

Measles, Mumps, Rubella Vaccine (PRIORIX): Recommendations of the Advisory Committee on Immunization Practices — United States, 2022

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Vaccination is the main means for preventing measles, mumps, and rubella virus infections and their related complications (1,2). Achieving and maintaining high 2-dose measles, mumps, and rubella vaccination coverage in the United States has led to elimination of endemic measles in 2000, rubella and congenital rubella syndrome in 2004, and a sharp decrease in mumps cases. However, measles and rubella remain endemic in many countries, leading to importations of cases and occasional local transmission within the United States (3). Reported U.S. mumps cases declined >99% from the prevaccine period (4); however, mumps is endemic worldwide, and since 2006, the number of mumps cases and mumps outbreaks has increased in the United States, with wider geographic spread since 2016 (4). Given the risk for importation of measles and rubella and the resurgence of mumps, maintaining high measles, mumps, and rubella (MMR) vaccination coverage is important. Since 1978, only one MMR vaccine, M-M-R II (Merck and Co., Inc.), has been available in the United States. On June 6, 2022, the Food and Drug Administration approved a second MMR vaccine, PRIORIX (GlaxoSmithKline Biologicals), for the prevention of measles, mumps, and rubella in persons aged ≥12 months. The three live attenuated viruses contained in PRIORIX are genetically similar or identical to the corresponding components in M-M-R II (Table) (5–7). On June 23, 2022, the Advisory Committee on Immunization Practices (ACIP) unanimously recommended PRIORIX as an option to prevent measles, mumps, and rubella according to the existing recommended schedules and for off-label uses (i.e., indications not included in the package insert)* (1,2).

*Off-label uses for both M-M-R II and PRIORIX: infants aged 6–11 months who will travel or live abroad or during measles outbreaks and third dose of MMR in persons previously vaccinated with 2 doses of a mumps virus-containing vaccine who are identified by public health authorities as being part of a group or population at increased risk for acquiring mumps because of an outbreak. In addition, measles postexposure prophylaxis is an off-label indicated use for PRIORIX; measles postexposure prophylaxis is an on-label indicated use for M-M-R II.

ACIP considered PRIORIX to be safe, immunogenic, and noninferior to M-M-R II. Both PRIORIX and M-M-R II are fully interchangeable for all indications for which MMR vaccination is recommended. This report contains ACIP recommendations specific to PRIORIX and supplements the existing ACIP recommendations for MMR use (1,2).

During January–June 2022, the ACIP Measles, Mumps, and Rubella Vaccine Work Group (Work Group) held monthly conference calls to review and assess the safety and immunogenicity of PRIORIX and to discuss implementation issues. The Work Group identified the following outcomes of interest for evaluation: 1) prevention of measles, mumps, and rubella; 2) short-term humoral immunity; 3) persistence of the humoral immune response; 4) reactogenicity of grade 3 or higher[†];

[†] Grade 3 intensity was defined as crying when the limb was moved or the limb was spontaneously painful (pain), event preventing normal activity (drowsiness), crying inconsolably, preventing normal activity (irritability), or not eating at all (loss of appetite).

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5) vaccine-related serious adverse events (SAEs)[§]; and 6) additional adverse events of interest (i.e., rate of febrile seizures, aseptic meningitis, and immune thrombocytopenic purpura [ITP]). SAEs and reactogenicity of grade 3 or higher were evaluated only in studies conducted at or above the licensed U.S. potency for PRIORIX. Additional adverse events and immunogenicity were evaluated at any potency of PRIORIX.[¶] The Evidence to Recommendations (EtR) framework was used to organize Work Group deliberations.^{**}

Data on the outcomes of interest were summarized based on findings from a systematic review of the literature in PubMed, Medline, Embase, Scopus, Cochrane databases, and clinicaltrials.gov. Search terms for the literature review, study inclusion criteria, and supporting evidence are available online. All studies conducted with PRIORIX at the U.S. potency were included. For studies conducted at a potency different from that for the U.S.-licensed product, the evidence reviewed was restricted to the highest level of evidence: experimental design (i.e., randomized controlled clinical trials) or high-quality reviews (i.e., Cochrane reviews, systematic reviews, or meta-analyses).

[§] A serious adverse event is defined as an undesirable experience associated with the vaccine resulting in death, hospitalization, or disability or requiring medical or surgical intervention to prevent a serious outcome.

[¶] PRIORIX has been licensed outside of the United States since 1997 and has been approved in more than 100 countries at the following potency: measles virus (Enders' Edmonston strain) $\geq 10^{3.0}$ cell culture infectious dose₅₀, mumps (Jeryl Lynn [B level]) strain $\geq 10^{3.7}$ cell culture infectious dose₅₀, and rubella (Wistar RA 27/3) $\geq 10^{3.0}$ cell culture infectious dose₅₀.

^{**} <https://www.cdc.gov/vaccines/acip/recs/grade/mmr-PRIORIX-etr.html>

The Work Group reviewed all included studies of PRIORIX to assess the safety and immunogenicity of PRIORIX and discussed implementation issues. Summaries of Work Group discussions were presented to ACIP on February 23, 2022 and on June 23, 2022. At the June 2022 meeting, a proposed recommendation was presented to the committee and, after a public comment period, was unanimously approved by the voting ACIP members. PRIORIX is recommended according to the existing recommended schedules and off-label uses as an option to prevent measles, mumps, and rubella.

Summary of Key Findings

SAEs related to administration of PRIORIX were assessed using findings from four randomized controlled clinical trials at the licensed U.S. potency of PRIORIX and one Cochrane review with PRIORIX at any potency (8–12). Four additional observational studies and one additional systematic review addressed additional adverse events of interest (i.e., rate of febrile seizures, aseptic meningitis, and ITP) (13–17). Outcomes for PRIORIX were compared with those for M-M-R II. In the four randomized controlled clinical trials at the U.S. potency of PRIORIX, safety profiles among 1,960 subjects receiving 1 or 2 doses of PRIORIX were compared with those among 933 subjects randomized to receive 1 or 2 doses of M-M-R II. The subjects ranged in age from 12 months to 12 years, with 90% aged 12–15 months. The frequency of vaccine-related SAEs was similar across the vaccine

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TABLE. Components and infectious dosage* of measles, mumps, and rubella vaccines† licensed in the United States

Vaccine characteristic	Viral component		
	Measles	Mumps	Rubella
M-M-R II			
Strain	Enders' Edmonston	Jeryl Lynn (B level)	Wistar RA 27/3
Infectious dose, minimum and maximum release potencies	$\geq 10^{3.0} - 10^{3.8}$ TCID ₅₀	$\geq 10^{4.1} - 10^{4.8}$ TCID ₅₀	$\geq 10^{3.0} - 10^{3.6}$ TCID ₅₀
PRIORIX			
Strain	Schwarz	RIT4385	Wistar RA 27/3
Infectious dose, minimum and maximum release potencies	$\geq 10^{3.4} - 10^{4.5}$ CCID ₅₀	$\geq 10^{4.2} - 10^{5.6}$ CCID ₅₀	$\geq 10^{3.3} - 10^{4.4}$ CCID ₅₀

Abbreviations: CCID₅₀ = cell culture infectious dose; TCID₅₀ = tissue culture infectious dose.

* TCID₅₀ and CCID₅₀ are closely related measures describing how much infectious virus is contained in a vaccine product.

† Both the measles and rubella strains in M-M-R II and PRIORIX are 100% identical on a nucleotide level. The Jeryl Lynn strain used in M-M-R II is a mixture of two viral lineages, JL1 and JL2. RIT4385 is a pure clone of JL1 and is 100% identical on a protein level to M-M-R II's JL1 component.

groups: 0.0%–0.2% among subjects receiving PRIORIX and 0.0%–0.3% among those receiving M-M-R II (8–11). No significant difference in frequency of vaccine-related SAEs was observed within each individual study; pooled estimates were not calculated.

The rate of febrile seizures is highest during the 6–11 days after vaccination for all MMR vaccines and is estimated to be 3.3–8.7 per 10,000 doses, based on two studies conducted in the United Kingdom, which included both PRIORIX and M-M-R II (13,15). In the clinical trials with PRIORIX of any potency that GlaxoSmithKline Biologicals conducted in the United States, after receipt of a first dose of MMR (PRIORIX or M-M-R II) at age 12–15 months, the rate of febrile seizures attributable to vaccination among 8,386 PRIORIX recipients was 9.5 per 10,000 (95% CI = 4.4–19.6) compared with 14.0 per 10,000 (95% CI = 5.2–34.8) among 3,561 M-M-R II recipients. These studies included coadministration of recommended age-appropriate vaccines, and all found the differences in rates of febrile seizures between the two vaccines to be non-significant (10,11,18,19). Similarly, the time course of fever was comparable for both vaccines across all studies, with most instances observed 5–12 days postvaccination (Remon Abu-Elyazeed, MD, PhD, GlaxoSmithKline Biologicals, personal communication, March 2022). No evidence of an association of aseptic meningitis with MMR vaccination was reported in the literature for vaccines containing Jeryl Lynn or Jeryl Lynn-derived mumps strains, which are included in both M-M-R II and PRIORIX for immunization against mumps (12,15,20).

ITP is associated with the receipt of live attenuated measles vaccines (12,14,16,17). In the four randomized controlled clinical trials at the U.S. potency of PRIORIX, one case of ITP was identified among 1,960 PRIORIX recipients and one case among 933 M-M-R II recipients. From a previous postmarketing study conducted in the United States, the rate of ITP after M-M-R II is estimated at 2.5 per 100,000 doses (14). However, strain- or vaccine formulation-specific data on ITP risk are sparse. Based on the clinical trials and the

literature (12,14,16,17), the rates of ITP after vaccination were considered similar for PRIORIX and M-M-R II.

Short-term humoral immunity was assessed using data from 13 randomized controlled trials (8–11,18,19,21–27), four at the licensed U.S. potency of PRIORIX, and nine at a lower potency of PRIORIX used in other countries. Serologic response thresholds were achieved for all three antigens in all studies. Antibodies in all studies were more than 8.8-fold higher than the predefined seroresponse threshold for measles (200 mIU per mL; correlate of protection 120 mIU per mL) and more than 4.2-fold higher than the rubella correlate (10 IU per mL). Although an antibody correlate of protection has not been established for mumps, the anti-mumps antibody level was ≥ 3.3 -fold higher than the mumps seroconversion threshold (10 IU per mL). The four studies conducted with PRIORIX at the U.S. potency found no significant difference in anti-measles, anti-mumps, or anti-rubella geometric mean concentrations (GMC) after the first dose between PRIORIX and M-M-R II recipients. Among the nine studies at a lower PRIORIX potency, eight showed no statistically significant difference between anti-measles or anti-rubella GMC levels, and seven showed no statistically significant difference between anti-mumps GMC levels. One study reported on persistence of the humoral immune response (2 years after vaccination) and found no difference between vaccines (8). None of the four studies that reported on GMC after a second dose noted a significant difference for any antigen at any potency after a second dose between PRIORIX or M-M-R II recipients (9,18,21,28).

Additional data reviewed within the EtR framework included findings from a focus group conducted with state immunization managers and a survey of pediatric and general practitioners regarding the feasibility for use and acceptability of PRIORIX. Both the focus group and the survey findings supported the interchangeability of M-M-R II and PRIORIX and the benefit of having a second MMR vaccine option available.

Summary**What is already known about this topic?**

Since 1978, M-M-R II has been the only measles, mumps, and rubella (MMR) combination vaccine used in the United States. In June 2022, the Food and Drug Administration licensed an additional MMR vaccine, PRIORIX.

What is added by this report?

The Advisory Committee on Immunization Practices recommends PRIORIX as an additional option to prevent MMR according to existing vaccine recommendations and off-label uses.

What are the implications for public health practice?

Both vaccines are interchangeable for all indications for which MMR vaccination is recommended. Availability from multiple manufacturers safeguards U.S. vaccine supply.

Rationale for Recommendation

Given the similarities in potency (Table) and vaccine components, and evidence for similar safety and immunogenicity, as well as stakeholder support, PRIORIX and M-M-R II are considered fully interchangeable, including for all off-label recommended uses. Either vaccine may be administered in any situation in which an MMR virus-containing vaccine is indicated. Two interchangeable vaccines from different manufacturers will help safeguard vaccine supply in the United States to maintain measles and rubella elimination and mitigate mumps cases and outbreaks.

ACIP Recommendation

PRIORIX is recommended according to the existing MMR recommended schedules and off-label uses (1,2) as an option to prevent measles, mumps, and rubella.

Clinical Guidance

PRIORIX is supplied as a single-dose vial of lyophilized antigen to be reconstituted with the accompanying prefilled syringe of sterile water diluent. A single dose after reconstitution is approximately 0.5 mL. PRIORIX is formulated without preservatives and is administered as subcutaneous injection (the same as M-M-R II) (5,29).

PRIORIX may be used according to the existing MMR recommendations for both on- and off-label use for prevention of measles, mumps, and rubella^{††} (1,2). For routine vaccination, 2 doses are recommended, the first at age 12–15 months, and the second at age 4–6 years. For catch-up vaccination of previously unvaccinated children and adolescents, 2 doses

should be administered ≥ 4 weeks apart. Before international travel, infants aged 6–11 months should receive a single dose. Travelers aged ≥ 12 months who have not received 2 doses of MMR should receive 2 doses separated by ≥ 28 days.

During a measles outbreak, infants aged 6–11 months should receive a single dose of MMR. For measles postexposure prophylaxis in unvaccinated persons, 1 dose of MMR should be administered within 72 hours of exposure to a person with infectious measles, and the 2-dose series (i.e., the second of 2 MMR doses) should be completed ≥ 28 days later. During mumps outbreaks, a third dose of MMR is recommended for persons identified by public health authorities as being part of a group or population at increased risk for acquiring mumps because of an outbreak.

Interchangeability

PRIORIX and M-M-R II are fully interchangeable. ACIP General Best Practices states a preference that doses of vaccine in a series come from the same manufacturer; however, vaccination should not be deferred when the manufacturer of the previously administered vaccine is unknown or when the vaccine from the same manufacturer is unavailable (30). Studies have shown that PRIORIX is safe and immunogenic when administered as a second dose after M-M-R II (10,21).

Timing of Vaccination and Coadministration with Other Vaccines

PRIORIX can be administered concomitantly, at different anatomic sites, with other routine childhood vaccines. Concomitant administration of PRIORIX with other live and nonlive vaccines^{§§} has been studied; results indicated no safety concerns or evidence for interference in the immune response to either (8,10,11,18,19,21,28). Additional live virus vaccines not administered on the same day should be separated by ≥ 4 weeks (30).

Precautions and Contraindications

Before administering PRIORIX, health care providers should consult the package insert for precautions, warnings, and contraindications (5,29). Contraindications for PRIORIX are the same as those for M-M-R II. PRIORIX should not be administered to persons with a history of severe allergic reactions (e.g., anaphylaxis) to any component of the vaccine or after a previous dose of any measles, mumps, and rubella virus-containing vaccine (unlike M-M-R II, PRIORIX does

^{††} No direct evidence for PRIORIX for off-label uses; recommendation is based on existing ACIP recommendations and comparative use of M-M-R II in similar situations.

^{§§} Among children aged 12–15 months: with 13-valent pneumococcal conjugate vaccine (PCV13-Prevnar), Varivax (VAR), Havrix (HAV), and 7-valent pneumococcal conjugate vaccine (PCV7). Among children aged 4–6 years: with Kinrix (DTaP-IPV) and Varivax.

not contain gelatin); persons with severe humoral or cellular (primary or acquired) immunodeficiency; or women who are pregnant. Pregnancy should be avoided for 1 month after receipt of MMR. Additional information on warnings and precautions can be found in the package insert and previous vaccine recommendations (1,5,29).

Reporting of Vaccine Adverse Events

Adverse events following administration of any vaccine should be reported to the Vaccine Adverse Event Reporting System (VAERS). Reports can be submitted to VAERS online, by fax, or by mail. Additional information about VAERS is available by telephone (1-800-822-7967) or online (<https://vaers.hhs.gov>). Any future revisions to this ACIP recommendation will be dictated by reported adverse events and new research evidence.

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Perception of Local COVID-19 Transmission and Use of Preventive Behaviors Among Adults with Recent SARS-CoV-2 Infection — Illinois and Michigan, June 1–July 31, 2022

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During the early stages of the COVID-19 pandemic, use of preventive behaviors was associated with perceived risk for contracting SARS-CoV-2 infection (1,2). Over time, perceived risk has declined along with waning COVID-19–related media coverage (3,4). The extent to which communities continue to be aware of local COVID-19 transmission levels and are implementing recommended preventive behaviors is unknown. During June 1–July 31, 2022, health departments in DuPage County, Illinois and metropolitan Detroit, Michigan surveyed a combined total of 4,934 adults who had received a positive test result for SARS-CoV-2 during the preceding 3 weeks. The association between awareness of local COVID-19 transmission and use of preventive behaviors and practices was assessed, both in response to perceived local COVID-19 transmission levels and specifically during the 2 weeks preceding SARS-CoV-2 testing. Both areas had experienced sustained high COVID-19 transmission during the study interval as categorized by CDC COVID-19 transmission levels.* Overall, 702 (14%) respondents perceived local COVID-19 transmission levels as high, 987 (20%) as substantial, 1,902 (39%) as moderate, and 581 (12%) as low; 789 (16%) reported they did not know. Adjusting for geographic area, age, gender identity, and combined race and ethnicity, respondents who perceived local COVID-19 transmission levels as high were more likely to report having made behavioral changes because of the level of COVID-19 transmission in their area, including wearing a mask in public, limiting travel, and avoiding crowded places or events. Continued monitoring of public perceptions of local COVID-19 levels and developing a better understanding of their influence on the use of preventive behaviors can guide COVID-19 communication strategies and policy making during and beyond the pandemic.

During June 1–July 31, 2022, adults aged ≥18 years who had received positive SARS-CoV-2 test results within the preceding 3 weeks who were reported to six participating health

departments[†] were invited via SMS text messages to complete anonymous, English-language Internet-based questionnaires as part of the COVID-19 Outbreak Public Evaluation (COPE) Initiative.[§] The number of surveys sent to eligible potential respondents during this interval is not known. Respondents self-reported demographic information and the number of COVID-19 vaccine doses they had received. Respondents also 1) characterized levels of local COVID-19 transmission when surveyed as high, substantial, moderate, low, or unknown[¶]; 2) classified their level of concern about new variants of SARS-CoV-2; 3) reported frequency of having used preventive behaviors, including wearing a mask in public (and mask type worn), limiting travel, and avoiding crowded places or events, during the 2 weeks preceding SARS-CoV-2 testing^{**}; and 4) reported changes in these preventive behaviors in response to perceived levels of local COVID-19 transmission.^{††}

This analysis reviewed survey responses from participating health departments with 1,000 or more respondents during the study interval, which included the metropolitan area of Detroit, Michigan (including Lapeer, Livingston, Macomb, Oakland, St. Clair, and Wayne counties) and DuPage County,

[†] Participating health departments included Clay County Health Department, Hayes, North Carolina; Public Health Madison and Dane County, Madison, Wisconsin; Denver Department of Public Health and Environment, Denver, Colorado; DuPage County Health Department, Wheaton, Illinois; Michigan Department of Health and Human Services, and New Mexico Department of Health.

[§] The COPE Initiative surveys included in this analysis were designed for rapid administration to persons identified and recruited through county and state health departments. The COPE Initiative case-control surveys were established in February 2021. <https://www.thecopeinitiative.org>

[¶] Survey respondents were asked, “Which of the following would you use to describe the level of COVID-19 transmission in your local area?” with response options of low, moderate, substantial, high, and unknown.

^{**} Participants were asked, “During the two weeks before your most recent COVID-19 test, how often would you say you were doing each of the following to protect against COVID-19?” Response options were “Never,” “Rarely,” “Sometimes,” “Often,” and “Always.” For this analysis, response options were collapsed into categories of never or rarely and often or always; responses of sometimes were excluded from analyses.

^{††} Survey respondents were asked about changes in personal preventive behavior with the question, “Have you changed your behavior due to the level of COVID-19 transmission in your local area?” Respondents who reported changes in behavior were asked whether they were more likely, less likely or just as likely to wear a mask, choose a more protective mask, delay or avoid travel, or avoid indoor gatherings. Responses of “not applicable” were excluded.

* CDC transmission levels are categorized as low, moderate, substantial, or high based on new COVID-19 case counts and the percentage of positive COVID-19 tests. CDC transmission levels, used for comparison with public perceptions, are available through the COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#county-view?list_select_state=all_states&list_select_county=all_counties&data-type=Risk&null=Risk (Accessed November 8, 2022).

Illinois. During June 1–July 31, 2022, a total of 5,575 persons from the Detroit metropolitan area, who had received a positive SARS-CoV-2 test result opened the survey, 4,274 (76.7%) of whom completed the survey; 3,934 (92.0%) of these respondents provided information for all of the variables included in this analysis (except for general health status) and were included in the analytic sample.^{§§} Also during this interval, 1,546 persons from DuPage County, Illinois who had received a positive SARS-CoV-2 test result opened the survey; 1,207 (78.1%) completed the survey and 1,000 (83.0%) of these respondents provided information for all of the variables included in this analysis and were added to the analytic sample. Pearson's chi-square tests were used to compare perceived local COVID-19 transmission across demographic groups, by number of vaccine doses received, and respondents' concern about new variants of SARS-CoV-2. To assess associations between perceived local COVID-19 transmission level and frequency of use of preventive behaviors during the 2 weeks before SARS-CoV-2 testing and changes in personal behaviors due to perceptions of local COVID-19 transmission, adjusted odds ratios (aORs) were estimated using multivariable logistic regression models^{¶¶} adjusted for geographic area, gender identity,^{***} age group, and combined race and ethnicity. Respondents provided consent electronically. Analyses were conducted using Python software (version 3.8.8; Python Software Foundation) and R software (version 4.2.0; R Foundation) using the R survey package (version 3.29). The Monash University Human Research Ethics Committee reviewed and approved the study. This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.^{†††}

Respondents, all adults, included 3,934 residents of the Detroit metropolitan area and 1,000 residents of DuPage County, Illinois. A total of 4,670 (94.6%) surveys were completed within 7 days of associated positive SARS-CoV-2

test results; all surveys were completed within 3 weeks of the associated positive test result.

During May–July 2022 (i.e., the study interval and reference time frame of questions answered by respondents), the Detroit metropolitan area and DuPage County had continuously high levels of local COVID-19 transmission as categorized by publicly available CDC transmission levels.^{§§§} Among all respondents, 702 (14%) characterized local COVID-19 transmission when surveyed as high, 971 (20%) as substantial, 1,902 (39%) as moderate, 581 (12%) as low, and 778 (16%) did not know (Table). Perceived level of local COVID-19 transmission varied by county, gender identity, age group, race and ethnicity, education, employment status, number of COVID-19 vaccine doses received, self-reported general health status, and respondents' level of concern about new variants of SARS-CoV-2. Respondents aged 30–59 years were more likely than those aged 18–29 years or ≥60 years to characterize local COVID-19 transmission as high. High perceived local COVID-19 transmission levels were also more common among adults with relatively higher education attainment, more concern about new SARS-CoV-2 variants, and receipt of more COVID-19 vaccine doses. Higher percentages of adults with a high school diploma or less, zero COVID-19 vaccine doses, and no expressed concern about new variants of SARS-CoV-2 indicated that they did not know the level of COVID-19 transmission in their local area.

Multivariable models revealed that perceived higher local COVID-19 transmission among respondents was associated with more frequent participation in preventive behaviors during the 2 weeks preceding SARS-CoV-2 testing (Figure 1). Compared with respondents who characterized COVID-19 transmission as low, those who perceived transmission levels as high were more likely to report having always or often worn masks in public settings (aOR = 3.0; 95% CI = 2.3–3.8), to have worn protective masks (aOR = 2.9; 95% CI = 2.2–3.7), limited travel (aOR = 1.7; 95% CI = 1.3–2.1), and avoided crowded places or events (aOR = 1.6; 95% CI = 1.3–2.0).

Compared with respondents who characterized local COVID-19 transmission as low, those who perceived local COVID-19 transmission as high were more likely to report

^{§§} The general health variable was added to the table after inclusion criteria had been established and the data locked on the final analytic sample; therefore, the table specifically indicates that eight of the 4,934 (0.2%) respondents in the final sample did not provide information on this variable.

^{¶¶} A subset of characteristics was included in multivariable regression models given inherent collinearity (e.g., between age and employment status or age and education attainment, or between concern about SARS-CoV-2 variants and COVID-19 vaccine status). Commonly assessed variables were included to guide potential tailoring of public health messaging about associations (e.g., by gender identity, age, or combined race and ethnicity).

^{***} To assess gender identity, respondents were asked, "What is your gender? (select one)" with response options of "male," "female," "trans, male/trans man," "trans female/trans woman," "genderqueer/gender nonconforming," "different identity (please state)," and "prefer not to say." For this analysis, gender identities were categorized as male, female, and other or unknown (including trans male/trans man, trans female/trans woman, genderqueer/gender nonconforming, different identity [please state], and prefer not to say).

^{†††} 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

^{§§§} During the study period, the mean 7-day new COVID-19 case counts per 100,000 population for each county were as follows: DuPage County, Illinois = 257.6; Lapeer County, Michigan = 94.9; Livingston County, Michigan = 139.7; Macomb County, Michigan = 185.6; Oakland County, Michigan = 198.7; Saint Clair County, Michigan = 118.2; Wayne County, Michigan = 174.2. The mean 7-day percentage reported SARS-CoV-2 positive test results for each county were DuPage County, Illinois = 13.6%; Lapeer County, Michigan = 16.8%; Livingston County, Michigan = 14.6%; Macomb County, Michigan = 17.8%; Oakland County, Michigan = 16.8%; Saint Clair County, Michigan = 19.0%; and Wayne County, Michigan = 11.1%. https://covid.cdc.gov/covid-data-tracker/#county-view?list_select_state=all_states&data-type= (Accessed October 4, 2022).

TABLE. Perception of local COVID-19 transmission among adults with recent positive SARS-CoV-2 test results — Illinois and Michigan, June 1–July 31, 2022

Characteristic	Perception of local COVID-19 transmission when surveyed, no. (%)						p-value*
	All	Don't know	Low	Moderate	Substantial	High	
Overall	4,934 (100.0)	778 (15.8)	581 (11.8)	1,902 (38.5)	971 (19.7)	702 (14.2)	NA
Survey completion interval							
Jun 1–15	1,179 (23.9)	152 (12.9)	91 (7.7)	408 (34.6)	270 (22.9)	258 (21.9)	<0.001
Jun 16–30	1,067 (21.6)	160 (15.0)	160 (15.0)	452 (42.4)	178 (16.7)	117 (11.0)	
Jul 1–15	1,341 (27.2)	242 (18.0)	173 (12.9)	534 (39.8)	240 (17.9)	152 (11.3)	
Jul 16–31	1,347 (27.3)	224 (16.6)	157 (11.7)	508 (37.7)	283 (21.0)	175 (13.0)	
Residence[†]							
Detroit, Michigan, metropolitan area	3,934 (79.7)	652 (16.6)	494 (12.6)	1,528 (38.8)	775 (19.7)	485 (12.3)	<0.001
Lapeer County	33 (0.7)	3 (9.1)	9 (27.3)	13 (39.4)	7 (21.2)	1 (3.0)	
Livingston County	176 (3.6)	34 (19.3)	27 (15.3)	79 (44.9)	22 (12.5)	14 (8.0)	
Macomb County	761 (15.4)	136 (17.9)	96 (12.6)	327 (43.0)	124 (16.3)	78 (10.2)	
Oakland County	1,487 (30.1)	226 (15.2)	169 (11.4)	585 (39.3)	332 (22.3)	175 (11.8)	
Saint Clair County	103 (2.1)	9 (8.7)	32 (31.1)	28 (27.2)	21 (20.4)	13 (12.6)	
Wayne County	1,374 (27.8)	244 (17.8)	161 (11.7)	496 (36.1)	269 (19.6)	204 (14.8)	
DuPage County, Illinois	1,000 (20.3)	126 (12.6)	87 (8.7)	374 (37.4)	196 (19.6)	217 (21.7)	
Gender							
Female	3,194 (64.7)	520 (16.3)	337 (10.6)	1,230 (38.5)	621 (19.4)	486 (15.2)	0.013
Male	1,676 (34.0)	245 (14.6)	237 (14.1)	652 (38.9)	339 (20.2)	203 (12.1)	
Other or unknown	64 (1.3)	13 (20.3)	7 (10.9)	20 (31.3)	11 (17.2)	13 (20.3)	
Age group, yrs							
18–29	638 (12.9)	127 (19.9)	54 (8.5)	258 (40.4)	136 (21.3)	63 (9.9)	<0.001
30–44	1,393 (28.2)	210 (15.1)	111 (8.0)	511 (36.7)	294 (21.1)	267 (19.2)	
45–59	1,579 (32.0)	237 (15.0)	201 (12.7)	604 (38.3)	290 (18.4)	247 (15.6)	
≥60	1,323 (26.8)	204 (15.4)	214 (16.2)	529 (40.0)	251 (19.0)	125 (9.4)	
Race and ethnicity							
Asian, non-Hispanic	322 (6.5)	57 (17.7)	45 (14.0)	131 (40.7)	56 (17.4)	33 (10.2)	<0.001
Black, non-Hispanic	575 (11.7)	137 (23.8)	64 (11.1)	192 (33.4)	111 (19.3)	71 (12.3)	
Hispanic or Latino, any race or races	262 (5.3)	49 (18.7)	25 (9.5)	98 (37.4)	48 (18.3)	42 (16.0)	
White, non-Hispanic	3,693 (74.8)	518 (14.0)	434 (11.8)	1,457 (39.5)	736 (19.9)	548 (14.8)	
Other race or races, non-Hispanic	82 (1.7)	17 (20.7)	13 (15.9)	24 (29.3)	20 (24.4)	8 (9.8)	
Highest level of education							
High school diploma or less	437 (8.9)	121 (27.7)	65 (14.9)	147 (33.6)	54 (12.4)	50 (11.4)	<0.001
College or some college	2,905 (58.9)	494 (17.0)	346 (11.9)	1,124 (38.7)	561 (19.3)	380 (13.1)	
More than bachelor's degree	1,592 (32.3)	163 (10.2)	170 (10.7)	631 (39.6)	356 (22.4)	272 (17.1)	
Employment status							
Employed	3,796 (76.9)	575 (15.1)	418 (11.0)	1,483 (39.1)	761 (20.0)	559 (14.7)	0.017
Not employed	1,138 (23.1)	203 (17.8)	163 (14.3)	419 (36.8)	210 (18.5)	143 (12.6)	
No. of COVID-19 vaccine doses received[§]							
0	252 (5.1)	68 (27.0)	40 (15.9)	90 (35.7)	26 (10.3)	28 (11.1)	<0.001
1	75 (1.5)	14 (18.7)	10 (13.3)	34 (45.3)	10 (13.3)	7 (9.3)	
2	921 (18.7)	190 (20.6)	121 (13.1)	349 (37.9)	146 (15.9)	115 (12.5)	
3	2,865 (58.1)	417 (14.6)	305 (10.6)	1,091 (38.1)	618 (21.6)	434 (15.1)	
4	821 (16.6)	89 (10.8)	105 (12.8)	338 (41.2)	171 (20.8)	118 (14.4)	
Self-reported health status[¶]							
Excellent	962 (19.5)	126 (13.1)	151 (15.7)	345 (35.9)	182 (18.9)	158 (16.4)	<0.001
Very good	2,200 (44.7)	317 (14.4)	277 (12.6)	863 (39.2)	445 (20.2)	298 (13.5)	
Good	1,355 (27.5)	243 (17.9)	126 (9.3)	546 (40.3)	269 (19.9)	171 (12.6)	
Fair	356 (7.2)	81 (22.8)	24 (6.7)	125 (35.1)	67 (18.8)	59 (16.6)	
Poor	53 (1.1)	10 (18.9)	2 (3.8)	19 (35.8)	8 (15.1)	14 (26.4)	
Level of concern about new variants of SARS-CoV-2							
Not at all concerned	287 (5.8)	85 (29.6)	68 (23.7)	82 (28.6)	29 (10.1)	23 (8.0)	<0.001
Somewhat unconcerned	331 (6.7)	40 (12.1)	57 (17.2)	132 (39.9)	60 (18.1)	42 (12.7)	
Neutral	939 (19.0)	161 (17.1)	135 (14.4)	406 (43.2)	153 (16.3)	84 (8.9)	
Somewhat concerned	2,312 (46.9)	309 (13.4)	244 (10.6)	946 (40.9)	482 (20.8)	331 (14.3)	
Very concerned	1,065 (21.6)	183 (17.2)	77 (7.2)	336 (31.5)	247 (23.2)	222 (20.8)	

See table footnotes on the next page.

TABLE. (Continued) Perception of local COVID-19 transmission among adults with recent positive SARS-CoV-2 test results — Illinois and Michigan, June 1–July 31, 2022

Abbreviation: NA = not applicable.

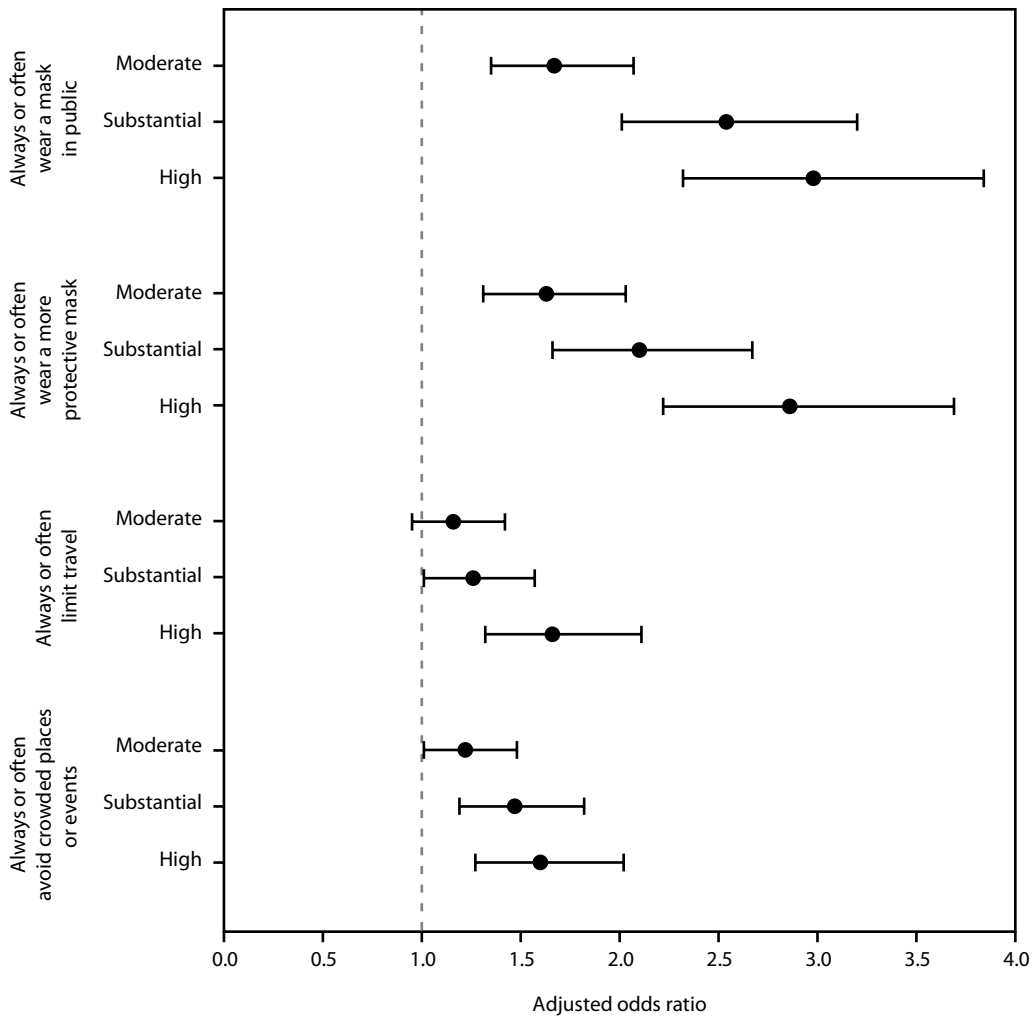
* Pearson’s chi-square tests were used to estimate p-values for differences across groups. A Bonferroni adjustment (10) was applied to account for the number of comparisons.

† During June 1–July 31, 2022, a total of 45,626 confirmed COVID-19 cases occurred in the metropolitan area of Detroit, Michigan, and 18,626 confirmed COVID-19 cases in DuPage County, Illinois.

§ Respondents answered the question, “How many COVID-19 vaccine doses have you received?”

¶ Percentages for this group are derived from among the 4,926 respondents who self-reported health status. Eight of the 4,934 (0.2%) respondents did not complete the question on self-reported health status.

FIGURE 1. Adjusted odds ratios* of participation in preventive behaviors,† by perceived level of local COVID-19 transmission§,¶ among adults with recent positive SARS-CoV-2 test results — Illinois and Michigan, June 1–July 31, 2022



* With 95% CIs indicated by error bars. Multivariable regression models are adjusted for geographic area, gender identity, age group, and combined race and ethnicity.

† Self-reported preventive behaviors were ascertained with the lead question, “Generally speaking, during the two weeks before your most recent COVID-19 test, how often would you say you were doing each of the following to protect against COVID-19?” Response options were “Never,” “Rarely,” “Sometimes,” “Often,” and “Always.” Models estimated odds of having “Always” or “Often” versus “Rarely” or “Never” used preventive behaviors, omitting “Sometimes” given the imprecision of this answer. Among 4,934 respondents, the numbers of respondents in each model (i.e., excluding persons who reported “Sometimes” for the preventive behavior) were as follows: wearing a mask in public (3,646); choosing to wear a more protective mask (3,768); limiting travel (3,792); and avoiding crowded places or events (3,668).

§ Referent group = low transmission.

¶ The group of respondents who selected “I don’t know” for local COVID-19 transmission (778) is not included.

changing their preventive behaviors in response to local transmission levels (aOR = 4.4; 95% CI = 3.2–5.0), substantial (aOR = 4.0; 95% CI = 3.2–5.0), or moderate (aOR = 2.1; 95% CI = 1.8–2.6) (Figure 2). Respondents who characterized local COVID-19 transmission as high were more likely than were those who characterized transmission as low to report having more frequently worn masks in public (aOR = 2.6; 95% CI = 1.7–4.1), chosen to wear a more protective mask (aOR = 1.7; 95% CI = 1.2–2.3), postponed or cancelled travel plans (aOR = 2.1; 95% CI = 1.4–3.1), and avoided crowded places or events (aOR = 2.0; 95% CI = 1.4–2.8).

Discussion

In two geographic areas with sustained high 7-day average rates of confirmed COVID-19 transmission during May–July 2022, 50% of adults with recent SARS-CoV-2 infections surveyed during June–July 2022 described the level of COVID-19 transmission in their local area as low or moderate. Persons who perceived local COVID-19 transmission to be high when surveyed were most likely to report changing preventive behaviors in response to local COVID-19 transmission, including more frequently wearing a mask in public, limiting travel, and avoiding crowded events. Further assessment of public perceptions of local COVID-19 levels and their associations with preventive behaviors can help to clarify how communication of pandemic indicators and related policy decisions might influence behaviors.

Differences in perceived local COVID-19 transmission observed across demographic groups, number of vaccine doses received, and concern about new variants of SARS-CoV-2 highlight the effects of individual risk perception on use of preventive measures. Differences in perceived transmission levels among adults aged 30–59 years and those who were older or younger might reflect differential sources of COVID-19 information or COVID-19 risk perception (6). Perceived transmission level also varied with the number of COVID-19 vaccine doses received. Despite higher risk for severe COVID-19 without vaccine-induced protection, adults who had received fewer COVID-19 vaccine doses more commonly characterized COVID-19 transmission as low compared with adults who had received more COVID-19 vaccine doses. This finding might reflect a decreased likelihood to get vaccinated and to pay attention to COVID-19 transmission levels among people who were less concerned about COVID-19. In addition, even among persons who were very concerned about new variants of SARS-CoV-2, only one in five perceived local COVID-19 transmission to be high, which might be related to reduced media coverage of COVID-19 (4).

CDC does not recommend that members of the public use transmission levels alone to guide prevention measures. Rather,

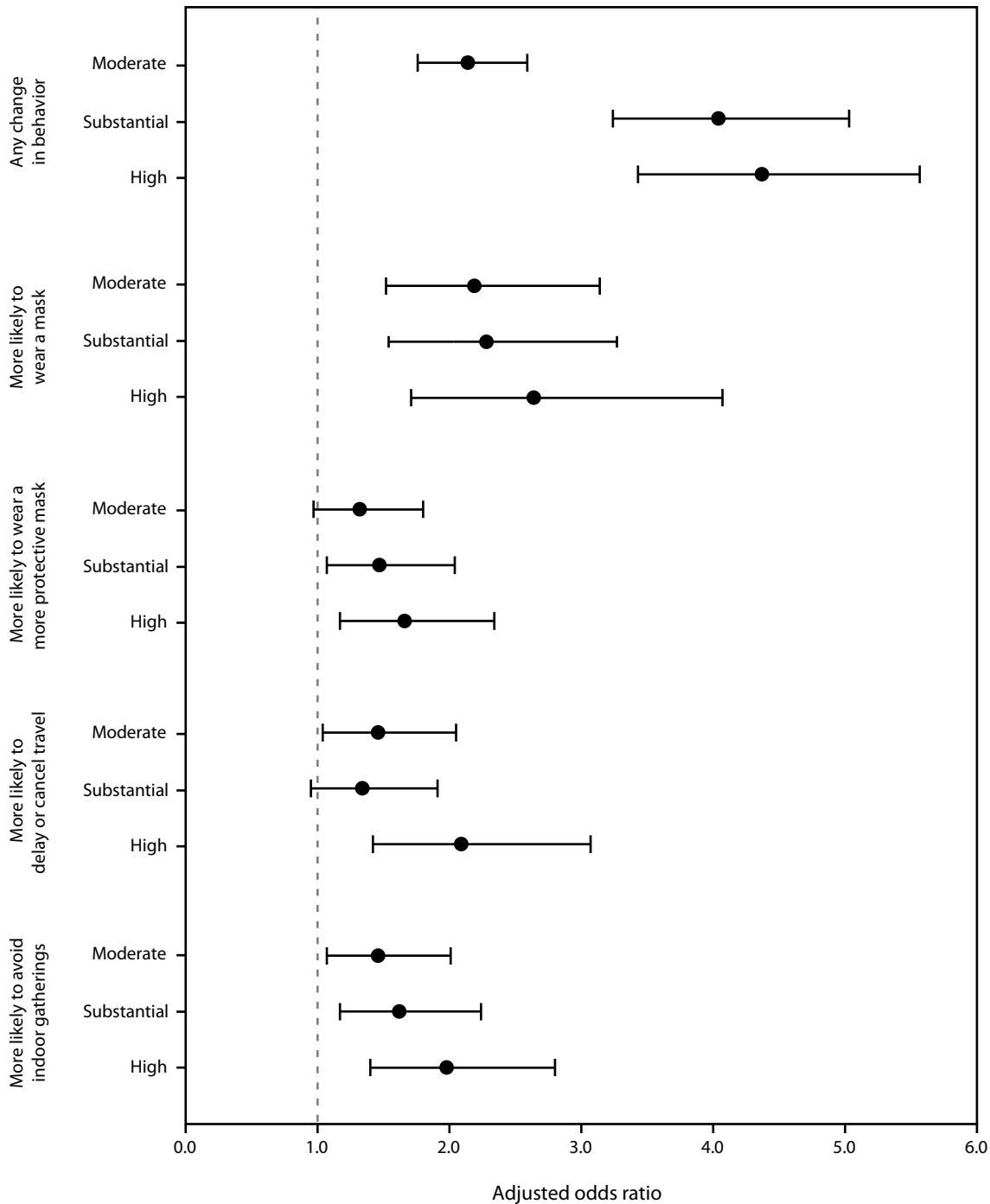
CDC developed COVID-19 Community Levels, which are measures of the impact of COVID-19 on a community in terms of hospitalizations and health care system strain, while accounting for transmission in the community. As such, calculation of COVID-19 Community Levels incorporates new COVID-19 hospital admissions and percentage of hospital beds occupied by patients with COVID-19, in addition to new COVID-19 cases in a community (7). Although not available at the time this survey was developed,^{***} CDC recommends use of COVID-19 Community Levels data to guide messaging about community and individual preventive actions (8).

The findings in this report are subject to at least five limitations. First, questionnaires were completed by adults who had recently received a positive SARS-CoV-2 test result, which could have influenced their perceptions about local COVID-19 transmission levels. Relatedly, perceived local COVID-19 transmission levels when surveyed might have differed from perceived transmission levels during reference intervals for behaviors and practices, though transmission levels in both areas were sustainably high during the entire study interval and reference time frame (May–July 2022). Second, some respondents might have been aware of the CDC COVID-19 Community Level site and responded to survey questions accordingly, resulting in relatively lower reported perceived local COVID-19 transmission levels. Third, respondents might have overreported use of preventive behaviors because of social desirability (9), and this study did not assess whether reported behavioral changes occurred before or after respondents received a positive SARS-CoV-2 test result. Fourth, this nonrandom convenience sample is subject to selection bias related to COVID-19 test-seeking, and the survey sample does not represent all county residents who received a positive SARS-CoV-2 test result during the study interval. Finally, the number of persons who received survey invitations and were eligible to consent to participate is unknown, precluding a reliable response rate estimate.

This analysis found that a low percentage of surveyed U.S. adults perceived local COVID-19 transmission to be high despite sustained documented high transmission levels, and that those who perceived local transmission to be high were more likely to practice behaviors to protect themselves and others from COVID-19. Continued monitoring of public perceptions of local COVID-19 levels, and developing a better understanding of their influence on use of preventive behaviors, can guide COVID-19 communication strategies and policy making during and beyond the pandemic.

^{***} CDC Community Levels database was first available in March 2022. <https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html>

FIGURE 2. Adjusted odds ratios* for having changed use of preventive behaviors† in response to perceived level of local COVID-19 transmission§,¶ among adults with recent positive SARS-CoV-2 test results — Illinois and Michigan, June 1–July 31, 2022



Abbreviation: Ref = referent group.

* With 95% CIs indicated by error bars. Multivariable regression models are adjusted for geographic area, gender identity, age group, and combined race and ethnicity.

† Respondents first answered “Yes” or “No” to the question, “Have you changed your behavior due to the level of COVID-19 transmission in your local area?” Respondents who answered “Yes” received the branching question, “In which of the following ways have you changed behavior?” for wearing a mask, choosing to wear a more protective mask, delaying or avoiding travel, or avoiding indoor gatherings with response options of “More likely,” “Unchanged,” “Less likely,” or “Not applicable.” Models estimated odds of any behavior change (versus no change) and higher likelihood (versus less likely or equally likely) of engaging in each preventive behavior, excluding persons who said they were not applicable.

§ Ref = low transmission.

¶ The group of respondents who selected “I don’t know” for local COVID-19 transmission (778) is not included.

Summary**What is already known about this topic?**

During June–July 2022, many U.S. counties experienced high COVID-19 transmission levels.

What is added by this report?

One half of adults surveyed during June–July 2022 who had recently received a positive SARS-CoV-2 test result in metropolitan Detroit, Michigan and DuPage County, Illinois perceived local COVID-19 transmission when surveyed to be low or moderate, despite documented sustained high transmission. Higher perceived local COVID-19 transmission was associated with more use of preventive behaviors, overall and in response to high local COVID-19 transmission.

What are the implications for public health practice?

Continued monitoring of public perceptions of local COVID-19 levels, and further understanding their impact on use of preventive behaviors, can guide pandemic-related communication strategies and policymaking.

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Sociodemographic Variation in Early Uptake of COVID-19 Vaccine and Parental Intent and Attitudes Toward Vaccination of Children Aged 6 Months–4 Years — United States, July 1–29, 2022

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COVID-19 vaccines are safe and effective for infants and young children, and on June 18, 2022, CDC recommended COVID-19 vaccination for infants and children (children) aged 6 months–4 years (1,2). As of November 9, 2022, based on administrative data reported to CDC,* 5.9% of children aged <2 years and 8.8% of children aged 2–4 years had received ≥1 dose. To better understand reasons for low coverage among children aged <5 years, CDC analyzed data from 4,496 National Immunization Survey-Child COVID Module (NIS-CCM) interviews conducted during July 1–29, 2022, to examine variation in receipt of ≥1 dose of COVID-19 vaccine and parental intent to vaccinate children aged 6 months–4 years by sociodemographic characteristics and by parental beliefs about COVID-19; type of vaccination place was also reported. Among children aged 6 months–4 years, 3.5% were vaccinated; 59.3% were unvaccinated, but the parent was open to vaccination; and 37.2% were unvaccinated, and the parent was reluctant to vaccinate their child. Openness to vaccination was higher among parents of Hispanic or Latino (Hispanic) (66.2%), non-Hispanic Black or African American (Black) (61.1%), and non-Hispanic Asian (Asian) (83.1%) children than among parents of non-Hispanic White (White) (52.9%) children and lower among parents of children in rural areas (45.8%) than among parents of children in urban areas (64.1%). Parental confidence in COVID-19 vaccine safety and receipt of a provider recommendation for COVID-19 vaccination were lower among unvaccinated than vaccinated children. COVID-19 vaccine recommendations from a health care provider, along with dissemination of information about the safety of COVID-19 vaccine by trusted persons, could increase vaccination coverage among young children.

NIS-CCM[†] is an ongoing, national random-digit-dialed mobile telephone survey of households that include children and adolescents aged 6 months–17 years (3,4). The survey respondent was a parent or guardian (parent) who indicated they were knowledgeable about the child's vaccination history. COVID-19 vaccination status was based on the parent's

response to the question, “Has [child] received at least one dose of a COVID-19 vaccine?” Among parents of unvaccinated children, parental intent was measured by asking, “How likely are you to get [child] a COVID-19 vaccine? Would you say you would definitely get a vaccine for [child], probably get a vaccine, probably not get a vaccine, definitely not get a vaccine, or are not sure?” Responses were grouped as follows: 1) child vaccinated with ≥1 dose; 2) child unvaccinated and parent open to vaccination, defined as parents of unvaccinated children reporting they definitely or probably would get the child vaccinated or were unsure; and 3) child unvaccinated and parent reluctant to vaccinate, defined as parents of unvaccinated children reporting they definitely or probably would not get the child vaccinated. Parents of vaccinated children also reported the type of place[§] where the child was vaccinated. Variables[¶] describing potential drivers of COVID-19 vaccine acceptance were derived from the Behavioral and Social Drivers of Vaccination (BeSD) framework (5).

[†] On July 22, 2021, NIS-CCM began including households with adolescents aged 13–17 years and asking the respondent about the adolescent's COVID-19 vaccination status and intention to vaccinate the adolescent. On October 1, 2021, children aged 12 years and children aged 5–11 years (intent questions only) were added, and on November 2, 2021, vaccination status questions were added for children aged 5–11 years. In December 2021, the survey was expanded to include children aged 6 months–4 years (intention question only), and on June 19, 2022, vaccination status questions were added for children aged 6 months–4 years. <https://www.cdc.gov/vaccines/imz-managers/nis/about.html#nis-ccm>

[§] The place-of-vaccination survey question was, “At what kind of place did [child] get [his/her] most recent COVID-19 vaccination?” Responses were coded by the interviewer into the following categories: doctor's office, health department, clinic or health center, hospital, other medically related place, mass vaccination place, pharmacy or drugstore, workplace, elementary/middle/high school, or other nonmedically related place.

[¶] The BeSD survey questions were 1) “How concerned are you about [child's name] getting COVID-19?” (“Not at all concerned, a little concerned, moderately concerned, or very concerned.”); 2) “How important do you think getting a COVID-19 vaccine is to protect [child's name] against COVID-19?” (“Not at all important, a little important, somewhat important, or very important.”); 3) “How safe do you think a COVID-19 vaccine is for [child's name]?” (“Not at all safe, somewhat safe, very safe, or completely safe.”); 4) “If you had to guess, about how many of your family and friends have gotten a COVID-19 vaccine for their children aged 6 months–4 years?” (“None, some, many, or almost all.”); 5) “Has a doctor, nurse, or another health professional ever recommended that you get a COVID-19 vaccine for [child's name]?” (“Yes or no.”); and 6) “How difficult would it be/was it for you to get [child's name] a COVID-19 vaccine?” (“Not at all difficult, a little difficult, somewhat difficult, or very difficult.”).

* Reported vaccination coverage estimates are by single year of age and, despite the vaccination recommendation targeting children aged 6 months to <5 years, population estimates for all children aged <5 years were used as the denominator. <https://covid.cdc.gov/covid-data-tracker/#vaccination-demographic>; <https://covid.cdc.gov/covid-data-tracker/#vaccination-demographics-trends>

Data from 4,496 interviews conducted during July 1–29, 2022, were analyzed; estimating parental intent to vaccinate their child began during December 2021.** The cumulative NIS-CCM response rate was 20.4%. Weighted proportions with 95% CIs were estimated, accounting for the complex survey design and weights, using SUDAAN (version 11.0.3; RTI International) and SAS (version 9.4; SAS Institute, Inc.).†† T-tests for proportions were used to test for differences, with p-values <0.05 considered statistically significant. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.§§

National COVID-19 Vaccination Coverage, Parental Intent, and Place of Vaccination

During the period preceding authorization of the vaccine for children aged 6 months–4 years, the percentage of children whose parent reported they definitely would get their child vaccinated decreased from 41.3% in December 2021 to 33.5% in May 2022 (Figure 1). By mid-July 2022, 3.5% of children were reported to have received ≥1 dose, 59.3% were unvaccinated and the parent reported being open to vaccination (22.6% definitely would, 16.4% probably would, and 20.3% were unsure), and 37.2% were unvaccinated and the parent was reluctant to vaccinate (13.0% probably would not and 24.3% definitely would not) (Figure 1). The distribution of places where vaccination was received was 78.5% in a medical setting (40.0% doctor's office, 21.1% clinic or health center, 11.4% hospital, 5.0% health department, and 1.0% other medical place); 15.0% at a pharmacy or drug store; 4.4% at a mass vaccination place; 1.8% at another nonmedical place; and 0.3% at a school.

Vaccination Coverage and Parental Intent, by Selected Characteristics

A higher percentage of White children (4.5%) had received COVID-19 vaccination during the first month of recommendation than Hispanic (2.5%) and Black children (1.0%)

** Parent interviews for 4,548 children aged 6 months–4 years were completed; among these interviews, 52 were excluded from the analyses (28 respondents didn't know or refused to disclose vaccination status, and vaccination intent for 24 unvaccinated children was not reported) for a resulting analytic sample of 4,496. Vaccination status was assessed as of the date of the interview. Vaccination coverage estimates are based on interviews conducted during July 1–29, 2022, and therefore represent coverage as of approximately the midpoint of the survey fielding dates. Estimates for December 2021–June 2022 are from NIS-CCM interviews conducted during November 28, 2021–June 30, 2022.

†† The NIS-CCM survey weights adjusted for nonresponse and households without mobile telephones and were calibrated to match counts of children aged 6 months–4 years within each HHS region who had received ≥1 dose of COVID-19 vaccine as of midmonth, by sex, using data reported to CDC by jurisdictions.

§§ 45 C.F.R. part 46.102(l)(2); 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

(Table). However, higher percentages of Asian (83.1%), Black (61.1%), and Hispanic (66.2%) children had parents reporting they were open to vaccination compared with White children (52.9%). A higher percentage of children in households with income >\$75,000 per year and with higher maternal educational attainment had received ≥1 dose of COVID-19 vaccine versus children from lower-income households and those whose mothers had lower educational attainment. A lower percentage of children living in rural areas had been vaccinated (1.6%) compared with those living in urban areas (4.2%), and a lower percentage of children living in rural areas (45.8%) had parents reporting they were open to getting their child vaccinated compared with those living in urban areas (64.1%). The percentage of children who received COVID-19 vaccination and the percentage of children with parents reporting they were reluctant to get their child vaccinated varied by U.S. Department of Health and Human Services (HHS) region (range = 1.6%–7.3% and 26.2%–48.4%), respectively.

Attitudes and Social Factors

A high percentage (87.3%) of unvaccinated children whose parent was open to vaccination had a parent reporting that getting a COVID-19 vaccine for their child was somewhat or very important; however, a lower percentage had parents perceive the vaccine as safe than among vaccinated children (57.1% versus 91.6%), and a lower percentage reported having received a provider recommendation for vaccination (24.6% versus 62.7%) (Figure 2). Among unvaccinated children whose parent was open to vaccination, a lower percentage of Hispanic (47.9%) and Black (47.3%) children's parents perceived the vaccine as safe compared with White children (66.6%), and a lower percentage of children in households below the poverty level (37.5%) had parents perceiving the vaccine as safe compared with children in households with income >\$75,000 per year (69.6%) (Supplementary Table, <https://stacks.cdc.gov/view/cdc/122000>). Parents reluctant to vaccinate their child were less likely to report being concerned about the child getting COVID-19 than parents of vaccinated children (20.8% versus 59.8%), consider vaccination to be important (24.3% versus 97.1%), consider COVID-19 vaccine to be safe (7.1% versus 91.6%), and report a provider recommendation for COVID-19 vaccination (17.0% versus 62.7%) (Figure 2).

Discussion

This analysis indicates that 3.5% of children aged 6 months–4 years had received a COVID-19 vaccination during the first month after the vaccine was recommended. In comparison, vaccination coverage among children aged 5–11 years was 20.7% during the first month after the recommendation (6). This report also identified early indications of

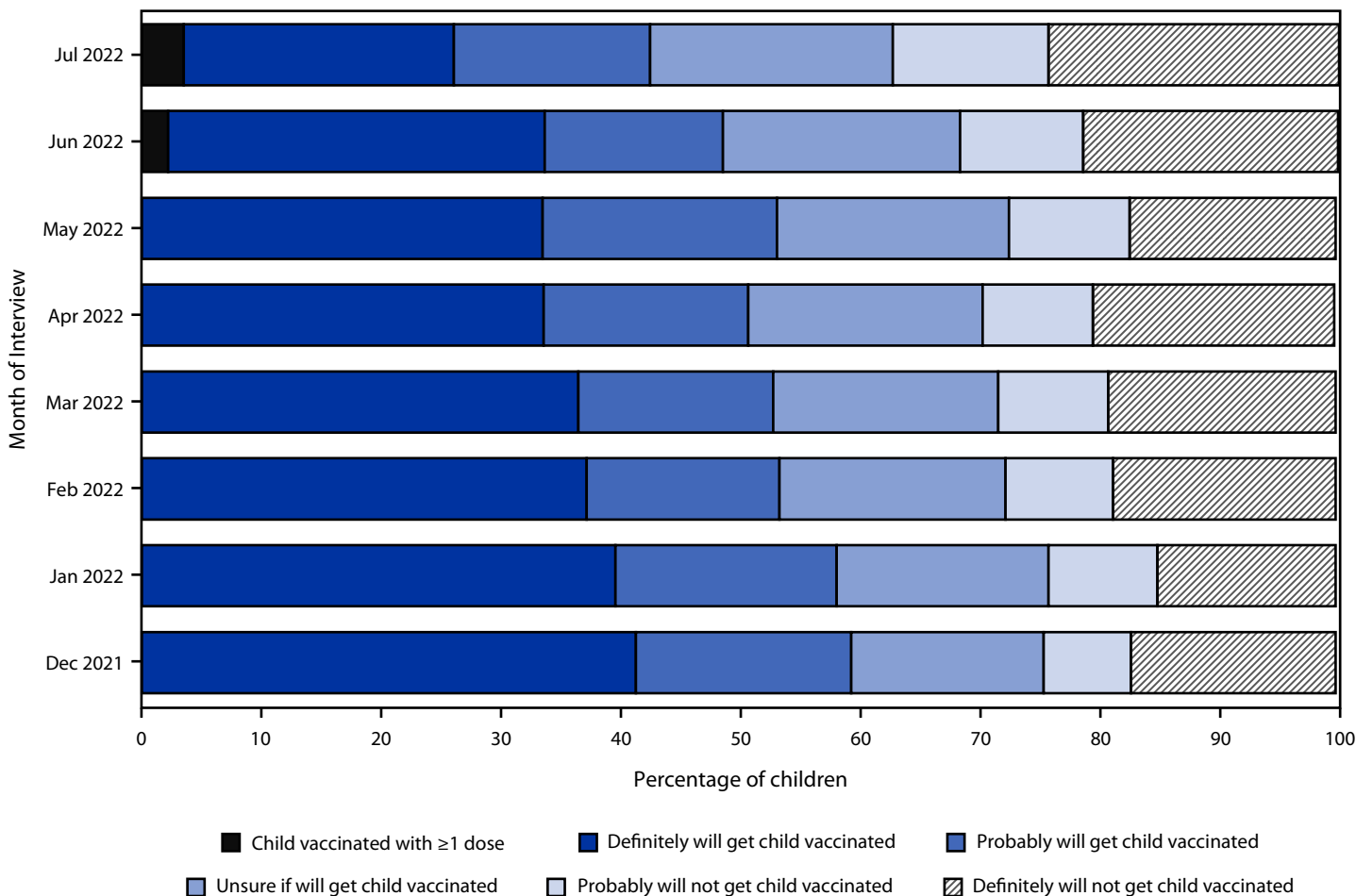
racial and ethnic and urban versus rural differences in coverage previously observed for children in other age groups during the first months after the recommendations (7).

Approximately 5 months have elapsed since COVID-19 vaccination of children aged 6 months–4 years was recommended; this report indicates that a large proportion of children have parents who intend to have them vaccinated, yet these parents have concerns about vaccine safety. Confidence in vaccine safety varied by race or ethnicity and household income. Trusted persons (e.g., a child’s pediatrician) providing accurate information to parents about vaccine safety, especially to parents of Hispanic or Black children or parents in lower-income households, might encourage these parents to have their child vaccinated.

This report indicates that approximately three fourths of vaccinated children aged 6 months–4 years received their COVID-19 vaccine at a medical place. This is a larger proportion than that for children and adolescents aged 5–17 years, 38% of whom were vaccinated at medical places and 45% at pharmacies (8). The larger role of the medical home,[¶] and medical places in general, in the delivery of vaccines to young children underscores the need for provider recommendation for vaccination. Studies have determined the importance of strong provider recommendations for vaccination (9), yet only approximately one fourth of unvaccinated children with

[¶] <https://www.aap.org/en/practice-management/medical-home/medical-home-overview/what-is-medical-home/>

FIGURE 1. Children’s COVID-19 vaccination status and parental intent to have unvaccinated children aged 6 months–4 years vaccinated — National Immunization Survey-Child COVID Module, United States, December 2021–July 2022*†



* The June 2022 estimate of the percentage of children aged 6 months–4 years who had received ≥1 COVID-19 vaccine dose was not calibrated to administrative data; the estimate is an overestimate of coverage and should be interpreted with caution. The estimate was retained so that the percentages would sum to 100%.
 † The recommendation for COVID-19 vaccination for this age group began on June 18, 2022. Estimates for July 2022 are from interviews conducted during July 1–29, 2022. Estimates for December 2021–June 2022 are from National Immunization Survey-Child COVID Module interviews conducted during November 28, 2021–June 30, 2022.

TABLE. COVID-19 vaccination status and intention of parents to vaccinate children aged 6 months–4 years, by sociodemographic characteristics — National Immunization Survey–Child COVID Module, United States, July 1–29, 2022

Characteristic	Total no.	Children, % (95% CI)*		
		Vaccinated with ≥1 dose	Unvaccinated, parent open to vaccination†	Unvaccinated, parent reluctant to vaccinate§
Overall	4,496	3.5 (3.0–4.1)	59.3 (56.7–61.8)	37.2 (34.8–39.8)
Age group				
6 mos–1 yr (Ref)	1,383	3.0 (2.2–4.0)	58.7 (54.1–63.2)	38.3 (33.8–43.0)
2–4 yrs	3,113	3.7 (3.1–4.5)	59.5 (56.5–62.5)	36.8 (33.8–39.8)
Race or ethnicity¶				
Asian	275	3.7 (1.8–6.7)	83.1 (76.0–88.9)**	13.1 (7.8–20.3)**
Black or African American	413	1.0 (0.3–2.6)**	61.1 (53.8–68.1)**	37.8 (30.9–45.2)
Hispanic or Latino	956	2.5 (1.6–3.7)**	66.2 (60.6–71.4)**	31.3 (26.1–36.8)**
White (Ref)	2,392	4.5 (3.7–5.4)	52.9 (49.5–56.4)	42.5 (39.1–46.0)
Multiple races or other	460	—††	52.8 (44.2–61.2)	42.5 (34.0–51.2)
Sex				
Male (Ref)	2,307	3.4 (2.7–4.3)	60.7 (57.1–64.1)	35.9 (32.4–39.4)
Female	2,179	3.5 (2.8–4.4)	57.8 (54.1–61.4)	38.7 (35.1–42.4)
Household income and poverty level§§				
>\$75,000/yr and above poverty level (Ref)	2,158	5.3 (4.4–6.3)	60.9 (57.1–64.6)	33.8 (30.1–37.6)
≤\$75,000/yr and above poverty level	1,040	2.3 (1.5–3.4)**	57.7 (52.5–62.7)	40.0 (35.0–45.1)**
Below poverty level	401	1.6 (0.6–3.4)**	54.0 (45.6–62.2)	44.4 (36.2–52.8)**
Not reported	897	3.0 (1.9–4.5)**	61.6 (56.2–66.8)	35.4 (30.3–40.8)
Mother's education level				
College degree or higher (Ref)	2,473	6.2 (5.3–7.3)	64.8 (61.3–68.2)	29.0 (25.7–32.4)
Some college or vocational school	1,059	2.0 (1.2–3.0)**	55.3 (50.6–59.9)**	42.7 (38.1–47.4)**
High school or equivalent	752	1.5 (0.7–2.6)**	54.6 (48.9–60.3)**	43.9 (38.3–49.6)**
Less than high school	212	2.2 (0.7–5.3)**	60.1 (49.2–70.2)	37.8 (27.7–48.6)
No. of children and adolescents aged <18 yrs in house				
1 (Ref)	2,148	3.9 (3.1–4.9)	61.7 (57.8–65.5)	34.4 (30.6–38.3)
2–3	2,117	3.4 (2.6–4.2)	58.9 (55.4–62.4)	37.7 (34.3–41.2)
≥4	231	2.4 (0.9–5.3)	49.1 (38.4–59.9)**	48.4 (37.8–59.2)**
Ever had COVID-19¶¶				
Yes (Ref)	1,718	3.5 (2.6–4.4)	63.9 (60.0–67.7)	32.6 (28.9–36.5)
No	2,690	3.6 (2.9–4.4)	56.9 (53.5–60.2)**	39.6 (36.3–42.9)**
Urban-rural residence***				
Urban (MSA, principal city) (Ref)	1,591	4.2 (3.3–5.3)	64.1 (59.7–68.3)	31.7 (27.6–36.1)
Suburban (MSA, nonprincipal city)	2,058	3.6 (2.8–4.5)	59.4 (55.7–62.9)	37.1 (33.6–40.7)
Rural (non-MSA)	739	1.6 (0.8–2.7)**	45.8 (39.4–52.3)**	2.6 (46.1–59.1)**
SVI of county of residence†††				
Low (Ref)	1,421	4.8 (3.8–6.1)	58.0 (53.6–62.3)	37.2 (32.9–41.6)
Moderate	1,440	3.5 (2.6–4.5)**	57.6 (53.0–62.1)	39.0 (34.5–43.6)
High	1,265	2.9 (2.1–4.0)**	62.8 (58.0–67.3)	34.3 (29.8–39.0)
HHS region§§§				
1 (Ref)	390	7.3 (4.9–10.4)	63.2 (55.2–70.7)	29.5 (22.3–37.6)
2	316	3.4 (1.7–6.0)**	61.0 (51.4–70.0)	35.6 (26.7–45.4)
3	657	5.5 (3.8–7.7)**	60.8 (54.4–67.0)	33.7 (27.6–40.1)
4	699	1.6 (0.8–2.8)**	57.3 (51.6–62.8)	41.1 (35.6–46.8)**
5	496	3.3 (1.9–5.2)**	56.4 (49.7–62.9)	40.3 (33.8–47.1)**
6	722	2.4 (1.4–3.8)**	56.7 (50.6–62.7)	40.9 (34.9–47.1)**
7	251	3.0 (1.3–6.0)**	48.6 (38.9–58.3)**	48.4 (38.8–58.2)**
8	421	3.6 (2.1–5.9)**	59.5 (51.7–67.0)	36.9 (29.5–44.7)
9	338	4.9 (2.8–7.7)	68.9 (59.7–77.2)	26.2 (18.1–35.6)
10	206	5.1 (2.5–9.0)	53.0 (42.4–63.4)	41.9 (31.7–52.7)

See table footnotes on the next page.

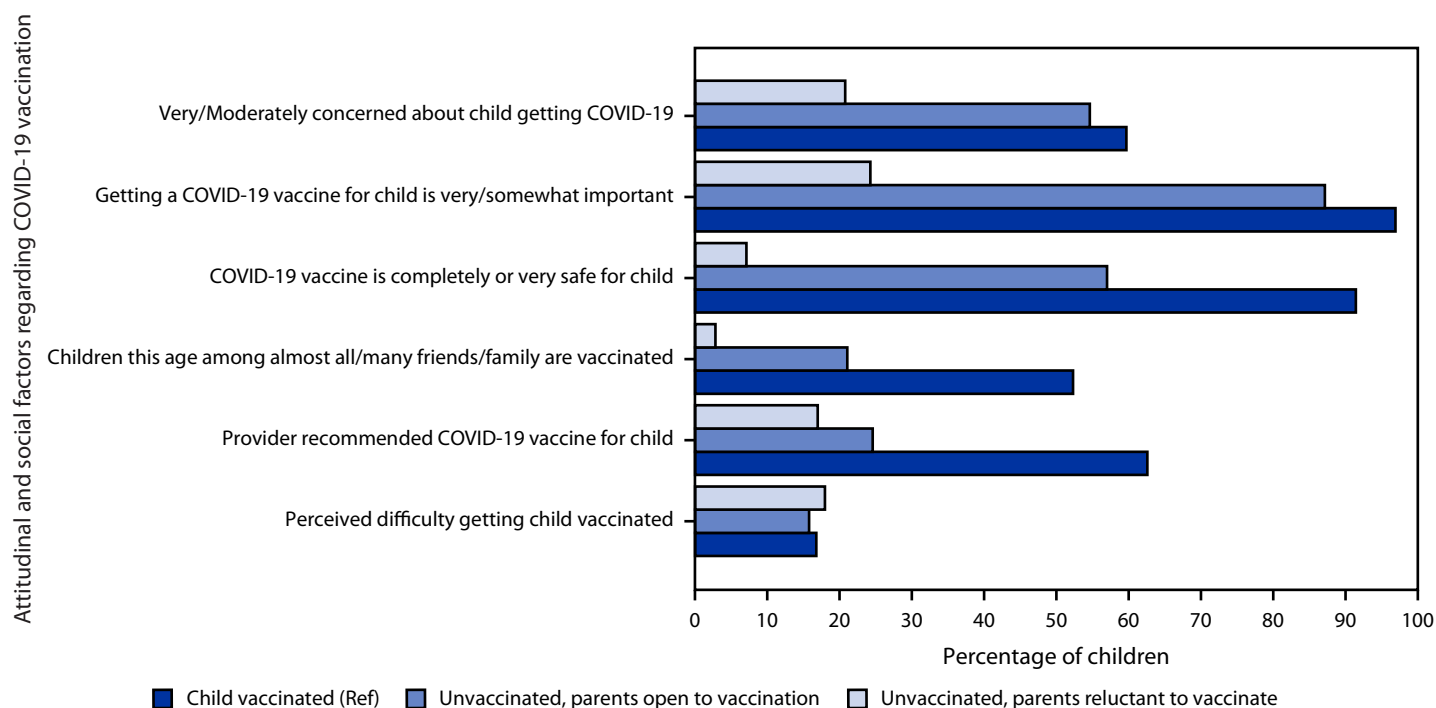
parents open to vaccination were reported to have received a provider recommendation. A majority of parents open to vaccination consider the vaccine to be important; the addition of a provider recommendation that includes accurate information about vaccine safety could be critical to these parents deciding to have their children vaccinated.

The findings in this report are subject to at least two limitations. First, the response rate was 20%. Survey weights were calibrated to COVID-19 vaccine administration data to mitigate possible bias from incomplete sample frame, nonresponse, and misclassification of vaccination status; however, bias in estimates might remain after weighting. Second, vaccination

TABLE. (Continued) COVID-19 vaccination status and intention of parents to vaccinate children aged 6 months–4 years, by sociodemographic characteristics — National Immunization Survey-Child COVID Module, United States, July 1–29, 2022

Abbreviations: HHS = U.S. Department of Health and Human Services; MSA = metropolitan statistical area; Ref = referent group; SVI = social vulnerability index.
 * Percentages are for rows.
 † Definitely or probably will get child vaccinated or are unsure.
 ‡ Definitely or probably will not get child vaccinated.
 ¶ Race of child was reported by parent or guardian respondent. Children who were Asian, Black or African American, multiracial, White, or other races were not Hispanic or Latino (non-Hispanic); children of Hispanic ethnicity might be of any race. Children identified as multiple races had more than one race category selected; "other" race included American Indian or Alaska Native and Native Hawaiian or other Pacific Islander. White race was used as the referent group because of the large sample size, higher vaccination coverage, and lower intent to vaccinate.
 ** Statistically significant at p<0.05 compared with referent group.
 †† Estimates not meeting reliability criteria for proportions were suppressed. https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf
 ‡‡ Household income and poverty level was defined based on total family income for the past calendar year and the U.S. Census Bureau poverty thresholds for that year. <https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html>
 ¶¶ On the basis of parent report and not confirmed by COVID-19 testing (respondents not reporting were excluded from the denominator).
 *** On the basis of respondent-reported zip code of residence.
 ††† Categorization of National Immunization Survey-Child COVID Module data into an SVI level was based on respondent-reported zip code of residence. <https://www.atsdr.cdc.gov/placeandhealth/svi/index.html>
 ‡‡‡ <https://www.hhs.gov/about/agencies/iea/regional-offices/index.html>

FIGURE 2. Attitudinal and social factors regarding COVID-19 vaccination, by vaccination status (≥1 dose) and intention of parents to vaccinate children aged 6 months–4 years* — National Immunization Survey-Child COVID Module, United States, July 1–29, 2022



Abbreviation: Ref = referent group.
 * The difference between parents who were reluctant to have their child vaccinated and parents of vaccinated children (Ref) was statistically significant for all factors except perceived difficulty in getting the child vaccinated. The difference between parents who were open to having their child vaccinated and parents of vaccinated children was statistically significant for all factors except 1) concern about the child getting COVID-19, and 2) perceived difficulty in getting the child vaccinated.

status and intent to vaccinate were parent-reported and subject to recall and social desirability biases.

These findings indicate that a large proportion of unvaccinated children have parents who are open to vaccination; however, many parents had concerns about vaccine safety and

had not received a provider recommendation. A strong vaccination recommendation from a trusted health care provider, along with accurate information about the safety of COVID-19 vaccination, could potentially increase COVID-19 vaccination coverage among young children.

References

Summary

What is already known about this topic?

Although COVID-19 vaccines are safe and effective, administrative data reported to CDC indicate that COVID-19 vaccination coverage among children aged <5 years is low.

What is added by this report?

Four percent of children aged 6 months–4 years had received ≥1 doses of COVID-19 vaccine based on interviews conducted during July 2022; 59% were unvaccinated, but the parent was open to vaccinating their child; and 37% were unvaccinated and the parent was reluctant to vaccinate. Among parents open to vaccination, 25% reported receiving a provider recommendation, and 57% were confident of the vaccine's safety; confidence of vaccine safety varied by race or ethnicity and household income.

What are the implications for public health?

Health care provider recommendations and assurances of COVID-19 vaccine safety by trusted persons could increase vaccination coverage among young children.

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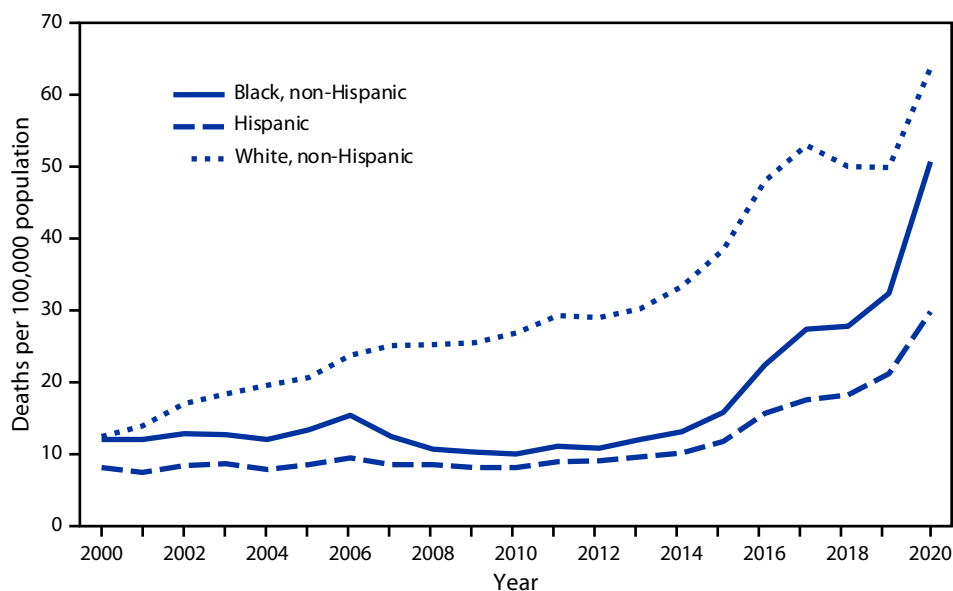
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QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Death Rates for Drug Overdose* Among Persons Aged 25–44 Years, by Race and Ethnicity†— United States, 2000–2020



* Drug overdose deaths were identified using the following *International Classification of Diseases, Tenth Revision* codes: X40–X44 (Unintentional), X60–X64 (Suicide), X85 (Homicide), and Y10–Y14 (Undetermined).

† Rates for 2000–2017 are based on multiple-race mortality data bridged to single-race categories, according to the 1977 Office of Management and Budget (OMB) standard for the classification of race. Rates for 2018–2020 were based on 1997 OMB standards and might differ slightly compared with the 1977 standards. <https://www.cdc.gov/nchs/data/nvsr/nvsr70/nvsr70-03-508.pdf>

From 2000 to 2013, the rate for drug overdose death increased for non-Hispanic White (White) persons aged 25–44 years but was stable for non-Hispanic Black (Black) and Hispanic persons in this age group. From 2013 to 2020, rates increased for all groups, from 30.2 to 63.8 per 100,000 population for White persons, from 12.0 to 50.7 for Black persons, and from 9.6 to 29.9 for Hispanic persons. From 2019 to 2020, all three racial and ethnic groups experienced the largest annual increase in drug overdose death rates (56% among Black, 41% among Hispanic, and 28% among White persons). In 2020, the drug overdose death rate for White persons was the highest among all groups, followed by Black and Hispanic persons.

Source: National Vital Statistics System, Mortality Data. <http://www.cdc.gov/nchs/nvss/deaths.htm>

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For more information on this topic, CDC recommends the following link: <https://www.cdc.gov/drugoverdose/health-equity/index.html>

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