

1 **COVID-19 vaccination coverage, intentions, attitudes and barriers by race/ethnicity, language of**
2 **interview, and nativity, National Immunization Survey Adult COVID Module, April 22, 2021–**
3 **January 29, 2022**

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1 **Abstract**

2 The National Immunization Survey Adult COVID Module used a random-digit-dialed phone survey
3 during April 22, 2021–January 29, 2022 to quantify COVID-19 vaccination, intent, attitudes, and barriers
4 by detailed race/ethnicity, interview language, and nativity. Foreign-born respondents overall and within
5 racial/ethnic categories had higher vaccination coverage (80.9%), higher intent to be vaccinated (4.2%),
6 and lower hesitancy towards COVID-19 vaccination (6.0%) than US-born respondents (72.6%, 2.9%, and
7 15.8%, respectively). Vaccination coverage was significantly lower for certain subcategories of national
8 origin or heritage (e.g., Jamaican (68.6%), Haitian (60.7%), Somali (49.0%) in weighted estimates).
9 Respondents interviewed in Spanish had lower vaccination coverage than interviewees in English but
10 higher intent to be vaccinated and lower reluctance. Collection and analysis of nativity, detailed
11 race/ethnicity and language information allow identification of disparities among racial/ethnic subgroups.
12 Vaccination programs could use such information to implement culturally and linguistically appropriate
13 focused interventions among communities with lower vaccination coverage.

14
15 **Keywords:**

16 Vaccination, COVID-19, nativity, language, foreign-born
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1 **Introduction**

2 COVID-19 disproportionately impacts U.S. racial and ethnic minority populations^{1,2}. Lower COVID-19
3 vaccination coverage is reported among Black, Hispanic/Latino, American Indian, and Alaska Native
4 persons than Asian and White persons³. The U.S. Census Bureau states, “race and ethnicity categories
5 generally reflect social definitions in the U.S. and are not an attempt to define race and ethnicity
6 biologically, anthropologically, or genetically” and include many nationalities and heritages within race
7 and ethnicity categories⁴. For example, the Census Bureau “Asian” racial category includes persons with
8 “origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent”;
9 “White” includes persons with origins in “Europe, the Middle East, or North Africa”; “Black or African
10 American” includes persons “having origins in any of the black racial groups of Africa”; “Hispanic or
11 Latino ethnicity” includes persons of many different nationalities with “Spanish culture or origin,”
12 regardless of race. Within broad racial and ethnic categories, there is substantial diversity in cultural
13 factors and social determinants of health by nativity, national origin, and preferred language, and
14 heterogeneity in attitudes towards, access to, and use of preventive services including vaccinations⁵.
15 Disaggregating broader race categories into subgroups has helped identify health disparities between
16 subgroups, which could inform tailored public health interventions. For example, disaggregating Hawaii
17 COVID-19 case and death data among Native Hawaiian, Pacific Islander and Asian origin subcategories
18 found 22% of Hawaii cases and deaths were among Pacific Islander persons (5% of Hawaii’s
19 population)⁶. In 2019, 13.7% of the U.S. population was foreign-born, and 9% of U.S. residents self-
20 identified as having limited English proficiency⁴. Vaccination coverage has previously differed by
21 nativity, language and national origin; foreign-born adults and adults with limited English proficiency
22 were less likely to receive routinely recommended vaccines before the COVID-19 pandemic^{7,8,9}.

23
24 Ensuring vaccination equity and addressing barriers to vaccination is critical to the national vaccination
25 effort and the overall COVID-19 response. Few published reports have used nationally representative data
26 to assess COVID-19 vaccination by detailed nativity, race/ethnicity, and language spoken. The objective
27 of this analysis is to assess vaccination coverage, intent, attitudes and barriers towards vaccination among
28 foreign-born and non-English speaking populations to better understand how COVID-19 vaccination
29 efforts are received by these communities.

30
31 **Methods**

32
33 We analyzed data from the National Immunization Survey Adult COVID Module (NIS-ACM)¹⁰ collected
34 between April 22, 2021–January 29, 2022 to assess COVID-19 vaccination coverage, intent to vaccinate,

1 and barriers to vaccination by race/ethnicity, nativity, and language of interview. The NIS-ACM collected
2 data from adults ≥ 18 years using a random-digit-dialed sample of U.S. cellular telephone numbers;
3 questions are publicly available¹⁰. Data were weighted to represent the non-institutionalized U.S. adult
4 population and calibrated to state-level COVID-19 vaccine administration data.

5 Surveys were conducted in English and Spanish; participants preferring another language were
6 interviewed using contracted phone interpretation services (LanguageLine Solutions, >140 languages
7 available). Nativity was considered U.S.-born if respondents answered “yes” to the question “Were you
8 born in the United States?” and foreign-born if respondents answered “no”. Respondents were asked to
9 self-identify Hispanic/Latino ethnicity with the question “Are you of Hispanic or Latino origin?”. All
10 respondents were asked to identify one or more categories describing their race, among White, Black or
11 African American, American Indian, Alaska Native, Asian, Native Hawaiian, and Pacific Islander.
12 Respondents identifying as Hispanic/Latino, Asian, or Black or African American were asked to identify
13 one or more subcategories, based on U.S. Census categories, describing their national origin or heritage.
14 Respondents identifying as White were not asked to identify a subcategory unless they also identified as
15 other races or ethnicities; based on U.S. Census definitions, “White” may include persons with national
16 origin or heritage in Europe, the Middle East, or North Africa among other regions. Available
17 subcategories for analysis are listed in Table 1.

18 Analyses by race/ethnicity were conducted among those self-identifying as Hispanic/Latino, non-
19 Hispanic Asian (hereafter, Asian), non-Hispanic Black (Black), non-Hispanic White (White), or non-
20 Hispanic other/multiple race (other/multiple race). Analyses by preferred language were conducted
21 among those interviewed in English, Spanish, or another language. Respondents were considered
22 vaccinated if they reported receiving at least one dose of a COVID-19 vaccine; otherwise, they were
23 asked whether they would definitely get a vaccine (categorized as intending to be vaccinated), probably
24 get a vaccine or unsure (categorized as undecided), or probably or definitely not get a vaccine
25 (categorized as reluctant) (Table 2). Respondents were asked attitudes toward COVID-19 vaccination,
26 such as concern about COVID-19 disease and perceived vaccine safety and efficacy (Supplemental Table
27 1), and about specific barriers to vaccination, such as difficulty finding a vaccine or a convenient
28 appointment time (Supplemental Table 2). Respondents were asked questions related to social
29 determinants of health, including household income, health insurance coverage, and zip code (Table 1).
30 Responses missing race/ethnicity information (2.9%) were excluded.

31

1 Weighted estimates and 95% confidence intervals were calculated for reported COVID-19 vaccination
2 (≥ 1 dose), vaccination intent, attitudes towards vaccination, and barriers to vaccination stratified by
3 nativity, race/ethnicity, and interview language. Survey weights were calibrated to COVID-19 vaccine
4 administration data to mitigate possible bias from incomplete sample frame, nonresponse, and
5 misclassification of vaccination status. Chi-square tests of distribution were conducted to test population
6 distributions by nativity and language of interview and to detect differences in percentages between
7 groups; differences were considered significant if p-values were < 0.05 . Data were analyzed using SAS
8 (version 9.4) and SUDAAN (version 11.0.1; Research Triangle Institute). This activity was reviewed by
9 the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable
10 federal law and CDC policy[†].

11 **Results**

12 Of 594,491 respondents (20.8% average response rate over this period), 577,110 (97.1%) reported
13 race/ethnicity and were included in this analysis. Of those, 558,409 (96.8%) reported nativity: 80,730
14 (14.5%) (weighted to 14.2%) were foreign-born and 477,679 (85.5%) (weighted to 85.8%) were U.S.-
15 born. Foreign-born and U.S.-born respondents differed in several statistically significant ways, including
16 by race/ethnicity (more foreign-born respondents identified as Asian or Hispanic/Latino, $p < 0.01$) and
17 social determinants of health: foreign-born respondents were more likely to have household incomes
18 below the federal poverty line, to lack health insurance, to have received no non-COVID-19 vaccines in
19 the past two years, and to live in a high social vulnerability index (SVI) county ($p < 0.01$) (Table 1).
20 Foreign-born respondents were also less likely to have medical comorbidities ($p < 0.01$) (Table 1).

21 By language of interview, 98.5% of participants (568,522 of 577,110) were interviewed in English, 1.2%
22 (6,760) in Spanish and 0.3% (1,828) in another language. Spanish-language interviewees were
23 significantly more likely than English-language interviewees to live below the federal poverty line (an
24 estimated 37.1% vs 10.4%, $p < 0.05$), lack health insurance (49.4% vs 9.3%, $p < 0.05$), or live in high SVI
25 counties (56.4% vs 32.2%, $p < 0.05$) (Table 1). Estimates of other-language interviewees differed
26 significantly ($p < 0.05$) from English-language interviewees by household income below the federal
27 poverty line (31.8% vs 10.4%) and lack of health insurance (17.9% vs 9.3%). A smaller estimated
28 percentage of Spanish-language interviewees than English-language interviewees had received a vaccine
29 other than COVID-19 in the past two years (38.6% vs. 54.3%, $p < 0.05$) (Table 1).

30 A higher estimated percentage of foreign-born respondents than U.S.-born respondents reported COVID-
31 19 vaccination (80.9% vs 72.6%, $p < 0.001$) (Table 2) or intended to be vaccinated (4.2% vs 2.9%,

1 p<0.001), and fewer were reluctant (6.0% vs 15.8%, p<0.001) (Table 2). Vaccination rate estimates
2 varied from a low of 76.5% among foreign-born respondents identifying as other/multiple race to a high
3 of 92.0% among foreign-born Asian respondents; by nativity and detailed race/ethnicity, vaccination rate
4 estimates ranged from 22.2% among US-born respondents with Somali heritage to 95.9% among foreign-
5 born Asian Indian respondents. Among Asian respondents of any nativity, an estimated 91.4% were
6 vaccinated; estimated vaccination rates were highest among respondents identifying as Asian Indian
7 (95.9%), followed by those identifying as Korean (93.0%), Chinese (92.2%), or Filipino (91.8%);
8 differences by nativity among Asian subgroups were not statistically significant. Differences in estimated
9 vaccination rate by nativity were observed among respondents identifying as White, Hispanic/Latino,
10 Black, and other/multiple race (Figure 1). Foreign-born respondents had higher estimated vaccination
11 rates within 14 of 17 racial/ethnic subgroups for which data were available, although not all differences
12 were statistically significant (Table 2). There was substantial heterogeneity in estimated vaccination rates
13 among racial/ethnic subgroups (Figure 2). Among Black subgroups, U.S.-born respondents identifying as
14 Somali, Haitian, or Jamaican had lower estimated vaccination coverage than African American persons
15 (22.2%, 54.2%, and 58.6%, respectively, vs. 69.7%) and the lowest of any racial/ethnic subgroups,
16 although sample sizes were small (Table 2). A smaller estimated percentage of foreign-born respondents
17 than U.S.-born respondents were reluctant to be vaccinated within each broad racial/ethnic category
18 (Table 2).

19 Spanish-language interviewees had lower estimated rates of vaccination (71.1%) than English-language
20 interviewees (73.7%, p<0.05) or other-language interviewees (77.4%, not a statistically significant
21 difference). A higher estimated percentage of Spanish-language interviewees than English-language
22 interviewees intended to be vaccinated (7.2% vs 2.9%, p<0.05) or were undecided (17.1% vs 8.6%,
23 p<0.05); few were reluctant (4.6% vs 14.8%, p<0.05) (Table 2).

24 Attitudes about vaccination varied by nativity: a higher estimated percentage of foreign-born than U.S.-
25 born respondents were concerned about COVID-19 disease (51.5% vs 42.7%, p<0.001), thought the
26 COVID-19 vaccine offers important protection (89.1% vs 79.1%, p<0.001), or had friends/family who
27 were vaccinated (78.1% vs 68.1%, p<0.001) (Supplemental Table 1). Foreign-born Asian respondents
28 were less likely to have confidence in COVID-19 vaccine safety than U.S.-born Asian respondents
29 (71.0% vs 79.4%, p<0.001), while foreign-born Hispanic and White respondents were more likely than
30 U.S. born Hispanic or White persons (61.4% and 72.5% vs 58.2% and 66.2%, p<0.001). Foreign-born
31 Asian Indian and Black respondents were less likely than Asian Indian or Black U.S.-born respondents to
32 have had a health care provider recommend vaccination (38.5% and 38.7% vs 51.9% and 41.7%, p<0.01)
33 (Supplemental Table 1). A statistically significant, higher estimated percentage of foreign-born

1 respondents had school or work vaccination requirements (31.4% vs 17.6%, $p<0.001$) (Supplemental
2 Table 1).

3 Among foreign-born respondents, an estimated 13.9% had difficulty getting vaccinated, compared to
4 15.8% of U.S.-born respondents ($p<0.001$) (Supplemental Table 2). Among the four specific barriers to
5 vaccination assessed, difficulty getting an appointment online was the most common (experienced by an
6 estimated 16.7% and 16.0% of foreign- and U.S.-born respondents, respectively) (Supplemental Table 2).
7 A higher proportion of foreign-born respondents did not know where to get vaccinated or reported
8 vaccination sites were hard to get to or not open at convenient times (8.8%, 6.4%, and 7.9% vs 7.8%,
9 5.7%, and 5.9%; $p<0.01$) (Supplemental Table 2).

10 Confidence in vaccine safety was lower among Spanish-language interviewees than English-language
11 interviewees (an estimated 53.2% vs 63.8%, respectively, $p<0.05$) (Supplemental Table 1). Spanish-
12 language interviewees were less likely to be concerned about COVID-19 illness (36.8% vs 44.0%,
13 $p<0.05$). Although Spanish-language interviewees overall had less difficulty in getting vaccinated or
14 making an appointment online (8.3% and 12.8% vs 15.7% and 16.2%, $p<0.001$), a greater proportion
15 reported not knowing where to get vaccinated or vaccines were not available at convenient times (10.7%
16 and 10.7% vs 7.9% and 6.0%, $p<0.001$).

17 **Discussion**

18 Disaggregation by nativity, detailed race/ethnicity, and language of interview found more heterogeneity in
19 vaccination coverage, intent, attitudes towards vaccination, and barriers to vaccination than grouping by
20 broad race/ethnic categories alone. Despite being more likely to have sociodemographic characteristics
21 previously associated with lower vaccination coverage such as low household income, lack of health
22 insurance, and living in a high SVI area¹¹, foreign-born respondents overall and within almost all
23 racial/ethnic groups were more likely than U.S.-born respondents to report vaccination or intent to be
24 vaccinated; the only exception, among Asian respondents, had high rates of vaccination regardless of
25 nativity. Foreign-born respondents overall were more likely to be concerned about COVID-19 disease,
26 think COVID-19 vaccination is safe and important, and to have vaccinated friends and family, and less
27 likely to have vaccine hesitancy than U.S.-born respondents; these attitudes may have helped promote
28 COVID-19 vaccination in these populations. COVID-19 vaccination messaging may have supported
29 some of these attitudes, although potentially influential messengers outside of family, friends and
30 healthcare providers were not assessed. Higher vaccination coverage among foreign-born persons
31 deviates from previously observed trends of lower adult vaccine coverage among the adult foreign-born

1 population prior to the COVID-19 pandemic⁶. Broad nationwide availability of vaccination, offered
2 irrespective of health insurance¹², immigration status¹³, at no cost, and in some cases in nontraditional
3 settings such as drive-through mass vaccination clinics¹⁴ or mobile clinics¹⁵, may have helped to address
4 logistical, financial, and legal barriers impacting uptake of other vaccines among foreign-born adults.

5 Despite higher vaccination coverage, a higher estimated percentage of foreign-born respondents than
6 U.S.-born respondents intend to be vaccinated but had not yet done so at the time of interview, suggesting
7 more work can be done to determine reasons for vaccination delay, address barriers to vaccination among
8 those intending to get vaccinated or undecided, and to increase vaccine confidence. Relatively low
9 vaccination rates among some racial and ethnic subgroups, including people who are Black identifying as
10 Haitian, Jamaican, or Somali, or Hispanic/Latinos identifying as Central Americans, suggests specific
11 communities that could benefit from focused efforts to support vaccine confidence and uptake¹⁶. U.S.-
12 born persons identifying as other/multiple race had the lowest estimated percentage of vaccination rates
13 and highest of reporting reluctance of any broad racial/ethnic category, suggesting a need to better
14 understand specific attitudes and barriers within the many communities grouped in this category.

15 The statistically significant, lower vaccination coverage estimate among Spanish-language interviewees
16 than English-language interviewees differs from the trend of higher vaccination coverage among foreign-
17 born respondents, despite most Spanish-language interviewees being foreign-born. Spanish-language
18 interviewees had higher estimated rates of poverty, lack of health insurance, and living in a high SVI area
19 than foreign-born respondents overall, which may be related to lower vaccination rates; Spanish-language
20 interviewees also had lower estimated rates of having received another vaccine in the previous two years.
21 Lower vaccination rates among Spanish-language interviewees may also be related to having lower
22 concern about COVID-19 disease or lower vaccine safety confidence than English-language interviewees,
23 or finding vaccines unavailable at convenient times or not knowing where to get a vaccine, in addition to
24 other barriers. Lower household income, living in a high SVI area, vaccine reluctance, and logistical
25 barriers to vaccination could be factors in vaccination disparities in this group and indicate specific needs
26 among Spanish speakers with limited English proficiency for more convenient vaccination site hours,
27 information about vaccination site locations, and enhanced linguistically appropriate information about
28 vaccine safety and potential health impacts of COVID-19; or indicate opportunities for social norms
29 interventions such as enlisting trusted community messengers and increasing vaccination
30 recommendations from healthcare providers¹⁶.

31 Barriers and attitudes data should be interpreted with caution as they may have changed over time with
32 changes in availability of vaccination, availability of information, and vaccination coverage within

1 communities. Vaccination rates among those interviewed in languages other than English or Spanish were
2 similar to English language interviewees, with higher intent and lower reluctance; findings are
3 challenging to interpret because although a majority (60.3%) identify as Asian, this group combines
4 speakers of many languages who may have heterogeneous vaccination rates, attitudes towards
5 vaccination, and social determinants of health.

6 This analysis is subject to several limitations. First, all information was self-reported and may be
7 impacted by social desirability bias. Second, data include surveys conducted in April 2021, within a few
8 weeks after all adults became eligible for COVID-19 vaccination in most U.S. jurisdictions; including
9 these allowed for larger groups for subcategory analysis. Third, the response rate was ~20%; while higher
10 than many phone surveys¹⁷, bias in estimates might remain after weighting for household nonresponse
11 and incomplete sample frame and calibrating survey weights to match vaccine provider counts of persons
12 receiving a dose of COVID-19 vaccine. Fourth, language was assessed based on interview language;
13 proficiency in English was not specifically assessed. Respondents from some racial/ethnic and nativity
14 groups and those interviewed in a language other than English are relatively few, which limits the
15 precision of those estimates and may reduce generalizability of those results. Fifth, respondents
16 identifying as White were not asked detailed national origin or heritage; subgroups of White respondents,
17 such as those from North Africa, the Middle East, or Western or Eastern Europe, could not be compared.
18 Sixth, respondents identifying as Alaska Native, American Indian, Native Hawaiian, or Pacific Islander
19 were not disaggregated in this data set and were grouped within “other/multiple race”, so these groups
20 could not be compared. Seventh, respondents self-reported nativity by answering the question, “Were you
21 born in the United States?” Because this question does not specifically include U.S. Territories such as
22 Puerto Rico or children born to U.S. parents abroad, some U.S.-born respondents may be counted as
23 foreign-born if they answered this question “no”. Eighth, this is a descriptive study that does not include
24 or adjust for all potential factors influencing vaccination. Subsequent multivariable analysis of these data
25 might help identify confounders and provide additional insight. Finally, respondents who were surveyed
26 soon after becoming eligible for vaccination might have reported barriers that have since been addressed;
27 vaccination coverage in all groups has improved over time¹⁸.

28 29 **Public Health Implications**

30 This is a unique, comprehensive evaluation of vaccination coverage, attitudes, and barriers by nativity and
31 detailed racial and ethnic subgroups and underscores the importance of collecting and reporting detailed
32 population data to better capture heterogeneity in vaccination rates and determinants in the increasingly
33 diverse U.S. population. The overall finding of COVID-19 vaccination coverage advantage among

1 foreign-born respondents, in contrast to other adult recommended vaccinations, suggests the importance
2 of making vaccines widely available at no cost and irrespective of health insurance and immigration
3 status to improve uptake among adults. The finding of substantial heterogeneity in vaccination rates,
4 intent, and reluctance by nativity, racial and ethnic subgroups, and language suggests a need to better
5 document, understand, and address specific barriers to vaccination within individual communities,
6 particularly those with lower vaccination rates identified in this analysis, and, more generally, suggests
7 use of broad racial/ethnic groups without disaggregation in public health data can obscure important
8 differences between communities. The NIS-ACM provides one example of best practices of collecting
9 critical demographic information and providing bilingual interviewers, interpreters in many languages,
10 and translated questionnaires when conducting population-based representative surveys. Collecting
11 information on specific country of birth, language spoken at home and level of English proficiency would
12 allow even more disaggregated data analysis to inform interventions that are culturally and linguistically
13 adapted to the diverse U.S. population, focused on subgroups with greater disparities and specific barriers
14 or attitudes. This approach can help achieve the national goal of eliminating racial and ethnic disparities
15 in COVID-19 vaccination.

16
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26
27 **Disclaimer:**

28 The findings and conclusions in this report are those of the authors and do not necessarily represent the
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30 †See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et
31 seq.

32 **Conflicts of Interest**

33 All authors declare they have no potential conflicts of interest and no sources of funding related to the
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- 24

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2 **FIGURE LEGENDS**

3

4 Figure 1. COVID-19 vaccination status and intent among adults age 18+ years by race/ethnicity and
5 nativity, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022.

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7 Figure 2. Heterogeneity in COVID-19 vaccination status in US adults illustrated by selected race/ethnicity
8 subgroups, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022

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10 Figure 3. COVID-19 vaccination status and intent among adults age 18+ years by preferred language of
11 interview, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022.

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Table 1. Sociodemographic characteristics by nativity and language of the interview, adults age 18+ years, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022.

	N	Foreign-Born Status*		Language of Interview		
		U.S.-born	Foreign-born	English	Spanish	Other
		(n = 477,679)	(n = 80,730)	(n = 568,522)	(n = 6,760)	(n = 1,828)
		% ^a (95% CI)		% ^a (95% CI)		
Overall	577,110	85.8 (85.6-86.0)	14.2 (14.0-14.4)	97.4 (97.3-97.5)	2.2 (2.1-2.3)	0.4 (0.4-0.4)
Age						
18-24	52,879	12.9 (12.7-13.1)	9.7 (9.3-10.1)	12.8 (12.6-12.9)	6.0 (5.0-7.1)	6.6 (4.8-9.0)
25-29	45,567	8.4 (8.2-8.6)	8.8 (8.4-9.2)	8.5 (8.3-8.6)	8.3 (7.2-9.5)	6.7 (5.0-8.9)
30-39	95,269	16.9 (16.6-17.1)	21.7 (21.2-22.3)	17.3 (17.1-17.5)	22.2 (20.5-24.0)	25.7 (22.2-29.5)
40-49	89,190	15.3 (15.1-15.5)	21.2 (20.6-21.8)	15.8 (15.6-16.0)	21.8 (20.1-23.5)	20.5 (17.2-24.4)
50-64	160,353	24.5 (24.3-24.8)	23.6 (23.0-24.2)	24.4 (24.1-24.6)	26.6 (24.8-28.4)	18.8 (15.9-22.1)
65-74	88,187	13.0 (12.9-13.2)	9.3 (8.8-9.7)	12.6 (12.4-12.8)	10.5 (9.3-11.9)	10.5 (8.1-13.6)
75+	39,359	8.9 (8.8-9.1)	5.7 (5.3-6.1)	8.6 (8.5-8.8)	4.7 (3.8-5.6)	11.2 (8.4-14.7)
Race/ethnicity						
Asian	29,721	1.5 (1.4-1.5)	21.0 (20.4-21.5)	4.1 (4.0-4.2)	0.1 (0.1-0.3)	60.3 (56.1-64.3)
Black	69,217	11.9 (11.7-12.1)	10.8 (10.3-11.2)	12.2 (12.0-12.4)	0.3 (0.2-0.6)	12.2 (9.8-15.2)
Hispanic	75,589	12.4 (12.2-12.7)	43.8 (43.0-44.5)	15.4 (15.2-15.6)	98.2 (97.7-98.6)	6.8 (5.0-9.1)
White	368,678	69.7 (69.4-69.9)	20.8 (20.2-21.3)	63.8 (63.5-64.0)	0.9 (0.6-1.3)	16.2 (13.5-19.3)
Other ^b /multiple race	33,905	4.5 (4.4-4.6)	3.7 (3.5-4.0)	4.5 (4.4-4.7)	0.4 (0.3-0.8)	4.5 (3.1-6.4)
Race/ethnicity subgroups						
Hispanic/Latino						
Mexican	28,093	54.8 (53.9-55.7)	42.8 (41.6-44.0)	48.9 (48.1-49.6)	59.1 (57.0-61.1)	11.6 (5.4-23.2)
Puerto Rican	23,450	17.4 (16.8-18.1)	13.5 (13.0-14.1)	17.8 (17.3-18.2)	4.8 (4.1-5.7)	8.7 (1.8-32.9)
Cuban	1,593	2.6 (2.3-2.9)	4.5 (3.9-5.2)	3.5 (3.1-3.8)	2.3 (1.7-3.2)	0.0 (-)
Central American	4,502	4.4 (4.1-4.8)	13.6 (12.7-14.5)	6.3 (6.0-6.7)	17.6 (16.0-19.4)	4.5 (1.8-11.1)
South American	5,515	3.9 (3.6-4.3)	13.2 (12.5-14.0)	7.5 (7.1-7.9)	4.8 (4.1-5.7)	55.6 (40.6-69.5)
Other	12,436	16.8 (16.2-17.5)	12.4 (11.6-13.2)	16.2 (15.6-16.7)	11.3 (10.1-12.7)	19.6 (11.9-30.4)
Asian						
Asian Indian	8,348	18.4 (16.7-20.3)	31.7 (30.4-33.0)	29.3 (28.2-30.4)	15.5 (4.1-44.1)	4.3 (2.6-7.0)
Chinese	6,105	24.3 (22.4-26.4)	23.4 (22.3-24.7)	21.8 (20.8-22.8)	5.8 (1.6-19.6)	49.3 (43.6-55.1)
Filipino	3,458	12.1 (10.7-13.7)	12.2 (11.3-13.2)	12.9 (12.1-13.8)	16.7 (2.4-61.7)	0.7 (0.3-1.7)
Japanese	1,981	10.5 (9.3-11.8)	1.7 (1.4-2.1)	4.5 (4.0-5.0)	4.0 (1.0-14.7)	1.2 (0.7-1.8)
Korean	1,881	7.5 (6.4-8.8)	5.7 (5.2-6.4)	6.1 (5.5-6.6)	1.1 (0.1-7.9)	8.5 (5.6-12.8)
Vietnamese	1,684	10.8 (9.3-12.5)	7.3 (6.4-8.1)	7.8 (7.1-8.5)	4.5 (0.7-23.0)	15.4 (11.5-20.4)

Other	6,264	16.3 (14.6-18.1)	17.9 (16.8-19.1)	17.8 (16.8-18.7)	52.5 (22.7-80.6)	20.5 (16.6-25.0)
Black						
African American	54,332	87.8 (87.2-88.4)	25.2 (23.4-27.0)	79.6 (78.9-80.2)	27.9 (10.5-56.0)	14.5 (8.1-24.5)
Jamaican	2,044	1.5 (1.3-1.7)	20.8 (19.0-22.7)	4.1 (3.8-4.5)	0.0 (-.)	2.4 (0.3-15.2)
Haitian	882	1.0 (0.8-1.2)	8.3 (7.0-9.9)	1.8 (1.6-2.1)	28.4 (5.4-73.3)	23.7 (14.6-36.1)
Nigerian	1,413	0.8 (0.6-0.9)	8.8 (7.8-9.9)	1.8 (1.6-2.0)	1.1 (0.1-8.1)	0.2 (0.0-1.6)
Ethiopian	621	0.2 (0.1-0.3)	3.9 (3.2-4.7)	0.6 (0.5-0.7)	0.0 (-.)	12.4 (6.4-22.8)
Somali	194	0.1 (0.1-0.4)	1.6 (1.2-2.0)	0.3 (0.2-0.5)	0.0 (-.)	9.4 (4.7-17.9)
Other	9,731	8.6 (8.1-9.1)	31.5 (29.6-33.5)	11.8 (11.3-12.3)	42.6 (15.9-74.4)	37.3 (27.1-48.8)
Language of interview						
English	568,522	99.8 (99.7-99.8)	83.9 (83.3-84.5)	100.0 (-.)	0.0 (-.)	0.0 (-.)
Spanish	6,760	0.2 (0.2-0.2)	13.6 (13.1-14.2)	0.0 (-.)	100.0 (-.)	0.0 (-.)
Other	1,828	0.0 (0.0-0.1)	2.5 (2.3-2.7)	0.0 (-.)	0.0 (-.)	100.0 (-.)
Nativity						
U.S.-born	477,679	100.0 (-.)	0.0 (-.)	87.8 (87.6-88.0)	8.3 (7.2-9.4)	8.6 (6.2-11.8)
Foreign-born	80,730	0.0 (-.)	100.0 (-.)	12.2 (12.0-12.4)	91.7 (90.6-92.8)	91.4 (88.2-93.8)
Sex						
Male	278,836	48.0 (47.7-48.3)	49.8 (49.1-50.5)	48.4 (48.2-48.7)	46.1 (44.1-48.2)	46.9 (42.6-51.2)
Female	296,407	52.0 (51.7-52.3)	50.2 (49.5-50.9)	51.6 (51.3-51.8)	53.9 (51.8-55.9)	53.1 (48.8-57.4)
Household income						
Below poverty	54,062	10.5 (10.3-10.7)	16.6 (16.1-17.2)	10.4 (10.3-10.6)	37.1 (35.1-39.2)	31.8 (27.8-36.1)
Above poverty, <\$75K	182,400	34.0 (33.7-34.3)	31.1 (30.5-31.8)	32.7 (32.5-33.0)	28.5 (26.7-30.4)	26.7 (23.3-30.4)
Above poverty, ≥\$75K	222,856	35.5 (35.2-35.8)	30.2 (29.6-30.9)	34.5 (34.3-34.7)	2.9 (2.2-3.7)	8.0 (6.1-10.4)
Unknown income	117,792	20.0 (19.8-20.3)	22.0 (21.4-22.6)	22.4 (22.1-22.6)	31.5 (29.6-33.4)	33.5 (29.5-37.8)
Health insurance						
Insured	523,866	91.3 (91.2-91.5)	81.5 (80.9-82.0)	90.7 (90.5-90.8)	50.6 (48.5-52.7)	82.1 (78.7-85.1)
Not insured	45,244	8.7 (8.5-8.8)	18.5 (18.0-19.1)	9.3 (9.2-9.5)	49.4 (47.3-51.5)	17.9 (14.9-21.3)
Urbanicity						
MSA, principal city	188,124	28.7 (28.5-29.0)	41.4 (40.7-42.1)	30.3 (30.0-30.5)	45.3 (43.3-47.4)	51.2 (46.9-55.5)
MSA, non-principal city	281,356	56.0 (55.7-56.3)	53.8 (53.1-54.5)	55.8 (55.5-56.0)	48.2 (46.2-50.3)	45.2 (41.0-49.5)
Non-MSA	107,630	15.3 (15.1-15.5)	4.8 (4.5-5.1)	14.0 (13.8-14.1)	6.4 (5.6-7.4)	3.6 (2.5-5.1)
Received any vaccine that was not a COVID-19 vaccine in the past 2 years						
Yes	341,823	55.1 (54.8-55.4)	49.7 (49.0-50.4)	54.3 (54.0-54.5)	38.6 (36.6-40.7)	52.9 (48.5-57.2)
No	231,890	44.9 (44.6-45.2)	50.3 (49.6-51.0)	45.7 (45.5-46.0)	61.4 (59.3-63.4)	47.1 (42.8-51.5)
Frontline and essential workers						
Essential health care	61,517	9.1 (9.0-9.3)	10.0 (9.6-10.4)	9.4 (9.2-9.5)	2.8 (2.2-3.5)	4.9 (3.5-6.8)

School and childcare	22,400	3.1 (3.0-3.2)	2.5 (2.3-2.7)	3.0 (3.0-3.1)	0.8 (0.5-1.2) 12.6 (11.2-14.1)	1.3 (0.6-2.8)
Other frontline worker	39,279	7.9 (7.8-8.1)	7.5 (7.1-7.9)	7.7 (7.6-7.9)	12.1 (11.9-12.3)	6.1 (4.6-8.2)
Other essential worker	65,208	12.3 (12.1-12.5)	12.4 (11.9-12.9)	12.1 (11.9-12.3)	20.5 (18.9-22.2)	10.8 (8.3-13.9)
Not a frontline or essential worker	385,521	67.6 (67.3-67.8)	67.7 (67.0-68.4)	67.8 (67.5-68.0)	63.4 (61.3-65.4)	76.9 (73.2-80.2)
Comorbidities						
Yes (any)	174,042	31.0 (30.7-31.2)	21.6 (21.0-22.2)	29.7 (29.5-30.0)	20.0 (18.4-21.7)	16.0 (12.9-19.6)
No	396,614	69.0 (68.8-69.3)	78.4 (77.8-79.0)	70.3 (70.0-70.5)	80.0 (78.3-81.6)	84.0 (80.4-87.1)
SVI of county of residence						
Low	172,777	29.4 (29.2-29.7)	22.6 (22.1-23.2)	28.9 (28.6-29.1)	12.2 (10.9-13.6)	20.6 (17.3-24.3)
Moderate	193,070	38.9 (38.6-39.1)	38.8 (38.1-39.6)	39.0 (38.7-39.2)	31.4 (29.2-33.6)	42.7 (38.0-47.4)
High	144,595	31.7 (31.4-32.0)	38.5 (37.7-39.3)	32.2 (31.9-32.4)	56.4 (54.2-58.7)	36.8 (32.3-41.5)

^a Weighted percentages.

^b 'Other' includes American Indian, Alaska Native, Native Hawaiian, and Pacific Islander.

*18,701 of 577,110 respondents (0.3%) did not provide nativity

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Table 2. COVID-19 vaccination status and intent by nativity, detailed race/ethnicity, and language of interview, adults age 18+ years, National Immunization Survey Adult COVID Module, April 22, 2021-January 29, 2022.

	N	Vaccination status and intent			
		Vaccinated	Intend to be vaccinated	Undecided	Reluctant
		% ^a (95% CI)			
Overall	556,872	73.8 (73.5-74.0)	3.1 (3.0-3.2)	8.7 (8.6-8.9)	14.4 (14.2-14.6)
U.S.-born	476,315	72.6 (72.3-72.9)	2.9 (2.8-3.0)	8.7 (8.5-8.9)	15.8 (15.6-16.1)
Foreign-born	80,557	80.9 (80.3-81.5)	4.2 (3.8-4.5)	8.9 (8.5-9.4)	6.0 (5.6-6.4)
Hispanic/Latino	71,080	72.9 (72.3-73.6)	4.3 (4.0-4.6)	11.4 (10.9-11.9)	11.4 (10.9-11.9)
U.S.-born	44,139	70.4 (69.5-71.3)	3.9 (3.5-4.3)	11.1 (10.5-11.8)	14.6 (13.9-15.3)
Foreign-born	26,941	77.4 (76.3-78.4)	5.0 (4.4-5.6)	11.7 (10.9-12.6)	6.0 (5.4-6.6)
Mexican	26,785	71.4 (70.4-72.4)	4.7 (4.2-5.2)	11.8 (11.1-12.6)	12.0 (11.3-12.8)
U.S.-born	19,514	69.4 (68.1-70.6)	4.2 (3.7-4.8)	11.4 (10.6-12.3)	15.0 (14.1-16.0)
Foreign-born	7,271	76.0 (74.3-77.8)	5.8 (4.9-6.9)	12.8 (11.5-14.2)	5.4 (4.5-6.3)
Puerto Rican	21,779	75.4 (73.8-76.9)	3.4 (2.8-4.1)	10.3 (9.2-11.4)	11.0 (9.8-12.2)
U.S.-born	12,482	72.7 (70.6-74.6)	3.8 (3.0-4.8)	10.6 (9.3-12.1)	12.9 (11.4-14.6)
Foreign-born	9,297	81.4 (79.4-83.3)	2.5 (1.9-3.4)	9.5 (8.1-11.0)	6.6 (5.3-8.1)
Cuban	1,506	75.3 (71.1-79.1)	4.7 (3.1-7.0)	8.1 (6.0-10.8)	11.9 (9.1-15.4)
U.S.-born	906	73.7 (67.8-78.8)	2.8 (1.4-5.6)	7.7 (5.2-11.3)	15.7 (11.6-21.1)
Foreign-born	600	76.8 (70.5-82.1)	6.6 (4.0-10.6)	8.5 (5.5-12.8)	8.2 (4.9-13.2)
Central American	4,263	71.9 (69.3-74.4)	5.8 (4.5-7.3)	14.2 (12.3-16.4)	8.1 (6.6-9.9)
U.S.-born	1,607	72.4 (67.9-76.5)	3.9 (2.6-5.9)	12.5 (9.7-16.1)	11.1 (8.3-14.9)
Foreign-born	2,656	71.6 (68.3-74.8)	6.8 (5.1-9.0)	15.2 (12.8-18.0)	6.3 (4.8-8.4)
South American	5,325	84.0 (81.8-85.9)	2.7 (1.9-3.7)	7.3 (5.9-8.9)	6.1 (4.9-7.5)
U.S.-born	1,651	79.8 (75.6-83.4)	3.2 (1.9-5.5)	8.1 (5.6-11.4)	8.9 (6.5-12.0)
Foreign-born	3,674	86.1 (83.6-88.3)	2.4 (1.6-3.6)	6.8 (5.3-8.8)	4.6 (3.4-6.3)
Other	11,422	70.1 (68.3-71.8)	3.7 (3.1-4.4)	12.1 (10.8-13.4)	14.1 (12.9-15.5)
U.S.-born	7,979	68.2 (66.1-70.2)	3.2 (2.6-4.0)	11.7 (10.2-13.3)	16.9 (15.3-18.6)
Foreign-born	3,443	74.6 (71.4-77.5)	4.7 (3.4-6.5)	13.0 (10.8-15.6)	7.7 (6.0-9.9)
Asian	28,582	91.4 (90.5-92.2)	3.0 (2.5-3.6)	3.5 (3.0-4.0)	2.1 (1.7-2.6)
U.S.-born	8,136	89.9 (88.0-91.6)	2.3 (1.5-3.5)	4.5 (3.4-5.8)	3.3 (2.3-4.6)
Foreign-born	20,446	92.0 (91.0-92.9)	3.3 (2.7-4.1)	3.1 (2.5-3.7)	1.6 (1.3-2.1)
Asian Indian	7,991	95.7 (94.6-96.5)	2.4 (1.7-3.3)	1.4 (1.0-2.0)	0.6 (0.3-1.1)
U.S.-born	1,293	94.9 (91.8-96.8)	1.4 (0.5-4.1)	3.3 (1.8-5.9)	0.4 (0.2-1.1)
Foreign-born	6,698	95.9 (94.6-96.8)	2.6 (1.8-3.7)	1.0 (0.6-1.5)	0.6 (0.3-1.3)
Chinese	5,946	92.2 (90.4-93.7)	3.2 (2.2-4.6)	2.7 (1.9-3.8)	1.9 (1.2-2.9)
U.S.-born	1,702	95.3 (92.6-97.0)	1.5 (0.7-3.5)	2.1 (1.0-4.3)	1.1 (0.5-2.6)
Foreign-born	4,244	90.9 (88.5-92.8)	3.9 (2.6-5.8)	3.0 (2.1-4.4)	2.2 (1.3-3.6)
Filipino	3,333	91.8 (89.3-93.8)	2.1 (1.1-3.7)	3.9 (2.6-5.8)	2.2 (1.3-3.6)
U.S.-born	1,011	88.6 (82.7-92.7)	1.3 (0.5-3.1)	5.5 (2.8-10.7)	4.6 (2.2-9.4)

Foreign-born	2,322	93.2 (90.4-95.2)	2.4 (1.2-4.8)	3.3 (2.0-5.3)	1.1 (0.6-2.1)
Japanese	1,945	91.6 (87.4-94.5)	2.3 (0.8-6.8)	4.0 (2.2-7.1)	2.0 (1.2-3.4)
U.S.-born	1,484	92.1 (86.3-95.5)	2.4 (0.6-9.6)	3.2 (1.3-7.5)	2.3 (1.3-4.1)
Foreign-born	461	90.5 (83.9-94.5)	2.2 (0.8-6.2)	6.0 (2.8-12.2)	1.3 (0.4-4.0)
Korean	1,836	93.0 (90.0-95.2)	2.5 (1.3-4.7)	2.2 (1.2-4.0)	2.3 (1.1-4.5)
U.S.-born	575	90.3 (83.3-94.6)	3.3 (1.3-8.6)	2.9 (1.0-8.2)	3.5 (1.2-9.4)
Foreign-born	1,261	94.5 (91.5-96.5)	2.0 (0.8-4.8)	1.9 (1.0-3.4)	1.6 (0.7-3.7)
Vietnamese	1,632	89.3 (84.8-92.5)	2.3 (1.1-5.0)	3.6 (2.2-5.8)	4.8 (2.5-9.2)
U.S.-born	653	84.6 (75.3-90.8)	2.8 (1.0-7.5)	3.6 (1.8-7.1)	9.1 (4.0-19.3)
Foreign-born	979	92.2 (87.5-95.2)	2.0 (0.6-6.2)	3.6 (1.9-6.8)	2.2 (0.8-5.8)
Other	5,899	83.6 (80.6-86.2)	5.2 (3.5-7.5)	7.7 (5.8-10.0)	3.5 (2.6-4.8)
U.S.-born	1,418	79.4 (72.4-84.9)	4.4 (1.8-10.5)	10.7 (6.6-17.0)	5.5 (3.3-9.2)
Foreign-born	4,481	85.2 (82.0-88.0)	5.5 (3.6-8.2)	6.5 (4.7-8.9)	2.8 (1.9-4.0)
Black	65,556	69.3 (68.5-70.1)	4.6 (4.3-4.9)	13.5 (12.9-14.1)	12.6 (12.0-13.2)
U.S.-born	54,752	68.7 (67.8-69.5)	4.4 (4.0-4.7)	13.4 (12.8-14.0)	13.6 (12.9-14.2)
Foreign-born	10,804	73.3 (71.3-75.3)	6.1 (5.1-7.2)	14.3 (12.7-16.1)	6.3 (5.3-7.4)
African American	51,659	69.9 (69.0-70.7)	4.3 (4.0-4.7)	13.2 (12.6-13.9)	12.6 (12.0-13.2)
U.S.-born	48,270	69.7 (68.9-70.6)	4.2 (3.9-4.6)	13.2 (12.6-13.9)	12.8 (12.1-13.5)
Foreign-born	3,389	72.7 (68.8-76.3)	6.1 (4.5-8.3)	13.2 (10.5-16.4)	8.0 (5.9-10.8)
Jamaican	1,932	68.6 (64.5-72.4)	5.2 (3.5-7.5)	15.8 (12.9-19.3)	10.4 (8.1-13.2)
U.S.-born	639	58.6 (51.0-65.8)	6.0 (3.2-11.0)	18.2 (13.1-24.8)	17.1 (12.3-23.3)
Foreign-born	1,293	73.4 (68.5-77.8)	4.8 (3.0-7.7)	14.7 (11.3-18.9)	7.1 (4.9-10.4)
Haitian	841	60.7 (53.8-67.3)	6.7 (4.2-10.7)	21.7 (16.2-28.6)	10.8 (7.1-16.0)
U.S.-born	367	54.2 (44.5-63.7)	7.9 (3.9-15.3)	20.5 (13.6-29.8)	17.4 (10.5-27.3)
Foreign-born	474	66.1 (56.2-74.7)	5.8 (3.0-10.9)	22.7 (14.9-33.0)	5.4 (2.8-10.1)
Nigerian	1,360	74.9 (69.6-79.6)	5.6 (3.6-8.5)	10.1 (6.9-14.4)	9.4 (6.4-13.6)
U.S.-born	427	68.5 (59.5-76.3)	3.0 (1.1-7.8)	8.9 (5.5-14.2)	19.5 (12.8-28.6)
Foreign-born	933	78.6 (71.8-84.2)	7.0 (4.3-11.3)	10.7 (6.5-17.3)	3.6 (1.6-7.8)
Ethiopian	583	77.2 (68.7-83.9)	6.8 (3.5-12.8)	11.0 (6.3-18.3)	5.1 (2.3-10.9)
U.S.-born	111	69.4 (48.6-84.4)	6.2 (1.8-19.7)	14.3 (4.5-36.8)	10.1 (3.0-28.9)
Foreign-born	472	79.7 (70.4-86.6)	7.0 (3.2-14.6)	9.9 (5.3-17.6)	3.4 (1.2-9.6)
Somali	180	49.0 (30.4-67.9)	5.3 (2.5-11.0)	17.1 (8.9-30.4)	28.6 (10.0-59.2)
U.S.-born	47	22.2 (6.8-52.5)	6.0 (1.4-22.0)	2.8 (0.5-13.1)	69.1 (34.0-90.6)
Foreign-born	133	65.1 (50.8-77.0)	4.8 (2.0-11.2)	25.7 (14.9-40.6)	4.4 (1.1-15.4)
Other	9,001	66.2 (63.8-68.5)	5.5 (4.4-6.9)	13.9 (12.3-15.6)	14.4 (12.6-16.4)
U.S.-born	4,891	62.0 (58.9-65.1)	4.9 (3.6-6.8)	13.9 (11.9-16.2)	19.1 (16.5-22.0)
Foreign-born	4,110	73.8 (70.3-77.0)	6.7 (5.0-8.9)	13.8 (11.2-16.8)	5.8 (4.4-7.6)
White	359,284	74.5 (74.2-74.8)	2.4 (2.3-2.5)	7.3 (7.1-7.5)	15.8 (15.6-16.1)
U.S.-born	341,213	74.1 (73.8-74.5)	2.4 (2.2-2.5)	7.3 (7.1-7.5)	16.2 (15.9-16.4)
Foreign-born	18,071	81.9 (80.6-83.1)	2.5 (2.0-3.0)	6.3 (5.5-7.2)	9.3 (8.4-10.3)
Other^b/multiple race	32,370	61.8 (60.5-63.0)	4.2 (3.7-4.9)	11.4 (10.6-12.3)	22.6 (21.4-23.8)

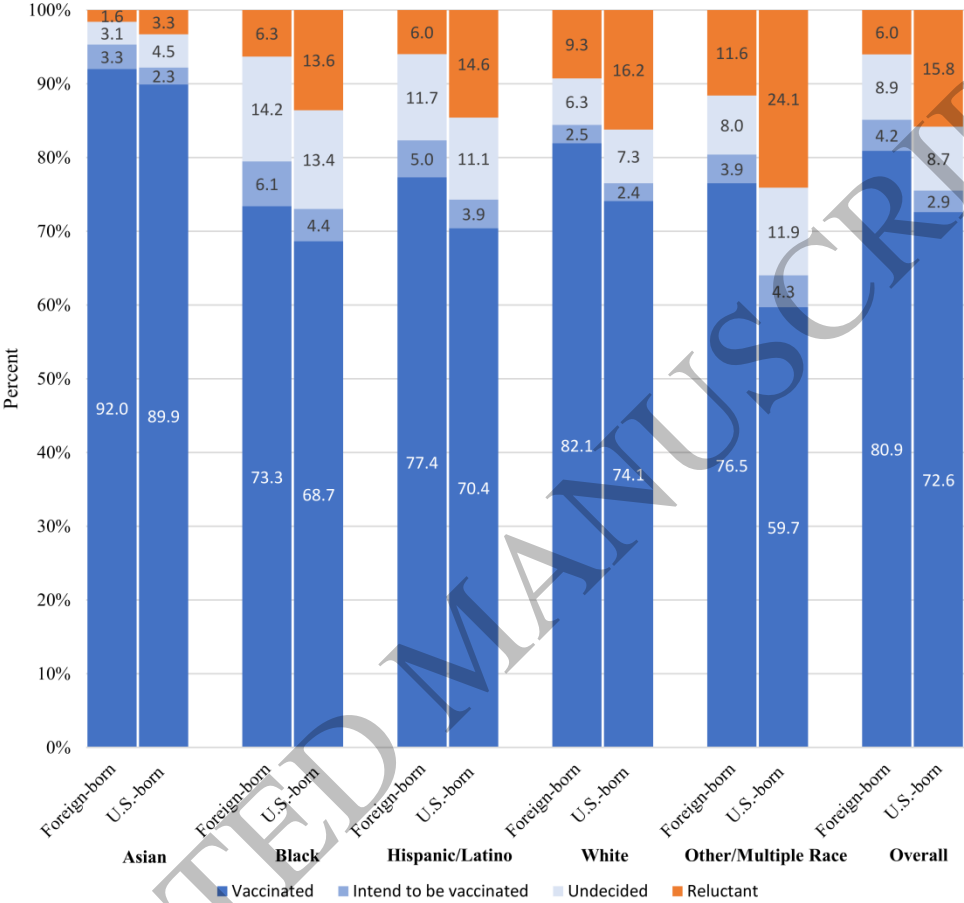
U.S.-born	28,075	59.7 (58.4-61.1)	4.3 (3.7-5.0)	11.9 (11.0-12.9)	24.1 (22.8-25.3)
Foreign-born	4,295	76.5 (73.0-79.7)	3.9 (2.7-5.7)	8.0 (6.2-10.3)	11.6 (9.1-14.7)
Language of interview	564,625	73.6 (73.4-73.9)	3.1 (3.0-3.2)	8.8 (8.6-8.9)	14.5 (14.3-14.8)
English	556,919	73.7 (73.4-73.9)	2.9 (2.8-3.1)	8.6 (8.4-8.8)	14.8 (14.6-15.0)
Spanish	6,049	71.1 (69.0-73.1)	7.2 (6.0-8.6)	17.1 (15.5-18.9)	4.6 (3.7-5.6)
Other	1,657	77.4 (73.0-81.2)	8.2 (5.6-11.7)	7.8 (5.8-10.5)	6.7 (4.6-9.6)
^a Weighted percentages. ^b 'Other' includes American Indian, Alaska Native, Native Hawaiian, and Pacific Islander.					

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ACCEPTED MANUSCRIPT

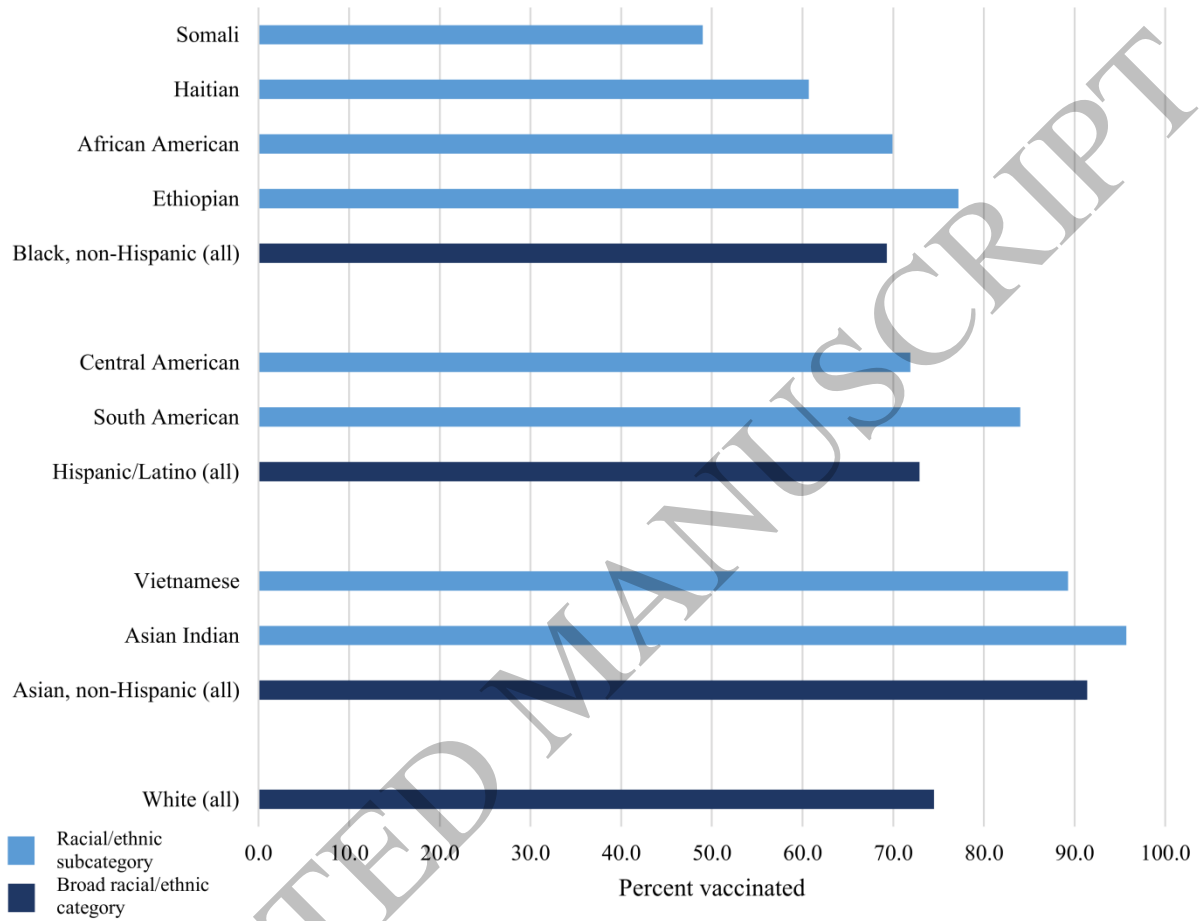
Figure 1. COVID-19 vaccination status and intent among adults age 18+ years by race/ethnicity and nativity, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022.



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Figure 1
216x279 mm (.38 x DPI)

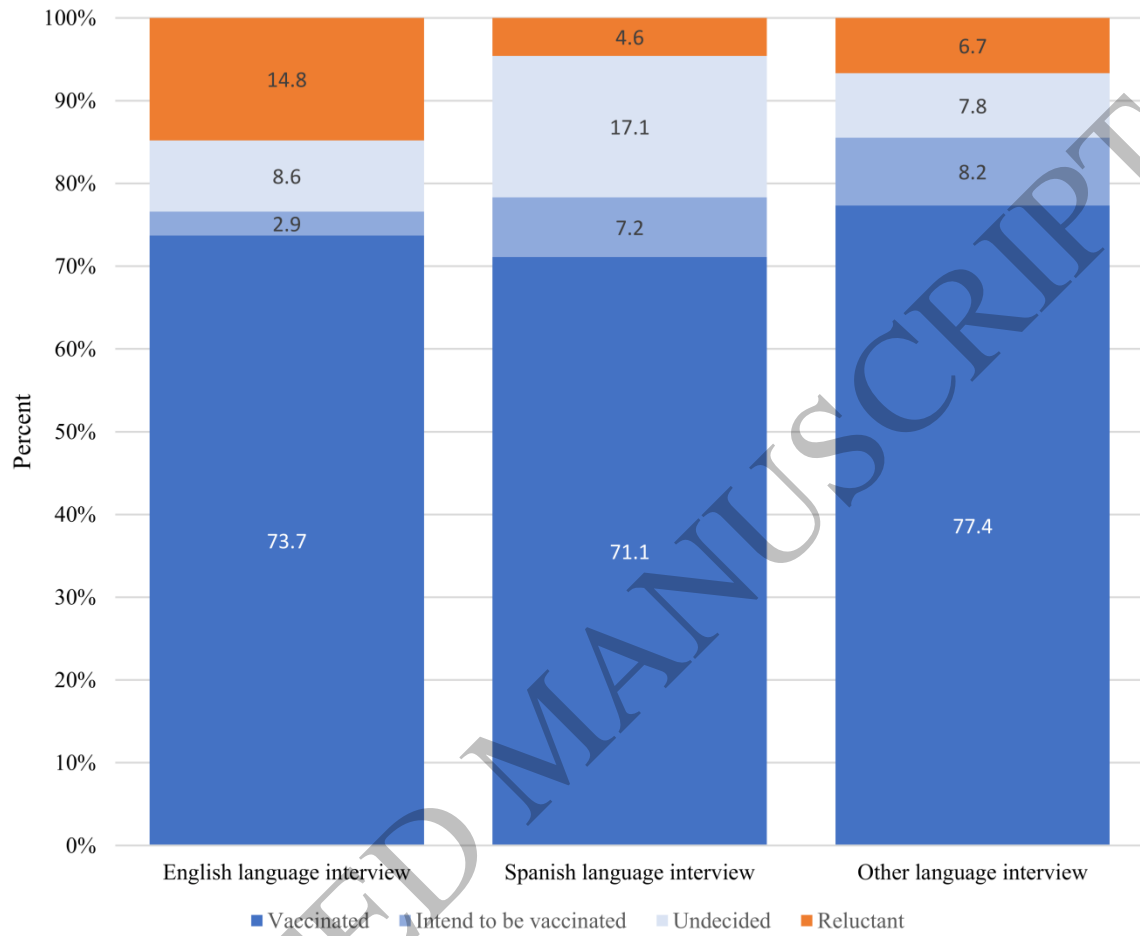
Figure 2. Heterogeneity in COVID-19 vaccination status in US adults illustrated by selected race/ethnicity subgroups, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022



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Figure 2
177x155 mm (.38 x DPI)

Figure 3. COVID-19 vaccination status and intent among adults age 18+ years by preferred language of interview, National Immunization Survey Adult COVID Module, April 22, 2021–January 29, 2022.



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Figure 3
175x145 mm (.38 x DPI)