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RESEARCH ARTICLE

COVID-19 Vaccination and Intent for Vaccination of Adults With Reported Medical Conditions

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Introduction: Individuals with certain medical conditions are at substantially increased risk for severe illness from COVID-19. The purpose of this study is to assess COVID-19 vaccination among U.S. adults with reported medical conditions.

Methods: Data from the National Immunization Survey-Adult COVID Module collected during August 1−September 25, 2021 were analyzed in 2022 to assess COVID-19 vaccination status, intent, vaccine confidence, behavior, and experience among adults with reported medical conditions. Unadjusted and age-adjusted prevalence ratios (PRs and APRs) were generated using logistic regression and predictive marginals.

Results: Overall, COVID-19 vaccination coverage with ≥1 dose was 81.8% among adults with reported medical conditions, and coverage was significantly higher compared with those without such conditions (70.3%) Among adults aged ≥18 years with medical conditions, COVID-19 vaccination coverage was significantly higher among those with a provider recommendation (86.5%) than those without (76.5%). Among all respondents, 9.2% of unvaccinated adults with medical conditions reported they were willing or open to vaccination. Adults who reported high risk medical conditions were more likely to report receiving a provider recommendation, often or always wearing masks during the last 7 days, concerning about getting COVID-19, thinking the vaccine is safe, and believing a COVID-19 vaccine is important for protection from COVID-19 infection than those without such conditions.

Conclusions: Approximately 18.0% of those with reported medical conditions were unvaccinated. Receiving a provider recommendation was significantly associated with vaccination, reinforcing that provider recommendation is an important approach to increase vaccination coverage. Ensuring access to vaccine, addressing vaccination barriers, and increasing vaccine confidence can improve vaccination coverage among unvaccinated adults.

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INTRODUCTION

Persons with certain medical conditions such as lung disease, heart disease, diabetes, renal disease, liver disease, and cancer are at substantially increased risk for severe illness from coronavirus disease 2019 (COVID-19), including hospitalization, admission to the intensive care unit, intubation or mechanical ventilation, and death.[1,2] Studies showed that nearly 90% of persons hospitalized for COVID-19 have an underlying medical condition.[2] The risk for COVID-19–associated hospitalization increases with an increasing number of medical conditions.[2]

Vaccination of persons with these conditions is a key public health strategy in preventing COVID-19–related morbidity and mortality. Although the Advisory Committee on Immunization Practices (ACIP) initially prioritized persons with certain medical conditions for receiving COVID-19 vaccination when vaccine supplies were limited, monitoring COVID-19 vaccination coverage among adults with these conditions at a population level has been challenging. The objective of this study was to assess COVID-19 vaccination status, intent, vaccine confidence, behavior, and experience among U.S. adults with reported medical conditions that increased their risk of COVID-19 using data from the National Immunization Survey-Adult COVID Module (NIS-ACM).[3]

METHODS

Study Sample

The NIS-ACM is a national telephone survey conducted by the Centers for Disease Control and Prevention (CDC). Interviews were conducted in English, Spanish, and other languages among U.S. adults aged ≥18 years using a random-digit-dialed sample of cellular telephone numbers. The data in this study were collected during August 1, 2021–September 25, 2021, and data were analyzed in 2022. Receipt of ≥1 dose of COVID-19 vaccine was based on response to the question *Have you received at least one dose of a COVID-19 vaccine*? Adults reporting not receiving a vaccine were asked *How likely are you to get a COVID-19 vaccine? Would you say you would definitely get a vaccine, probably get a vaccine, probably not get a vaccine, definitely not get a vaccine, or are not sure*? Survey questions also collected information on vaccine confidence, behaviors, and experiences such as concern about getting COVID-19, thinking that COVID-19 vaccines are safe, believing that COVID-19 vaccines are important for protection from COVID-19, whether the respondent often or always wore a mask, and whether the respondent had difficulty in getting a COVID-19 vaccine (e.g., difficulty in getting an appointment online, difficulty in knowing where to get vaccinated, difficulty in getting to vaccination sites). Respondents were asked *Do you have a health condition that may put you at higher risk for COVID-19?* Those answering yes were considered high-risk medical conditions (referred to as high-risk medical conditions in the remaining part of this paper). To further identify what type of conditions people have, those answering yes to the question mentioned earlier were further asked *Can you tell me what that is?* Adults aged ≥65 years who only reported older age as a health condition were not considered to have a high-risk medical condition. Information on demographic and access-to-care characteristics and whether the respondent ever had COVID-19 were also collected.[3]

Measures

COVID-19 vaccination coverage was stratified by demographic and access-to-care characteristics. Race/ethnicity was classified as non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic Others (including non-Hispanic Asians, non-Hispanic American Indian/Alaska Native, non-Hispanic Pacific Islander/Native Hawaiian, and other or multiple race). Urbanicity status was derived on the basis of the centroid of the ZIP code of residence, categorized as metropolitan statistical area (MSA) principal city, MSA nonprincipal city, and non-MSA.[4] Social vulnerability index (SVI) was categorized as low, moderate, or high on the basis of the county of residence (CDC/Agency for Toxic Substances and Disease Registry) using tertiles of SVI score.[5]

Statistical Analysis

Data were analyzed using SAS (version 9.4) and SUDAAN (version 11.0.1) (Research Triangle Institute). All percentages were weighted to represent the non-institutionalized U.S. adult population. Survey weights were also calibrated to state-level vaccine administration data reported to CDC.[6] Unadjusted prevalence ratios (PRs) and age-adjusted prevalence ratios were generated using logistic regression and predictive marginals.[7] *T*-tests were used to determine the differences between groups with statistical significance at $p<0.05$. This activity was reviewed by CDC and was conducted in consistence with applicable federal law and CDC policy.

RESULTS

The response rate was 20.5% in August and 20.9% in September. Of the 136,619 adults who completed an interview, 39,365 (28.3%) reported that they had high-risk medical conditions. Coverage with ≥1 dose of COVID-19 vaccine was 81.8% among adults with reported high-risk medical conditions, and coverage was significantly higher than among those who did not report such conditions (70.3%) (Table 1). Overall, 9.2% of adults with reported high-risk medical conditions still planned to get vaccinated or were unsure, whereas 9.0% probably will not or definitely will not get vaccinated. Adults with reported high-risk medical conditions were half as likely to report that they were unvaccinated and would probably or definitely not get vaccinated than those who did not report such conditions (9.0% vs 16.6%). Percentage estimates of reporting "probably will not or definitely will not get vaccinated" were significantly lower among those with reported high-risk medical conditions than among those without such

Table 1. COVID-19 Vaccination, Intent, and Vaccine Confidence/Behavior by Status of Reported Medical Conditions That Increased Their Risk of COVID-19 Among Adults Aged ≥18 Years, NIS-ACM, August 1—September 25, 2021

		Persons aged ≥18 years		Persons aged 18—49 years		Persons aged 50—64 years		Persons aged ≥65 years	
COVID-19 vaccine and vaccination related characteristics	**Total (N=136,619) %[a] (95% CI)**	**Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=39,365) %[a] (95% CI)**	**Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=95,520) %[a] (95% CI)**	**Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=13,161) %[a] (95% CI)**	**Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=53,227) %[a] (95% CI)**	**Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=13,523) %[a] (95% CI)**	**Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=23,411) %[a] (95% CI)**	**Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=12,134) %[a] (95% CI)**	**Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=17,240) %[a] (95% CI)**
Vaccination coverage (≥1 dose)	73.3 (72.9, 73.8)	81.8 (80.9, 82.6)	**70.3 (69.7, 70.9)[b]**	70.9 (69.2, 72.4)	**62.1 (61.3, 62.9)[b]**	83.8 (82.4, 85.1)	**78.3 (77.1, 79.4)[b]**	92.8 (91.8, 93.7)	**90.4 (89.4, 91.3)[b]**
Vaccination intent among unvaccinated adults									
Definitely plan to get vaccinated	2.9 (2.7, 3.1)	2.6 (2.3, 3.0)	3.0 (2.7, 3.2)	4.0 (3.3, 4.8)	4.0 (3.6, 4.4)	2.5 (2.0, 3.1)	**1.8 (1.5, 2.2)[b]**	1.1 (0.7, 1.5)	0.7 (0.5, 1.0)
Probably will get vaccinated or unsure	9.3 (8.9, 9.6)	6.6 (6.1, 7.2)	**10.2 (9.8, 10.6)[b]**	11.1 (10.0, 12.4)	**13.4 (12.8, 14.0)[b]**	5.1 (4.4, 6.0)	**7.2 (6.5, 8.0)[b]**	2.9 (2.4, 3.6)	2.7 (2.3, 3.3)
Probably or definitely will not get vaccinated	14.5 (14.1, 14.9)	9.0 (8.4, 9.6)	**16.6 (16.1, 17.1)[b]**	14.0 (12.8, 15.3)	**20.6 (19.9, 21.3)[b]**	8.6 (7.6, 9.7)	**12.8 (11.9, 13.7)[b]**	3.2 (2.7, 3.9)	**6.1 (5.4, 6.9)[b]**
Vaccine confidence, behavior, experience, and other characteristics									
Concerned about getting COVID-19 (very or moderately)	49.1 (48.6, 49.6)	62.8 (61.9, 63.7)	**43.7 (43.1, 44.3)[b]**	59.2 (57.6, 60.7)	**40.1 (39.3, 40.9)[b]**	64.7 (63.1, 66.3)	**47.9 (46.7, 49.2)[b]**	65.4 (63.7, 67.0)	**51.5 (50.0, 53.0)[b]**
Thinks a COVID-19 vaccine is safe (completely or very)	62.2 (61.7, 62.7)	67.5 (66.5, 68.4)	**60.3 (59.7, 61.0)[b]**	59.2 (57.6, 60.9)	**54.3 (53.5, 55.2)[b]**	67.4 (65.8, 69.0)	**64.6 (63.3, 65.9)[b]**	77.5 (76.0, 79.0)	77.3 (75.9, 78.6)
Thinks a COVID-19 vaccine is important protection (very or somewhat)	80.4 (80.0, 80.9)	88.5 (87.8, 89.1)	**77.4 (76.9, 78.0)[b]**	82.7 (81.3, 84.0)	**72.7 (71.9, 73.5)[b]**	89.4 (88.2, 90.4)	**80.8 (79.7, 81.9)[b]**	94.6 (93.8, 95.3)	**91.0 (90.0, 91.8)[b]**

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Table 1. COVID-19 Vaccination, Intent, and Vaccine Confidence/Behavior by Status of Reported Medical Conditions That Increased Their Risk of COVID-19 Among Adults Aged ≥18 Years, NIS-ACM, August 1—September 25, 2021 (*continued*)

COVID-19 vaccine and vaccination related characteristics	Total (N=136,619) %[a] (95% CI)	Persons aged ≥18 years		Persons aged 18–49 years		Persons aged 50–64 years		Persons aged ≥65 years	
		Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=39,365) %[a] (95% CI)	Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=95,520) %[a] (95% CI)	Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=13,161) %[a] (95% CI)	Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=53,227) %[a] (95% CI)	Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=13,523) %[a] (95% CI)	Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=23,411) %[a] (95% CI)	Persons who reported that they had medical conditions that increased their risk of COVID-19 (*n*=12,134) %[a] (95% CI)	Persons who did not report that they had medical conditions that increased their risk of COVID-19 (*n*=17,240) %[a] (95% CI)
Had friends/family that were vaccinated (almost all or many)	67.9 (67.4, 68.3)	72.3 (71.4, 73.2)	**66.3 (65.7, 66.9)**[b]	66.9 (65.3, 68.4)	**61.3 (60.5, 62.1)**[b]	71.4 (69.8, 72.9)	70.1 (68.9, 71.3)	79.8 (78.3, 81.2)	80.2 (78.9, 81.3)
Provider recommendation of the COVID-19 vaccine	39.6 (39.1, 40.1)	52.5 (51.6, 53.5)	**34.5 (34.0, 35.1)**[b]	50.2 (48.6, 51.8)	**33.0 (32.3, 33.7)**[b]	54.5 (52.8, 56.1)	**36.3 (35.1, 37.5)**[b]	53.3 (51.6, 55.1)	**38.2 (36.8, 39.7)**[b]
Often or always wore masks during last 7 days	68.0 (67.5, 68.4)	73.5 (72.6, 74.3)	**65.9 (65.3, 66.4)**[b]	72.5 (71.1, 74.0)	**65.3 (64.6, 66.1)**[b]	73.5 (72.1, 74.9)	**64.5 (63.3, 65.7)**[b]	74.7 (73.1, 76.2)	**69.6 (68.2, 70.9)**[b]
Vaccination difficulty among unvaccinated adults									
Difficulty getting vaccinated (very or somewhat)	13.6 (12.9, 14.5)	17.9 (15.9, 20.0)	**12.5 (11.6, 13.4)**[b]	17.7 (15.1, 20.6)	**12.8 (11.8, 13.9)**[b]	16.3 (13.1, 20.2)	**10.6 (8.9, 12.6)**[b]	24.3 (18.8, 30.8)	**12.9 (9.7, 17.1)**[b]
Difficulty getting an appointment online	4.1 (3.6, 4.6)	6.4 (5.2, 7.8)	**3.5 (3.1, 4.0)**[b]	5.7 (4.2, 7.7)	**3.5 (3.0, 4.1)**[b]	5.8 (4.0, 8.4)	3.9 (2.9, 5.1)	11.3 (7.6, 16.4)	**3.9 (2.6, 5.9)**[b]
Difficulty with not knowing where to get vaccinated	5.1 (4.6, 5.7)	7.2 (5.9, 8.8)	**4.6 (4.1, 5.2)**[b]	7.4 (5.7, 9.7)	**4.9 (4.3, 5.6)**[b]	6.2 (4.2, 9.1)	3.7 (2.7, 5.0)	9.3 (6.2, 13.7)	**4.5 (2.8, 7.2)**[b]
Hard to get to vaccination sites	5.2 (4.7, 5.8)	8.3 (7.0, 9.8)	**4.3 (3.8, 4.9)**[b]	8.0 (6.3, 10.2)	**4.6 (4.0, 5.3)**[b]	5.7 (3.9, 8.4)	3.3 (2.5, 4.4)	16.0 (11.6, 21.6)	**3.7 (2.2, 6.2)**[b]
Vaccination sites are not open at convenient times	6.7 (6.2, 7.3)	9.4 (8.0, 11.1)	**6.0 (5.4, 6.7)**[b]	10.4 (8.3, 12.8)	**6.7 (5.9, 7.5)**[b]	7.7 (5.6, 10.5)	**3.8 (2.9, 5.1)**[b]	9.7 (6.4, 14.5)	**3.6 (2.1, 6.1)**[b]

Note: Boldface indicates statistical significance ($p<0.05$).
[a]Weighted percentages.
[b]$p<0.05$ by *t* test for comparisons between persons who reported medical conditions that increased their risk of COVID-19 and persons who did not report those medical conditions.
NIS-ACM, National Immunization Survey-Adult COVID Module.

Table 2. COVID-19 Vaccination Coverage of Adults Aged ≥18 Years by Status of Reported Medical Conditions That Increased Their Risk of COVID-19 and Sociodemographic and Access-to-Care Characteristics, NIS-ACM, August 1–September 25, 2021

	Persons who reported that they had medical conditions that increased their risk of COVID-19		Persons who did not report that they had medical conditions that increased their risk of COVID-19		Unadjusted PR comparing vaccination coverage for persons who reported that medical conditions increased their risk of COVID-19 with that for those who did not report those medical conditions	Age adjusted PR (APR) comparing vaccination coverage for persons who reported that medical conditions increased their risk of COVID-19 with that for persons who did not report those medical conditions
Characteristics	***n***	**Vaccinated (at least 1 dose) %[a] (95% CI)**	***n***	**Vaccinated (at least 1 dose) %[a] (95% CI)**	**PR (95% CI)**	**APR (95% CI)**
Total	39,302	81.8 (80.9, 82.6)	95,140	70.3 (69.7, 70.9)	**1.16 (1.15, 1.18)[b]**	**1.09 (1.08, 1.11)[b]**
Age group, years						
18–49[c]	13,136	70.9 (69.2, 72.4)	53,058	62.1 (61.3, 62.9)	**1.14 (1.11, 1.17)[b]**	NA
50–64	13,504	**83.8 (82.4, 85.1)[c]**	23,316	**78.3 (77.1, 79.4)[c]**	**1.07 (1.05, 1.09)[b]**	NA
≥65	12,120	**92.8 (91.8, 93.7)[c]**	17,179	**90.4 (89.4, 91.3)[c]**	**1.03 (1.01, 1.04)[b]**	NA
Sex						
Male[d]	16,779	83.3 (82.0, 84.5)	48,269	67.7 (66.9, 68.6)	**1.23 (1.21, 1.25)[b]**	**1.14 (1.11, 1.16)[b]**
Female	22,261	**80.8 (79.7, 81.9)[c]**	46,086	**73.4 (72.5, 74.2)[c]**	**1.10 (1.08, 1.12)[b]**	**1.05 (1.03, 1.07)[b]**
Race/ethnicity						
White, non-Hispanic[d]	25,037	82.8 (81.8, 83.7)	59,715	71.3 (70.5, 72.0)	**1.16 (1.14, 1.18)[b]**	**1.10 (1.08, 1.12)[b]**
Black, non-Hispanic	5,359	**80.3 (78.0, 82.4)[c]**	10,540	**63.2 (61.4, 65.0)[c]**	**1.27 (1.22, 1.32)[b]**	**1.16 (1.11, 1.21)[b]**
Hispanic	4,529	82.3 (79.8, 84.5)	11,740	70.2 (68.5, 71.8)	**1.17 (1.13, 1.22)[b]**	**1.09 (1.05, 1.12)[b]**
Other, non-Hispanic	3,363	**76.6 (73.1, 79.7)[c]**	10,295	**76.1 (74.2, 77.9)[c]**	1.01 (0.96, 1.06)	0.97 (0.92, 1.02)
Urbanicity						
MSA, principal city[d]	13,432	82.5 (81.0, 83.9)	34,082	72.7 (71.7, 73.7)	**1.13 (1.11, 1.16)[b]**	**1.07 (1.04, 1.09)[b]**
MSA, nonprincipal city	18,638	82.9 (81.8, 84.0)	44,212	**71.4 (70.5, 72.2)[c]**	**1.16 (1.14, 1.18)[b]**	**1.09 (1.07, 1.11)[b]**
Non-MSA	7,232	**75.9 (73.7, 78.0)[c]**	16,846	**59.8 (58.2, 61.4)[c]**	**1.27 (1.22, 1.32)[b]**	**1.17 (1.12, 1.22)[b]**
SVI of county of residence[e]						
Low[d]	11,357	84.3 (82.7, 85.7)	29,237	74.8 (73.7, 75.8)	**1.13 (1.10, 1.15)[b]**	**1.07 (1.05, 1.10)[b]**
Moderate	13,205	**81.5 (80.0, 82.9)[c]**	31,614	**72.4 (71.4, 73.4)[c]**	**1.13 (1.10, 1.15)[b]**	**1.06 (1.04, 1.09)[b]**
High	10,573	**81.6 (80.0, 83.0)[c]**	22,852	**67.1 (65.9, 68.3)[c]**	**1.22 (1.18, 1.25)[b]**	**1.13 (1.10, 1.16)[b]**

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Table 2. COVID-19 Vaccination Coverage of Adults Aged ≥18 Years by Status of Reported Medical Conditions That Increased Their Risk of COVID-19 and Sociodemographic and Access-to-Care Characteristics, NIS-ACM, August 1–September 25, 2021 (*continued*)

	Persons who reported that they had medical conditions that increased their risk of COVID-19		Persons who did not report that they had medical conditions that increased their risk of COVID-19		Unadjusted PR comparing vaccination coverage for persons who reported that medical conditions increased their risk of COVID-19 with that for those who did not report those medical conditions	Age adjusted PR (APR) comparing vaccination coverage for persons who reported that medical conditions increased their risk of COVID-19 with that for persons who did not report those medical conditions
Characteristics	***n***	**Vaccinated (at least 1 dose) %[a] (95% CI)**	***n***	**Vaccinated (at least 1 dose) %[a] (95% CI)**	**PR (95% CI)**	**APR (95% CI)**
Household income						
Below poverty[d]	4,430	66.9 (64.2, 69.5)	7,629	58.6 (56.6, 60.7)	**1.14 (1.08, 1.20)[b]**	1.04 (0.99, 1.10)
Above poverty, <$75,000	13,404	**82.0 (80.6, 83.3)[c]**	28,599	**67.7 (66.6, 68.8)[c]**	**1.21 (1.18, 1.24)[b]**	**1.12 (1.09, 1.15)[b]**
Above poverty, ≥$75,000	13,404	**89.2 (87.9, 90.3)[c]**	38,825	**78.1 (77.1, 79.0)[c]**	**1.14 (1.12, 1.16)[b]**	**1.10 (1.08, 1.12)[b]**
Unknown income	8,064	**80.4 (78.5, 82.1)[c]**	20,087	**67.2 (65.9, 68.5)[c]**	**1.20 (1.16, 1.23)[b]**	**1.11 (1.07, 1.15)[b]**
Education level						
High school graduate or less[d]	10,003	76.5 (75.0, 78.0)	22,536	61.4 (60.2, 62.5)	**1.25 (1.21, 1.28)[b]**	**1.12 (1.09, 1.16)[b]**
Some college	12,089	**79.5 (77.9, 80.9)[c]**	24,893	**68.1 (66.9, 69.2)[c]**	**1.17 (1.14, 1.20)[b]**	**1.10 (1.07, 1.12)[b]**
≥College graduate	16,121	**92.0 (91.0, 92.9)[c]**	44,787	**84.4 (83.6, 85.2)[c]**	**1.09 (1.08, 1.11)[b]**	**1.06 (1.05, 1.08)[b]**
Health insurance						
Insured	36,454	**82.9 (82.1, 83.8)[c]**	83,832	**73.2 (72.5, 73.8)[c]**	**1.13 (1.12, 1.15)[b]**	**1.08 (1.06, 1.09)[b]**
Not insured[d]	1,841	64.2 (60.0, 68.2)	8,356	52.1 (50.2, 54.0)	**1.23 (1.14, 1.33)[b]**	**1.13 (1.05, 1.21)[b]**
Mental health						
Excellent, very good, or good	33,442	**83.0 (82.2, 83.9)[c]**	85,743	70.4 (69.7, 71.0)	**1.18 (1.16, 1.20)[b]**	**1.10 (1.09, 1.12)[b]**
Fair or poor[d]	5,590	75.7 (73.3, 77.9)	8,804	70.0 (68.0, 71.9)	**1.08 (1.04, 1.13)[b]**	1.03 (0.99, 1.07)
Frontline and essential workers[f]						
Yes	10,375	**79.3 (77.6, 80.9)[c]**	31,868	**67.0 (65.9, 68.1)[c]**	**1.18 (1.15, 1.22)[b]**	**1.11 (1.09, 1.14)[b]**
No[d]	28,457	82.8 (81.8, 83.7)	61,633	72.4 (71.6, 73.1)	**1.14 (1.13, 1.16)[b]**	**1.08 (1.06, 1.10)[b]**
Disability[g]						
Yes (any)	6,831	**78.2 (76.3, 80.0)[c]**	4,681	70.8 (68.1, 73.3)	**1.11 (1.06, 1.16)[b]**	**1.08 (1.03, 1.14)[b]**
No[d]	32,381	82.6 (81.7, 83.5)	90,346	70.3 (69.6, 70.9)	**1.18 (1.16, 1.19)[b]**	**1.11 (1.09, 1.12)[b]**

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Table 2. COVID-19 Vaccination Coverage of Adults Aged ≥18 Years by Status of Reported Medical Conditions That Increased Their Risk of COVID-19 and Sociodemographic and Access-to-Care Characteristics, NIS-ACM, August 1–September 25, 2021 (*continued*)

	Persons who reported that they had medical conditions that increased their risk of COVID-19		Persons who did not report that they had medical conditions that increased their risk of COVID-19		Unadjusted PR comparing vaccination coverage for persons who reported that medical conditions increased their risk of COVID-19 with that for those who did not report those medical conditions	Age adjusted PR (APR) comparing vaccination coverage for persons who reported that medical conditions increased their risk of COVID-19 with that for persons who did not report those medical conditions
Characteristics	***n***	**Vaccinated (at least 1 dose) %[a] (95% CI)**	***n***	**Vaccinated (at least 1 dose) %[a] (95% CI)**	**PR (95% CI)**	**APR (95% CI)**
Ever had COVID-19						
Yes	6,554	**67.6 (65.4, 69.8)[c]**	16,699	**55.8 (54.3, 57.2)[c]**	**1.21 (1.16, 1.26)[b]**	**1.11 (1.07, 1.16)[b]**
No[d]	32,262	85.4 (84.6, 86.3)	77,366	74.4 (73.7, 75.0)	**1.15 (1.13, 1.16)[b]**	**1.09 (1.07, 1.10)[b]**
Received any vaccine that was not a COVID-19 vaccine in the past 2 years						
Yes	26,458	**90.1 (89.3, 90.9)[c]**	51,309	**86.1 (85.4, 86.8)[c]**	**1.05 (1.03, 1.06)[b]**	**1.02 (1.00, 1.03)[b]**
No[d]	12,641	67.0 (65.4, 68.7)	43,222	56.2 (55.3, 57.1)	**1.19 (1.16, 1.23)[b]**	**1.09 (1.6, 1.13)[b]**
Provider recommendation of the COVID-19 vaccine						
Yes	21,367	**86.5 (85.5, 87.5)[c]**	35,122	**77.6 (76.6, 78.6)[c]**	**1.11 (1.10, 1.13)[b]**	**1.07 (1.06, 1.09)[b]**
No[d]	17,515	76.5 (75.2, 77.8)	59,085	66.3 (65.5, 67.1)	**1.15 (1.13, 1.18)[b]**	**1.06 (1.04, 1.08)[b]**

Note: Boldface indicates statistical significance ($p<0.05$).
[a]Weighted percentages.
[b]$p<0.05$ by *t* test for comparisons of vaccination coverage between persons who reported that they had medical conditions that increased their risk of COVID-19 and persons who did not report those medical conditions within each level of each characteristic.
[c]$p<0.05$ by *t* test for comparisons of vaccination coverage within each variable with that at the indicated reference level.
[d]Reference level.
[e]CDC/Agency for Toxic Substances and Disease Registry Social Vulnerability Index uses 15 U.S. Census variables to help officials identify communities that may need support before, during, or after disasters.
[f]Essential workers included those in health care, social service, preschool or daycare, K-12 school, other schools and instructional settings, first response, death care, correctional facility, food and beverage store, agriculture, forestry, fishing, or hunting, food manufacturing facility, non-food manufacturing facility, public transit, and U. S. Postal Service and other essential workers.
[g]*Disability* was defined as an affirmative response to the following survey question: *Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?*
APR, adjusted prevalence ratio; CDC, Centers for Disease Control and Prevention; K-12, kindergarten to 12th grade; MSA, metropolitan statistical area; NA, not applicable; NIS-ACM, National Immunization Survey-Adult COVID Module; PR, prevalence ratio; SVI, social vulnerability index.

conditions within each age group (18–49, 50–64, and ≥65 years), with estimate highest in the youngest age group. Among adults with reported high-risk medical conditions, the prevalence of provider recommendation for COVID-19 vaccine was 50.2% among those aged 18–49 years, 54.5% among those aged 50–64 years, and 53.3% among those aged ≥65 years. Among adults not reporting such conditions, the prevalence of provider recommendation for COVID-19 vaccine was 33.0% among those aged 18–49 years, 36.3% among those

aged 50−64 years, and 38.2% among those aged ≥65 years.

Adults who reported high-risk medical conditions were more likely to report receiving a provider recommendation for a COVID-19 vaccine (52.5% vs 34.5%), often or always wearing masks during the last 7 days (73.5% vs 65.9%), being concerned about getting COVID-19 (62.8% vs 43.7%), thinking that the vaccine is safe (67.5% vs 60.3%), and believing that a COVID-19 vaccine is important for protection from COVID-19 infection than those who did not report high-risk medical conditions (88.5% vs 77.4%) (Table 1). Larger percentages of unvaccinated adults who reported high-risk medical conditions reported difficulties in getting a COVID-19 vaccine (e.g., difficulty in getting an appointment online, difficulty in knowing where to get vaccinated, and difficulty in getting to vaccination sites) than those who did not report medical conditions (Table 1).

Among adults who reported high-risk medical conditions, COVID-19 vaccination coverage among those aged 50−64 years (83.8%) and ≥65 years (92.8%) was significantly higher than that among those aged 18−49 years (70.9%) (Table 2). Vaccination coverage among adults reporting high-risk medical conditions was significantly lower among non-Hispanic Blacks (80.3%) and individuals of non-Hispanic other race/ethnicity (76.6%) than among non-Hispanic Whites (82.8%) ($p<0.05$). In addition, among adults who reported high-risk medical conditions, those who lived at or above the poverty level; had some college or higher education; had health insurance; had perceived mental health status classified as excellent, very good, or good; had received a vaccine other than COVID-19 in the past 2 years; and had received a provider recommendation for a COVID-19 vaccine had higher vaccination coverage than the respective reference groups indicated in Table 2. Women, those living in a non-MSA, those living in a moderate or high SVI county, those who were frontline or essential workers, those with a disability, and those with a previous COVID-19 infection had lower vaccination coverage than the respective reference groups (Table 2). Factors associated with COVID-19 vaccination among adults who did not report high-risk medical conditions were generally similar to factors among those who reported such conditions (Table 2).

The PRs comparing vaccination coverage among adults who reported high-risk medical conditions with that among those who did not report these conditions were significantly higher across each level of all sociodemographic and access-to-care characteristics except for non-Hispanic other race/ethnicity (Table 2). Age-adjusted PRs were also significantly higher across each level of all sociodemographic and access-to-care characteristics except for non-Hispanic other race/ethnicity, those with household income below poverty, and adults with perceived mental health status classified as fair or poor.

The most prevalent medical conditions reported among adults aged ≥18 years with reported high-risk medical conditions were chronic lung diseases (7.4%) and diabetes (7.3%), followed by heart diseases (5.4%), overweight (2.1%), and immunocompromise (2.0%); the least prevalent conditions were sickle cell disease, having received an organ or blood transplant, dementia or other neurologic conditions, and HIV infection (0.1% for each of those 4 conditions) (Table 3). The prevalence of each medical condition among adults aged 50−64 years and ≥65 years was generally higher than among those aged 18−49 years.

COVID-19 vaccination coverage was highest among adults aged ≥18 years with reported high-risk medical conditions and who also reported that they were overweight (88.9%), followed by those who had HIV infection (87.0%), chronic kidney disease (86.3%), cancers (85.9%), diabetes (85.8%), heart diseases (83.9%), and stroke or cerebrovascular disease (83.8%); had received an organ or blood transplant (80.5%); were smokers (80.1%); who had liver disease (78.9%), chronic lung disease (78.6%), and dementia or other neurologic conditions (76.8%); were immunocompromised (76.7%); and had sickle cell disease (64.7%) (Table 3).

DISCUSSION

COVID-19 vaccination coverage was higher among adults with reported high-risk medical conditions than among those who did not report these conditions, possibly owing to the ACIP recommendation to prioritize persons at high risk of severe illness from COVID-19 for vaccination early in the vaccination program and public health messaging emphasizing the importance of COVID-19 vaccines for persons with increased risk of severe COVID-19.[2] However, by late summer 2021, about 18.0% of adults with reported high-risk medical conditions still had not received ≥1 dose of a COVID-19 vaccine even though they were less likely to report "probably will not or definitely will not get vaccinated" than those who did not report these conditions. With another 9.2% reporting that they still planned to get vaccinated or were unsure, vaccination coverage might improve and reach 90.0%. Public health messaging to make people aware of their risk status is especially important given that most COVID-19 vaccines were not administered by a person's primary healthcare provider.

Adults with reported high-risk medical conditions reported more positive attitudes toward vaccination

Table 3. Vaccination Coverage (≥1 Dose) by Reported High-Risk Medical Conditions Among Adults Aged ≥18 Years, U.S. NIS-ACM, August 1—September 25, 2021

	Persons aged ≥18 years		Persons aged 18—49 years		Persons aged 50—64 years		Persons aged ≥65 years	
High-risk medical conditions	**Prevalence of conditions %[a](95% CI)**	**COVID-19 vaccination coverage (≥1 dose) %[a](95% CI)**	**Prevalence of conditions %[a](95% CI)**	**COVID-19 vaccination coverage (≥1 dose) %[a](95% CI)**	**Prevalence of conditions %[a](95% CI)**	**COVID-19 vaccination coverage (≥1 dose) %[a](95% CI)**	**Prevalence of conditions %[a](95% CI)**	**COVID-19 vaccination coverage (≥1 dose) %[a](95% CI)**
Chronic lung diseases[b]	7.4 (7.1, 7.7)	78.6 (76.9, 80.3)	6.2 (5.8, 6.5)	69.1 (66.2, 71.8)	8.6 (8.0, 9.2)	**82.5 (79.4, 85.3)[d]**	9.4 (8.8, 10.1)	**90.8 (88.2, 92.8)[d]**
Heart diseases[c]	5.4 (5.2, 5.7)	83.9 (82.1, 85.6)	2.2 (2.0, 2.4)	65.9 (60.8, 70.7)	7.4 (6.9, 7.9)	**81.9 (78.7, 84.7)[d]**	11.8 (11.1, 12.6)	**93.8 (92.1, 95.2)[d]**
Diabetes	7.3 (7.0, 7.5)	85.8 (84.3, 87.1)	3.3 (3.0, 3.5)	76.0 (72.2, 79.4)	11.8 (11.2, 12.5)	**85.4 (82.9, 87.5)[d]**	12.6 (11.8, 13.3)	**93.2 (91.3, 94.7)[d]**
Cancers	1.7 (1.6, 1.9)	85.9 (82.6, 88.7)	0.6 (0.5, 0.7)	64.6 (54.4, 73.6)	2.5 (2.2, 2.9)	**82.4 (75.6, 87.7)[d]**	3.9 (3.5, 4.4)	**96.0 (94.1, 97.3)[d]**
Chronic kidney disease	0.4 (0.4, 0.5)	86.3 (79.4, 91.2)	0.2 (0.1, 0.2)	62.7 (43.7, 78.5)	0.6 (0.4, 0.8)	**93.6 (87.5, 96.9)[d]**	0.9 (0.7, 1.2)	**92.0 (83.1, 96.4)[d]**
Liver disease	0.3 (0.2, 0.3)	78.9 (69.4, 86.1)	0.2 (0.1, 0.3)	76.5 (61.2, 87.1)	0.4 (0.3, 0.6)	71.4 (51.1, 85.7)	0.4 (0.3, 0.5)	88.2 (73.5, 95.2)
Overweight	2.1 (2.0, 2.3)	88.9 (86.4, 91.1)	2.1 (2.0, 2.3)	86.6 (82.5, 89.9)	2.7 (2.4, 3.0)	**93.4 (90.2, 95.6)[d]**	1.6 (1.4, 1.9)	88.9 (81.8, 93.5)
Sickle cell disease	0.1 (0.1, 0.1)	64.7 (48.3, 78.3)	0.1 (0.1, 0.1)	63.7 (39.7, 82.3)	0.1 (0.1, 0.2)	63.4 (32.9, 85.9)	0.1 (0.1, 0.2)	—[e]
Smoking	0.5 (0.4, 0.6)	80.1 (73.6, 85.3)	0.4 (0.4, 0.5)	71.9 (61.2, 80.5)	0.7 (0.6, 1.0)	**86.4 (78.2, 91.9)[d]**	0.4 (0.3, 0.6)	**90.5 (76.5, 96.6)[d]**
Organ or blood transplant	0.1 (0.1, 0.1)	80.5 (63.1, 90.9)	0.0 (0.0, 0.1)	58.8 (28.3, 83.7)	0.1 (0.1, 0.2)	87.4 (71.8, 95.0)	0.2 (0.1, 0.3)	89.6 (52.8, 98.5)
Stroke or cerebrovascular disease	0.2 (0.1, 0.2)	83.8 (73.2, 90.7)	0.1 (0.0, 0.1)	87.1 (62.4, 96.5)	0.2 (0.1, 0.3)	76.0 (59.0, 87.4)	0.4 (0.3, 0.6)	87.5 (66.2, 96.2)
Dementia or other neurologic conditions	0.1 (0.1, 0.2)	76.8 (61.7, 87.2)	0.1 (0.0, 0.1)	75.1 (48.3, 90.7)	0.2 (0.1, 0.3)	62.0 (38.5, 80.9)	0.2 (0.1, 0.4)	95.7 (81.4, 99.1)
Immunocompromised state	2.0 (1.8, 2.1)	76.7 (73.1, 80.0)	1.8 (1.6, 1.9)	65.1 (59.5, 70.3)	2.6 (2.3, 3.0)	**83.9 (77.5, 88.7)[d]**	1.8 (1.5, 2.1)	**94.0 (88.9, 96.8)[d]**
HIV infection	0.1 (0.1, 0.2)	87.0 (77.2, 92.9)	0.1 (0.1, 0.1)	66.9 (47.9, 81.6)	0.3 (0.2, 0.4)	**97.1 (86.7, 99.4)[d]**	0.1 (0.1, 0.3)	**97.6 (90.0, 99.5)[d]**
Pregnant	NA	61.2 (48.8, 72.3)	0.3 (0.2, 0.4)	60.4 (47.9, 71.6)	NA	NA	NA	NA
Other conditions	4.8 (4.5, 5.0)	77.9 (75.7, 80.0)	3.7 (3.4, 4.0)	66.6 (62.6, 70.3)	6.2 (5.8, 6.7)	**81.3 (77.7, 84.5)[d]**	6.0 (5.5, 6.5)	**92.1 (89.2, 94.3)[d]**
≥1 high-risk condition	28.3 (27.9, 28.8)	81.8 (80.9, 82.6)	19.2 (18.7, 19.8)	70.9 (69.2, 72.4)	37.9 (36.9, 38.8)	**83.8 (82.4, 85.1)[d]**	41.0 (39.9, 42.1)	**92.8 (91.8, 93.7)[d]**
No high-risk conditions	71.7 (71.2, 72.1)	70.3 (69.7, 70.9)	80.8 (80.2, 81.3)	62.1 (61.3, 62.9)	62.1 (61.2, 63.1)	**78.3 (77.1, 79.4)[d]**	59.0 (57.9, 60.1)	**90.4 (89.4, 91.3)[d]**

Note: Boldface indicates statistical significance ($p<0.05$).
[a]Weighted percentages.
[b]Chronic lung disease includes COPD, asthma (moderate to severe), interstitial lung disease, cystic fibrosis, and pulmonary hypertension.
[c]Heart disease includes heart failure, coronary artery disease, cardiomyopathies, or hypertension.
[d]$p<0.05$ by t test for comparisons of vaccination coverage between persons aged 18—49 years and persons aged 50—64 years and persons aged 18—49 years and persons aged ≥65 years within each level of each characteristic.
[e]Cells with denominator $n<30$ are suppressed.
COPD, chronic obstructive pulmonary disease; NA, not applicable; NIS-ACM, National Immunization Survey-Adult COVID Module.

than those who did not report these conditions. Higher levels of concern about COVID-19 and positive attitudes toward vaccination among adults with reported high-risk medical conditions (e.g., more likely to report believing that COVID-19 vaccines are safe and important for protection from COVID-19 infection) may contribute to higher vaccination coverage among those with reported high-risk medical conditions. A larger number of unvaccinated adults with reported high-risk medical conditions reported difficulties in getting a COVID-19 vaccine (e.g., difficulty in getting an appointment online, difficulty in knowing where to get vaccinated, difficulty in getting to vaccination sites) than those without these conditions. Many of these barriers could be reduced if vaccinations could be provided in the office of their usual medical provider, however, the cold chain requirement for storing the vaccine might still be a challenge for implementing this effort. Reducing barriers to COVID-19 vaccination could improve vaccination coverage among adults with or without reported high-risk medical conditions. In addition, one study indicated that the most common reasons for not receiving COVID-19 vaccines were "concerned about possible side effects" and "don't trust the COVID-19 vaccine."[8] Clear, consistent messages from healthcare providers, public health officials, and immunization partners about the safety and effectiveness of the vaccine could increase vaccination coverage and vaccine confidence more broadly.[9]

Healthcare provider recommendation is significantly associated with vaccine uptake.[10] This report showed that COVID-19 vaccination coverage was significantly higher among adults aged ≥18 years with a provider recommendation for the vaccine than among those without, reinforcing the importance of provider recommendation on COVID-19 vaccination uptake. Providers should recommend the vaccination when they have the opportunity to do so. Patients usually trust the opinions of their healthcare providers regarding vaccination more than the opinions of others.[10,11] Clinicians and healthcare providers should follow ACIP recommendations,[2] recommend needed vaccinations, and encourage eligible persons to be fully vaccinated against COVID-19.

Findings from this study showed that vaccination coverage among adults aged 50−64 and ≥65 years with reported high-risk medical conditions was significantly higher than among those aged 18−49 years with reported high-risk medical conditions. The risk for severe illness from COVID-19 increases with age, with older adults at the highest risk.[1,12] Higher COVID-19 vaccination coverage among older adults may also be owing to ACIP prioritization and recognition of the increased risk of severe COVID-19 in this population.[2] The higher prevalence of provider recommendation of COVID-19 vaccine among older adults from this study might also contribute to higher vaccination coverage among this group. Healthcare providers should ensure that persons at high risk receive COVID-19 vaccination if they are eligible regardless of age. Among adults with reported high-risk medical conditions, vaccination coverage was particularly low among adults living in poverty or without health insurance, and efforts are needed to continue to be made to reach these people and reduce inequities.[11,13,14]

COVID-19 vaccination coverage varied substantially by type of reported high-risk medical conditions. Lower COVID-19 vaccination coverage for adults reporting sickle cell disease, liver disease, dementia, or other neurologic conditions and for those who were immunocompromised is concerning, and intervention and education efforts targeting individual groups where vaccination coverage is low may be beneficial. Adults with sickle cell disease, liver disease, dementia, or other neurologic conditions and those who are immunocompromised are often in the care of subspecialists, so it is important for subspecialists to recommend vaccines to these patients even if they are not vaccine providers themselves. In addition, some adults may not consider themselves at increased risk for severe COVID-19; the messaging might need to be tailored differently for these groups.[11]

Limitations

Several limitations should be considered when interpreting these findings. First, NIS-ACM has a low response rate (20.5% in August and 20.9% in September) but is consistent with other National Immunization Survey surveys.[3] Second, COVID-19 vaccination was self-reported and may be subject to recall or social desirability bias. However, because vaccines have been available for about 6 months at the time the survey was conducted, the reliability of self-reported COVID-19 vaccination may be comparable with that of self-report of influenza vaccination for current or recent seasons, which has been shown to have a relatively high agreement with vaccination status ascertained from medical records.[15,16] Moreover, survey weights were calibrated to COVID-19 vaccine administration data to mitigate possible bias from incomplete sample frame, nonresponse, and misclassification of vaccination status. Third, the question on medical conditions could have been interpreted by some survey respondents as medical conditions that place them at higher risk for exposure to COVID-19; however, a secondary analysis found that approximately 75% of conditions reported by those who identified themselves in this survey as having a condition that puts them at higher risk of COVID-19

were among the conditions recognized by the ACIP as increasing one's risk of severe COVID-19 disease. Furthermore, coverage among insured adults who reported having conditions that put them at increased risk of COVID-19 on the basis of this study (82.9%) matched well with an estimate of coverage among insured adults with medical conditions based on data from 8 integrated healthcare organizations as of September (84.0%) (CDC unpublished data). In addition, medical conditions were self-reported, but self-reported medical conditions have been shown to have a relatively high agreement compared with medical records.[17] Finally, provider recommendation of the COVID-19 vaccine was self-reported and may be subject to recall bias.

CONCLUSIONS

COVID-19 vaccination coverage among adults with reported high-risk medical conditions varied substantially by medical condition and remains suboptimal. Higher COVID-19 vaccination coverage in those with reported high-risk medical conditions may be owing to ACIP prioritization and recognition of the increased risk of severe COVID-19 in persons who reported these medical conditions. Even among this group that recognized themselves as high risk, vaccination can be improved, with 82.0% vaccinated and another 9.0% planning or unsure about getting vaccinated. Clinicians and other healthcare providers, such as pharmacists and clinical subspecialists, can educate and encourage everyone, especially older people, to be fully vaccinated against COVID-19.[18] CDC resources are available for building vaccine confidence in the community.[9,19] As of April 21, 2022, ACIP has recommended that immunocompromised people who received a 2-dose series of mRNA (or 1 dose of Janssen) COVID-19 vaccine receive an additional primary dose of mRNA (or Janssen) COVID-19 vaccine because studies indicate a reduced antibody response in immunocompromised people after a primary vaccine series compared with that in healthy vaccine recipients.[20,21] Adults with high-risk medical conditions have been recommended to receive a booster dose 6 months after the primary series of mRNA vaccines or 2 or more months after Janssen vaccine.[22,23] Continual monitoring of primary, additional (among immunocompromised), and booster dose vaccination will be helpful for developing tailored strategies to improve vaccination coverage among this high-risk population.

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