, Marketplace and other private,

Figure 1. Flu vaccination rate, by Covid-19 health risk and gender, 2016-18.

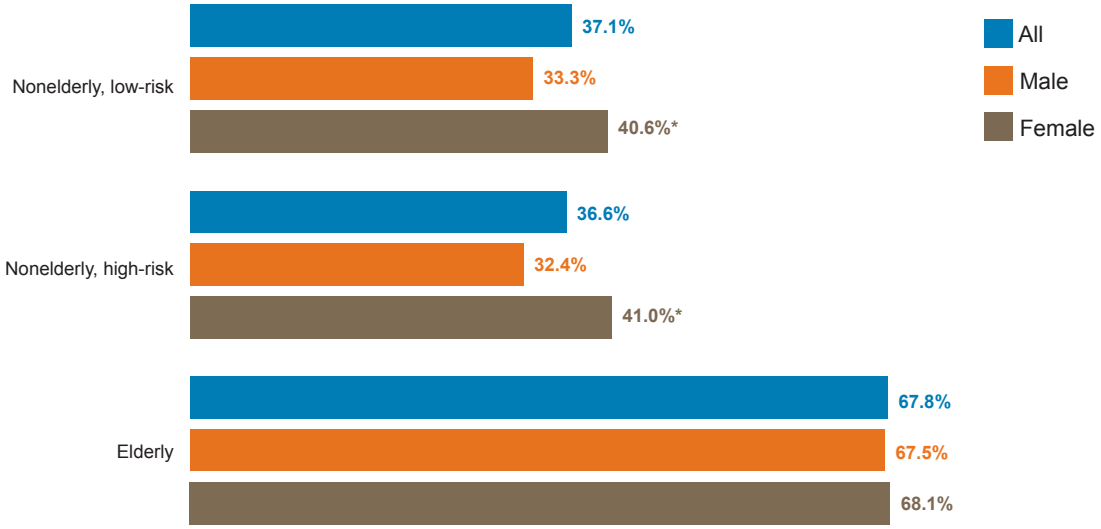


Figure 2. Flu vaccination rate, by Covid-19 health risk and region, 2016-18.

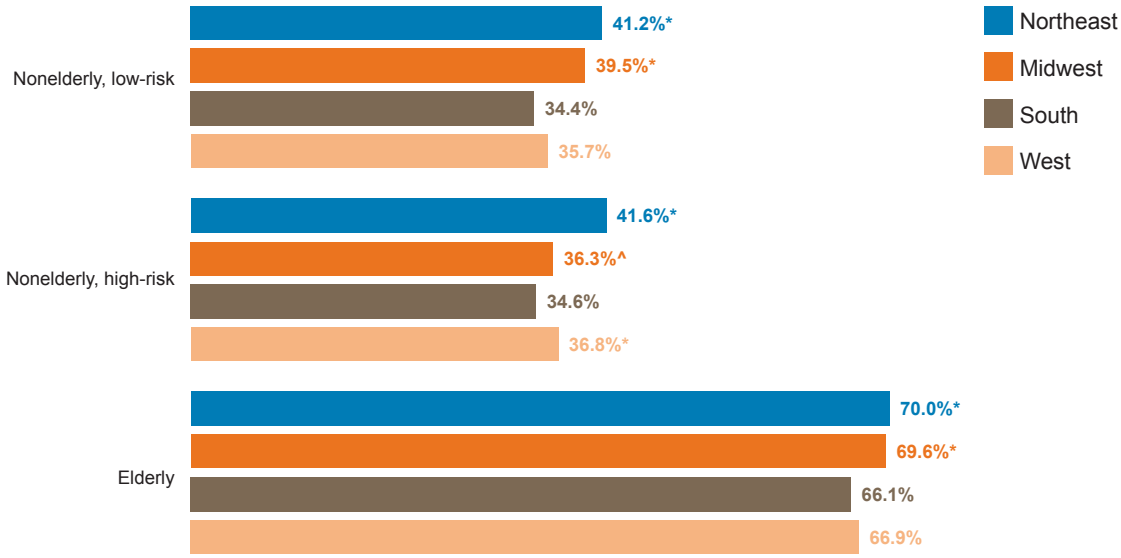
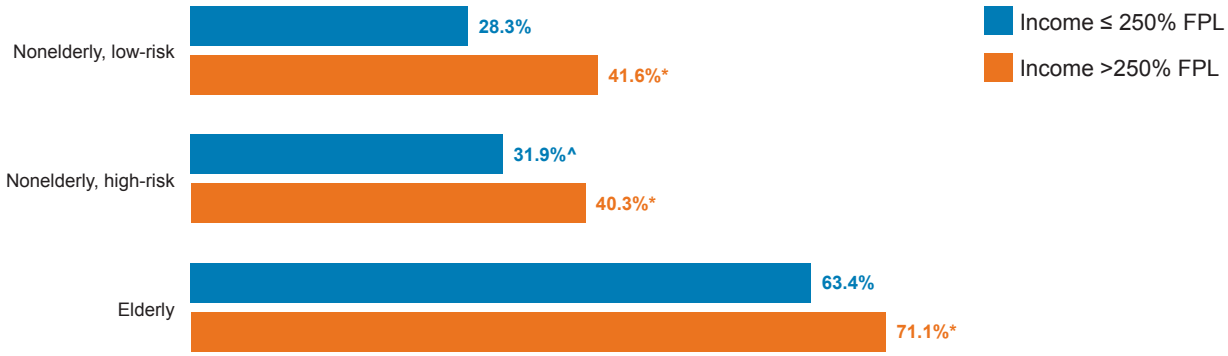


Figure 3. Flu vaccination rate, by Covid-19 health risk and income, 2016-18.



Figures 1–3
Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Note: FPL=Federal Poverty Level. Nonelderly adults are ages 19-64. Elderly adults are ages 65 or above. Among the nonelderly, high risk for severe illness from Covid-19 includes those with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers. Rates for elderly adults are significantly different from their nonelderly counterparts in each risk group at p<0.05. ^denotes significant difference between nonelderly low and high-risk at p<0.05. *denotes significant difference from male (fig. 1), south (fig. 2), or low-income (fig. 3) at p<0.05.*

uninsured), and presence of a usual source of care. To further explore the relationship between race/ethnicity, income and vaccine receipt, we examine the vaccination rates for Black, Hispanic, and white adults by Covid-19 health risk group and income. For subgroup analyses, we suppress estimates with a sample size under 200. We use two-sided t-tests to assess differences across groups. Finally, we describe the demographic, socioeconomic and health characteristics of high risk nonelderly and elderly adults that did not receive a flu vaccine.

The NHIS data have some limitations, particularly relative to the BRFSS which was the main alternative data source for this analysis. Region is the most detailed geography on the publicly available NHIS data, and small sample sizes for some subgroups of interest are not sufficient to produce reliable estimates (e.g., elderly AI/AN adults). The NHIS data also provide no additional information on where respondents received their vaccines or reasons for noncompliance. Advantages relative to the BRFSS include a stronger survey design and higher response rate, as well as more detailed information on income and health insurance coverage types.

As with all survey data, responses are self-reported and therefore subject to recall and social desirability biases, but no alternative data source can provide more objective population-based estimates. Finally, this analysis presents bivariate comparisons only, so vaccination patterns by race, for example, also reflect the underlying income and insurance distributions of each group. This analysis does not attempt to determine the independent effects of any of these characteristics on vaccine use.

Results

Among nonelderly adults, about 37 percent of both low and high-risk adults received a flu shot in the past year, compared to 68 percent of elderly adults (Figure 1). Nonelderly women were more likely than men to get a flu vaccine, regardless of risk group, but elderly men and women had similar vaccination rates. There were no significant differences by risk among the nonelderly, but the elderly were much more likely to receive their flu vaccine than their nonelderly counterparts.

Patterns by region and income were relatively consistent across risk groups. Vaccination rates were lowest in the south and highest in the northeast in all groups, but regional disparities were somewhat narrower among the elderly than among the nonelderly (Figure 2). For all risk groups, adults with higher incomes were much more likely to receive a flu vaccine than their counterparts with incomes below 250 percent of the FPL (Figure 3). In addition, higher risk nonelderly adults with low incomes were more likely to be vaccinated (31.9%) than their lower risk counterparts (28.3%).

Both low and high risk nonelderly Black and Hispanic adults were less likely to receive a flu vaccine than their white counterparts (Figure 4). However, higher risk Black (34.2%) and Hispanic (33.3%) nonelderly adults were more likely to have received flu vaccines than their lower risk counterparts (26.2% and 28.4%, respectively). Moreover, higher risk white adults were less likely than lower risk white adults to receive a flu vaccine, and as a result, the Black-white and Hispanic-white gaps in the flu vaccination rate were much smaller among higher risk nonelderly adults.

Among the elderly, vaccination rates were higher for all racial and ethnic groups compared to the nonelderly, but Black (58.4%) and Hispanic adults (61.8%) remained least likely to receive a flu vaccine. Across nonelderly and elderly groups, Asian Americans and AI/AN adults had vaccination rates that were similar to their white counterparts, though small sample size prevented a reliable estimate for the elderly AI/AN population, and higher risk nonelderly Asian adults were more likely than white adults to receive a flu vaccine.

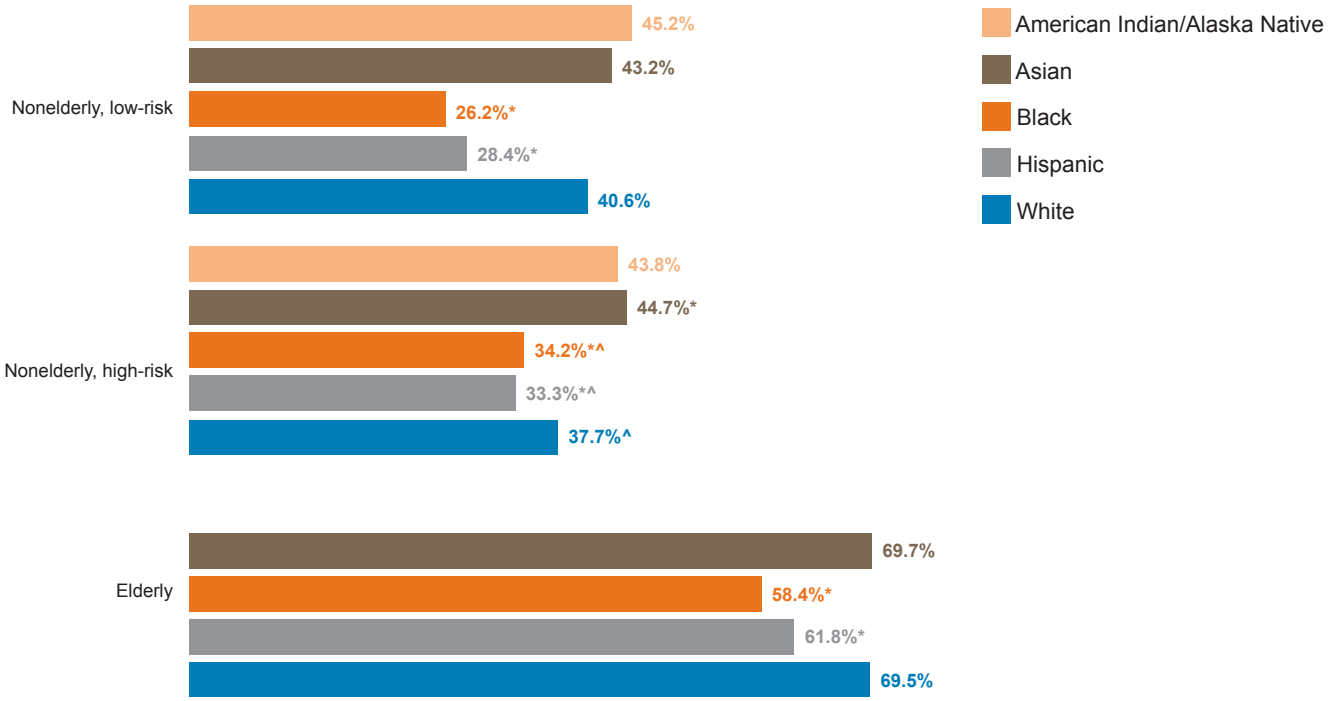
Lower flu vaccination rates among Black and Hispanic adults compared to white adults were generally persistent across risk and income groups (Table 1).[32] There were no significant differences in flu vaccination rates by race or ethnicity among lower income, high risk nonelderly adults, however, and racial and ethnic differences in vaccine receipt were more pronounced among higher income nonelderly adults in both risk groups.

Among the nonelderly, uninsured adults had the lowest rates of vaccination by far, at 15.4 percent for lower risk and 16.9 percent for higher risk uninsured adults (Figure 5). Nonelderly adults with employer coverage were more likely than those with Medicaid/CHIP to be vaccinated, but higher risk nonelderly adults with Medicaid/CHIP (34.2%) and Medicare or other public coverage (51.2%) were more likely to receive a flu vaccine than their lower risk counterparts with the same coverage (29.5% and 42.9%, respectively). On the contrary, high risk nonelderly adults with employer coverage (40.6%) were less likely to receive a vaccine than their lower risk counterparts (42.1%), and the resulting gap in the flu vaccination rate between Medicaid/CHIP and employer covered adults was much smaller among higher risk adults.

Among the elderly, only two coverage types had sufficient sample size for reliable estimates, but those with Medicare or other public coverage were more likely than those with employer coverage to be vaccinated. Regardless of risk group, there were also large gaps in flu vaccination rates between those with and without a usual source of care, and high risk nonelderly adults without a usual source of care were even less likely (14.9%) than lower risk adults with no usual source of care (19.9%) to receive a flu vaccine (Figure 6).

Among the elderly, patterns for pneumonia and shingles vaccines were broadly similar to those for flu, but a few inconsistencies are worth noting (Table 2). Shingles vaccination rates were quite low, at about 39 percent overall compared to rates of about 68 percent for both flu and pneumonia vaccines. Elderly Black adults had the lowest rate of flu vaccination (58%), followed closely by Hispanic adults (62%), with white and Asian elderly adults reporting rates of about 70 percent. For the shingles vaccine, however, the gaps in vaccination rates for Black and Hispanic elderly adults compared to white adults were much larger than for the flu vaccine.

Figure 4. Flu vaccination rate, by Covid-19 health risk and race/ethnicity, 2016-18.



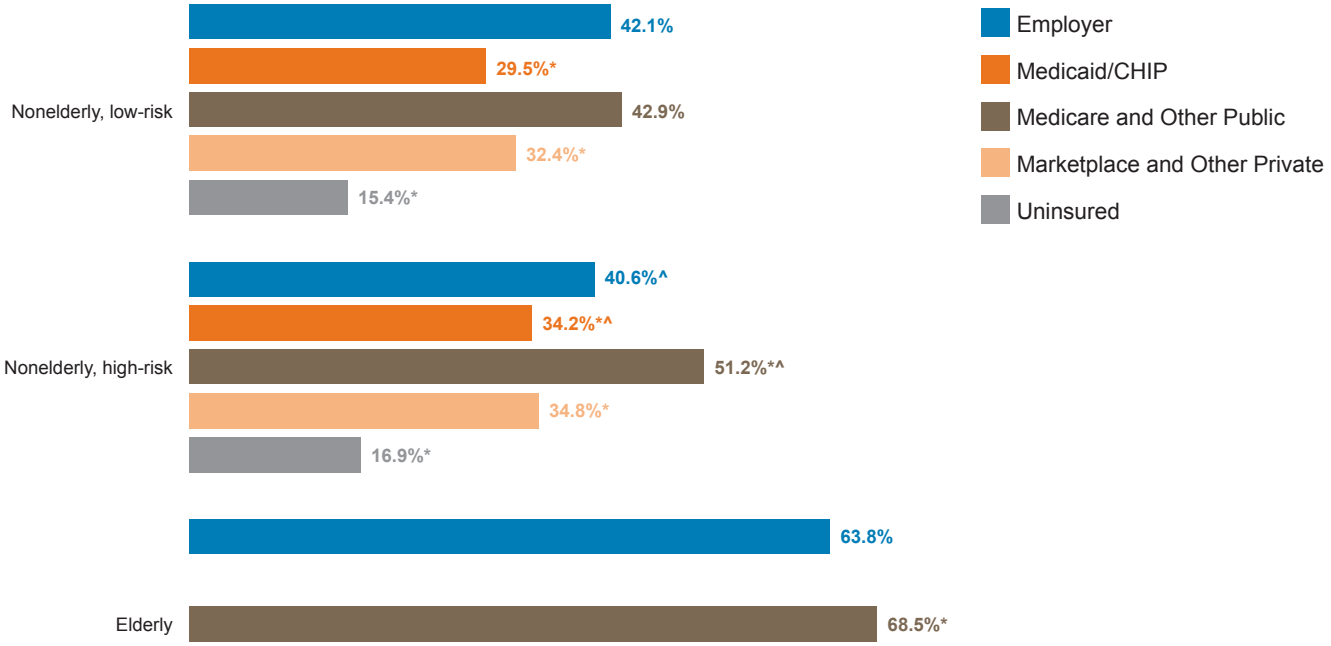
Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Notes: Nonelderly adults are ages 19-64. Elderly adults are ages 65 or above. Among the nonelderly, high risk for severe illness from Covid-19 includes those with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers. White, Black, Asian and American Indian/Alaska Native are non-Hispanic. Rates for elderly adults are significantly different from their nonelderly counterparts in each risk group at p<0.05. ^denotes significant difference between nonelderly low and high-risk at p<0.05. *denotes significant difference from white at p<0.05. Estimates for elderly American Indian/Alaska Native adults are not shown due to insufficient sample size (n<200).*

Table 1. Flu vaccination rate, by Covid-19 health risk, race/ethnicity and income, 2016-18.

	Income ≤250% FPL	Income above 250% FPL
Nonelderly, low-risk		
Black	22.9%*	29.5%*^
Hispanic	24.7%*	32.9%*^
White	31.4%	43.7%^
Nonelderly, high-risk		
Black	32.3%	36.8%*^
Hispanic	32.2%	35.0%*
White	31.0%	41.6%^
Elderly		
Black	55.7%*	62.6%*^
Hispanic	60.2%*	65.4%*
White	65.4%	71.9%^

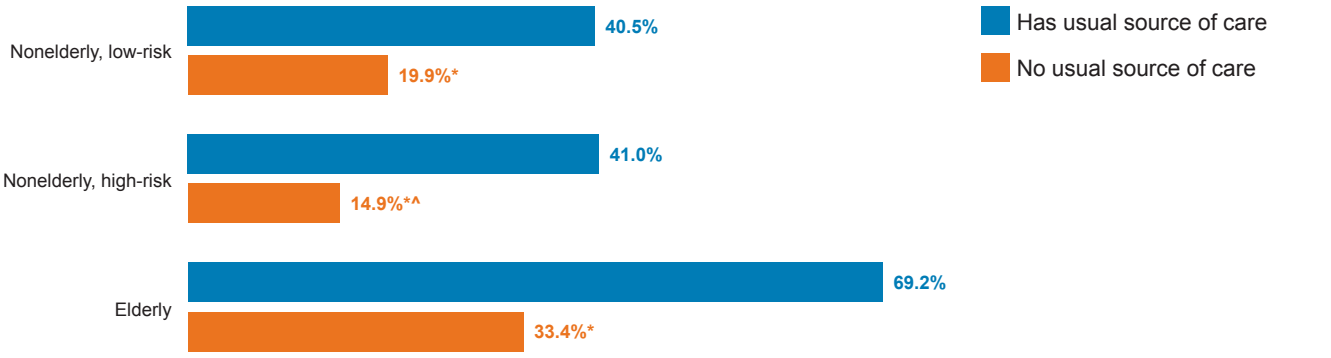
Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Notes: FPL=Federal Poverty Level. Nonelderly adults are ages 19-64. Elderly adults are ages 65 or above. Among the nonelderly, high risk for severe illness from Covid-19 includes those with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers. White and Black are non-Hispanic. *denotes significant difference from white at p<0.05. ^denotes significant difference from low-income at p<.05.*

Figure 5. Flu vaccination rate, by Covid-19 health risk and insurance coverage, 2016-18.



Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Notes: Nonelderly adults are ages 19-64. Elderly adults are ages 65 or above. Among the nonelderly, high risk for severe illness from Covid-19 includes those with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers. Rates for elderly adults are significantly different from their nonelderly counterparts in each risk group at p<0.05. ^denotes significant difference between nonelderly low and high-risk at p<0.05. *denotes significant difference from employer at p<0.05. Estimates for each coverage type were significantly different from uninsured at p<0.05 among each group of nonelderly adults. Estimates for Medicaid/CHIP, Marketplace and other private, and uninsured among elderly adults are not shown due to insufficient sample size (n<200).*

Figure 6. Flu vaccination rate, by Covid-19 health risk and presence of a usual source of care, 2016-18.



Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Notes: Nonelderly adults are ages 19-64. Elderly adults are ages 65 or above. Among the nonelderly, high risk for severe illness from Covid-19 includes those with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers. Rates for elderly adults are significantly different from their nonelderly counterparts in each risk group at p<0.05. ^denotes significant difference between nonelderly low and high-risk at p<0.05. *denotes significant difference from those with a usual source of care at p<0.05.*

Also, pneumonia and flu vaccination rates were similar for white elderly adults (about 70 percent) and for Black elderly adults (about 58 percent), but Asian and Hispanic elderly adults were less likely to receive the pneumonia vaccine than the flu vaccine.

About 63 percent of the high risk nonelderly and 32 percent of the elderly had not received a flu vaccine during the study period. Among the nonelderly, those who had not received a flu vaccine were younger, more likely to be male, more likely to be Black and less likely to be white or Asian than the high-risk population as a whole (Table 3). Though the vast majority were citizens, those who did not receive a flu vaccine were slightly more likely to be noncitizens than the overall population. About 72 percent of those who did not receive a flu vaccine were employed, but about 50 percent of those who were employed did not have paid sick leave. These were higher rates of employment and lower rates of paid sick leave than for the population as a whole. Just over half of those who did not receive their flu vaccine had employer coverage, while about 15 percent had Medicaid/CHIP and nearly 20 percent were uninsured. High risk nonelderly adults with low incomes and those with Medicaid/CHIP and the uninsured were overrepresented among the population that did not receive a vaccine compared to the population as whole. Finally, while most high risk nonelderly adults who were not in compliance with flu vaccine recommendations did have a usual source of care (77%), they were less likely to have a usual source of care and more likely to report cost-related problems getting care than the population as a whole.

Many of these patterns were similar among the elderly, although the share of the elderly that had not received a flu vaccine was much smaller. Compared to the elderly population overall, those who had not received a vaccine were younger, and more likely to be Black, Hispanic, noncitizens, and to have incomes below 250 percent of the FPL. The elderly that did not receive their flu vaccine were much less likely to be married than the population as a whole, and about one in five elderly who did not receive the vaccine were employed, a greater share than among all elderly adults. Finally, though over 90 percent of the elderly who had not received their flu vaccine reported a usual source of care, this was lower than among the elderly overall and those who had not received a flu vaccine were also more likely to report problems getting care due to cost.

Table 2. ***Vaccine receipt among elderly adults, by selected characteristics, 2016-2018***

	Flu vaccine, past 12m	Shingles vaccine, ever	Pneumonia vaccine, ever
All elderly adults	67.8%	39.0%	68.3%
Male^	67.5%	38.0%	66.9%
Female	68.1%	39.9%	69.5%*
Asian	69.7%	31.0%*	54.4%*
Black	58.4%*	20.6%*	57.6%*
Hispanic	61.8%*	21.8%*	51.4%*
White^	69.5%	43.6%	72.3%
Northeast	70.0%*	38.3%*	67.5%
Midwest	69.6%*	42.6%*	73.4%*
South^	66.1%	34.7%	66.3%
West	66.9%	43.1%*	67.3%
Income ≤250% FPL^	63.4%	28.5%	63.9%
Income above 250% FPL	71.1%*	46.7%*	71.5%*
Employer^	63.8%	34.0%	51.3%
Medicare and other public	68.5%*	39.7%*	69.5%*
Has usual source of care^	69.2%	39.9%	69.6%
No usual source of care	33.4%*	17.5%*	36.2%*

Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Note: FPL=Federal Poverty Level. Elderly adults are ages 65 and over. White, Black and Asian are non-Hispanic. American Indian/Alaska Native, Medicaid/CHIP, Marketplace and other private coverage, and uninsured are not shown due to insufficient sample size (n<200). ^denotes reference category. *denotes significant difference from reference category at p<0.05.*

Table 3. Characteristics of adults at high risk of severe illness from Covid-19, overall and among those who did not receive a flu vaccine, 2016-2018.

	High-risk Nonelderly Adults		Elderly Adults	
	All	No flu vaccine in past 12m	All	No flu vaccine in past 12 m
Age 19-34	27.7%	31.9%*		
Age 35-49	31.4%	33.2%*		
Age 50-64	41.0%	34.9%*		
Age 65-79			77.0%	80.2%*
Age 80+			23.0%	19.8%*
Male	49.5%	52.9%*	44.8%	42.3%
Female	50.5%	47.1%*	55.2%	57.7%
American Indian/Alaska Native	1.1%	1.0%	0.4%	0.4%
Asian	2.7%	2.4%*	4.6%	3.6%
Black	15.6%	16.2%*	8.9%	12.2%*
Hispanic	14.4%	15.1%	8.5%	9.5%*
Other race	2.5%	2.6%	1.2%	1.4%
White	63.7%	62.7%*	76.5%	72.9%*
Citizen	94.0%	93.3%*	97.3%	96.7%*
Noncitizen	6.0%	6.7%*	2.7%	3.3%*
Married or living with partner	49.6%	48.5%*	59.0%	41.5%*
Widowed, separated divorced	23.1%	21.9%*	36.1%	50.8%*
Never married	27.2%	29.6%*	4.9%	7.6%*
Northeast	15.5%	14.4%*	19.2%	17.2%*
Midwest	25.1%	25.2%	22.3%	22.1%
South	39.4%	40.5%*	36.0%	38.3%
West	20.0%	19.9%	22.5%	22.4%
Income ≤250% FPL	46.7%	47.4%*	42.7%	48.2%*
Income above 250% FPL	53.3%	52.6%*	57.3%	51.8%*
Employed	69.4%	71.6%*	17.7%	20.4%*
Has paid sick leave	54.4%	49.4%*	61.9%	58.3%*
Unemployed	4.8%	5.4%*	0.5%	0.7%
Not in labor force	25.7%	22.9%*	81.7%	78.9%*
Employer coverage	54.4%	51.2%*	3.4%	3.4%
Medicaid/CHIP	14.8%	15.2%*	0.8%	1.0%*
Medicare and other public coverage	8.7%	6.7%*	94.7%	93.7%*
Marketplace and other private coverage	7.9%	8.1%	0.5%	0.6%*
Uninsured	14.2%	18.7%*	0.6%	1.3%*
Has usual source of care	83.0%	77.3%*	96.1%	91.5%*
No usual source of care	17.0%	22.7%*	3.9%	8.5%*
Unmet need due to cost	11.6%	13.0%*	2.9%	4.3%*
Delayed care due to cost	15.5%	17.1%*	3.9%	5.7%*

Source: Authors' analysis of National Health Interview Survey, 2016-18.
*Note: FPL= Federal Poverty Level. Nonelderly adults are ages 19-64. Elderly adults are ages 65 and above. Among the nonelderly, high risk for severe illness from Covid-19 includes those with chronic kidney disease, emphysema, chronic bronchitis, coronary heart disease, angina, heart attack, diabetes and those who are obese or current smokers. White, Black, Asian, American Indian/Alaska Native and other race are non-Hispanic. Share with paid sick leave is among those who are employed. *denotes significant difference from population share at p<0.05.*

Discussion

Our findings are largely consistent with existing work on vaccine patterns across demographic and socioeconomic groups.[33,34] We find lower vaccination rates among Black, Hispanic and lower income adults, as well as lower rates in the southern US. We also find very low vaccination rates among uninsured nonelderly adults, and differing patterns for public versus private coverage depending on age. Elderly adults with public coverage, predominantly Medicare, were more likely to receive vaccines than their privately insured counterparts, but among the nonelderly, those with employer coverage were more likely to receive vaccines than those with Medicaid/CHIP.

A few patterns stand out with potential implications for the continued rollout of the Covid-19 vaccine. Among the nonelderly Black, Hispanic, Medicaid/CHIP and lower income adult populations, the higher risk group was more likely to receive their flu vaccine than their lower risk counterparts, and this pattern was particularly pronounced among lower income Black and Hispanic adults. The health conditions that put individuals at higher risk may also increase their contact with and trust in their health care providers and thereby increase vaccine uptake. A recent survey found that, among those who were hesitant to get a Covid-19 vaccine, adults of all races and ethnicities were more likely to trust their doctor or health care provider than public health officials, elected officials or community leaders for information about the vaccine.[35] This reinforces the importance of having a trusted provider and suggests the potential benefits of increasing access to the Covid-19 vaccine through primary care physicians and other individual providers.[36]

Another noteworthy finding was that, among the nonelderly, the AI/AN population had similar flu vaccination rates to white adults. Given the large health and health care disparities observed for this population more generally,[37] understanding existing vaccination policies and programs among the Native population may hold insights both for the Covid-19 vaccine and for other populations that are lagging behind on vaccinations. In fact, early evidence suggests that the Covid-19 vaccine rollout among Native Americans has been very successful, with many tribes using call centers rather than online systems to schedule appointments and taking advantage of a variety of existing outreach media including newsletters, radio announcements and direct mail.[38] Some credit may go to the Indian Health Service for its centralized role in distribution with additional credit to the creativity of Native communities in ensuring distributed doses are not wasted. Some of these strategies, especially less reliance on internet-based scheduling and extremely targeted outreach to the most vulnerable, could improve access for other older, less tech savvy populations who may be left behind at the expense of those who are wealthy, well-connected or willing to bend the rules.[39,40]

Consistent with prior research, we also observed extremely low vaccination rates among uninsured adults and those without a usual source of care. Low vaccination rates in the south may also be related to lower rates of insurance coverage, and in the absence of progress on Medicaid or other coverage expansions, it will be important to focus on community health centers and other delivery sites that serve the uninsured. The Biden administration has recently started shipping Covid-19 vaccines directly to community health centers, and the Health Resources and Services Administration is targeting those centers that serve the most hard to reach populations including the homeless, migrant workers, public housing residents and those with limited English proficiency.[41] Scaling up this program as vaccine supply increases will have important implications for the populations disproportionately served by the health center program including individuals with low incomes, no insurance and patients of color.

Moreover, for those that do not have a usual source of care, nontraditional delivery sites will be particularly important. These may include retail pharmacies, which have also started receiving direct shipments of Covid-19 vaccines in an effort to improve equity of vaccine distribution, and mass vaccination sites such as stadiums and convention centers.[42,43] In addition, given that most nonelderly adults who did not receive a flu vaccine were working, employers could potentially play an important role in outreach and as delivery sites as the economy continues to reopen and vaccine supply increases. Similarly, leveraging the communication networks of places of worship, schools, sports leagues, and other trusted community organizations to promote vaccination will be critical in reaching individuals who may not regularly interact with the health care system.

Additional efforts will also be needed to overcome relatively high rates of hesitancy about the Covid-19 vaccine.[44,45] This will require clinicians to listen to their patients concerns, tailor their responses to address specific fears, educate their patients on both the vaccine development and regulatory process, and acknowledge remaining uncertainty about the vaccine's efficacy and safety.[46] These strategies will be useful for any patient voicing concerns about the vaccine, but will be critical for people of color who have experienced discrimination inside and outside the health care system. These efforts will also need to be coupled with outreach and education efforts by trusted community leaders among lower risk individuals who have more limited engagement with the health care system. Together, a robust and varied network of vaccine providers, assistance with the logistics of scheduling appointments, and targeted messages to address vaccine hesitancy will be critical for an equitable vaccine distribution process.

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The views expressed are those of the authors and should not be attributed to the Robert Wood Johnson Foundation or the Urban Institute, its trustees, or its funders.

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Stacey McMorrow is a Principal Research Associate and Tyler W. Thomas is a Research Assistant, both in the Urban Institute's Health Policy Center. The authors are grateful to Jessica Banthin, Lisa Dubay and John Holahan for helpful comments and suggestions.

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