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Influenza Vaccination Prevalence Among Adults with Increased Risk of Severe COVID-19

Didem M. Bernard, PhD, Thomas M. Selden, PhD, and Zhengyi Fang, MS

Abstract

There is growing evidence that many of the same socioeconomic groups that have experienced disproportionate morbidity and mortality during the ongoing pandemic are also experiencing low COVID-19 vaccination prevalence. Analysis of pre-pandemic data on influenza vaccination prevalence can offer useful insights into which groups may require additional public effort. One group of particular interest is the subset of persons with underlying health issues placing them at greatest risk of severe COVID-19. Using pre-pandemic data from the 2016 Medical Expenditure Panel Survey, we examined influenza vaccination prevalence among adults with increased risk of severe COVID-19 due to underlying health issues. Adults with increased risk of severe COVID-19 had substantially higher influenza vaccination prevalence than did adults with lower risk of severe COVID-19. Nevertheless, many of the same socioeconomic and geographic disparities in vaccination prevalence that have been observed among all adults also exist among the subset of adults with increased risk of severe COVID-19.

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Contact

Didem M. Bernard, Senior Economist, Division of Research and Modeling, Center for Financing, Access and Cost Trends, Agency for Healthcare Research and Quality, 5600 Fishers Lane, Mailstop 07W41A, Rockville, MD 20857

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Center for Financing, Access and Cost Trends
Agency for Healthcare Research and Quality
5600 Fishers Lane, Mailstop 07W41A
Rockville, MD 20857
http://www.meps.ahrq.gov

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Introduction

Despite the rapid increase in the number of United States residents who have received SARS-CoV-2 vaccination and the fact that all persons qualified under the terms of the applicable COVID-19 vaccine Emergency Use Authorization are now eligible to be vaccinated, concerns remain whether overall vaccination prevalence, in combination with naturally obtained immunity, will be high enough to achieve herd immunity (Mayo Clinic, 2021; Spellberg, Nielsen, & Casadevall, 2021). There is also concern that COVID-19 vaccination prevalence may be especially low among the same socioeconomic groups that are experiencing disproportionate COVID-19 morbidity and mortality. Emerging evidence suggests that COVID-19 vaccination prevalence is below average among some racial and ethnic minority groups (The Centers for Disease Control and Prevention [CDC], 2021; Ndugga et al., 2021) and among adults with low incomes (Goldhill, 2021). The initial scarcity of the COVID-19 vaccine and the logistical challenges of launching such a massive public health effort may be factors in low vaccination prevalence among minorities and lower-income adults. These differences may also reflect in part the composition of early vaccine priority groups with respect to race, ethnicity, and poverty level (Selden, Berdahl, & Fang, 2021). Nevertheless, it may well also be that the early differences in COVID-19 vaccination prevalence reflect longstanding patterns of lower vaccination prevalence, reflecting a wide range of historical, cultural, social, and political factors, among non-Hispanic Blacks, Hispanics, and people with low income, as has been observed for influenza vaccination (Planalp & Hest, 2021; CDC, 2019).

An important question is whether adults with increased risk of severe COVID-19 are more or less likely than other adults to receive the COVID-19 vaccine. On the one hand, vaccination prevalence in this group might tend to be higher than average, because patients and their providers may view the underlying health issues as factors increasing the benefits of vaccination. In addition, socioeconomic groups that have historically experienced below-average access to and use of medical care are disproportionately represented among adults with increased risk of severe COVID-19. For example, COVID-19 risk factors like obesity, diabetes, and heart disease occur disproportionately among racial and ethnic groups that have below-average vaccination prevalence—both for influenza (Planalp & Hest, 2021; CDC, 2019) and now for COVID-19 (CDC, 2021; Ndugga et al., 2021; Goldhill, 2021). Prior research has found higher influenza vaccination prevalence among adults with diabetes, heart disease, asthma, other respiratory conditions, or cancer (other than non-melanoma skin cancer)—conditions that are some of the factors associated

with increased risk of severe COVID-19 (CDC, 2018; O'Halloran et al., 2016; Lu et al., 2013; Lu et al., 2019).

This Research Findings report uses data collected prior to the ongoing COVID-19 pandemic to examine influenza vaccination prevalence among adults with risk factors that have now been associated with increased risk of severe COVID-19. Examining influenza vaccination prevalence within this key population subgroup may yield insights into COVID-19 vaccination prevalence; however, there may also be important differences between influenza vaccination and COVID-19 vaccination with respect to price (the COVID-19 vaccine being free), availability (with new vaccination centers opening at a rapid pace), and perceived benefit from vaccination (with COVID-19 posing a greater risk to unvaccinated persons than influenza).

Estimates in this Research Findings report were based on data from the 2016 Medical Expenditure Panel Survey (MEPS), a household survey of the civilian noninstitutionalized population that is sponsored by the Agency for Healthcare Research and Quality (AHRQ, 2019). MEPS does not include nursing home residents or adults who are incarcerated, two groups with particularly high prevalence of COVID-19 morbidity and mortality (Henry J. Kaiser Family Foundation, 2021; Saloner et al., 2020). We examined self-reported influenza vaccination over the past 12 months among adults age 18 and older as of the end of 2016. Because past-year influenza vaccination information was collected in the early months of 2017, the prior 12 months pertains to vaccinations that would have likely been received during the last several months of 2016 (some responses, however, might have pertained to influenza vaccinations received as recently as early 2017 or as far back as early 2016). While the influenza season that began in late 2016 was fairly typical in terms of hospitalizations and mortality, the prior influenza season (beginning in late 2015) had below-average influenza-related mortality (CDC, 2020a), potentially tending to reduce 2016 vaccination prevalence.

To identify adults with increased (or potentially increased) risk of severe COVID-19, we applied CDC-defined risk factors (CDC, 2020b) to MEPS data on age, obesity, health conditions, and smoking (see Definitions section below). We identified three adult risk groups: adults at increased risk of severe COVID-19, lower-risk adults who live with increased-risk adults, and other lower-risk adults (Selden & Berdahl, 2020; Selden, Berdahl, & Fang, 2020). We examined the socioeconomic and geographic dimensions of age, sex, race and ethnicity, education level, poverty level, health insurance coverage, Census division, and urbanicity.

Highlights

- Adults with increased risk of severe COVID-19 had influenza vaccination prevalence of 52.5 percent compared to influenza vaccination prevalence of 34.9 percent among adults with lower risk of severe COVID-19.

- Disparities in influenza vaccination prevalence within the increased-risk group mirrored those we observed among the broader adult population across poverty level, education level, race and ethnicity, and geographic location. Among adults with increased risk, influenza vaccination prevalence was 55.4 percent for non-Hispanic White adults versus 44.4 percent for non-Hispanic Black adults and 44.0 percent for Hispanic adults. Non-Hispanic Asian adults had the highest influenza vaccination prevalence among adults with increased risk of severe COVID-19, at 63.5 percent.
- Lower-risk adults who lived with increased-risk adults had vaccination prevalence (35.4 percent) that was very similar to those who did not (34.5 percent).

Findings

All adults

Table 1 presents estimates of influenza vaccination prevalence for the full civilian noninstitutionalized adult population. Overall, there were 249.0 million adults in this population in 2016. The overall influenza vaccination rate was 45.7 percent. Corresponding estimates of influenza vaccination prevalence were 41.7 percent in the Behavioral Risk Factor Surveillance System and 43.4 percent in the National Health Interview Survey (CDC, 2019).

Patterns across sex, age, race and ethnicity, and income mirror those found elsewhere in the influenza vaccination prevalence literature (Planalp & Hest, 2021; CDC, 2019). Vaccination prevalence among women was 9.6 percentage points higher than among men. Vaccination prevalence was 72.3 percent among adults age 65 and older, versus 32.0 percent among adults age 18 to 34. Vaccination prevalence among non-Hispanic White adults was 10.2 percentage points greater than among non-Hispanic Black adults and 12.7 percentage points greater than among Hispanic adults (see also figure 1). And adults with family incomes of 400 percent of the federal poverty level (FPL) and higher had vaccination prevalence that was 9.1 percentage points higher than those with family incomes below the FPL (see also figure 2). We observed little difference across urbanicity, whereas the range of vaccination prevalence across Census divisions was 8.7 percentage points, from New England at 51.4 percent to East South Central at 42.7 percent.

Influenza vaccination by risk of severe COVID-19

The bottom portion of table 1 presents influenza vaccination prevalence for subgroups defined by the risk factors we used to identify persons at increased risk of severe COVID-19. Groups were not mutually exclusive, so that some adults are in more than one category. Adults who smoked tobacco were the only group with below-average influenza vaccination prevalence. All the other risk factors, apart from obesity, were associated with substantially above-average vaccination prevalence.

Table 2 presents vaccination prevalence by socioeconomic group separately for adults with at least one CDC-defined risk factor for increased (or potentially increased) risk of severe COVID-19 versus all adults with lower-risk. Overall, 152.4 million adults had increased risk versus 96.6 million adults with lower risk. Vaccination prevalence among adults who were at increased risk of severe COVID-19 was 52.5 percent compared to 34.9 percent among adults with lower risk of severe COVID-19. Looking across socioeconomic characteristics and geographic location, we observed many of the same patterns in both risk groups. There was a somewhat steeper age gradient for increased-risk adults, with statistically significant difference-in-differences between the reference category of ages 55 to 64 and ages 18 to 34 and ages 35 to 44, for increased-risk versus lower-risk adults. Also, among adults under age 65, the difference between percentages of adults with past-year influenza vaccination for those with public versus private health insurance coverage was smaller for increased-risk adults than for lower-risk adults. In contrast, we saw very similar patterns across race and ethnicity (figure 1) and across poverty levels (figure 2) for the two risk groups. The higher vaccination prevalence among non-Hispanic Asian adults becomes more apparent in results stratified by risk level than in the overall population. Among adults with increased risk of severe COVID-19, non-Hispanic Asian adults had the highest vaccination prevalence at 63.5 percent.

Influenza vaccination among adults with lower risk of severe COVID-19 by presence of an adult with increased risk of severe COVID-19 in the household

Adults with lower risk who live with increased-risk adults might be expected to be more likely than those who do not live with increased-risk adults to be vaccinated against influenza out of concern for their family members. However, as table 3 shows, we found that among lower-risk adults, those living in households with increased-risk adults had an average vaccination prevalence (35.4 percent) that was very similar to the average vaccination prevalence (34.5 percent) among other lower-risk adults (those who do not live in households with increased-risk adults). Moreover, we saw very similar patterns in vaccination prevalence across groups defined by socioeconomic characteristics and geographic location.

Data Source

The estimates shown in this Research Findings report were drawn from analyses conducted by the MEPS staff from the MEPS Full-Year Consolidated Public Use File HC-192 (2016). The public use files are available at https://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp.

Our analysis examined only the civilian noninstitutionalized population, thereby excluding adults in nursing homes and long-term care facilities, as well as adults who are incarcerated—groups that have experienced high COVID-19 morbidity and mortality (Henry J. Kaiser Family Foundation, 2021; Saloner et al., 2020). Our data are from 2016 and therefore do not measure any changes in income, health

insurance, or influenza vaccination prevalence that may have occurred in response to the pandemic.

Definitions

Influenza vaccination

For each person age 18 and older, MEPS asks how long it has been since receiving an influenza vaccination. In this Research Findings report, we examined the prevalence of having received an influenza vaccination within the past year. Because this question was asked in early 2017, the prior year approximately spanned early 2016 to early 2017. Population estimates use the full MEPS sample, whereas influenza vaccination estimates were constructed excluding the 8.9 percent of responses with missing values.

Age

Age was categorized based on the person's age at the end of the calendar year (or the last time a person was observed, for those leaving the MEPS sample during the year due to reasons including death, institutionalization, or becoming an active-duty member of the military).

Race-ethnicity

Race and ethnicity were defined for respondents whose single reported race was White, Black, or Asian, and for respondents of Hispanic ethnicity (any race). The remaining racial and ethnic category combines all non-Hispanic adults with other race or multiple races.

Health insurance status

Individuals ages 18–64 were classified into the following three insurance categories, based on household responses to health insurance status questions:

- *Any private health insurance:* Individuals who, at any time during the year, had insurance that provides coverage for hospital and physician care (other than Medicare, Medicaid/Children's Health Insurance Program [CHIP], or other public hospital/physician coverage) were classified as having private insurance. Insurance coverage by TRICARE (uniformed services–related coverage) was also included as private health insurance. Insurance that provides coverage for a single service only, such as dental or vision coverage, was not included.
- *Public coverage only:* Individuals were considered to have public coverage only if they met both of the following criteria: 1) they were not covered by private insurance at any time during the year, and 2) they were covered by any of the following public programs at any point during the year: Medicare, Medicaid/CHIP, or other public hospital/physician coverage.
- *Uninsured:* The uninsured were defined as people not covered by private hospital/physician insurance, Medicare, TRICARE, Medicaid/CHIP, or other

public hospital/physician programs at any time during the entire year or period of eligibility for the survey.

Individuals age 65 and older were classified into the following three insurance categories:

- *Medicare and private insurance:* Individuals who were classified as Medicare beneficiaries and covered by Medicare and a supplementary private policy.
- *Medicare and other public insurance:* Individuals who were classified as Medicare beneficiaries and who met both of the following criteria: 1) they were not covered by private insurance at any point during the year, and 2) they were covered by one of the following public programs at any point during the year: Medicaid or other public hospital/physician coverage.
- *Medicare only:* Individuals who were classified as Medicare beneficiaries but not classified as having Medicare and private insurance or as having Medicare and other public insurance. This group includes persons who were enrolled in Medicare Advantage (Part C) and persons who had traditional Medicare fee-for-service coverage only.

Education

Education was coded based on the data regarding the highest degree obtained and years of education completed. Adults without a high school diploma or other equivalent credential (or, if highest degree is missing, then less than 12 years of education) were coded less than high school. Adults with a high school diploma or General Educational Development (GED) certificate and less than 13 years of education (or, if highest degree was missing, then 12 years of education) were coded as high school or GED. Remaining adults, with a college degree or with a high school diploma or GED certificate and more than 12 years of education, were coded as some college. We excluded from estimates by education level the small number of cases missing education data (see note to each table for percentage of cases affected).

Poverty

Four income groups were defined based on total family income as a percentage of the FPL: 1) under 100 percent of FPL, 2) 100–199 percent of FPL, 3) 200–399 percent of FPL, and 4) 400 percent of FPL and higher. Family income was constructed by summing all sources of income across all family members. Next, total family income value was divided by the appropriate poverty threshold, based on family size and composition.

Health risk measures

Using the risk factors listed in CDC (2020b), we classified persons as being at increased risk of severe COVID-19 if they had obesity (body mass index of 30 kg/m^2 or greater); age greater than or equal to 65; or any of the following treated conditions: diabetes, cancer (other than non-melanoma skin cancers), emphysema or other chronic obstructive pulmonary disease (COPD), kidney disease, or coronary

heart disease (Selden & Berdahl, 2020, 2021; Selden, Berdahl, & Fang, 2020, 2021). We also included in our increased risk group current smokers and those with treated asthma or high blood pressure—factors identified by the CDC as potentially placing adults at increased risk of severe COVID-19.

We used MEPS data on current smoking even though it was missing for 12.9 percent of all adults. Of these, 41.9 percent had other factors associated with increased risk of severe COVID-19, so the absence of smoking data did not affect our categorization of risk. We classified the remaining cases with missing smoking status as adults with lower risk. Based on smoking prevalence among persons with non-missing current smoking data and no other risk factors, we estimated that approximately 2.7 percent of adults classified as having lower risk may have been current smokers who should have been classified as adults with increased risk of severe COVID-19.

Although we believe our measure of increased risk covers most of the populations identified by CDC (2020b), we did not include all risk factors listed by CDC. We were unable to include Down syndrome as a risk factor, despite the prevalence of Down syndrome in the population (CDC, 2020c), because MEPS measures conditions associated with medical care, and no MEPS participants were reported to have received medical treatment for Down syndrome in 2016. Nor do we include relatively uncommon conditions such as solid organ transplants or immunocompromised states. We did not include HIV over concerns about self-reporting this condition in a household survey. Although we did not include cerebrovascular disease, many adults in this group are already classified as high risk due to their age, obesity, or high blood pressure. Also, we did not include pregnancy, despite this being a more prevalent CDC risk factor. According to the CDC, pregnancy is listed as a risk factor even though the relative youth of most pregnant women places them in a low overall risk category (albeit higher than similar-age women who are not pregnant). Two factors complicating the use of MEPS pregnancy information for our study are that we can observe pregnancies only when they are listed as conditions for which medical care is received (including deliveries in medical settings), and pregnancies that resulted in live births prior to the fall vaccination season would not have played a role in subsequent influenza vaccination decisions.

Risk status of adults living in same household

Households were defined as persons who lived together at any point between January 1 and the first interview of the calendar year. One exception was persons who moved elsewhere in the United States during this period (we count them as forming separate households). Households also included persons who joined MEPS after the first interview of the year. We used this definition of household to define two groups of lower-risk adults: those who lived in households with increased-risk adults and other lower-risk adults (those who did not live in households with

increased-risk adults). Adults not co-residing with other adults were among those classified as not living with increased-risk adults.

As noted above, not all respondents provided information on current smoking. For this reason, a small number of lower-risk adults whom we classified as not living in households with increased-risk adults may in fact have lived with adults with increased risk of severe COVID-19 due to (unreported) current smoking.

Urbanicity

We applied urban-rural continuum codes (United States Department of Agriculture, 2013) to define three levels of urbanization: one comprising counties in metropolitan statistical areas (MSAs), one for non-metropolitan counties that are adjacent to MSAs, and then other (more rural) counties.

About MEPS-HC

The Medical Expenditure Panel Survey-Household Component (MEPS-HC) collects nationally representative data on healthcare use, expenditures, sources of payment, and insurance coverage for the U.S. civilian noninstitutionalized population. The MEPS-HC is cosponsored by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS). More information about the MEPS-HC can be found on the MEPS website at https://meps.ahrq.gov.

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Table 1: Population Estimates and Percentage of Adults Who Received an Influenza Vaccination within the Past Year, by Socioeconomic Characteristics and Geographic Location, 2016

	Population (millions)	(SE)	Influenza Vaccination Prevalence (%)	(SE)	
All adults	249.0	(5.5)	45.7	(0.6)	
Sex					
Male	120.4	(2.8)	40.7	(0.7)	**
Female[a]	128.6	(2.9)	50.3	(0.7)	
Age					
18–34	73.7	(2.2)	32.0	(0.9)	**
35–44	39.9	(1.3)	37.1	(1.2)	**
45–54	42.3	(1.3)	39.3	(1.2)	**
55–64[a]	41.6	(1.2)	52.4	(1.2)	
65+	51.4	(1.6)	72.3	(0.9)	**
Race and ethnicity					
Non-Hispanic White[a]	157.9	(4.6)	48.9	(0.8)	
Non-Hispanic Black	29.4	(1.5)	38.7	(1.1)	**
Non-Hispanic Asian	14.8	(1.1)	50.9	(2.0)	
Hispanic (all races)	39.7	(2.1)	36.2	(0.9)	**
Non-Hispanic other or multiple race	7.3	(0.8)	45.0	(3.2)	
Insurance coverage (ages 18–64)					
Any private[a]	146.1	(3.9)	41.9	(0.7)	
Public only	30.0	(1.2)	37.3	(1.1)	**
Uninsured	21.5	(0.9)	19.9	(1.4)	**
Insurance coverage (ages 65+)					
Medicare only	17.7	(0.8)	72.1	(1.5)	
Medicare and private[a]	27.3	(1.2)	74.6	(1.2)	
Medicare and other public only	5.6	(0.3)	66.0	(2.6)	**
Poverty level					
Under 100% FPL	37.6	(1.3)	40.9	(1.1)	**
100% to 199% FPL	30.6	(1.0)	43.0	(1.1)	**
200% to 399% FPL	72.1	(2.1)	42.8	(1.0)	**
400% FPL and over[a]	108.7	(3.3)	50.0	(0.9)	
Education level					
Less than high school	33.5	(1.1)	39.1	(1.1)	**
High school or GED	77.0	(2.2)	41.2	(0.9)	**
Some college[a]	137.6	(3.8)	49.8	(0.7)	
Census division					
New England[a]	12.0	(2.8)	51.4	(2.9)	
Middle Atlantic	32.3	(2.5)	48.2	(1.6)	
East North Central	34.8	(2.5)	43.0	(1.2)	**
West North Central	17.2	(1.5)	50.6	(2.5)	

South Atlantic	49.0	(3.6)	43.8	(1.5)	*
East South Central	15.0	(3.4)	42.7	(2.2)	*
West South Central	29.4	(2.8)	44.2	(2.0)	*
Mountain	15.3	(3.0)	46.1	(1.5)	
Pacific	43.9	(3.0)	46.6	(1.2)	
Urbanicity					
Metropolitan area[a]	214.2	(5.5)	45.9	(0.6)	
Non-metropolitan, adjacent	25.5	(3.3)	44.0	(2.5)	
Non-metropolitan, non-adjacent	9.4	(1.9)	47.0	(3.1)	
Risk factors					
Diabetes	23.8	(0.8)	67.2	(1.3)	
Asthma	11.1	(0.5)	62.2	(1.9)	
Cancer	10.6	(0.6)	73.8	(2.0)	
Emphysema and COPD	4.8	(0.4)	73.0	(2.8)	
High blood pressure	59.6	(1.6)	64.7	(0.9)	
Coronary heart disease	9.9	(0.5)	72.0	(2.0)	
Obesity (BMI >= 30)	79.4	(2.0)	48.2	(0.9)	
Current tobacco smoker	30.7	(1.2)	34.4	(1.3)	

[a] Indicates reference category.
Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016. Sample size was 25,444 for population estimates and 23,173 for influenza vaccination estimates, due to exclusion of missing values. Influenza vaccination estimates by education level excluded the 0.6% of the sample with missing education values.
SE = standard error, FPL = federal poverty level, GED = General Educational Development, COPD = chronic obstructive pulmonary disease, BMI = body mass index
* (**) denotes statistically significant difference from the reference category at 5% (1%) level.

Table 2: Percentage of Adults Who Received an Influenza Vaccination within the Past Year by COVID-19 Risk Groups, Socioeconomic Characteristics, and Geographic Location, 2016

	Adults with Increased Risk of Severe COVID-19					Adults with Lower Risk of Severe COVID-19				
	Population (millions)	(SE)	Influenza Vaccination Prevalence (%)	(SE)		Population (millions)	(SE)	Influenza Vaccination Prevalence (%)	(SE)	
All adults	152.4	(3.5)	52.5	(0.7)		96.6	(2.7)	34.9	(0.8)	
Sex										
Male	74.2	(1.9)	47.8	(0.8)	**	46.2	(1.4)	29.2	(1.0)	**
Female[a]	78.3	(1.9)	57.0	(0.8)		50.4	(1.5)	40.0	(1.1)	
Age										
18–34	27.0	(1.0)	32.0	(1.3)	**††	46.7	(1.6)	32.0	(1.2)	**
35–44	20.2	(0.8)	37.4	(1.6)	**††	19.7	(0.8)	36.9	(1.7)	**
45–54	25.3	(0.9)	43.5	(1.5)	**	17.1	(0.7)	33.0	(1.7)	**
55–64[a]	28.5	(0.9)	55.9	(1.3)		13.2	(0.6)	44.7	(2.0)	
65+	51.4	(1.6)	72.3	(0.9)	**					
Race and ethnicity										
Non-Hispanic White[a]	101.4	(3.1)	55.4	(0.9)		56.5	(2.2)	37.2	(1.2)	
Non-Hispanic Black	19.8	(1.1)	44.4	(1.2)	**	9.5	(0.6)	26.8	(1.6)	**
Non-Hispanic Asian	5.5	(0.5)	63.5	(2.6)	**	9.3	(0.7)	43.5	(2.1)	**
Hispanic (all races)	21.0	(1.3)	44.0	(1.1)	**	18.7	(1.0)	27.3	(1.3)	**
Non-Hispanic other or multiple race	4.7	(0.6)	49.0	(4.3)		2.6	(0.3)	37.3	(3.9)	
Insurance coverage (ages 18–64)										
Any private[a]	71.3	(2.0)	45.5	(0.9)		74.8	(2.4)	38.5	(0.9)	
Public only	18.7	(0.9)	43.1	(1.4)	††	11.3	(0.5)	27.5	(1.7)	**
Uninsured	11.0	(0.5)	23.2	(2.0)	**	10.5	(0.6)	16.2	(1.5)	**
Insurance coverage (ages 65+)										
Medicare only	17.7	(0.8)	72.1	(1.5)						
Medicare and private[a]	27.3	(1.2)	74.6	(1.2)						

Medicare and other public only	5.6	(0.3)	66.0	(2.6)	**					
Poverty level										
Under 100% FPL	25.5	(1.0)	47.5	(1.3)	**	12.2	(0.5)	27.0	(1.4)	**
100% to 199% FPL	21.0	(0.8)	49.6	(1.3)	**	9.6	(0.5)	28.7	(1.8)	**
200% to 399% FPL	44.8	(1.3)	49.3	(1.1)	**	27.3	(1.0)	31.9	(1.5)	**
400% FPL and over[a]	61.2	(2.0)	57.8	(1.0)		47.5	(1.8)	39.8	(1.3)	
Education level										
Less than high school	20.8	(0.8)	47.7	(1.4)	**†	12.7	(0.6)	25.0	(1.5)	**
High school or GED	54.0	(1.6)	47.1	(1.0)	**	23.0	(0.9)	26.9	(1.3)	**
Some college[a]	76.9	(2.3)	57.5	(0.9)		60.6	(2.0)	39.8	(1.1)	
Census division										
New England[a]	7.2	(1.8)	59.8	(2.6)		4.8	(1.1)	38.9	(5.6)	
Middle Atlantic	18.7	(1.6)	55.0	(2.0)		13.6	(1.1)	38.6	(2.4)	
East North Central	22.4	(1.6)	49.0	(1.7)	**	12.4	(1.1)	32.3	(1.9)	
West North Central	10.9	(0.9)	54.5	(2.7)		6.4	(0.7)	44.0	(3.5)	
South Atlantic	32.0	(2.6)	50.4	(1.7)	**	17.0	(1.3)	31.5	(1.9)	
East South Central	10.5	(2.3)	48.6	(2.7)	**	4.5	(1.1)	28.8	(3.5)	
West South Central	18.1	(1.8)	51.1	(2.5)	*	11.3	(1.2)	33.4	(1.7)	
Mountain	8.4	(1.7)	54.9	(2.1)		6.9	(1.5)	35.2	(2.7)	
Pacific	24.2	(2.0)	55.6	(1.3)		19.7	(1.3)	35.3	(1.9)	
Urbanicity										
Metropolitan area[a]	127.2	(3.5)	52.8	(0.7)		87.0	(2.6)	35.7	(0.8)	
Non-metropolitan, adjacent	18.5	(2.4)	50.1	(2.7)		6.9	(1.0)	26.9	(2.9)	**
Non-metropolitan, non-adjacent	6.7	(1.3)	54.0	(3.1)		2.6	(0.6)	29.0	(4.7)	

[a] Indicates reference category.
Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016. Sample sizes for population estimates were 15,407 and 10,037 for adults with and without increased risk, respectively. Corresponding sample sizes for influenza vaccination estimates were 14,281 and 8,892 due to exclusion of missing values. Estimates by education level excluded cases with missing values, accounting for 0.5% and 0.6% of the samples of adults with increased risk and lower risk, respectively.

SE = standard error, FPL = federal poverty level, GED = General Educational Development

* (**) denotes statistically significant difference from the reference category at 5% (1%) level.
† (††) denotes statistically significant difference-in-differences between category and reference category for the two groups at 5% (1%) level.

Table 3: Percentage of Lower-Risk Adults Who Received an Influenza Vaccination within the Past Year, by Presence in Household of Increased-Risk Adult, Socioeconomic Characteristics, and Geographic Location, 2016

	Adults with Lower Risk of Severe COVID-19 Living in Households with Adults with Increased Risk of Severe COVID-19					Adults with Lower Risk of Severe COVID-19 Who Do Not Live in Households with Adults with Increased Risk of Severe COVID-19				
	Population (millions)(SE)		Influenza Vaccination Prevalence (%)(SE)			Population (millions)(SE)		Influenza Vaccination Prevalence (%)(SE)		
All adults	41.9	(1.4)	35.4	(1.1)		54.7	(1.9)	34.5	(1.0)	
Sex										
Male	19.7	(0.8)	29.3	(1.5)	**	26.5	(1.0)	29.2	(1.2)	**
Female[a]	22.2	(0.9)	40.7	(1.6)		28.1	(1.0)	39.4	(1.3)	
Age										
18–34	20.7	(0.9)	31.5	(1.7)	**†	26.0	(1.2)	32.3	(1.6)	**
35–44	6.8	(0.3)	38.5	(2.5)	**	12.9	(0.6)	36.0	(2.1)	
45–54	7.7	(0.4)	32.1	(2.6)	**	9.4	(0.5)	33.8	(2.2)	*
55–64[a]	6.7	(0.4)	48.4	(2.6)		6.4	(0.4)	41.2	(2.7)	
Race and ethnicity										
Non-Hispanic White[a]	23.4	(1.2)	39.0	(1.8)		33.2	(1.5)	36.0	(1.4)	
Non-Hispanic Black	4.9	(0.4)	24.7	(2.1)	**	4.6	(0.3)	28.7	(2.2)	**
Non-Hispanic Asian	3.5	(0.3)	44.4	(3.3)		5.8	(0.5)	42.9	(2.6)	*
Hispanic (all races)	9.2	(0.5)	27.2	(1.5)	**	9.5	(0.6)	27.3	(1.7)	**
Non-Hispanic other or multiple race	1.1	(0.2)	46.1	(6.2)		1.5	(0.2)	31.3	(4.8)	
Insurance coverage (ages 18–64)										
Any private[a]	30.9	(1.2)	39.7	(1.4)		44.0	(1.6)	37.6	(1.2)	
Public only	5.7	(0.3)	29.0	(2.6)	**	5.5	(0.3)	26.0	(2.0)	**
Uninsured	5.3	(0.3)	16.3	(1.9)	**	5.1	(0.4)	16.1	(2.1)	**
Poverty level										
Under 100% FPL	5.0	(0.3)	25.6	(2.0)	**	7.2	(0.4)	27.9	(1.9)	**

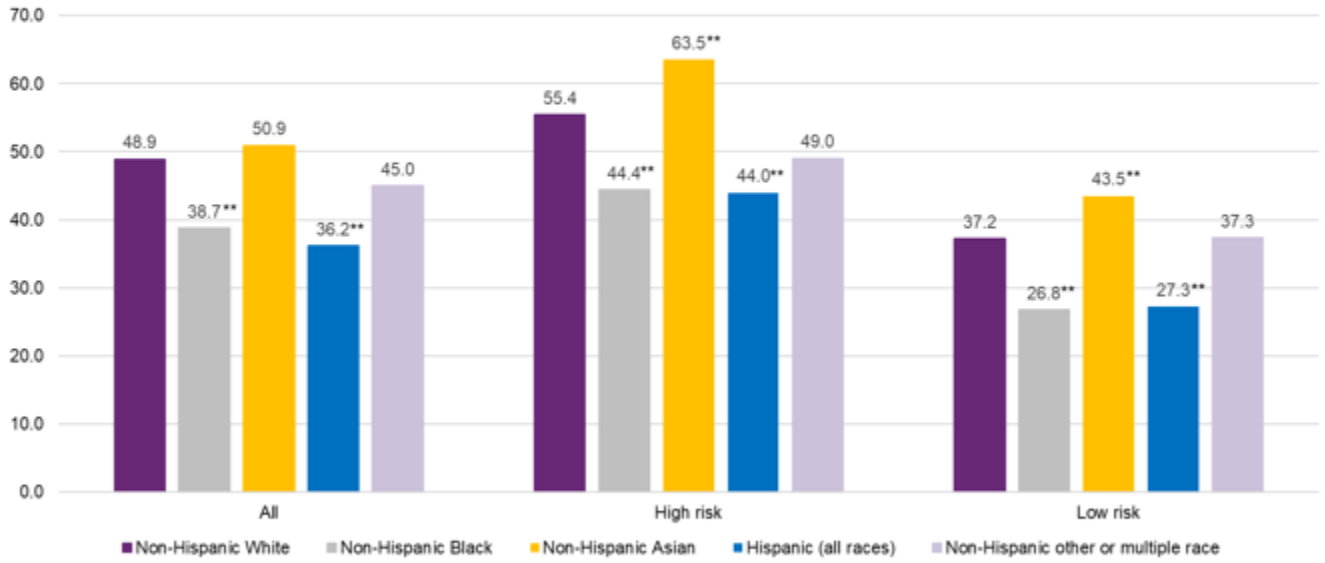
100% to 199% FPL	4.2	(0.3)	29.4	(2.7)	**	5.4	(0.4)	28.2	(2.4)	**
200% to 399% FPL	13.0	(0.6)	31.3	(1.8)	**	14.3	(0.7)	32.3	(2.0)	*
400% FPL and over[a]	19.8	(1.0)	41.6	(1.9)		27.7	(1.3)	38.5	(1.6)	
Education level										
Less than high school	7.5	(0.4)	26.5	(2.1)	**	5.1	(0.3)	22.8	(2.3)	**
High school or GED	12.1	(0.6)	27.7	(2.0)	**	10.9	(0.5)	26.1	(1.9)	**
Some college[a]	22.2	(0.9)	42.5	(1.7)		38.5	(1.5)	38.3	(1.2)	
Census division										
New England[a]	1.8	(0.5)	35.2	(7.6)		3.0	(0.6)	40.9	(5.4)	
Middle Atlantic	6.1	(0.6)	37.9	(3.0)		7.5	(0.6)	39.1	(3.3)	
East North Central	5.7	(0.5)	34.2	(2.8)		6.7	(0.7)	30.8	(2.9)	
West North Central	2.6	(0.4)	47.1	(5.9)		3.8	(0.4)	42.0	(3.7)	
South Atlantic	7.9	(0.7)	31.2	(2.6)		9.1	(0.7)	31.7	(2.3)	
East South Central	2.1	(0.5)	23.5	(3.3)		2.4	(0.7)	33.1	(5.5)	
West South Central	5.1	(0.6)	37.9	(2.9)	†	6.2	(0.7)	29.7	(2.0)	
Mountain	2.5	(0.6)	39.9	(3.8)		4.4	(1.0)	32.7	(3.1)	
Pacific	8.2	(0.7)	35.2	(2.8)		11.5	(0.8)	35.3	(2.0)	
Urbanicity										
Metropolitan area[a]	36.9	(1.4)	36.3	(1.2)		50.1	(1.8)	35.3	(1.1)	
Non-metropolitan, adjacent	3.6	(0.6)	28.5	(4.0)		3.3	(0.5)	25.1	(4.2)	*
Non-metropolitan, non-adjacent	1.4	(0.4)	30.6	(5.9)		1.2	(0.3)	27.2	(7.7)	

[a] Indicates reference category.
Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016.
Sample sizes for population estimates were 4,763 and 5,274 for adults living with and without an increased-risk adult in household, respectively. Corresponding sample sizes for influenza vaccination estimates were 4,365 and 4,527 due to exclusion of missing values. Estimates by education level excluded cases with missing values, accounting for 0.7% and 0.5% of the samples of adults living with and not living with increased-risk adults, respectively.

SE = standard error, FPL = federal poverty level, GED=General Educational Development

* (**) denotes statistically significant difference from the reference category at 5% (1%) level.
† (††) denotes statistically significant difference-in-differences between category and reference category for the two groups at 5% (1%) level.

Figure 1: Percentage of Adults Who Received an Influenza Vaccination within the Past Year by Race/ethnicity and COVID-19 Risk Groups, 2016



Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016.

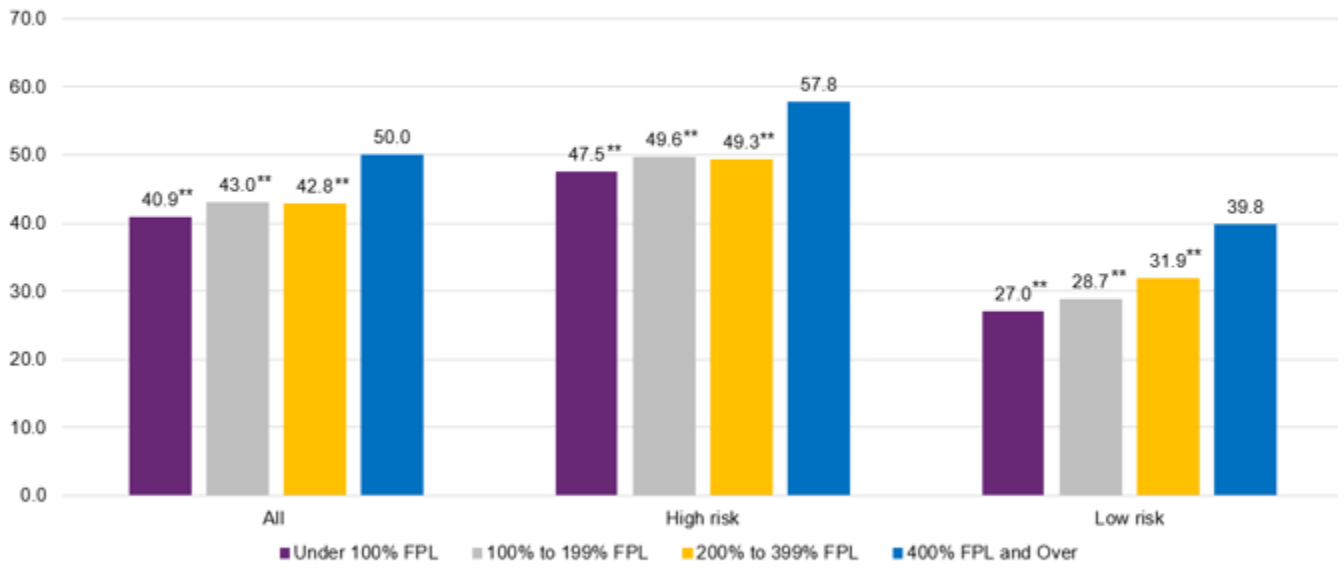
* (**) denotes statistically significant difference from the reference category (Non-Hispanic White) at 5% (1%) level.

Figure 1: Percentage of Adults Who Received an Influenza Vaccinations within the Past Year by Race/ethnicity and COVID-19 Risk Groups, 2016

Race and ethnicity	All	High risk	Low risk
Non-Hispanic White	48.9%	55.4%	37.2%
Non-Hispanic Black	38.7%**	44.4%**	26.8%**
Non-Hispanic Asian	50.9%	63.5%**	43.5%**
Hispanic (all races)	36.2%**	44.0%**	27.3%**
Non-Hispanic other or multiple race	45.0%	49.0%	37.3%

Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016.
* (**) denotes statistically significant difference from the reference category (Non-Hispanic White) at 5% (1%) level.

Figure 2: Percentage of Adults Who Received an Influenza Vaccination within the Past Year by Poverty Level and COVID-19 Risk Groups, 2016



Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016.

FPL=Federal Poverty Level

* (**) denotes statistically significant difference from the reference category (400% FPL and over) at 5% (1%) level.

Figure 2: Percentage of Adults Who Received an Influenza Vaccination within the Past Year by Poverty Level and COVID-19 Risk Groups, 2016

Poverty level	All	High risk	Low risk
Under 100% FPL	40.9%**	47.5%**	27.0%**
100% to 199% FPL	43.0%**	49.6%**	28.7%**
200% to 399% FPL	42.8%**	49.3%**	31.9%**
400% FPL and Over	50.0%	57.8%	39.8%

Source: Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, Household Component, 2016.
FPL=Federal Poverty Level
* (**) denotes statistically significant difference from the reference category (400% FPL and over) at 5% (1%) level.