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Donor Human Milk Use in Advanced Neonatal Care Units — United States, 2020

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Approximately 50,000 infants are born in the United States each year with very low birthweight (VLBW) (<1,500 g).* Benefits of human milk to infants with VLBW include decreased risk for necrotizing enterocolitis, a serious illness resulting from inflammation and death of intestinal tissue that occurs most often in premature infants, especially those who are fed formula rather than human milk; late-onset sepsis; chronic lung disease; retinopathy of prematurity; and neurodevelopmental impairment (*1*). When mother's own milk is unavailable or insufficient, pasteurized donor human milk (donor milk) plus a multinutrient fortifier is the first recommended alternative for infants with VLBW (*2*). CDC's 2020 Maternity Practices in Infant Nutrition and Care (mPINC) survey was used to assess practices for donor milk use in U.S. advanced neonatal care units of hospitals that provide maternity care (*3*). Among 616 hospitals with neonatal intensive care units (level III or IV units),† 13.0% reported that donor milk was not available for infants with VLBW; however, approximately one half (54.7%) reported that most (≥80%) infants with VLBW do receive donor milk. Donor milk availability for infants with VLBW was more commonly reported among hospitals with a level IV unit, higher annual birth volume, location in the Midwest and Southwest regions, nonprofit and teaching status, and those designated Baby-Friendly.§ Addressing hospitals' barriers to providing donor milk could help ensure that infants with VLBW receive donor milk when needed and help reduce morbidity and mortality in infants with VLBW (*1*,*4*).

The mPINC survey is a biennial census of all maternity care hospitals in the United States and territories to monitor practices and policies related to infant feeding. The survey is completed electronically by the persons most knowledgeable about the hospital's practices related to infant nutrition. In 2020, hospitals with advanced neonatal care units (level II, III, or IV) were asked how many infants (<1,500 g and ≥1,500 g) receive donor milk at any time while in the unit: few (0%–19%), some (20%–49%), many (50%–79%), most (≥80%), or donor milk not available.

The prevalence of donor milk use was examined by unit level and infant weight¶ (<1,500 g and ≥1,500 g). For infants weighing ≥1,500 g, analyses included hospitals with level II,

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

* https://www.cdc.gov/nchs/data/nvsr/nvsr70/nvsr70-02-tables-508.pdf

† Level II = special care nursery; level III = neonatal intensive care unit; level IV = regional neonatal intensive care unit. https://doi.org/10.1542/peds.2012-1999

§ Baby-Friendly USA is the accrediting body and national authority for the Baby-Friendly Hospital Initiative (BFHI) in the United States. BFHI is a global program to encourage the broad-scale implementation of steps to provide mothers with information, confidence, and skills necessary to successfully initiate and continue breastfeeding. https://www.babyfriendlyusa.org

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III, or IV units. Analyses for infants weighing <1,500 g were restricted to hospitals with level III or IV units, where infants with VLBW typically receive care (*3*). Donor milk use among infants with VLBW was also examined by hospital characteristics: hospital type, teaching hospital status, Baby-Friendly designation, number of annual births, and region.** Availability was also examined by state or territory (state) by calculating the percentage of participating hospitals with a level III or IV neonatal intensive care unit in each state reporting that donor milk was available for infants with VLBW. Data were suppressed for states with fewer than five hospitals reporting. Descriptive analyses were conducted using SAS (version 9.4; SAS Institute). Because this is a census sample, SEs were not calculated, and statistical testing was not performed. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.††

In 2020, among 2,810 eligible maternity hospitals, 2,103 (74.8%) participated in mPINC. Among participating hospitals, 1,260 (59.9%) reported having an advanced neonatal care unit, including 642 (60.0%) level II, 528 (41.9%) level III, and 90 (7.1%) level IV units. Hospitals that did not answer the donor milk question were excluded, resulting in analytic samples of 616 hospitals with level III and IV units for infants <1,500 g and 1,256 hospitals with level II, III, or IV units for infants ≥1,500 g.

Among hospitals with level III or IV units, 13.0% reported that donor milk was not available for infants with VLBW, and 54.7% reported it was received by ≥80% of infants with VLBW (Table 1). Among hospitals with level II, III, or IV units, for infants weighing ≥1,500 g, 40.1% reported that donor milk was not available, and 15.9% reported that it was received by most of these infants. For both weight categories, donor milk was more commonly available and used at hospitals with level IV units than in those with level II or III.

Donor milk was reported to be unavailable for infants with VLBW in 11.6% of nonprofit, 16.0% of for-profit, and 17.1% of government or military hospitals (Table 2). Among teaching hospitals, 12.4% reported that donor milk was not available, and 53.3% reported it was received by ≥80% of infants with VLBW, compared with 16.9% and 64.0%, respectively, among nonteaching hospitals. Donor milk was not available for infants with VLBW in 11.1% of Baby-Friendly designated hospitals, compared with 14.3% of non–Baby-Friendly designated hospitals. Although donor milk was available for infants with VLBW in almost all (97.8%) level IV units (Table 1), its availability and use among hospitals with a level III unit varied by hospital size. Among the largest hospitals with a level III unit (≥5,000 annual births), 6.3% reported that donor milk was

¶ In response to the survey question "How many infants receive donor human milk at any time while cared for in your hospital's Special Care Nursery (level II)/Neonatal Intensive Care Unit (levels III, IV)? Infants <1500 grams, infants ≥1500 grams."

** https://www.fns.usda.gov/fns-regional-offices#

†† 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.

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TABLE 1. Donor milk use among infants in hospitals with advanced neonatal care units, by infant weight and unit level — Maternity Practices in Infant Nutrition and Care, United States, 2020*,†

Infant weight/ Neonatal care unit level	No. of hospitals	% of hospitals§,¶ Donor milk not available	% of infants receiving donor milk 0–19	20–49	50–79	≥80
<1,500 g						
Total	**616**	**13.0**	**5.0**	**10.1**	**17.2**	**54.7**
Level III	526	14.8	4.4	9.9	17.1	53.8
Level IV	90	2.2	8.9	11.1	17.8	60.0
≥1,500 g						
Total	**1,256**	**40.1**	**14.7**	**14.7**	**14.6**	**15.9**
Level II	640	65.3	7.0	7.3	8.0	12.3
Level III	526	15.8	23.4	21.7	20.2	19.0
Level IV	90	3.3	17.8	26.7	28.9	23.3

* SEs were not calculated, and statistical testing not performed, because Maternity Practices in Infant Nutrition and Care is a census sample.
† Level II = special care nursery; level III = neonatal intensive care unit; level IV = regional neonatal intensive care unit. https://doi.org/10.1542/peds.2012-1999
§ Hospitals reporting the percentage of infants who receive donor human milk at any time while cared for in the advanced neonatal care unit.
¶ Row percentages might not sum to 100% because of rounding.

not available, and 40.6% reported it was received by ≥80% of infants with VLBW, compared with 44.0% and 36.0%, respectively, among the smallest such hospitals (<1,000 annual births). By region, nonavailability of donor milk for infants with VLBW ranged from 4.1% of hospitals in the Midwest to 23.8% in the Northeast, among those with level III or IV units.

Twenty-three U.S. states had at least 10 hospitals with a level III or IV neonatal intensive care unit, 13 had five to nine level III or IV hospitals, 15 had one to four level III or IV hospitals, and five had no hospital with level III or IV neonatal intensive care units participating in mPINC. Among the 36 states with five or more hospitals with a level III or IV unit, the statewide percentage of hospitals reporting donor milk availability for infants with VLBW ranged from 0% to 100% (median = 92.0%) (Figure). In 12 states (Alabama, Arkansas, Colorado, Indiana, Iowa, Massachusetts, Minnesota, New Mexico, Oregon, Utah, Washington, and Wisconsin), 100% of hospitals with level III or IV units reported donor milk was available for infants with VLBW; in seven states (Illinois, Maryland, North Carolina, Ohio, Pennsylvania, Texas, and Virginia), 90% to <100% of hospitals reported donor milk availability; in 10 states (Connecticut, Florida, Kentucky, Louisiana, Michigan, Mississippi, Nebraska, New Jersey, South Carolina, and Tennessee), 80% to <90% of hospitals reported donor milk availability; and in seven jurisdictions (California, Georgia, Kansas, Missouri, New York, Oklahoma, and Puerto Rico), <80% of hospitals reported that donor milk was available.

TABLE 2. Donor milk use among infants weighing <1,500 g in hospitals with a level III or IV neonatal intensive care unit, by hospital characteristics — Maternity Practices in Infant Nutrition and Care, United States, 2020*,†

Characteristic	No. of hospitals	% of hospitals§,¶ Donor milk not available	% of infants receiving donor milk 0–19	20–49	50–79	≥80
Total	**616**	**13.0**	**5.0**	**10.1**	**17.2**	**54.7**
Hospital type						
Nonprofit, private	438	11.6	5.5	9.4	17.4	56.2
For-profit, private	94	16.0	3.2	10.6	14.9	55.3
Government or military	82	17.1	4.9	12.2	18.3	47.6
Teaching hospital status						
Yes	525	12.4	5.7	10.7	17.9	53.3
No	89	16.9	1.1	5.6	12.4	64.0
Baby-Friendly hospital designation**						
Yes	244	11.1	4.9	11.5	17.2	55.3
No	370	14.3	5.1	8.9	17.0	54.6
Annual no. of live births						
<1,000	53	41.5	5.7	5.7	9.4	37.3
1,000–1,999	201	13.9	4.5	7.0	15.4	59.2
2,000–4,999	315	8.9	5.1	11.1	18.4	56.5
≥5,000	47	4.3	6.4	21.3	25.5	42.6
Region††						
Midwest	97	4.1	5.2	12.4	20.6	57.7
Southwest	111	6.3	4.5	10.8	16.2	62.2
Mid-Atlantic	89	13.5	4.5	7.9	22.5	51.7
Southeast	102	13.7	4.9	15.7	17.7	48.0
Mountain Plains	50	16.0	6.0	12.0	8.0	58.0
Western	104	19.2	5.8	2.9	12.5	59.6
Northeast	63	23.8	4.8	9.5	20.6	41.3

* SEs were not calculated, and statistical testing not performed, because Maternity Practices in Infant Nutrition and Care is a census sample.
† Level II = special care unit; level III = neonatal intensive care unit; level IV = regional neonatal intensive care unit. https://doi.org/10.1542/peds.2012-1999
§ Hospitals reporting the percentage of infants weighing <1,500 g who receive donor human milk at any time while cared for in a neonatal intensive care unit.
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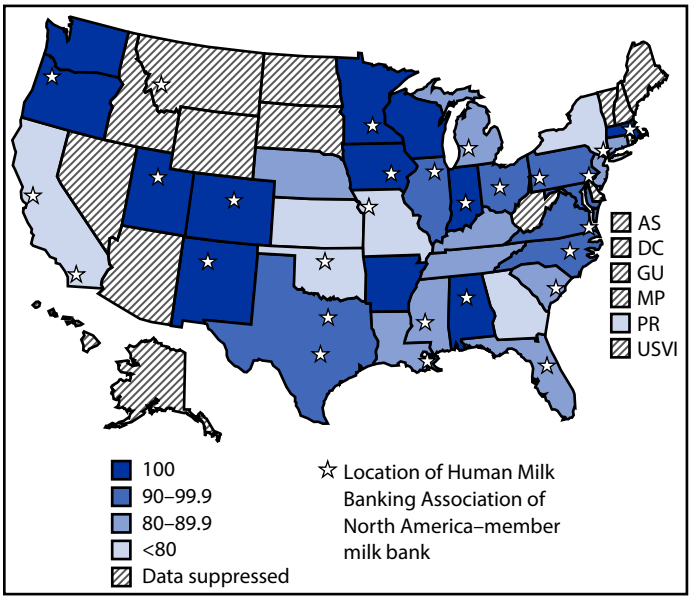
†† Regions defined by U.S. Department of Agriculture Food and Nutrition Service. https://www.fns.usda.gov/fns-regional-offices

Discussion

Although human milk is the recommended nutrition source for infants with VLBW, with donor milk as the preferred alternative to mother's own milk when needed, this analysis found that donor milk was unavailable or not frequently used in some hospitals caring for those infants. In mPINC 2020, 13.0% of hospitals with a level III or IV unit reported donor milk was not available for infants with VLBW; however, availability might be improving. In

FIGURE. Percentage of hospitals with level III or IV neonatal intensive care units reporting donor milk was available for infants weighing <1,500 g, by state* — Maternity Practices in Infant Nutrition and Care, United States, 2020



Abbreviations: AS = American Samoa; DC = District of Columbia; GU = Guam; MP = Northern Mariana Islands; PR = Puerto Rico; USVI = U.S. Virgin Islands.
* Includes all U.S. states, territories, and DC; data were suppressed when the sample was <5. The locations of 28 Human Milk Banking Association of North America–member milk banks are also noted.

CDC's 2018 mPINC survey, 16.5% of hospitals with a level III or IV unit reported donor milk was not available for infants with VLBW (CDC, unpublished data, 2022). In general, availability and use of donor milk for infants in advanced care units appears to be increasing over time. A 2011 study using mPINC data found that 45.2% of U.S. hospitals with a neonatal intensive care unit reported ever using donor milk (for infants of any birthweight); an increase from 25.1% in 2007 and 28.7% in 2009 (*5*).

Limitations in the availability and use of donor milk for infants with VLBW might be due to a variety of factors. Most hospitals access donor milk from banks accredited by the nonprofit Human Milk Banking Association of North America, with 28 member milk banks currently operating in 25 states.[§§] Availability of donor milk at hospitals might be affected by supply from milk banks, cost, and reimbursement, which can vary by state and payment source (*6*). Milk bank supply is in turn affected by barriers persons might face when considering milk donation, such as lack of knowledge about milk banking and beliefs about acceptability of donation (*7*). Hospital leadership support and logistical challenges to implementing donor milk programs might also play a role in donor milk availability (*8*).

When donor milk is available, additional hospital- and individual-level factors might affect how often it is used. These include lack of standardized policies and staff member training related to donor milk use, as well as staff member and parent knowledge and perceptions about the health benefits and safety of donor milk (*6*).

The findings in this report are subject to at least three limitations. First, the percentage of infants with VLBW needing supplementation to mother's own milk or full feedings with donor milk is not well documented, making interpreting prevalence estimates of donor milk use among hospitals where it is available challenging because the ideal prevalence is not known. Second, there is potential for social desirability bias or other measurement error because hospitals' use of donor milk is self-reported. Finally, mPINC does not collect data from neonatal units in hospitals that do not provide maternity care, such as children's hospitals; therefore, donor milk use for infants with VLBW in those settings is not represented in this analysis.

Addressing barriers related to the availability of milk banks, donation to milk banks, use of donor milk in hospitals, and knowledge and attitudes about donor milk could potentially increase its availability and use for infants with VLBW. The American Academy of Pediatrics and Baby-Friendly USA recently published documents outlining recommended practices for promoting human milk use for infants with VLBW and in the neonatal intensive care setting, which could provide guidance to hospitals implementing a donor milk program (*1*,*4*). State Perinatal Quality Collaboratives are another tool that could help birthing hospitals implement quality improvement initiatives to increase access to and use of donor milk to reduce morbidity and mortality in infants with VLBW.[¶¶]

Summary

What is already known about this topic?

Infants with very low birthweight (VLBW) are at increased risk for long- and short-term health problems. Human milk is the recommended nutrition source for infants with VLBW, who should receive supplemental donor milk when mother's own milk is insufficient or unavailable.

What is added by this report?

Analysis of CDC's 2020 Maternity Practices in Infant Nutrition and Care survey data found that donor milk was not available for infants with VLBW at 13.0% of U.S. hospitals with neonatal intensive care units (level III or IV).

What are the implications for public health practice?

Identifying and addressing barriers to provision of donor milk for infants with VLBW could help ensure that these infants receive donor milk when needed and help decrease associated morbidity and mortality.

[§§] https://www.hmbana.org/find-a-milk-bank/overview.html

[¶¶] https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pqc.htm

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Progress Toward Measles Elimination — South-East Asia Region, 2003–2020

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In 2013, member states of the World Health Organization (WHO) South-East Asia Region* (SEAR) adopted the goal of measles elimination and rubella and congenital rubella syndrome control† by 2020 (*1*). In 2014, to provide impetus toward achieving this goal, the Regional Director declared measles elimination and rubella control one of the Regional Flagship Priorities. In 2019, SEAR member states declared a revised goal of eliminating both measles and rubella§ by 2023 (*2*). The recommended strategies to achieve elimination include 1) achieving and maintaining ≥95% coverage with 2 doses of measles- and rubella-containing vaccine in every district through routine or supplementary immunization activities¶ (SIAs); 2) developing and sustaining a sensitive and timely case-based surveillance system that meets recommended performance indicators**; 3) developing and maintaining an accredited laboratory network; 4) achieving timely identification, investigation, and response to measles outbreaks; and 5) collaborating with other public health initiatives to achieve the preceding four strategies. This report updates a previous report and describes progress toward measles elimination in SEAR during 2003–2020 (*3*). In 2002, coverage with the first dose of a measles-containing vaccine in routine immunization (MCV1) was 70%, and only three countries in SEAR had added a second routine dose of measles-containing vaccine in routine immunization (MCV2). During 2003–2020, all countries introduced MCV2, and estimated coverage with MCV1 increased 35%, from 65% to 88%, and coverage with MCV2 increased 1,233% from 6% to 80%. Approximately 938 million persons were vaccinated in SIAs. Annual reported measles incidence declined by 92%, from 57.0 to 4.8 cases per 1 million population, and estimated deaths decreased by 97%; an estimated 9.3 million deaths were averted by measles vaccination. By 2020, five countries were verified as having achieved measles elimination. To achieve measles elimination in the region by 2023, additional efforts are urgently needed to strengthen routine immunization services and improve measles-containing vaccine (MCV) coverage, conduct periodic high-quality SIAs, and strengthen measles case-based surveillance and laboratory capacity.

Immunization Activities

MCV1 was introduced in all 11 countries in SEAR before 2003 (Table 1). MCV2 was introduced in three countries (Indonesia, Sri Lanka, and Thailand) before 2003; the remaining eight countries introduced MCV2 during 2003–2020.

Countries report coverage for national and subnational MCV1 and MCV2 doses delivered through the routine immunization program to WHO and UNICEF, which use data from administrative records (vaccine doses administered divided by the estimated target population) and surveys reported by member states to estimate MCV1 and MCV2 coverage (*4*). Estimated MCV1 regional coverage increased 35%, from 65% in 2003 to 88% in 2020; five countries reported ≥95% MCV1 coverage in 2020 (Table 1) (Figure). The highest regional MCV1 coverage (94%) was reached in 2019, just before the start of the COVID-19 pandemic. Estimated MCV2 coverage increased 1,233%, from 6% in 2003 to 80% in 2020, with a peak of 83% in 2019; estimated MCV2 coverage in three countries was ≥95% in 2020. During 2003–2020, measles SIAs were conducted in all countries and reached approximately 938 million persons (Supplementary Table; https://stacks.cdc.gov/view/cdc/120144).

Surveillance Activities

By 2020, case-based measles surveillance with laboratory confirmation of suspected cases†† was implemented in all countries in SEAR. A measles-rubella laboratory network was established in the region by 2003 as an integral component of the WHO Global Measles and Rubella Laboratory Network. By 2020, the

* The WHO SEAR consists of 11 countries: Bangladesh, Bhutan, Burma, India, Indonesia, Maldives, Nepal, North Korea, Sri Lanka, Thailand, and Timor-Leste.

† Measles elimination is defined as the absence of endemic measles cases for a period of ≥12 months in the presence of adequate surveillance. Rubella and congenital rubella syndrome control is defined as 95% reduction in disease incidence from the 2013 level.

§ Rubella elimination is defined as the absence of endemic rubella cases for a period of ≥12 months in the presence of adequate surveillance.

¶ SIAs are generally conducted using two target age ranges. An initial, nationwide catch-up SIA focuses on all children and adolescents aged 9 months–14 years, with the goal of eliminating susceptibility to measles in the general population. Follow-up SIAs are generally conducted nationwide every 2–4 years and target children aged 9–59 months with the goal of eliminating any measles susceptibility that has developed in recent birth cohorts and protecting children who did not respond to the first measles-containing vaccine dose.

** These indicators include 1) ≥2 discarded nonmeasles nonrubella cases per 100,000 population at the national level per year; 2) ≥2 discarded nonmeasles nonrubella cases per 100,000 population per year in ≥80% of subnational administrative units; 3) testing of ≥80% of suspected measles cases for measles immunoglobulin M antibodies; 4) adequate investigation conducted within 48 hours of notification of ≥80% of suspected cases; 5) adequate collection of samples for detecting measles or rubella viruses and testing in accredited laboratory of ≥80% of laboratory-confirmed chains of transmission; and 6) an annualized incidence rate of zero for confirmed endemic measles cases.

†† The definition of a suspected measles case was "acute fever with maculopapular rash" in nine member states and "fever and rash with cough, coryza or conjunctivitis" in the other two.

TABLE 1. Estimated coverage* with the first and second dose of measles-containing vaccine, vaccination schedule,† number of reported measles cases,§ and measles incidence,¶, by country — World Health Organization South-East Asia Region, 2003 and 2020**

	2003						2020						% Change, 2003–2020	
	MCV schedule† and vaccine type		WHO/UNICEF estimated coverage,* %		No. of reported measles cases§	Measles incidence¶,**	MCV schedule† and vaccine type		WHO/UNICEF estimated coverage,* %		No. of reported measles cases§	Measles incidence¶,**		
Country	MCV1	MCV2	MCV1	MCV2			MCV1	MCV2	MCV1	MCV2			MCV1 coverage	Measles incidence**
Bangladesh	M, 9 mos	—††	76	—††	4,067	29.8	MR, 9 mos	MR, 15 mos	97	93	2,410	14.4	28	−52
Bhutan	M, 9 mos	—††	88	—††	0	0.0	MMR, 9 mos	MMR, 24 mos	93	92	0	0.0	6	0
Burma§§	M, 9 mos	—††	80	—††	830	17.7	MR, 9 mos	MR, 18 mos	91	90	444	8.3	14	−53
India	M, 9 mos	—††	60	—††	47,147	42.2	MR, 9 mos	MR, 16–24 mos	89	81	5,604	4.0	48	−91
Indonesia	M, 9 mos	M, 7 yrs¶¶	74	21¶¶	24,457	109.6	MR, 9 mos	MR, 18 mos***	76	60	524	1.9	3	−98
Maldives	M, 9 mos	—††	96	—††	75	252.3	MR, 9 mos	MMR, 18 mos	99	96	15	29.2	3	−88
Nepal	M, 9 mos	—††	75	—††	13,344	519.6	MR, 9 mos	MR, 15 mos	87	74	388	13.2	16	−97
North Korea	M, 9 mos	—††	95	—††	0	0.0	MR, 9 mos	MR, 15 mos	99	99	0	0.0	4	0
Sri Lanka	M, 9–12 mos†††	MR, 3 yrs	99	90	65	3.4	MMR, 1 yr	MMR, 3 yrs	96	96	2	0.1	−3	−97
Thailand	M, 9 mos	MMR, 6 yrs	96	92	4,519	69.8	MMR, 9 mos	MMR, 2.5 yrs	96	87	NR§§§	—¶¶¶	0	—¶¶¶
Timor-Leste	M, 9 mos	—††	55	—††	94	101.4	MR, 9 mos	MR, 18 mos	79	78	2	1.5	44	−99
Region overall	**NA**	**NA**	**65**	**6**	**94,598**	**57.0**	**NA**	**NA**	**88**	**80**	**9,389**	**4.8**	**35**	**−92**

Abbreviations: JRF = Joint Reporting Form; M = measles; MCV = measles-containing vaccine; MCV1 = first dose of MCV in routine immunization; MCV2 = second dose of MCV in routine immunization; MMR = measles-mumps-rubella; MR = measles-rubella; NA = not applicable; NR = not reported; WHO = World Health Organization.

* Data were from WHO and UNICEF estimates, 2021 revision (as of July 2022). http://immunizationdata.who.int

† As reported to WHO/UNICEF on JRFs for the year.

§ JRF was submitted to WHO and UNICEF by member states with the official immunization data and the number of measles cases in the country for the year.

¶ Measles incidence is calculated based on the reported measles cases and population by member states through WHO/UNICEF JRF.

** Cases per 1 million population.

†† MCV2 was not introduced into routine immunization.

§§ *MMWR* uses the U.S. Department of State's short-form name "Burma"; WHO uses "Myanmar."

¶¶ Subnational introduction in schools of West Java at age 7 years.

*** MCV third dose administered in schools at grade 1.

††† Changed in 2011 from age 9 months to 9–12 months.

§§§ Thailand did not report measles case data to the JRF in 2020.

¶¶¶ Could not be calculated.

regional laboratory network included 49 proficient laboratories§§ with one regional reference laboratory (in Thailand); all countries had at least one proficient laboratory. In 2019, eight of 11 member states achieved the sensitivity indicator target of ≥2 discarded¶¶ measles cases per 100,000 population, and the regional discard rate was 1.68. In 2020, however, only five countries achieved the target discard rate of ≥2 per 100,000 population, and the regional discard rate was 0.98.

Reported Measles Incidence and Measles Virus Genotypes

During 2003–2020, the number of reported*** measles cases decreased 90%, from 94,598 (2003) to 9,389 (2020). Annual measles incidence decreased 92%, from 57.0 cases per 1 million population to 4.8 cases per 1 million population (Table 1) (Figure).

Among isolates from patients during 2017–2020, measles virus genotypes detected and reported in the region included D8 in the nine countries with endemic measles†††; B3 in Bangladesh, Burma,§§§ India, Sri Lanka, and Thailand; D4 mainly in India; and H1 in Burma, India, Sri Lanka, and Thailand. However, genotype information is available for fewer than 1% of all confirmed measles cases in the region.

Measles Case and Mortality Estimates

A previously described model for estimating measles cases and deaths (*5*,*6*) was updated with recent data for countries in SEAR. Based on the updated model, the estimated number of measles cases decreased 84%, from 16,225,870 in 2003 to 2,552,584 in 2020; estimated annual measles deaths decreased 97%, from 163,044 to 5,649 (Table 2). During 2003–2020, compared with no vaccination, measles vaccination averted an estimated 9.3 million deaths in the region.

Regional Verification of Measles Elimination

The WHO South-East Asia Regional Verification Commission for measles and rubella elimination was

§§ A laboratory that has met defined criteria as outlined in the report, "Framework for verifying elimination of measles and rubella." https://www.who.int/wer

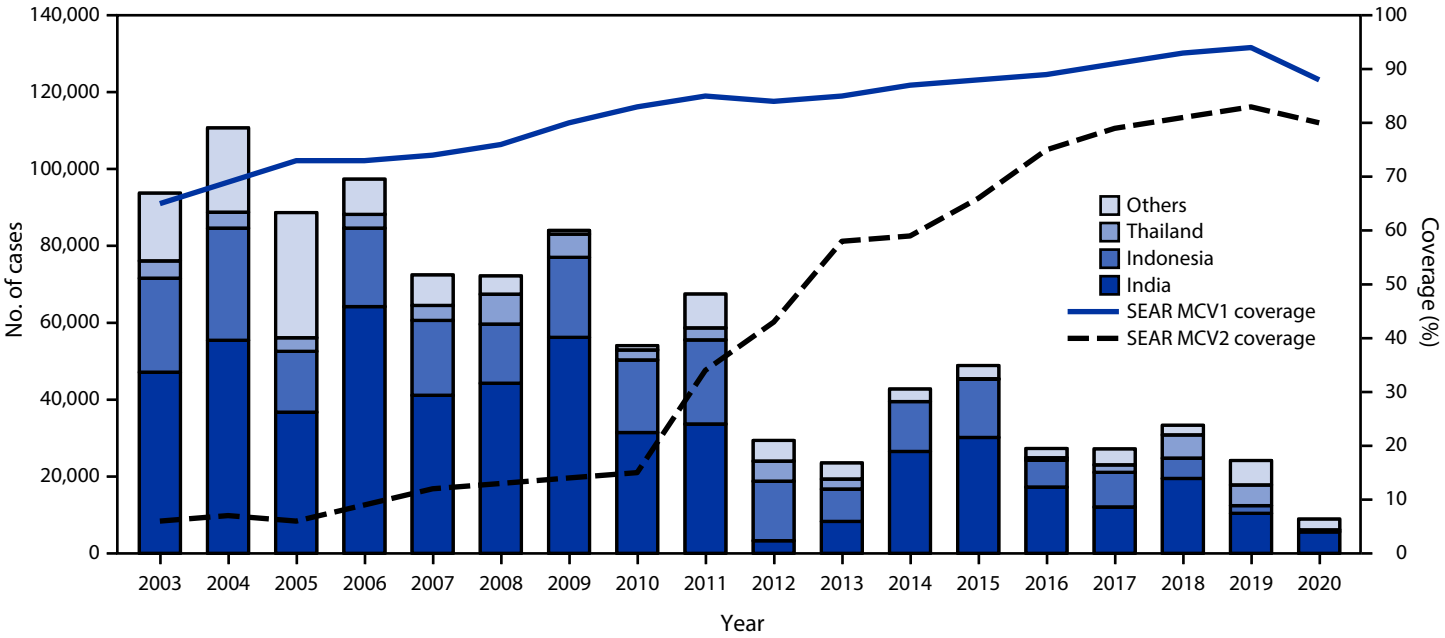
¶¶ A discarded case is defined as a suspected case that has been investigated and determined to be neither measles nor rubella using 1) laboratory testing in a proficient laboratory or 2) epidemiologic linkage to a laboratory-confirmed outbreak of another communicable disease that is not measles or rubella. The discarded case rate is used to measure the sensitivity of measles surveillance.

*** Countries report the number of incident measles cases to WHO and UNICEF annually using the Joint Reporting Form.

††† Bhutan and Maldives eliminated endemic measles transmission in 2017.

§§§ *MMWR* uses the U.S. Department of State short-form name "Burma"; WHO uses "Myanmar."

FIGURE. Number of reported measles cases,* by country,†,§ and estimated percentage of children who received their first and second dose of measles-containing vaccine¶ — World Health Organization South-East Asia Region, 2003–2020



Abbreviations: MCV = measles-containing vaccine; MCV1 = first dose of MCV in routine immunization; MCV2 = second dose of MCV in routine immunization; SEAR = South-East Asia Region; WHO = World Health Organization.
* Cases of measles reported to WHO and UNICEF through the Joint Reporting Form from WHO-SEAR.
† Others include Bangladesh, Bhutan, Burma, Maldives, Nepal, North Korea, Sri Lanka, and Timor-Leste.
§ *MMWR* uses the U.S. Department of State's short-form name "Burma"; WHO uses "Myanmar."
¶ Data were from WHO and UNICEF estimates, 2021 revision (as of July 2022). http://immunizationdata.who.int

established in 2016 and developed a framework for verification of measles and rubella elimination in the region (*7*). Subsequently, national verification committees have been established in all 11 countries; the national committees have provided annual reports on progress toward measles elimination. As of 2020, the Regional Commission has verified measles elimination in Bhutan (2017), Maldives (2017), North Korea (2018), Sri Lanka (2019), and Timor-Leste (2018).

Discussion

During 2003–2020, substantial progress was made toward measles elimination in SEAR. Through implementation of the regional strategies, estimated MCV1 and MCV2 coverage increased 35% and 1,233%, respectively; reported measles incidence declined by 92%; and estimated measles deaths decreased by 97%. By the end of 2019, five of the 11 countries had been verified as having eliminated endemic measles transmission.

In September 2019, after an extensive review of the progress made and the biologic, programmatic, and financial feasibility of measles and rubella elimination, the member states in the region updated the goal to achieve measles and rubella elimination by 2023 (*2*). However, challenges to achieving measles elimination in SEAR exist. During the COVID-19 pandemic, routine MCV1 coverage in the region declined from a peak of 94% in 2019 to 88% in 2020, and MCV2 coverage declined from a peak of 83% (2019) to 80% (2020). In 2020, among the estimated 22.3 million infants who did not receive MCV1 worldwide, approximately 18% were from SEAR, including 3 million in India and 0.6 million in Indonesia (*4*). In addition, measles surveillance sensitivity declined in all countries in the region, perhaps because COVID-19 mitigation measures (e.g., physical distancing and masking) decreased transmission of measles and other respiratory viruses but also because of reductions in clinic visits for febrile rash illness resulting from movement restrictions imposed nationally and the deployment of surveillance staff members to respond to the COVID-19 pandemic. A recent independent review of progress toward measles elimination in SEAR (*8*) concluded that several challenges, including immunity gaps, suboptimal sensitivity of surveillance, inadequate outbreak response and preparedness, funding gaps, and the negative effects of the COVID-19 pandemic on immunization programs threaten achievement of the 2023 target.

The findings in this report are subject to at least four limitations. First, coverage estimates are based on administrative data and might be inaccurate because of errors in recording of doses administered or in estimates of the target populations. Second, surveillance data might underestimate true disease incidence

TABLE 2. Estimated number of measles cases and deaths,* by country — World Health Organization South-East Asia Region, 2003–2020†

Country	Estimated no. of measles cases (95% CI)		Estimated no. of measles deaths (95% CI)		Estimated reduction, % 2003–2020		Cumulative no. of measles deaths averted by vaccination, 2003–2020 (95% CI)
	2003	2020	2003	2020	Measles cases	Measles deaths	
Bangladesh	874,838 (794,238–1,102,424)	322,731 (44,721–625,438)	5,969 (5,484–7,389)	454 (63–892)	63	92	712,715 (537,975–905,653)
Bhutan	1,299 (442–3,404)	524 (108–1,180)	8 (3–20)	1 (0–2)	60	88	1,635 (1,282–2,012)
Burma§	226,184 (195,311–263,080)	120,944 (104,245–140,792)	2,659 (2,293–3,056)	465 (402–538)	47	83	541,464 (439,755–653,704)
India	13,402,107 (11,154,888–24,654,928)	1,442,956 (1,247,122–1,623,281)	146,724 (123,133–268,096)	3,509 (3,122–3,889)	89	98	6,531,078 (5,112,728–7,919,715)
Indonesia	1,246,487 (541,014–1,930,834)	454,063 (77,520–1,209,218)	4,170 (2,549–7,759)	681 (137–1,912)	64	84	1,256,352 (1,012,703–1,515,588)
Maldives	710 (160–1,783)	112 (4–273)	NA¶ (0–1)	NA¶	84	NA	62 (46–79)
Nepal	284,033 (84,060–524,799)	182,663 (16,196–259,162)	3,075 (919–5,638)	506 (48–701)	36	84	231,909 (193,698–266,911)
North Korea	66,795 (12,907–170,701)	6,019 (2,245–14,544)	168 (33–426)	7 (3–16)	91	96	3,382 (1,756–4,555)
Sri Lanka	325 (163–1,300)	10 (5–40)	NA¶	NA¶	97	NA	44,962 (35,933–55,278)
Thailand	122,621 (102,377–136,307)	22,506 (17,145–28,182)	271 (228–305)	27 (21–34)	82	90	6,459 (4,474–8,577)
Timor-Leste	470 (235–1,880)	55 (28–220)	NA¶	NA¶	88	NA	9,228 (7,066–11,626)
Region overall	**16,225,870 (12,885,794–28,791,441)**	**2,552,584 (1,509,338–3,902,331)**	**163,044 (134,642–292,689)**	**5,649 (3,796–7,984)**	**84**	**97**	**9,339,246 (7,347,415–11,343,699)**

Abbreviations: NA = not applicable; WHO = World Health Organization.

* A measles mortality model was used to generate estimated measles cases and deaths using the WHO/UNICEF estimates of national immunization coverage data, as well as updated surveillance data. https://doi.org/10.1016/S0140-6736(12)60522-4

† Data were from WHO and UNICEF estimates, 2021 revision (as of July 2022). http://immunizationdata.who.int

§ *MMWR* uses the U.S. Department of State's short-form name "Burma"; WHO uses "Myanmar."

¶ Estimated measles mortality was too low to allow reliable measurement of mortality reduction.

Summary

What is already known about this topic?

In 2002, coverage with the first dose of measles-containing vaccine (MCV1) in the World Health Organization's South-East Asia Region (SEAR) was 70%, but only three countries had added a second routine dose of measles-containing vaccine (MCV2).

What is added by this report?

During 2003–2020, all countries in SEAR introduced MCV2, and estimated MCV1 and MCV2 coverage increased from 65% to 88% and from 6% to 80%, respectively. Reported measles incidence declined by 92%; measles vaccination averted an estimated 9.3 million deaths. Five countries achieved measles elimination by 2020, and the region adopted a 2023 goal of measles and rubella elimination.

What are the implications for public health practice?

To achieve measles elimination in SEAR by 2023, additional efforts are urgently needed to strengthen routine immunization services and improve measles-containing vaccine coverage, conduct periodic high-quality supplementary immunization activities, and strengthen measles case-based surveillance and laboratory capacity.

because not all patients seek care and not all measles cases in patients who seek care are reported. Third, genotype data are based on a limited number of sequences and might not reflect the predominant genotypes in the region. Finally, the measles estimation model might be inaccurate because of errors in the immunization coverage estimates and reported cases as well as the inherent uncertainty of estimates based on modeling.

Achieving measles elimination in SEAR by 2023 will require urgent intensified efforts by countries to implement strategies optimally and in a very short period, especially to mitigate the deleterious effects of the COVID-19 pandemic on immunization services. The 2023 target date represents an opportunity to re-energize efforts and maintain momentum in the region to 1) obtain the highest level of political commitment from member states and support from partners; 2) strengthen routine immunization and achieve ≥95% coverage with MCV1 and MCV2; 3) conduct high-quality SIAs; 4) enhance surveillance sensitivity and increase collection of specimens for measles virus detection and genotyping; and 5) leverage measles elimination activities to enhance efforts to restore immunization services and reduce gaps

in immunity to all vaccine-preventable diseases in recovery from the COVID-19 pandemic. As of 2020, all 11 countries in SEAR had developed national plans for elimination based on strategies outlined in the Global Measles and Rubella Strategic Plan (*9*) and the regional committee resolution (*2*). With 34.3 million surviving infants in SEAR (24% of the global total), regional measles elimination represents a substantial opportunity to decrease measles-related death and illness worldwide by 2023 (*1*,*6*,*8*).

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Safety Monitoring of Pfizer-BioNTech COVID-19 Vaccine Booster Doses Among Children Aged 5–11 Years — United States, May 17–July 31, 2022

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On May 17, 2022, the Food and Drug Administration (FDA) amended the Emergency Use Authorization (EUA) for BNT162b2 (Pfizer-BioNTech) COVID-19 vaccine to authorize a homologous* booster dose for children aged 5–11 years ≥5 months after receipt of the second primary series dose† (*1*) based on findings from a clinical trial conducted among 401 children aged 5–11 years (*2*). To further characterize the safety of booster vaccination in this age group, CDC reviewed adverse events and health impact assessments after receipt of a Pfizer-BioNTech third dose reported to v-safe, a voluntary smartphone-based safety surveillance system for adverse events occurring after COVID-19 vaccination, and adverse events reported to the Vaccine Adverse Event Reporting System (VAERS), a passive vaccine safety surveillance system comanaged by CDC and FDA. During May 17–July 31, 2022, approximately 657,302 U.S. children aged 5–11 years received a third Pfizer-BioNTech dose (either a third primary series dose administered to immunocompromised children or a booster dose administered to immunocompetent children)§; 3,249 Pfizer-BioNTech third doses were reported to v-safe for children in this age group. Local and systemic reactions were reported to v-safe after a second dose and a third dose with similar frequency; some reactions (e.g., pain) were reported to be moderate or severe more frequently after a third dose. VAERS received 581 reports of adverse events after receipt of a Pfizer-BioNTech third dose by children aged 5–11 years; 578 (99.5%) reports were considered nonserious, and the most common events reported were vaccine administration errors. Three (0.5%) reports were considered serious; no reports of myocarditis or death were received. Local and systemic reactions were common among children after Pfizer-BioNTech third dose vaccination, but reports of serious adverse events were rare. Initial safety findings are consistent with those of the clinical trial (*2*).

V-safe is a voluntary smartphone-based U.S. active safety surveillance system established to monitor adverse events after COVID-19 vaccination (https://vsafe.cdc.gov/en/). The v-safe platform allows existing registrants to report receipt of a third COVID-19 vaccine dose and new registrants to enter information about all doses they received. Registrants aged ≤15 years must be enrolled by a parent or guardian. Health surveys are sent daily during the first week after vaccine administration and include questions about potential local injection site and systemic reactions and health impacts.¶ CDC's v-safe call center contacts parents who indicate that medical care was sought for their child after vaccination and encourages completion of a VAERS report, if indicated.

VAERS is a U.S. national passive vaccine safety surveillance system comanaged by CDC and FDA that monitors adverse events after vaccination (*3*). VAERS accepts reports from health care providers, vaccine manufacturers, and members of the public.** VAERS reports are classified as serious if any of the following are reported: hospitalization, prolongation of hospitalization, life-threatening illness, permanent disability, congenital anomaly or birth defect, or death.†† VAERS staff members assign Medical Dictionary for Regulatory Activities (MedDRA) preferred terms (PTs) to the signs, symptoms, and diagnostic findings in VAERS reports.§§ CDC and FDA physicians reviewed serious reports to VAERS to form a clinical impression based on available data. Selected MedDRA PTs were used to search for possible cases of myocarditis.

* Homologous refers to a booster dose of the same product administered for the primary series.

† The Advisory Committee on Immunization Practices recommends that all persons aged ≥5 years receive 1 booster dose of a COVID-19 vaccine ≥5 months after completing their primary series with either Pfizer-BioNTech or Moderna mRNA primary series. At the time of publication, only Pfizer-BioNTech vaccine was authorized for use as a booster dose among children aged 5–17 years. https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html

§ https://covid.cdc.gov/covid-data-tracker/#vaccination-demographics-trends

¶ Health surveys for the most recent dose reported are sent via text messages that link to web-based surveys on days 0–7 after receipt of a vaccine dose, then weekly during 6 weeks after vaccination, and then at 3, 6, and 12 months after vaccination. Local injection site reactions include itching, pain, redness, and swelling. Systemic reactions include abdominal pain, myalgia, chills, diarrhea, fatigue, fever, headache, joint pain, nausea, rash, and vomiting. Health impacts include inability to perform normal daily activities, inability to attend school, and receipt of medical care. Parents and guardians use the following definitions to describe the severity of a child's symptoms: mild (noticeable, but not problematic), moderate (limit normal daily activities), or severe (make daily activities difficult or impossible).

** CDC and FDA encourage health care providers to report adverse events to VAERS, and providers are required by COVID-19 vaccine EUAs to report certain adverse events, including death, after vaccination to VAERS. https://vaers.hhs.gov/faq.html

†† VAERS reports are classified as serious based on 21 C.F.R. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr

§§ Each VAERS report might be assigned more than one MedDRA PT. A MedDRA-coded event does not indicate a medically confirmed diagnosis. https://www.meddra.org/how-to-use/basics/hierarchy

Myocarditis and pericarditis are rare adverse events that have been associated with receipt of mRNA-based COVID-19 vaccines, especially among adolescent males and young adults (*4*).

This report assessed local and systemic reactions and health impacts reported in the week after vaccination among v-safe registrants aged 5–11 years who received a homologous Pfizer-BioNTech third dose ≥5 months after completion of their primary series during May 17–July 31, 2022. At least one survey after a third and at least one survey after a previous vaccine dose were required for inclusion. The odds of reporting an adverse reaction or health impact after receipt of the third dose and previous doses were compared using multivariable generalized estimating equations models.¶¶ VAERS reports for children aged 5–11 years who received a Pfizer-BioNTech third dose during May 17–July 31, 2022, were described by serious and nonserious classification, demographic characteristics, and MedDRA PTs.*** SAS software (version 9.4; SAS Institute) was used for all analyses. These surveillance activities were reviewed by CDC and conducted consistent with applicable federal law and CDC policy.†††

Review of v-safe Data

During May 17–July 31, 2022, a total of 3,249 homologous Pfizer-BioNTech third doses were reported to v-safe for children aged 5–11 years. The most frequently reported adverse reactions were injection site pain (2,166; 66.7%), fatigue (938; 28.9%), and headache (647; 19.9%) (Table 1). Most reported reactions were mild in severity; reporting was most frequent the day after vaccination. Local injection site reactions (2,224; 68.5%) and systemic reactions (1,483; 45.6%) were frequently reported after third dose vaccination (Table 2). Local injection site reactions were reported with equal frequency after dose 3 (68.5%) and dose 2 (68.0%) (p = 0.65). The prevalences of reported systemic reactions were similar after dose 3 (45.6%) and dose 2 (45.8%) (p = 0.91). Although mild symptoms were most frequently reported, the frequency of reporting moderate or severe symptoms was higher after receipt of dose 3 than after dose 2 among those reporting pain, fatigue, headache, or myalgia.

In the week after third dose vaccination, 6.9% (225) of enrolled children were reported to be unable to attend school, and 12.1% (392) were unable to complete daily activities. Approximately 1.0% of parents reported seeking medical care for their child after third dose vaccination, most commonly in an outpatient clinic (16; 0.5%) or via telehealth visit (11; 0.3%). No children received care at a hospital after third dose vaccination. Inability to attend school was reported less frequently after receipt of dose 3 (6.9%) than after dose 2 (10.0%) (p<0.001). Inability to complete daily activities was reported more frequently after dose 3 (12.1%) than after dose 2 (7.5%) (p<0.001). Receipt of medical care after dose 3 (1.0%) and dose 2 (0.9%) did not differ significantly (p = 0.52).

TABLE 1. Most frequently reported adverse reactions reported* to v-safe for children aged 5–11 years who received homologous Pfizer-BioNTech COVID-19 booster vaccination† (N = 3,249), by severity§ and dose — United States, May 17–July 31, 2022

Reported event	% Reporting event		
	Dose 1	Dose 2	Dose 3
Injection site pain	**60.7**	**66.1**	**66.7**
Mild	50.1	50.7	44.9
Moderate	10.2	14.9	20.8
Severe	0.3	0.6	1.0
Fatigue	**22.9**	**29.9**	**28.9**
Mild	15.0	17.5	15.1
Moderate	7.2	11.6	12.0
Severe	0.7	0.8	1.7
Headache	**15.2**	**20.6**	**19.9**
Mild	10.5	13.1	11.4
Moderate	4.4	7.1	7.5
Severe	0.2	0.4	1.0
Myalgia	**7.1**	**10.2**	**13.9**
Mild	4.8	6.0	7.2
Moderate	2.1	4.0	6.3
Severe	0.2	0.2	0.4
Chills	**3.8**	**7.6**	**7.4**
Mild	2.6	4.6	4.1
Moderate	1.1	3.0	2.9
Severe	0.1	0.1	0.4
Fever¶	**1.4**	**3.9**	**5.1**
Mild	0.9	2.2	2.7
Moderate	0.4	1.0	1.4
Severe	0.1	0.6	0.9
Very severe	0.03	0.1	0.1

* Percentage of registrants who reported a reaction or health impact at least once during days 0–7 after vaccination.

† Includes only persons who received Pfizer-BioNTech COVID-19 vaccine for primary series and first booster dose and completed at least one survey after their booster dose and at least one survey after a previous vaccine dose.

§ Includes the most severe episode reported during the day 0–7 window for each event. Parents and guardians who participate in v-safe use the following definitions to describe the severity of a child's symptoms: mild (noticeable, but not problematic), moderate (limit normal daily activities), or severe (make daily activities difficult or impossible). The odds of reporting a moderate or severe symptom after booster dose and previous doses were compared using a multivariable generalized estimating equations model that accounted for repeated measures among doses reported by each registrant; statistical significance was defined by p<0.05. All booster dose and dose 1 comparisons were statistically significant (p<0.01). All booster dose and dose 2 comparisons were statistically significant (p<0.05) except "chills" (p = 0.38).

¶ Includes those who reported a temperature and met the definition for fever (≥100.4°F [≥38.0°C]) during days 0–3. If information was available, fever was classified further as mild (100.4°F–101.1°F [38.0°C–38.3°C]), moderate (101.2°F–102.0°F [38.4°C–38.9°C]), severe (102.1°F–104.0°F [39.0°C–40.0°C]), or very severe (>104.0°F [>40°C]). Because few registrants reported a temperature that met the definition for fever, statistics were not estimated for this variable.

¶¶ This model accounted for repeated measures among doses reported by each registrant. The threshold for statistical significance was p<0.05.

*** This analysis excluded reports to v-safe or VAERS of children aged 5–11 years who were vaccinated with a booster dose before authorization for a booster dose for their age group (i.e., before May 17, 2022).

††† 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.

TABLE 2. Adverse reactions and health impacts reported to v-safe for children aged 5–11 years who received homologous Pfizer-BioNTech COVID-19 booster vaccination* (N = 3,249) — United States, May 17–July 31, 2022

Reported event	% Reporting event†		
	Dose 1	Dose 2	Dose 3
Any local injection site reaction	**62.6**	**68.0**	**68.5**
Itching	4.9	4.9	5.3
Pain	60.7	66.1	66.7
Redness	4.5	5.5	8.5
Swelling	4.2	6.2	9.6
Any systemic reaction	**38.1**	**45.8**	**45.6**
Abdominal pain	5.3	7.4	6.1
Myalgia	7.1	10.2	13.9
Chills	3.8	7.6	7.4
Diarrhea	2.6	2.2	2.4
Fatigue	22.9	29.9	28.9
Fever	7.8	15.4	16.9
Headache	15.2	20.6	19.9
Joint pain	2.2	3.0	3.4
Nausea	4.8	7.1	7.1
Rash	1.0	0.8	1.3
Vomiting	1.9	2.5	3.1
Any health impact	**9.4**	**14.5**	**16.3**
Unable to perform normal daily activities	4.7	7.5	12.1
Unable to attend school	6.5	10.0	6.9
Needed medical care	1.1	0.9	1.0
Clinic	0.5	0.5	0.5
Telehealth	0.2	0.2	0.3
Emergency department visit	0.03	0.1	0.03
Hospitalization	0.03	0	0

* Includes only persons who received Pfizer-BioNTech COVID-19 vaccine for primary series and first booster dose and completed at least one survey after their booster dose and at least one survey after a previous vaccine dose.

† Percentage of registrants who reported a reaction or health impact at least once during days 0–7 after vaccination. The odds of reporting any local injection site or systemic reaction or health impact after booster dose and previous doses were compared using a multivariable generalized estimating equations model that accounted for repeated measures among doses reported by each registrant; the threshold for statistical significance was $p<0.05$. All booster dose and dose 1 comparisons were statistically significant ($p<0.001$), except "unable to attend school" and "needed medical care." Among booster dose and dose 2 comparisons, "any health impact" ($p<0.05$), "unable to perform normal daily activities" ($p<0.001$), and "unable to attend school" ($p<0.001$) were statistically significant; "needed medical care" was not significantly different.

Review of VAERS Data

During May 17–July 31, 2022, VAERS received and processed 581 reports of one or more adverse events after Pfizer-BioNTech third dose vaccination among children aged 5–11 years; recipients' median age was 9 years, and 275 (47.3%) reports were for girls. Most reports (573; 98.6%) indicated that the third COVID-19 dose was the sole vaccine administered at the encounter. Overall, 578 (99.5%) VAERS reports were classified as nonserious (Table 3). Among nonserious reports, the most commonly reported events (413; 71.1%) were related to vaccine preparation or administration errors (e.g., product preparation issue or error, incorrect dose administered, and product administered to patient of inappropriate age); 63 (15.3%) of these 413 reports also listed an adverse health event. Other commonly reported events among nonserious reports included fever (45; 7.8%), pain in extremity (38; 6.6%), and fatigue (28; 4.8%). The three serious reports included new onset type 1 diabetes 10 days after vaccination, facial swelling 3 days after vaccination, and generalized pain, fatigue, and malaise 5 days after vaccination requiring hospitalization. There were no reports to VAERS of either myocarditis or death.

TABLE 3. Reports of nonserious and serious events to the Vaccine Adverse Event Reporting System for children aged 5–11 years who received a Pfizer-BioNTech COVID-19 booster dose (N = 581) — United States, May 17–July 31, 2022

Reported events	No. (%)
Nonserious VAERS reports	578 (100)
Symptom, sign, diagnostic result, or condition (MedDRA PT*)	
Product preparation issue	145 (25.1)
Incorrect dose administered	128 (22.2)
No adverse event†	105 (18.2)
Product administered to patient of inappropriate age	55 (9.5)
Product preparation error	53 (9.2)
Expired product administered	46 (8.0)
Fever	45 (7.8)
Pain in extremity	38 (6.6)
Fatigue	28 (4.8)
Headache	22 (3.8)
Injection site pain	22 (3.8)
Product storage error	22 (3.8)
Vomiting	22 (3.8)
Chills	18 (3.1)
Dizziness	18 (3.1)
Serious VAERS reports§,¶	**3 (100)**
Clinical impression	
Generalized pain, fatigue, and malaise requiring hospitalization	1 (33.3)
New onset type 1 diabetes	1 (33.3)
Facial swelling	1 (33.3)

Abbreviations: MedDRA PT = Medical Dictionary for Regulatory Activities preferred terms; VAERS = Vaccine Adverse Event Reporting System.

* Signs and symptoms in VAERS reports are assigned MedDRA PTs by VAERS staff members. Each VAERS report might be assigned more than one MedDRA PT and can include normal diagnostic findings. A MedDRA PT does not represent a medical diagnosis made or confirmed by a provider or clinical reviewer.

† All reports classified as no adverse event were accompanied by at least one report of vaccine error (e.g., product preparation issue, incorrect dose administered, product preparation error, product administered to patient of inappropriate age, expired product administered, or product storage error). A total of 413 reports were classified as vaccine errors; the most common specific errors are listed in the table. Of the 413 reports of vaccine error, 105 included the MedDRA PT "no adverse event," 63 listed an adverse health event, and the remaining reports only indicated that a vaccine error occurred.

§ VAERS reports are classified as serious if any of the following are reported: hospitalization, prolongation of hospitalization, life-threatening illness, permanent disability, congenital anomaly or birth defect, or death.

¶ Serious reports to VAERS were reviewed by CDC physicians to form a clinical impression. The clinical impression of the event does not establish a causal role with vaccination. https://www.meddra.org/how-to-use/basics/hierarchy

Discussion

This report provides safety findings from v-safe and VAERS data collected during the first 10 weeks of administration of Pfizer-BioNTech booster doses to children aged 5–11 years, a period in which approximately 657,302 third doses were

Summary

What is already known about this topic?

A Pfizer-BioNTech COVID-19 vaccine booster dose is recommended for children aged 5–11 years; approximately 657,302 third doses were administered to children in this age group during May–July 2022.

What is added by this report?

Among children aged 5–11 years, local and systemic reactions were reported to v-safe with similar frequency after doses 2 and 3; specific reactions differed in severity. Vaccine administration errors were the most common events reported to the Vaccine Adverse Event Reporting System. No reports of myocarditis or death after receipt of dose 3 were received.

What are the implications for public health practice?

Among children aged 5–11 years, serious adverse events after dose 3 are rare. Additional provider education might prevent vaccine administration errors.

administered in this age group. Adverse reactions reported to v-safe and VAERS for children aged 5–11 years after receipt of a third dose were similar to adverse reactions reported in the Pfizer-BioNTech clinical trial, reinforcing the safety of vaccination in this population (*2*).

Among reports to v-safe for children aged 5–11 years, reports of local and systemic reactions after third dose vaccination were similar in frequency to those reported after a primary series (*5*–*7*). Although local and systemic reactions were similarly reported after receipt of dose 2 and dose 3, some reactions were more frequently reported as moderate or severe after a third than a second dose. This reporting pattern is consistent with clinical trial results (*2*). Parents reported symptom severity in v-safe based on how the symptom affected their child's ability to complete daily activities. Thus, more common reporting of moderate-to-severe reactions likely reflects increased reporting of the health impact "inability to perform normal daily activities." However, there was no significant difference between the proportions of children receiving medical attention after receipt of the second or third doses of Pfizer-BioNTech vaccine.

Approximately 99% of reports to VAERS for children aged 5–11 years after a Pfizer-BioNTech third dose were classified as nonserious. The most common adverse events reported were related to vaccine administration errors, most of which did not have an accompanying adverse health event. Children aged 5–11 years were the first to receive a smaller amount of mRNA (10 μg, 0.2 mL) than that recommended for persons aged ≥12 years (30 μg, 0.3 mL) (*1*). Therefore, continued education of vaccine providers might help reduce administration errors, including incorrect dosing, among children. Other common reactions reflect known associations with mRNA vaccines. These findings are consistent with previous analyses of VAERS reports following primary series vaccination in this age group (*5*,*6*).

No VAERS reports of myocarditis after third doses among children aged 5–11 years were received. Among children and adolescents aged <18 years, myocarditis risk after COVID-19 vaccination is higher in males (*4*), and risk decreases with decreasing age (*4*,*8*); the myocarditis reporting rate to VAERS after dose 2 was 2.6 per 1 million doses among boys aged 5–11 years and 46.4 per 1 million doses among males aged 12–15 years (*8*). The risk for myocarditis after dose 3 appears to be less than that after dose 2; among males aged 12–15 years, the reporting rate to VAERS after dose 3 (15.3 per 1 million doses) was approximately one third of that after dose 2 (46.4) (*8*).

The findings in this report are subject to at least five limitations. First, v-safe participation is voluntary, and data might not be representative of the entire vaccinated U.S. population. Second, recipients who experience an adverse event might be more likely to respond to v-safe surveys. Third, v-safe does not include information about immune status; third dose recipients likely include persons with and without immunocompromising conditions. Fourth, VAERS is subject to reporting biases and underreporting, especially of nonserious events (*3*). Finally, these data are limited by the 10-week surveillance period. Findings might change as safety monitoring continues and more children aged 5–11 years receive booster doses. In particular, the frequency of vaccine error reports might decline as vaccine administrators gain additional experience with pediatric doses of mRNA COVID-19 vaccines.

The Advisory Committee on Immunization Practices recommends that all children aged 5–11 years receive 1 COVID-19 mRNA booster dose ≥5 months after completion of their primary COVID-19 mRNA series; immunocompromised children aged 5–11 years are recommended to receive a 3-dose primary series (with dose 3 administered ≥4 weeks after dose 2), followed by a booster dose ≥3 months after completion of the primary series.[§§§] Vaccination continues to be the most effective preventive measure against serious illness and death from COVID-19. Preliminary safety findings for third doses administered to children aged 5–11 years are generally similar to those reported in the clinical trial (*2*). Health care providers and parents should expect local and systemic reactions among children in the week after Pfizer-BioNTech booster vaccination. Serious reports of adverse events are rare. CDC and FDA will continue to monitor vaccine safety and will provide updates as needed to guide COVID-19 vaccination recommendations.

[§§§] https://www.cdc.gov/vaccines/acip/recs/grade/pfizer-biontech-covid19-booster-children-etr.html

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COVID-19 Outbreaks and Mortality Among Public Transportation Workers — California, January 2020–May 2022

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Work-related factors can contribute to risk for exposure to and infection with SARS-CoV-2, the virus that causes COVID-19, and subsequent COVID-19–attributable outcomes, including death. Comparing COVID-19 metrics across industries can help identify workers at highest risk. Elevated COVID-19 mortality rates have been reported among all transportation workers, as well as specifically in public transportation industries (*1*–*3*). The California Department of Public Health (CDPH) calculated public transportation industry–specific COVID-19 outbreak incidence during January 2020–May 2022 and analyzed all laboratory-confirmed COVID-19 deaths among working-age adults in California to calculate public transportation industry–specific mortality rates during the same period. Overall, 340 confirmed COVID-19 outbreaks, 5,641 outbreak-associated cases, and 537 COVID-19–associated deaths were identified among California public transportation industries. Outbreak incidence was 5.2 times as high (129.1 outbreaks per 1,000 establishments) in the bus and urban transit industry and 3.6 times as high in the air transportation industry (87.7) as in all California industries combined (24.7). Mortality rates were 2.1 times as high (237.4 deaths per 100,000 workers) in transportation support services and 1.8 times as high (211.5) in the bus and urban transit industry as in all industries combined (114.4). Workers in public transportation industries are at higher risk for COVID-19 workplace outbreaks and mortality than the general worker population in California and should be prioritized for COVID-19 prevention strategies, including vaccination and enhanced workplace protection measures.

This report assessed confirmed COVID-19 outbreaks in California workplaces that began during January 1, 2020–May 26, 2022, and were reported to CDPH as of June 27, 2022. Confirmed COVID-19 outbreaks were defined as the occurrence of three or more probable or confirmed COVID-19 cases within a 14-day period among persons who are epidemiologically linked in the setting, are from different households, and are not identified as close contacts of one another in any other case investigation (*4*). Since January 1, 2021, California employers have been required to report workplace clusters of three or more COVID-19 cases within 14 days to their local health department (LHD); previously, outbreak reporting requirements varied by setting and jurisdiction. LHDs report confirmed COVID-19 outbreaks and the number of outbreak-associated cases, which might include workers and nonworkers, to CDPH.

Separately, deaths among persons with laboratory-confirmed* COVID-19 were ascertained from California's COVID-19 case registry, using LHD determinations to identify COVID-19 decedents.† Case registry records were probabilistically matched to state death certificate data, which include information about decedent industry and occupation. COVID-19 decedents with date of death during January 1, 2020–May 26, 2022, were analyzed; analysis was restricted to working adults aged 18–64 years.

Standard 2012 U.S. Census Bureau industry codes were manually assigned to outbreaks using employer information and were assigned to death certificate free text for "usual industry" using an automated coding system (*5*). The numbers of outbreaks, outbreak-associated cases, and COVID-19–associated deaths were calculated for public transportation industries overall and for the five included individual industries§: air transportation, rail transportation, bus service and urban transit, taxi and limousine service (including shared ride services), and transportation support services (e.g., transportation maintenance services and airport cargo or terminal services).

For industries with 10 or more outbreaks during the study period, industry-specific outbreak incidence, defined as number of outbreaks per 1,000 business establishments, was calculated, using data on numbers of establishments from the California Employment Development Department in 2020 as denominators.¶ Monthly employment data from the U.S. Census

* Laboratory-confirmed cases were defined as those found among persons with detection of SARS-CoV-2 RNA in a clinical or autopsy specimen using a molecular test.

† CDPH recommends that LHDs use Council of State and Territorial Epidemiologists guidelines in making COVID-19 death determinations. https://cdn.ymaws.com/www.cste.org/resource/resmgr/pdfs/pdfs2/20211222_interim-guidance.pdf

§ Corresponding U.S. Census Bureau 2012 industry codes are 6070 (air transportation), 6080 (rail transportation), 6180 (bus service and urban transit), 6190 (taxi and limousine service), and 6290 (services incidental to transportation, referred to here as transportation support services).

¶ The California Employment Development Department defines an establishment as "an economic unit, such as a farm, mine, factory, or store that produces goods or provides services…typically at a single physical location address." For public transportation industries, this might include a single bus depot at which employees are based, or a single airline office at an airport. If a single establishment reported more than one outbreak during the study period, each outbreak was counted separately (i.e., a single establishment could be responsible for more than one outbreak in the data set). Establishment numbers for 2020 (https://www.labormarketinfo.edd.ca.gov/qcew/cew-select.asp) were extrapolated for 2021–2022 because complete data for 2021–2022 were not available.

Bureau's 2020–2022 Current Population Survey were used as denominators to calculate industry-specific annual, cumulative, and age-standardized mortality rates. Outbreak incidence and mortality rates in public transportation industries were compared to overall rates for all California industries combined. Analyses were performed using SAS software (version 9.4; SAS Institute). The California Health and Human Services Agency's Committee for the Protection of Human Subjects determined that this project constituted public health practice, not research, and therefore did not require further human subjects review.**

A total of 340 COVID-19 outbreaks, 5,641 outbreak-associated cases, and 537 COVID-19–associated deaths occurred in public transportation industries in California (Table 1) (Table 2). The largest number of outbreaks (194; 57.1%) occurred in bus and urban transit workplaces, the largest number of outbreak-associated cases occurred in air transportation (2,411; 42.7%), and the largest number of deaths (270; 50.3%) occurred among workers in transportation support services.

** 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 January 1, 2020–May 26, 2022, the cumulative outbreak incidence for all public transportation industries (35.3 outbreaks per 1,000 establishments) was 1.4 times as high as that for all industries (24.7) (Table 1). Among individual public transportation industries, cumulative outbreak incidence was 5.2 times as high in bus and urban transit (129.1) and 3.6 times as high in air transportation (87.7) as in all industries. Annual outbreak incidence in public transportation industries increased by 68.4%, from 11.7 outbreaks per 1,000 establishments in 2020 to 19.7 in 2021, whereas outbreak incidence across all industries increased by 22.9% (from 8.3 to 10.2) during the same period. Numbers of outbreaks increased during COVID-19 surges; the highest monthly number of COVID-19 outbreaks in public transportation industries (79) was reported in December 2021, during the SARS-CoV-2 B.1.1.529 (Omicron) variant surge (Figure).

The cumulative crude mortality rate for all public transportation industries was 174 per 100,000 workers, 1.5 times as high as the rate across all industries (Table 2). Cumulative crude mortality rates among workers in transportation support

TABLE 1. COVID-19 outbreaks and outbreak incidence* in public transportation industries — California, January 2020–May 2022

Industry	No. of outbreaks				No. (%) of outbreak-associated cases†	No. of establishments*	Annual outbreak incidence*		Cumulative outbreak incidence*
	2020	2021	2022	Total (%)†			2020	2021	
Air transportation	16	31	6	**53 (15.6)**	2,411 (42.7)	604	26.5	51.3	87.7
Rail transportation§	0	4	0	**4 (1.2)**	48 (0.9)	9	NA	NA	NA
Bus service and urban transit	73	97	24	**194 (57.1)**	2,129 (37.7)	1,502	48.6	64.5	129.1
Taxi and limousine service§	0	0	0	**0 (—)**	0 (—)	770	NA	NA	NA
Transportation support services	24	58	7	**89 (26.2)**	1,053 (18.7)	6,755	3.6	8.6	13.2
All public transportation industries	**113**	**190**	**37**	**340 (100)**	**5,641 (100)**	**9,772**	**11.7**	**19.7**	**35.3**
All industries	**13,571**	**16,572**	**10,078**	**40,221**	**495,427**	**1,629,893**	**8.3**	**10.2**	**24.7**

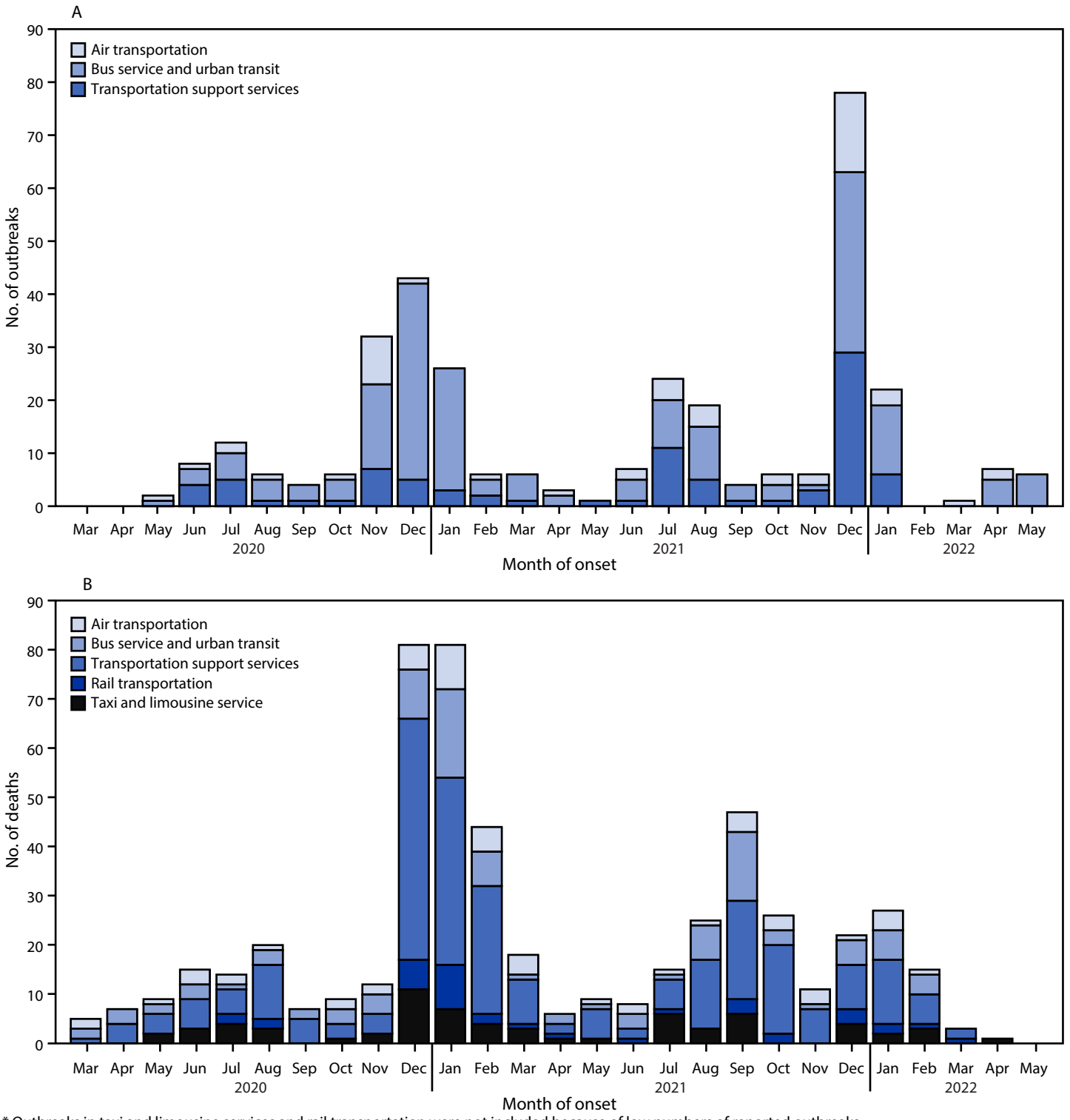
Abbreviation: NA = not applicable.
* Outbreak incidence was calculated as number of outbreaks per 1,000 establishments; an annual rate was not calculated for 2022 because of incomplete data. Cumulative outbreak incidence was calculated as total number of outbreaks during the study period per 1,000 establishments. Establishment numbers reflect 2020 data because complete data for 2021–2022 were not available; 2020 establishments were extrapolated for 2021 and cumulative incidence calculations.
† Percentages were calculated as percentages of outbreaks or outbreak-associated cases among all public transportation industries.
§ Outbreak incidence was not calculated for industries with small numbers (<10) of reported outbreaks.

TABLE 2. COVID-19 deaths and mortality rates* among workers in public transportation industries — California, January 2020–May 2022

Industry	No. of COVID-19 deaths				Total no. of workers (x 1,000)	Annual mortality rate*		Cumulative mortality rate*
	2020	2021	2022	Total (%)†		2020	2021	
Air transportation	18	34	5	**57 (10.6)**	62.5	31.2	68.0	91.3
Rail transportation	10	23	4	**37 (6.9)**	15.3	51.5	230.1	241.8
Bus service and urban transit	33	63	10	**106 (19.7)**	50.1	76.6	114.3	211.5
Taxi and limousine service	26	35	6	**67 (12.5)**	66.6	31.4	58.3	100.6
Transportation support services	92	157	21	**270 (50.3)**	113.8	99.5	132.2	237.4
All public transportation industries	**179**	**312**	**46**	**537 (100)**	**308.3**	**60.6**	**106.1**	**174.2**
All industries	**6,330**	**11,567**	**2,455**	**20,442**	**17,875.3**	**35.6**	**65.2**	**114.4**

* Mortality rates were calculated as number of deaths per 100,000 workers and were not calculated for 2022 because of incomplete annual data. Reported rates are crude mortality rates. Cumulative mortality rate was calculated as total number of deaths during the study period per 100,000 workers, using average employment during the study period.
† Percentages were calculated as percentages of deaths among all public transportation industries.

FIGURE. COVID-19 outbreaks* (A) and COVID-19–associated deaths (B) in public transportation industries, by month of onset — California, March 2020–May 2022†



* Outbreaks in taxi and limousine services and rail transportation were not included because of low numbers of reported outbreaks.
† No outbreaks or deaths in public transportation industries were reported during January or February 2020.

Summary

What is already known about this topic?

Workers who perform in-person work and come into close, frequent contact with other workers or the public might be at increased risk for SARS-CoV-2 exposure and infection.

What is added by this report?

Public transportation industries in California experienced cumulative COVID-19 outbreak incidence and mortality rates 1.5 times as high as that for all industries; outbreak incidence was 5.2 times as high, and mortality was 1.8 times as high in bus and urban transit industries as in all industries.

What are the implications for public health practice?

Public transportation workers should be prioritized for COVID-19 prevention strategies, including vaccination and enhanced workplace protection measures.

services (237), rail transportation (242), and bus service and urban transit (211) were approximately twice those across all industries (114). Age-adjusted mortality rates for all public transportation industries combined increased 68.1%, from 55.5 per 100,000 workers during 2020 to 93.3 during 2021 and were 1.5 times as high in 2020 and 1.4 times as high during 2021 as in all industries. The highest monthly number of COVID-19–associated deaths occurred during December 2020 and January 2021 (81 per month); an increase was also observed in September 2021 during California's SARS-CoV-2 B.1.617.2 (Delta) variant surge (Figure).

Discussion

COVID-19 outbreak incidence and mortality rates are higher in public transportation industries in California compared with all industries combined. Workers in these industries have continued to report to work throughout the pandemic, and many have jobs involving close, frequent contact with coworkers and the public. Among New York City transit workers who died of COVID-19 early in the pandemic, 57% worked in public-facing positions (*6*). Previous reports in Europe identified elevated mortality risk among public transportation workers; taxi and bus drivers were found to have the highest COVID-19 mortality rates among all occupational groups (*2*,*3*). This report also identified elevated outbreak incidence and mortality rates among bus and urban transit workers, in addition to elevated risk across all public transit industries combined.

Although both outbreak incidence and mortality rates were elevated in the bus and urban transit industry, some differences were observed in other industries. Whereas COVID-19 fatalities were observed in the taxi and limousine industry, no outbreaks were identified, which might reflect the nature of the work (e.g., infrequent direct interaction with other workers) and the challenges of case and outbreak ascertainment with independent contractor work arrangements. Conversely, elevated outbreak incidence in air transportation relative to other transportation industries might partially reflect this industry's enhanced outbreak identification and contact tracing capability, in addition to other work-related factors, such as duration and intensity of contact with others.

Previous reports of excess all-cause mortality and COVID-19 mortality across occupational groups in California identified elevated mortality rates among non-Hispanic Black and Hispanic workers compared with non-Hispanic White workers in transportation occupations (*1*,*7*). Although examination of outcomes by race and ethnicity was not possible in this analysis because of small numbers and missing data, additional investigation should explore how race, ethnicity, and other socioeconomic factors intersect with occupational risk for COVID-19 in public transportation industries.

The findings in this report are subject to at least six limitations. First, results were limited to California and might not be generalizable to other jurisdictions. Second, a statewide outbreak-reporting mandate was not implemented until January 1, 2021, which might have resulted in underestimation of 2020 outbreaks and limits the ability to compare outbreak incidence between 2020 and 2021. Third, age-adjusted mortality rates could not be calculated for individual industries because of small numbers; other confounding factors (e.g., race and ethnicity, presence of underlying medical conditions, vaccination status, and use of protective measures such as masks) might also affect outbreak and mortality rates and could not be adjusted for in this analysis. Fourth, although the industries analyzed here are public transportation industries, they include some workers who are not in public-facing roles; distinguishing these workers from public-facing workers was not possible in this analysis, and transmission might have occurred between coworkers as well as between workers and members of the public. Fifth, workers could not be distinguished from nonworkers in outbreak-associated case counts and, although death counts were limited to working-age persons and excluded those identified as unemployed or retired, some misclassification of working status remains possible. Decedents were classified by "usual industry," which might also have led to misclassification of persons with more than one source of employment. Finally, identifying a specific source of COVID-19 exposure for individual patients is challenging because of the occurrence of presymptomatic and asymptomatic transmission and limitations in contact tracing, particularly for workers who come into frequent close contact with many persons; therefore, determining whether and how COVID-19 exposures occurred in the workplace can be difficult, particularly when analyzing aggregate data.

The elevated outbreak incidence identified in public transportation industries suggests higher risk for SARS-CoV-2 workplace exposure among public transportation workers, and elevated mortality rates suggest increased risk for dying from COVID-19. Regardless of whether exposures occur from interactions with the public, coworkers, or other sources, these observations indicate that public transportation workers represent a vulnerable group who should be prioritized for COVID-19 prevention strategies. Such strategies can include targeted vaccination efforts, access to antiviral treatments, public health messaging, and enhanced workplace protection measures, such as improved ventilation and use of well-fitted masks or respirators (e.g., N95s) by workers and members of the public (*8*,*9*).

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Summary of Guidance for Minimizing the Impact of COVID-19 on Individual Persons, Communities, and Health Care Systems — United States, August 2022

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As SARS-CoV-2, the virus that causes COVID-19, continues to circulate globally, high levels of vaccine- and infection-induced immunity and the availability of effective treatments and prevention tools have substantially reduced the risk for medically significant COVID-19 illness (severe acute illness and post–COVID-19 conditions) and associated hospitalization and death (*1*). These circumstances now allow public health efforts to minimize the individual and societal health impacts of COVID-19 by focusing on sustainable measures to further reduce medically significant illness as well as to minimize strain on the health care system, while reducing barriers to social, educational, and economic activity (*2*). Individual risk for medically significant COVID-19 depends on a person's risk for exposure to SARS-CoV-2 and their risk for developing severe illness if infected (*3*). Exposure risk can be mitigated through nonpharmaceutical interventions, including improving ventilation, use of masks or respirators indoors, and testing (*4*). The risk for medically significant illness increases with age, disability status, and underlying medical conditions but is considerably reduced by immunity derived from vaccination, previous infection, or both, as well as timely access to effective biomedical prevention measures and treatments (*3*,*5*). CDC's public health recommendations change in response to evolving science, the availability of biomedical and public health tools, and changes in context, such as levels of immunity in the population and currently circulating variants. CDC recommends a strategic approach to minimizing the impact of COVID-19 on health and society that relies on vaccination and therapeutics to prevent severe illness; use of multicomponent prevention measures where feasible; and particular emphasis on protecting persons at high risk for severe illness. Efforts to expand access to vaccination and therapeutics, including the use of preexposure prophylaxis for persons who are immunocompromised, antiviral agents, and therapeutic monoclonal antibodies, should be intensified to reduce the risk for medically significant illness and death. Efforts to protect persons at high risk for severe illness must ensure that all persons have access to information to understand their individual risk, as well as efficient and equitable access to vaccination, therapeutics, testing, and other prevention measures. Current priorities for preventing medically significant illness should focus on ensuring that persons 1) understand their risk, 2) take steps to protect themselves and others through vaccines, therapeutics, and nonpharmaceutical interventions when needed, 3) receive testing and wear masks if they have been exposed, and 4) receive testing if they are symptomatic, and isolate for ≥5 days if they are infected.

Vaccines and Therapeutics To Reduce Medically Significant Illness

COVID-19 vaccination. COVID-19 vaccines are highly protective against severe illness and death and provide a lesser degree of protection against asymptomatic and mild infection (*6*). Receipt of a primary series alone, in the absence of being up to date with vaccination* through receipt of all recommended booster doses, provides minimal protection against infection and transmission (*3*,*6*). Being up to date with vaccination provides a transient period of increased protection against infection and transmission after the most recent dose, although protection can wane over time. The rates of COVID-19–associated hospitalization and death are substantially higher among unvaccinated adults than among those who are up to date with recommended COVID-19 vaccination, particularly adults aged ≥65 years (*5*,*7*). Emerging evidence suggests that vaccination before infection also provides some protection against post–COVID-19 conditions,† and that vaccination among persons with post–COVID-19 conditions might help reduce their symptoms (*8*). Continuing to increase vaccination coverage and ensuring that persons are up to date with vaccination are essential to preventing severe outcomes. Overall booster dose coverage in the United States remains low,§ which is concerning given the meaningful reductions in risk for severe illness and death that booster doses provide and the importance of booster doses to counter waning of vaccine-induced immunity. Public health efforts to expand reach and promote equitable access to vaccination have resulted in similar rates of

* https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html

† Vaccination is also effective in preventing multisystem inflammatory syndrome in children, a rare but severe postinfectious hyperinflammatory condition that can occur after mild or asymptomatic infection among children. https://www.cdc.gov/mmwr/volumes/71/wr/mm7102e1.htm

§ https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-people-additional-dose-totalpop

primary series coverage across most racial and ethnic groups (*9*); however, racial and ethnic disparities in booster coverage have emerged (*10*). Supporting community partnerships and leveraging trusted sources of information must continue in order to eliminate persistent disparities and achieve equity in booster dose coverage, including through increasing education efforts and promotion of equitable vaccination outreach. Public health efforts need to continue to promote up-to-date vaccination for everyone, especially with vaccines targeting emerging novel variants that might be more transmissible or immune-evasive.

Preexposure prophylaxis. COVID-19 vaccine effectiveness against severe outcomes is lower in persons who are immunocompromised than in those who are not, and persons who are immunocompromised and have COVID-19 are at increased risk for intensive care unit admission and death while hospitalized, irrespective of their vaccination status (*11*,*12*). Preexposure prophylaxis with Evusheld[¶] can help protect persons with moderate to severe immunocompromise who might not mount an adequate immune response after COVID-19 vaccination, as well as persons for whom COVID-19 vaccination is not recommended because of their personal risk for severe adverse reactions. In addition to early antiviral treatment if infected, persons who are moderately or severely immunocompromised can benefit from COVID-19 preexposure prophylactic medication to help prevent severe COVID-19 illness, as an adjunct to up-to-date vaccination for themselves and their close contacts, early testing, nonpharmaceutical interventions, and prompt access to treatment if they are infected.

Medications to treat COVID-19. Antiviral medications (Lagevrio [molnupiravir], Paxlovid [nirmatrelvir and ritonavir], and Veklury [remdesivir]) and monoclonal antibodies (bebtelovimab) are available to treat COVID-19 in persons who are at increased risk for severe illness,[**] including older adults, unvaccinated persons, and those with certain medical conditions[††] (*13*). Antiviral agents reduce risk for hospitalization and death when administered soon after diagnosis. The federal Test to Treat initiative facilitates rapid, no-cost access to oral COVID-19 treatment for eligible persons who receive a positive SARS-CoV-2 test result.[§§] Recent expansion of prescribing authority of Paxlovid to pharmacists intends to further facilitate access.[¶¶] Continued efforts are needed to reduce racial and ethnic differences in receipt of monoclonal antibody therapies (*14*) and disparities in dispensing rates for oral antiviral prescriptions by community social vulnerability (*15*).

COVID-19 Prevention Strategies

Monitoring COVID-19 Community Levels to guide COVID-19 prevention efforts. Persons can use information about the current level of COVID-19 impact on their community to decide which prevention behaviors to use and when (at all times or at specific times), based on their own risk for severe illness and that of members of their household, their risk tolerance, and setting-specific factors. CDC's COVID-19 Community Levels reflect the current effect of COVID-19 on communities and identify geographic areas that might experience increases in severe COVID-19–related outcomes, based on hospitalization rates, hospital bed occupancy, and COVID-19 incidence during the preceding period[***] (*1*). Prevention recommendations based on COVID-19 Community Levels have the explicit goals of reducing medically significant illness and limiting strain on the health care system. At all COVID-19 Community Levels (low, medium, and high), recommendations emphasize staying up to date with vaccination, improving ventilation, testing persons who are symptomatic and those who have been exposed, and isolating infected persons. At the medium COVID-19 Community Level, recommended strategies include adding protections for persons who are at high risk for severe illness (e.g., use of masks or respirators that provide a higher level of wearer protection). At the high COVID-19 Community Level, additional recommendations focus on all persons wearing masks indoors in public and further increasing protection to populations at high risk.[†††] As SARS-CoV-2 continues to circulate, changes

[¶] Adults and adolescents aged ≥12 years might be eligible for Evusheld, a combination of two monoclonal antibodies (tixagevimab copackaged with cilgavimab, administered as two consecutive intramuscular injections), if they are moderately or severely immunocompromised and might not mount an adequate immune response to COVID-19 vaccination or have a history of severe allergic reactions to COVID-19 vaccines, and do not currently have COVID-19 and have not recently had close contact with someone with COVID-19. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html#preventive; https://www.fda.gov/media/154701/download

[**] Paxlovid, which is taken orally, and remdesivir, administered intravenously, are the current primary treatments, with Lagevrio and monoclonal antibodies as alternates (https://www.covid19treatmentguidelines.nih.gov/management/clinical-management/). Some patients who have completed a 5-day course of Paxlovid and have recovered can experience recurrent illness; patients experiencing COVID-19 rebound should be advised to follow CDC's recommendations for isolation (https://emergency.cdc.gov/han/2022/pdf/CDC_HAN_467.pdf).

[††] https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html

[§§] https://aspr.hhs.gov/TestToTreat/Pages/default.aspx

[¶¶] https://www.fda.gov/media/155049/download

[***] CDC recommends the use of three indicators to measure COVID-19 Community Levels: 1) new COVID-19 hospital admissions per 100,000 population in the last 7 days; 2) percentage of staffed inpatient beds occupied by patients with confirmed COVID-19 (7-day average); and 3) new COVID-19 cases per 100,000 population in the last 7 days. The COVID-19 Community Level is determined by the higher of the new admissions and inpatient beds occupied metrics, based on the current level of new cases per 100,000 population in the last 7 days. The indicators combine to result in three COVID-19 Community Levels: low, medium, and high. COVID-19 Community Levels do not apply in health care settings, such as hospitals and nursing homes. Performance of COVID-19 Community Levels (including the component metrics and performance overall) will be reassessed and adjusted, if necessary, to accommodate changes in factors such as viral dynamics, emergence of novel variants of concern, or ecological changes that affect indicator data (e.g., shifts to greater use of self-testing or changes in reporting cadence).

[†††] Recommendations are additive, in that recommendations for the low community level apply to the medium and high levels, and the additional recommendations for medium level apply to the high level.

in COVID-19 Community Levels for a jurisdiction help signal when use of some prevention strategies should be discontinued or increased, based on an individual person's level of risk for severe illness or that of their household or social contacts. The COVID-19 Community Levels provide a broad framework for public health officials and jurisdictions to use and adapt as needed based on local context by combining local information to assess the need for public health interventions.

Nonpharmaceutical interventions. Implementation of multiple prevention strategies helps protect individual persons and communities from SARS-CoV-2 exposure and reduce risk for medically significant illness and death by reducing risk for infection (Table). Implementation of multiple nonpharmaceutical preventive interventions can complement use of vaccines and therapeutics, especially as COVID-19 Community Levels increase and among persons at high risk for severe illness. CDC's COVID-19 prevention recommendations no longer differentiate based on a person's vaccination status because breakthrough infections occur, though they are generally mild (*16*), and persons who have had COVID-19 but are not vaccinated have some degree of protection against severe illness from their previous infection (*17*). In addition to strategies recommended at all COVID-19 Community Levels, education and messaging to help individual persons understand their risk for medically significant illness complements recommendations for prevention strategies based on risk.

Testing for current infection. Diagnostic testing can identify infections early so that infected persons can take action to reduce their risk for transmitting virus and receive treatment, if clinically indicated, to reduce their risk for severe illness and death. All persons should seek testing for active infection when they are symptomatic or if they have a known or suspected exposure to someone with COVID-19. When considering whether and where to implement screening testing of asymptomatic persons with no known exposure, public health officials might consider prioritizing high-risk congregate settings, such as long-term care facilities, homeless shelters, and correctional facilities, and workplace settings that include congregate housing with limited access to medical care.[§§§] In these types of high-risk congregate settings, screening testing might complement diagnostic testing of symptomatic persons by identifying asymptomatic infected persons (*18,19*). When implemented, screening testing strategies should include all persons, irrespective of vaccination status. Screening testing might not be cost-effective in general community settings, especially if COVID-19 prevalence is low (*20,21*).

Isolation. Symptomatic or infected persons should isolate promptly, and infected persons should remain in isolation for ≥5 days and wear a well-fitting and high-quality mask or respirator if they must be around others. Infected persons may end isolation after 5 days, only when they are without a fever for ≥24 hours without the use of medication and all other symptoms have improved, and they should continue to wear a mask or respirator around others at home and in public through day 10[¶¶¶] (Figure) (*22,23*). Persons who have access to antigen tests and who choose to use testing to determine when they can discontinue masking should wait to take the first test until at least day 6 and they are without a fever for ≥24 hours without the use of fever-reducing medication and all other symptoms have improved. Use of two antigen tests with ≥48 hours between tests provides more reliable information because of improved test sensitivity (*24*). Two consecutive test results must be negative for persons to discontinue masking. If either test result is positive, persons should continue to wear a mask around others and continue testing every 48 hours until they have two sequential negative results.[****]

Managing SARS-CoV-2 exposures. CDC now recommends case investigation and contact tracing only in health care settings and certain high-risk congregate settings.[††††] In all other circumstances, public health efforts can focus on

[§§§] In high-risk settings such as nursing homes, modeling suggests that serial screening testing might be effective when performed very frequently (e.g., daily), although such high frequency is likely logistically challenging. https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciac505/6611848

[¶¶¶] Persons at high risk of severe illness should wear masks or respirators (N95/KN95s) that provide more protection indoors in public at medium and high COVID-19 Community Levels. All persons should wear well-fitting masks or respirators indoors in public at high COVID-19 Community Levels (https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html). Persons who had moderate illness from COVID-19, including those who show evidence of lower respiratory illness such as shortness of breath or difficulty breathing, should isolate for ≥10 days. Persons who had severe illness from COVID-19, including those who were hospitalized and those who required intensive care or mechanical ventilation, and persons with immunocompromising conditions should isolate for ≥10 days and talk with a health care provider to determine end of isolation. https://www.covid19treatmentguidelines.nih.gov/overview/clinical-spectrum/

[****] Persons who choose to use testing to determine when to discontinue masking can end isolation after day 5 even if they receive a positive test result. They should continue wearing a well-fitting and high-quality mask around others at home and in public until they receive two consecutive negative test results, with tests taken ≥48 hours apart. For some persons, this might mean that they will continue masking longer than 10 days since symptom onset. https://www.fda.gov/medical-devices/coronavirus-disease-2019-covid-19-emergency-use-authorizations-medical-devices/in-vitro-diagnostics-euas-antigen-diagnostic-tests-sars-cov-2

[††††] Case investigation and contact tracing are fundamental activities that involve working with a patient (symptomatic or asymptomatic) who has received a diagnosis of an infectious disease to identify and provide support to persons (contacts) who might have been infected through exposure to the patient. CDC recommends that health departments prioritize case investigation and contact tracing in high-risk congregate settings, for clusters or outbreaks that involve unusual clusters of cases, or for novel or emerging variants that might pose significant risks for severe illness, hospitalization, or death. https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/prioritization.html

TABLE. Person- and community-level public health strategies to minimize the impact of COVID-19 on individual persons, communities, and health care systems — United States, August 2022

Recommended public health strategy	Person- and household-level prevention behaviors	Community-level prevention strategies*	Links to guidance and scientific evidence
COVID-19 vaccination	Stay up to date with COVID-19 vaccination	Distribute and administer vaccines to achieve high community vaccination coverage and ensure health equity Support community partnerships and leverage trusted sources of information to expand booster coverage	Vaccines for COVID-19: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/index.html Stay up to date with COVID-19 vaccines: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html Science brief: COVID-19 vaccines and vaccination: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html
Preexposure prophylaxis	Persons who are moderately or severely immunocompromised might benefit from COVID-19 preexposure prophylactic treatment (Evusheld) to prevent severe COVID-19 illness	Provide education and communication outreach to patients and clinical care organizations that serve patients with immunocompromising conditions to support equitable access to preexposure prophylaxis	COVID-19 preventive medication: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html#preventive Prevention of SARS-CoV-2 infection: https://www.covid19treatmentguidelines.nih.gov/overview/prevention-of-sars-cov-2/
Medications for treatment of COVID-19	Persons at increased risk for severe illness should have a plan for rapid access to tests and treatment if they become infected	Enable rapid access to oral COVID-19 treatment within ≤5 days of diagnosis Support clinical-community linkages to ensure access to antiviral and monoclonal antibody treatment and reduce health disparities	COVID-19 treatments and medication: https://www.cdc.gov/coronavirus/2019-ncov/your-health/treatments-for-severe-illness.html Clinical management of COVID-19: https://www.covid19treatmentguidelines.nih.gov/management/clinical-management/
Improved ventilation	Increase ventilation and filtration	Take steps to increase ventilation and filtration in public places	Improving ventilation in your home: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/Improving-Ventilation-Home.html Ventilation in buildings: https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html Ventilation in schools and childcare programs: https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/ventilation.html Science brief: SARS-CoV-2 transmission: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html
Masks and respirators	Persons at high risk for severe illness should wear a mask or respirator (N95/KN95) that provides more protection indoors in public at medium and high COVID-19 community levels All persons should wear well-fitting masks or respirators indoors in public at high COVID-19 Community Levels†	Recommend all persons wear well-fitting masks or respirators at high COVID-19 Community Levels and support use of masks through messaging and resources	Masks and respirators: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/types-of-masks.html Science brief: community use of masks to control and spread of SARS-CoV-2: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/masking-science-sars-cov2.html
Testing	Persons with a known or suspected exposure to someone with COVID-19 and those who experience symptoms should promptly seek testing through point-of-care and at-home tests	Increase equitable access to testing, including through point-of-care and at-home tests for all persons Recommend use of screening testing in certain high-risk settings (e.g., long-term care facilities or correctional facilities) to reduce risks of outbreaks Support Test to Treat and other initiatives to support rapid access to treatment among persons at high risk for severe illness	Overview of testing for SARS-CoV-2: https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing-overview.html Technical page: guidance for healthcare workers about COVID-19 (SARS-CoV-2) testing: https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing.html

See table footnotes on the next page.

TABLE. (*Continued*) Person- and community-level public health strategies to minimize the impact of COVID-19 on individual persons, communities, and health care systems — United States, August 2022

Recommended public health strategy	Person- and household-level prevention behaviors	Community-level prevention strategies*	Links to guidance and scientific evidence
Isolation	Symptomatic persons should isolate promptly and seek testing Infected persons should stay home for ≥5 days; for 10 days, infected persons should wear a mask around others at home and in public and avoid contact with persons at high risk for severe illness¶	Increase equitable access to testing, including through point-of-care and at-home tests for all persons Support case investigation and contact tracing in high-risk settings where recommended	Isolation: https://www.cdc.gov/coronavirus/2019-ncov/your-health/isolation.html Science brief: SARS-CoV-2 transmission: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html
Managing exposures to SARS-CoV-2	Persons with recent exposure should wear a mask indoors in public for 10 days and test ≥5 days after last exposure	Increase equitable access to testing, including through point-of-care and at-home tests for all persons Support case investigation and contact tracing in high-risk settings where recommended§	What to do if you are exposed: https://www.cdc.gov/coronavirus/2019-ncov/your-health/if-you-were-exposed.html Definition of close contacts: https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/appendix.html#contact Science brief: SARS-CoV-2 transmission: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html
Hand hygiene	Wash hands frequently	Ensure provision of adequate hand sanitation supplies	How to protect yourself and others: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html Science brief: SARS-CoV-2 transmission: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html
Increasing space and distance	Persons at high risk for severe illness can consider avoiding crowded areas and minimizing direct physical contact, especially in settings where there is high risk for exposure	Provide education to populations at high risk for severe illness to advise them to consider taking steps to protect themselves in settings where there is high risk for exposure	How to protect yourself and others: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html Science brief: SARS-CoV-2 transmission: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html

* Recommended strategies relate to general community settings; adapted setting-specific guidance and recommendations include schools and early childhood settings (https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-childcare-guidance.html), high-risk congregate settings such as correctional facilities and homeless shelters (https://www.cdc.gov/coronavirus/2019-ncov/community/high-risk-congregate-settings.html), health care settings (https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html), and travel (https://www.cdc.gov/coronavirus/2019-ncov/travelers/index.html).

† Although all masks and respirators provide some level of protection, properly fitting respirators provide the highest level of protection. Persons may consider the situation and other factors when choosing a mask or respirator that offers greater protection. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/types-of-masks.html#DifferentSituations

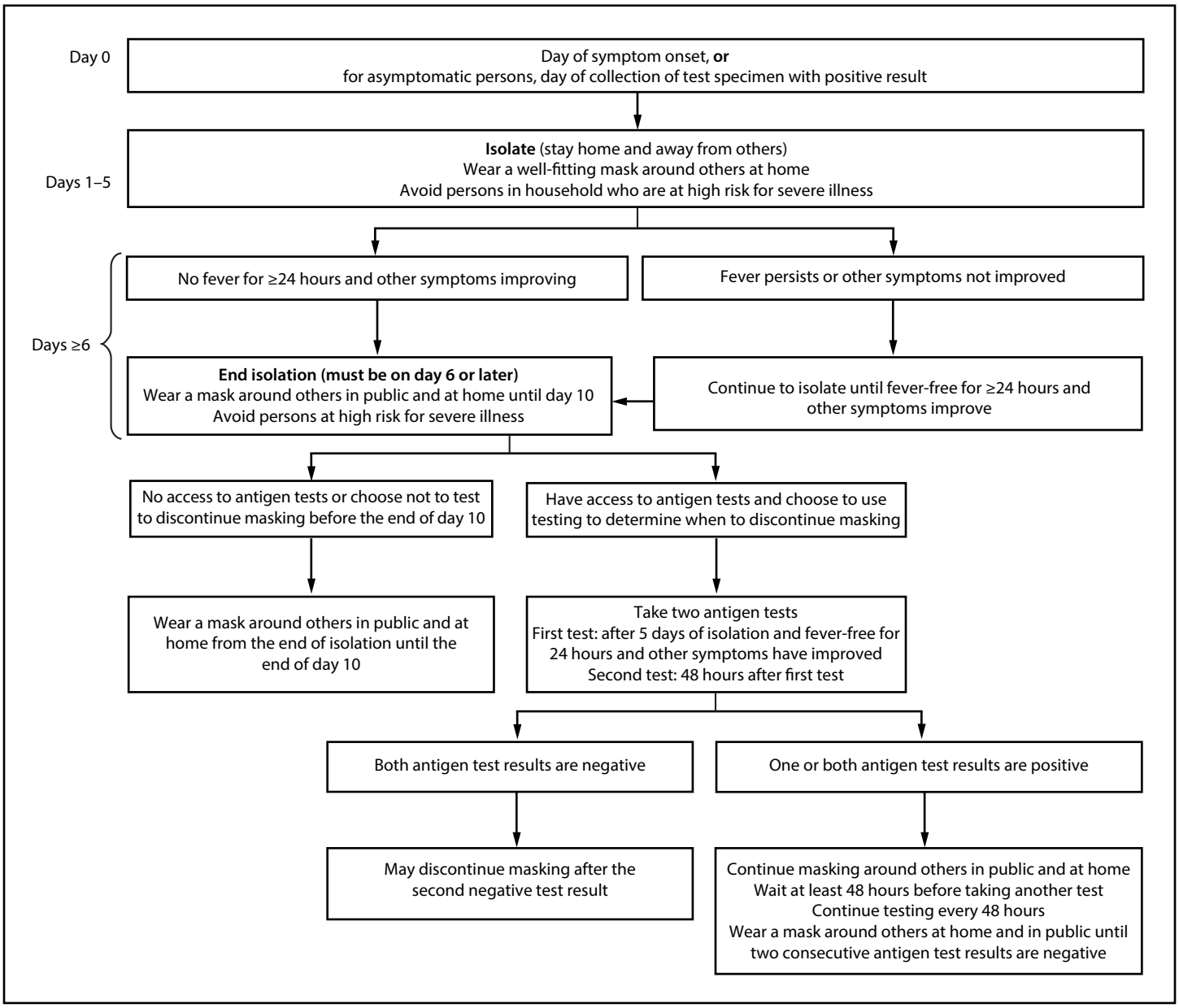
§ Universal case investigation and contact tracing are not recommended for COVID-19; health departments and jurisdictions should prioritize investigation of COVID-19 cases, clusters, and outbreaks involving high-risk congregate settings such as long-term care facilities and correctional facilities or unusual clusters of cases. https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/prioritization.html

¶ Infected persons should end isolation only when they are without a fever for ≥24 hours without use of medication and all other symptoms have improved. Persons who had moderate illness from COVID-19, including those who show evidence of lower respiratory disease such as shortness of breath or difficulty breathing should isolate for ≥10 days. Persons who had severe illness from COVID-19 (including those who were hospitalized or required intensive care) and persons who are immunocompromised should consult with a health care provider about how to determine end of isolation. https://www.covid19treatmentguidelines.nih.gov/overview/clinical-spectrum/

case notification and provision of information and resources to exposed persons about access to testing. Persons who have had recent confirmed or suspected exposure to an infected person should wear a mask for 10 days around others when indoors in public and should receive testing ≥5 days after exposure (or sooner, if they are symptomatic), irrespective of their vaccination status.[§§§§] In light of high population levels of anti–SARS-CoV-2 seroprevalence (*7*,*16*), and to limit social

[§§§§] For persons unable to wear a mask or children aged <2 years, other prevention actions should be taken, such as additional physical distancing and increased ventilation. Exposed persons who develop symptoms should receive testing promptly.

FIGURE. Recommendations for isolation,* masking,† and additional precautions for persons with COVID-19 illness§ or who receive a positive SARS-CoV-2 test result¶, — United States, August 2022**



* Symptomatic persons should isolate immediately and get tested. They should remain in isolation until they receive a test result. If the test result is positive, they should follow the full isolation recommendations. Asymptomatic persons should begin counting isolation from the first full day after a positive test result (day 0 is the date the test specimen was collected). If an infected person develops symptoms after a positive test result, the isolation count starts again with day 0 being the first day of symptoms.

† Persons at high risk for severe illness should wear a mask or respirator (N95/KN95) that provides more protection indoors in public at medium and high COVID-19 Community Levels. All persons should wear well-fitting masks or respirators indoors in public at high COVID-19 Community Levels. https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html

§ Persons who had moderate illness from COVID-19, including those who show evidence of lower respiratory disease such as shortness of breath or difficulty breathing should isolate for ≥10 days. Persons who had severe illness from COVID-19, including those who were hospitalized and those who required intensive care or mechanical ventilation, and persons with immunocompromising conditions should isolate for ≥10 days and consult with a health care provider to determine end of isolation. https://www.covid19treatmentguidelines.nih.gov/overview/clinical-spectrum/

¶ Infected persons can contact their health care provider to discuss their test results and available treatment options. They should monitor fever and other symptoms. If they develop an emergency warning sign, they should seek emergency medical care immediately. Emergency warning signs include trouble breathing; persistent pain or pressure in chest; new confusion; inability to awaken or stay awake; and pale, gray, or blue-colored skin, lips, or nailbeds, depending on skin tone. https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

** If symptoms worsen from the end of isolation through day 10, infected persons should restart isolation; they should consider consulting with a health care provider to determine care.

Summary

What is already known about this topic?

High levels of immunity and availability of effective COVID-19 prevention and management tools have reduced the risk for medically significant illness and death.

What is added by this report?

To prevent medically significant COVID-19 illness and death, persons must understand their risk, take steps to protect themselves and others with vaccines, therapeutics, and nonpharmaceutical interventions when needed, receive testing and wear masks when exposed, receive testing if symptomatic, and isolate for ≥5 days if infected.

What are the implications for public health practice?

Medically significant illness, death, and health care system strain can be reduced through vaccination and therapeutics to prevent severe illness, complemented by use of multiple prevention methods to reduce exposure risk and an emphasis on protecting persons at high risk for severe illness.

and economic impacts, quarantine of exposed persons is no longer recommended, regardless of vaccination status.

Protecting Persons Most at Risk for Severe Illness

Multiple nonpharmaceutical and medical prevention measures are available to substantially reduce the risk for medically significant illness and death among persons at particularly high risk for these outcomes because of older age, disability, moderate or severe immunocompromise (*25*), or other underlying medical conditions (including pregnancy) (*26*). In addition to recommending that persons stay up to date with vaccination, public health strategies to protect persons at high risk include use of masks or respirators (i.e., specialized filtering masks such as N95/KN95s) that provide more protection for the wearer,[¶¶¶¶] preexposure prophylaxis if indicated (e.g., for persons who are immunocompromised), and early access to and use of antivirals. At medium and high COVID-19 Community Levels, persons at high risk for severe illness and their contacts should consider wearing well-fitting masks or respirators that provide more protection to the wearer because of better filtration and fit to reduce exposure and infection risk. Persons who have household or social contact with persons at high risk should consider self-testing to detect infection before contact at medium and high COVID-19 Community Levels. Public health efforts should promote health equity by purposefully reaching out to all populations at high risk for severe illness to broaden access to preexposure prophylaxis, testing, and oral antivirals. Public health practitioners and organizations should consider the characteristics of their local or setting-specific populations when determining whether to strengthen or add prevention strategies that supplement disease control efforts and protect those persons at highest risk for severe illness or death. Strengthening public health communications and messaging can also help persons assess their personal level of risk for severe illness and use that knowledge to choose preventive behaviors to protect themselves and those around them.[*****]

[¶¶¶¶] Masks and respirators can provide different levels of protection depending on the type of mask and how they are used. Loosely woven cloth products provide the least protection, layered finely woven products offer more protection, well-fitting disposable surgical masks and KN95s offer even more protection, and well-fitting CDC National Institute for Occupational Safety and Health–approved respirators (including N95s) offer the highest level of protection. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/types-of-masks.html#DifferentSituations

Discussion

COVID-19 remains an ongoing public health threat; however, high levels of vaccine- and infection-induced immunity and the availability of medical and nonpharmaceutical interventions have substantially reduced the risk for medically significant illness, hospitalization, and death from COVID-19. As transmission of SARS-CoV-2 continues, the current focus on reducing medically significant illness, death, and health care system strain are appropriate and achievable aims that are supported by the broad availability of the current suite of effective public health tools. Rapid identification of emergent variants necessitating a shift in prevention strategy makes continued detection, monitoring, and characterization of novel SARS-CoV-2 variants essential. Incorporating actions to mitigate the impact of COVID-19 into long-term sustainable routine practices is imperative for society and public health.

[*****] https://www.cdc.gov/coronavirus/2019-ncov/your-health/factors-affecting-risk-of-getting-sick.html

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Public Health Response to a Case of Paralytic Poliomyelitis in an Unvaccinated Person and Detection of Poliovirus in Wastewater — New York, June–August 2022

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On July 18, 2022, the New York State Department of Health (NYSDOH) notified CDC of detection of poliovirus type 2 in stool specimens from an unvaccinated immunocompetent young adult from Rockland County, New York, who was experiencing acute flaccid weakness. The patient initially experienced fever, neck stiffness, gastrointestinal symptoms, and limb weakness. The patient was hospitalized with possible acute flaccid myelitis (AFM). Vaccine-derived poliovirus type 2 (VDPV2) was detected in stool specimens obtained on days 11 and 12 after initial symptom onset. To date, related Sabin-like type 2 polioviruses have been detected in wastewater* in the patient's county of residence and in neighboring Orange County up to 25 days before (from samples originally collected for SARS-CoV-2 wastewater monitoring) and 41 days after the patient's symptom onset. The last U.S. case of polio caused by wild poliovirus occurred in 1979, and the World Health Organization Region of the Americas was declared polio-free in 1994. This report describes the second identification of community transmission of poliovirus in the United States since 1979; the previous instance, in 2005, was a type 1 VDPV (*1*). The occurrence of this case, combined with the identification of poliovirus in wastewater in neighboring Orange County, underscores the importance of maintaining high vaccination coverage to prevent paralytic polio in persons of all ages.

Case Findings

In June 2022, a young adult with a 5-day history of low-grade fever, neck stiffness, back and abdominal pain, constipation, and 2 days of bilateral lower extremity weakness visited an emergency department and was subsequently hospitalized with suspected AFM; the patient was unvaccinated against polio (Figure). As part of national AFM surveillance,† the suspected case was reported to NYSDOH and then to CDC. The patient was discharged to a rehabilitation facility 16 days after symptom onset with ongoing lower extremity flaccid weakness. A combined nasopharyngeal/oropharyngeal swab and cerebrospinal fluid sample were negative by reverse transcription–polymerase chain reaction (RT-PCR) testing for enteroviruses and human parechovirus, as well as for a panel of common respiratory pathogens and encephalitic viruses by molecular methods (*2*). RT-PCR and sequencing of a stool specimen by the NYSDOH laboratory identified poliovirus type 2. Specimens were tested at CDC using RT-PCR (*3*) and sequencing, confirming the presence of poliovirus type 2 in both stool specimens. Additional sequencing identified the virus as VDPV2 (*4*), differing from the Sabin 2 vaccine strain by 10 nucleotide changes in the region encoding the viral capsid protein, VP1, suggesting transmission for up to 1 year although the location of that transmission is unknown.

Based on the typical incubation period for paralytic polio, the presumed period of exposure occurred 7 to 21 days before the onset of paralysis.§ Epidemiologic investigation revealed that the patient attended a large gathering 8 days before symptom onset and had not traveled internationally during the presumed exposure period. No other notable or known potential exposures were identified.

Public Health Response

Upon notification of the poliovirus-positive specimen, CDC, NYSDOH, and local health authorities launched an investigation and response on July 18, 2022. Activities included issuing a NYSDOH advisory on July 22 to increase health care provider awareness,¶ enhancing surveillance for potentially infected persons, testing wastewater from Rockland and surrounding New York counties, assessing vaccination coverage in the patient's community, supplying inactivated polio vaccine (IPV) to county immunization providers, and launching vaccination clinics throughout Rockland County.

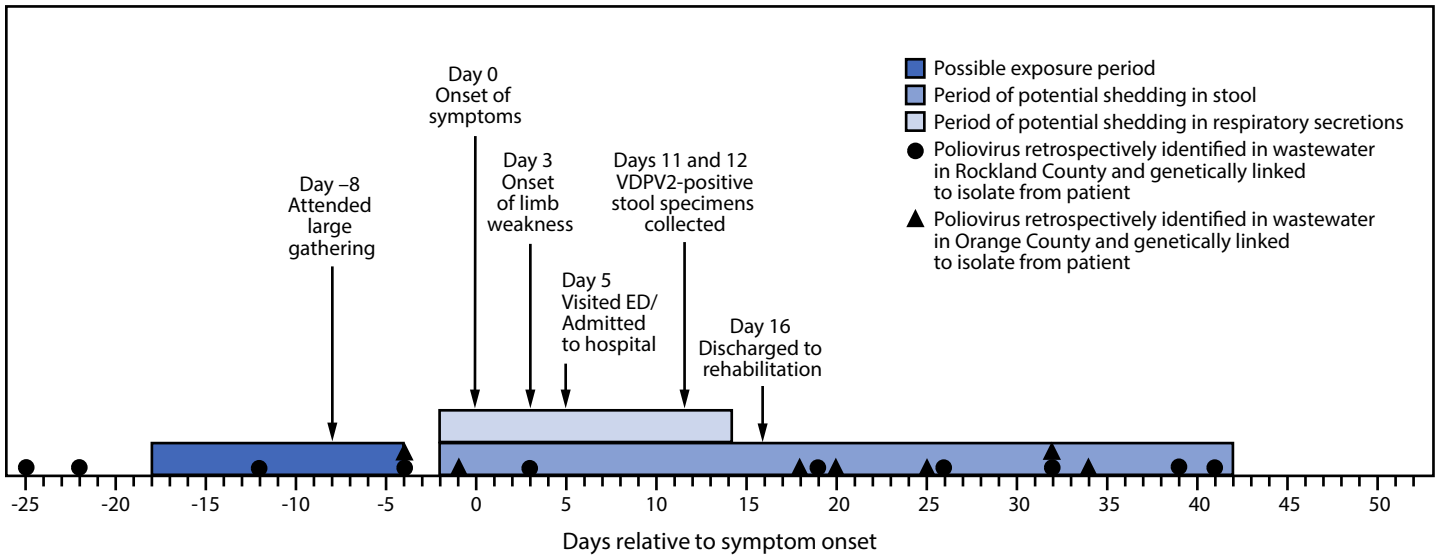
* Wastewater, also referred to as sewage, includes water from household or building use (e.g., toilets, showers, and sinks) that can contain human fecal waste and water from non-household sources (e.g., rain and industrial use). https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance/wastewater-surveillance.html#how-wastewater-surveillance-works

† https://www.cdc.gov/acute-flaccid-myelitis/hcp/case-definitions.html

§ https://www.cdc.gov/vaccines/pubs/pinkbook/polio.html

¶ https://health.ny.gov/diseases/communicable/polio/docs/2022-07-29_han.pdf

FIGURE. Timeline of patient activities, potential poliovirus exposures, shedding, and poliovirus-positive wastewater* samples† genetically linked to a patient with a case of type 2 vaccine-derived poliovirus — New York, May–August 2022



Abbreviations: ED = emergency department; VDPV2 = type 2 vaccine-derived poliovirus.

* Wastewater, also referred to as sewage, includes water from household or building use (e.g., toilets, showers, and sinks) that can contain human fecal waste and water from non-household sources (e.g., rain and industrial use).

† More than one positive wastewater sample might have been collected on the same day in Rockland County or Orange County.

Enhanced surveillance defined persons under investigation (PUIs) as those who met clinical criteria and who lived in or traveled to specific counties or neighborhoods in New York or had international travel since May 1, 2022.** As of August 10, three additional persons have been classified as PUIs; available specimens from the PUIs (i.e., stool, cerebrospinal fluid, serum, nasopharyngeal, or oropharyngeal swabs) yielded negative poliovirus test results.

As of August 10, a total of 260 wastewater samples from treatment plants in Rockland and Orange Counties, including samples originally collected for SARS-CoV-2 surveillance, were tested for poliovirus. Among these samples, 21 (8%) yielded positive poliovirus test results using RT-PCR and partial genome sequencing, including 13 from Rockland County and eight from Orange County. Twenty specimens from wastewater samples collected during May, June, and July were genetically linked to virus from the patient's stool samples; one additional sample, from April in Orange County, was sequenced as poliovirus type 2, but the sequence was incomplete, precluding assessment of genetic linkage to the case. After these results, in August 2022, additional clinical and public health surveillance activities, including additional outreach to local providers and syndromic surveillance, were launched to identify the presence of symptomatic nonparalytic infection (characterized by mild symptoms [e.g., low-grade fever and sore throat] or more severe symptoms [e.g., aseptic meningitis])†† and asymptomatic infection in the counties with poliovirus-positive wastewater findings.

According to the New York State Immunization Information System, 3-dose polio vaccination coverage among infants and children aged <24 months living in Rockland County was 67.0% in July 2020 and declined to 60.3% by August 2022, with zip code–specific coverage as low as 37.3%.§§ National coverage for IPV by age 24 months was 92.7% among infants born during 2017–2018 (*5*). The Rockland County Department of Health launched a countywide catch-up

** The full case definition included epidemiologic, clinical, and laboratory criteria. Epidemiologic criteria included being a person who lived in or traveled to specific counties or neighborhoods in the state of New York or traveled internationally since May 1, 2022. Clinical criteria included 1) acute onset of flaccid paralysis of one or more limbs with decreased or absent tendon reflexes in the affected limbs, without other apparent cause, and without sensory or cognitive loss, or 2) meningitis, with either a positive enterovirus test result in any specimen or, if adequate testing for enteroviruses was not available, the absence of another apparent cause. Laboratory criteria included detection of wild or vaccine-derived poliovirus in a clinical specimen. PUIs were persons who met both epidemiologic and clinical criteria; confirmed cases of paralytic polio were defined as meeting both laboratory criteria and clinical criterion 1. Confirmed nonparalytic polio cases were defined as meeting laboratory criteria and clinical criterion 2, or meeting laboratory but not clinical criteria.

†† https://www.cdc.gov/vaccines/pubs/pinkbook/polio.html

§§ https://www.cdc.gov/vaccines/imz-managers/coverage/schoolvaxview/data-reports/index.html

vaccination effort on July 22, 2022. Although there was a brief increase in administration of polio-containing vaccines (IPV alone and combination vaccines including IPV), the number of doses administered at temporary and established clinics was not sufficient to meaningfully increase population IPV coverage levels.

Discussion

The findings in this report represent only the second community transmission of poliovirus identified in the United States since 1979 (*1*). At present, the origin of the VDPV2 detected in the patient's stool and in sewage samples remains unknown. Because the patient had not traveled internationally during the potential exposure period, detection of VDPV2 in the patient's stool samples indicates a chain of transmission within the United States originating with a person who received a type 2-containing oral polio vaccine (OPV) abroad; OPV was removed from the routine immunization schedule in the United States in 2000. Genome sequence comparisons have identified a link to vaccine-related type 2 polioviruses recently detected in wastewater in Israel and the United Kingdom.[¶¶] In general, approximately one in 1,900 poliovirus type 2 infections among unvaccinated persons is expected to result in paralysis (*6*). As of August 10, 2022, no additional poliomyelitis cases have been identified, although the detection of VDPV2 genetically linked to virus from the patient in wastewater specimens from two counties in New York State over the course of ≥2 months indicates community transmission and ongoing risk for paralysis to unvaccinated persons.

VDPVs can emerge when live, attenuated OPV is administered in a community with low vaccination coverage. Replication of OPV in a person who was recently vaccinated can result in viral reversion to neurovirulence, which can cause paralytic poliomyelitis in unvaccinated persons who are exposed to the vaccine-derived virus. Since removal of OPV from the routine U.S. immunization schedule in 2000, IPV has been the only polio vaccine used in the United States. An inactivated vaccine, IPV does not replicate, revert to VDPV, or cause vaccine-associated paralytic polio. Vaccination with 3 doses of IPV is >99% effective in preventing paralysis[***]; however, IPV does not prevent intestinal infection and therefore does not prevent poliovirus transmission.

Before this case, the last detection of poliovirus in a person in the United States was in 2013, in an immunocompromised infant who received OPV in India and then immigrated to the United States (*1*). VDPVs were identified in the United States in 2005 and 2008 in unvaccinated or immunodeficient persons who were in contact with a person who had recently received OPV; the 2008 case did not result in community transmission. Globally, type 2-containing vaccine (OPV2) has not been used in routine immunization since 2016, although monovalent OPV2 is used for specific vaccination campaigns to control circulating VDPV2 outbreaks (*7*).

Low vaccination coverage in the patient's county of residence indicates that the community is at risk for additional cases of paralytic polio. Even a single case of paralytic polio represents a public health emergency in the United States. Vaccination plays a critical role in protecting persons from paralysis if they are exposed to poliovirus. During the COVID-19 pandemic, routine vaccination services were disrupted, leading to a decline in vaccine administration and coverage (*8,9*), including with IPV, and leaving many communities at risk for outbreaks of vaccine-preventable diseases. Until poliovirus eradication is achieved worldwide, importations of both wild polioviruses and VDPVs into the United States are possible. This case highlights the risk for paralytic disease among unvaccinated persons; all persons in the United States should stay up to date on recommended IPV vaccination to prevent paralytic disease.[†††]

Summary

What is already known about this topic?

Sustained poliovirus transmission has been eliminated from the United States for approximately 40 years; vaccines are highly effective in preventing paralysis after exposure.

What is added by this report?

In June 2022, poliovirus was confirmed in an unvaccinated immunocompetent adult resident of New York hospitalized with flaccid lower limb weakness. Vaccine-derived poliovirus type 2 was isolated from the patient and identified from wastewater samples in two neighboring New York counties.

What are the implications for public health practice?

Unvaccinated persons in the United States remain at risk for paralytic poliomyelitis if they are exposed to either wild or vaccine-derived poliovirus; all persons in the United States should stay up to date on recommended poliovirus vaccination.

[¶¶] https://polioeradication.org/news-post/vaccine-derived-poliovirus-type-2-vdpv2-detected-in-environmental-samples-in-london-uk/

[***] https://www.cdc.gov/vaccines/pubs/pinkbook/polio.html

[†††] https://www.cdc.gov/vaccines/vpd/polio/public/index.html

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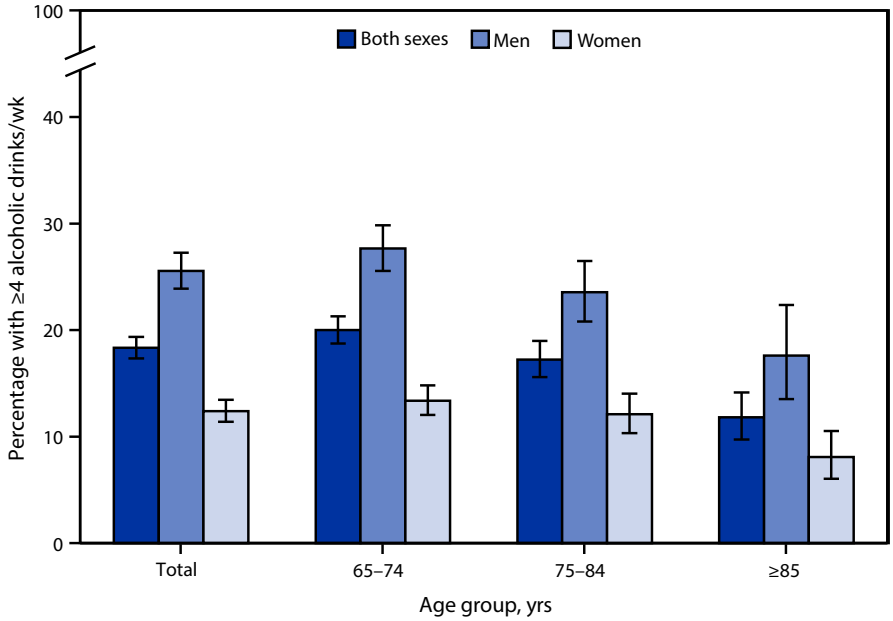
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥65 Years Who Drank Four or More Alcoholic Drinks Per Week,† by Sex and Age — National Health Interview Survey, United States, 2020§



* With 95% CIs indicated by error bars.
† Based on responses to a series of questions about consumption of alcoholic beverages for adults who had at least one drink in their lifetime.
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2020, 18.3% of adults aged ≥65 years reported drinking four or more alcoholic drinks per week. Among adults aged ≥65 years, men were more likely (25.6%) than women (12.4%) to have four or more drinks. Percentages of those having four or more drinks were higher among men than women for the following age groups: 65–74 years (27.7% versus 13.4%), 75–84 years (23.6% versus 12.1%) and ≥85 years (17.6% versus 8.1%). Among both men and women, the percentage of adults aged ≥65 years who drank four or more alcoholic drinks per week decreased as age increased, from 20.0% for those aged 65–74 years to 11.8% for those aged ≥85 years.

Source: National Health Interview Survey, 2020. https://www.cdc.gov/nchs/nhis.htm

Reported by: Robin A. Cohen, PhD, rzc6@cdc.gov, 301-458-4152; Michael E. Martinez, MPH, MHSA.

For more information on this topic, CDC recommends the following link: https://www.cdc.gov/alcohol/index.htm

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