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Continued elimination of measles, rubella and congenital rubella syndrome in the United States, January 2022–June 2024

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1. Commentary

As a member country of the Pan American Health Organization (PAHO), the United States of America (hereafter the United States or U.S.) is committed to the goal of sustaining measles, rubella, and congenital rubella syndrome (CRS) elimination. Measles and rubella were declared eliminated in the United States in 2000 and 2004, respectively. To verify elimination of measles, rubella, and CRS, the Centers for Disease Control and Prevention (CDC) has prepared annual reports for the PAHO Measles and Rubella Regional Monitoring and Re-Verification Commission (RVC); the PAHO RVC first verified rubella and CRS elimination in 2015 and measles elimination in 2016 in the United States [1]. PAHO serves as the Secretariat for the RVC. Prior to submission to PAHO, the annual reports are reviewed by an independent National Sustainability Committee which makes an independent judgment regarding the ongoing elimination of measles, rubella, and CRS in the United States. Sustained elimination is assessed based on five lines of evidence: 1) current and

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CRedit authorship contribution statement

Thomas D. Filardo: Conceptualization, Investigation, Writing – original draft. **Adria D. Mathis:** Conceptualization, Formal analysis, Visualization, Writing – review & editing. **Kelley Raines:** Formal analysis, Writing – review & editing. **Stephen N. Crooke:** Data curation, Writing – review & editing. **R. Suzanne Beard:** Data curation, Writing – review & editing. **Jessica Prince-Guerra:** Data curation, Writing – review & editing. **Paul A. Rota:** Conceptualization, Supervision, Writing – review & editing. **David E. Sugerman:** Conceptualization, Supervision, Writing – review & editing.

Declaration of competing interest

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past epidemiology of measles, rubella, and CRS; 2) the quality of surveillance for these conditions; 3) the molecular epidemiology of measles and rubella, which documents viral transmission chains within the United States; 4) evaluation of population immunity to measles and rubella; and 5) the sustainability of elimination [2].

Here, we summarize the report submitted to the PAHO RVC regarding the sustained elimination of measles, rubella, and CRS during January 2022–June 2024, focusing on the five lines of evidence.

1.1. Epidemiology of measles, rubella, and CRS in the United States, January 2022–June 2024

During January 2022–June 2024, a total of 338 measles cases, 17 rubella cases, and no CRS cases were reported to the CDC by U.S. jurisdictions. All cases were confirmed according to definitions published by the United States Council for State and Territorial Epidemiologists (CSTE); measles cases reported during this timeframe are shown in the Fig. 1. Most reported measles cases (90 %) were in unvaccinated people (247/338 [73 %]) or people with an unknown vaccination status (57/338 [17 %]); a total of 34 (10 %) cases occurred in people with documented measles vaccination. Among people with reported rubella, 8 (47 %) had previously received rubella vaccination, 7 (41 %) had unknown vaccination status, and 2 (12 %) were unvaccinated.

In national surveillance, an outbreak of measles or rubella is defined as ≥ 3 cases that are connected in a single chain of transmission within the United States. During January 2022–June 2024, a total of 21 measles outbreaks were reported. Most measles outbreaks were limited to 3–5 cases ($n = 15$) and only 6 outbreaks resulted in ≥ 6 cases. Two outbreaks during January 2022–June 2024 resulted in > 50 measles cases, which represent 2 of 10 measles outbreaks in the United States since 2000 that have included ≥ 50 measles cases. The first was an 85-case outbreak in Ohio which lasted 63 days; this was the largest outbreak and the outbreak with the longest period of sustained transmission during 2022–2024 [3]. The second was a 57-case outbreak of measles in a large migrant shelter in Chicago, Illinois during the Spring of 2024 [4]. During January 2022–June 2024, no rubella outbreaks were reported.

1.2. Quality of surveillance

Evaluating the quality of surveillance for measles, rubella, and CRS includes assessment of pre-specified surveillance indicators, including the proportion of reported cases with complete clinical and epidemiologic information, the proportion that are laboratory confirmed, and the proportion that are classified according to epidemiologic group (e.g., imported versus domestically acquired).

Measles national surveillance demonstrates high quality in the United States, with timely and complete epidemiologic data available for most cases. Measles surveillance is sufficiently sensitive to detect imported cases (89 imported cases were reported during January 2022–June 2024) and to identify epidemiologic linkages to secondary cases that may occur related to subsequent domestic transmission. In total, 93 % of measles cases were laboratory confirmed, 95 % of which were confirmed by real-time reverse-transcriptase

polymerase chain reaction (rRT-PCR). Nearly all measles cases (99 %) had complete clinical and epidemiologic variables reported. Additional surveillance indicators are further discussed in a *MMWR* article on measles surveillance during January 2020–March 2024 [5].

Rubella national surveillance reveals more concerns about surveillance quality, including data completeness and the specificity of the current case definition. Of the 17 reported cases, only 8 (47 %) had complete reporting of clinical and epidemiologic variables. Although all 17 cases were laboratory confirmed, only 1 was confirmed by rRT-PCR and 3 had reported clinical suspicion of rubella (Table 1). The remaining 13 were confirmed only by IgM among people without reported clinical suspicion for rubella and without documented epidemiologic risk for rubella (i.e., lack of international travel or known rubella exposure). IgM testing for measles and rubella may return a false positive result due to cross-reactivity with other causes of viral exanthems or related to intrinsic lower specificity of indirect IgM tests; therefore, national surveillance may be capturing rubella cases which do not represent true rubella infections, given overall low positive predictive value of IgM testing in elimination settings [6]. To improve domestic rubella surveillance, CSTE has updated the confirmed rubella case definition; this case definition will go into effect in January 2025, and is expected to improve the specificity of the case definition [7].

1.3. Molecular epidemiology

The CDC and the regional Association of Public Health Laboratories (APHL) Vaccine Preventable Disease Reference Centers perform genotyping of all measles and rubella cases with available specimens (i.e., those positive by rRT-PCR). Genotyping can track importations and spread of measles and rubella in the United States and provide additional evidence for elimination of domestic transmission. During January 2022–June 2024, 75 % of measles cases successfully underwent genotyping, and were assigned distinct sequence identifiers (DSIDs) based on analysis of a 450-nucleotide sequence from the viral nucleoprotein gene (N-450) [8]. During the reporting period, 251 sequences were reported to the World Health Organization global measles database (MeaNS); 137 were genotype B3 and 114 were genotype D8. Molecular epidemiologic findings supported ongoing elimination of domestic transmission, given lack of consistent detection of any DSID among domestically acquired cases suggestive of endemic transmission patterns.

1.4. Evaluation of population immunity

Measles elimination in the United States was achieved and maintained through the widespread adoption of a 2-dose measles-mumps-rubella (MMR) vaccination strategy, as recommended by the Advisory Committee on Immunization Practices. Since 2000, the United States has overall maintained high MMR coverage, which promotes prevention of measles and rubella importation, transmission, and outbreaks. However, there are concerning trends in domestic MMR coverage that threaten maintenance of ongoing elimination. Data from the National Immunization Survey-Child showed 90.3 % of children aged 24 months in the 2020–2021 birth cohort had received ≥ 1 dose of MMR; this was a decrease from 90.6 % in the 2018–2019 birth cohort [9]. Data reported to CDC regarding vaccination among kindergartners showed decreases in 2-dose MMR coverage at school entry, with coverage dropping from 95.2 % during the 2019–2020 school year to 92.7 % during the 2023–2024

school year [10]. School entry vaccination coverage data have also shown a consistent rise in the numbers of non-medical exemptions in most U.S. jurisdictions, leaving more school-aged children vulnerable to vaccine preventable illnesses [10]. It is also clear that national data do not provide an optimal understanding of measles and rubella outbreak risk at the community level; data from the New York State Immunization Information System show that there can be substantial regional heterogeneity, such that high immunization coverage at the state or national level obscures outbreak risk at the local or community level [11]. Decreases in routine measles and rubella vaccination at the national, state, and community level leave individuals and communities vulnerable to measles and rubella outbreaks, and threaten the ongoing elimination of these viruses in the United States.

1.5. Sustainability of elimination

The United States has sustained elimination of measles and rubella through achievement of high 2-dose coverage of MMR and a strong commitment by public health agencies to maintain measles and rubella prevention and outbreak response activities. Maintenance of measles, rubella, and CRS elimination depends on ongoing commitments from multiple partners, including the CDC, state and local public health departments, and healthcare providers and healthcare systems which support routine vaccination and outbreak response activities. At CDC, national measles and rubella activities are coordinated through the Viral Vaccine Preventable Disease Branch within the National Center for Immunization and Respiratory Diseases; funding includes epidemiologic and laboratory support for state and local health departments, as well as funding for the APHL reference laboratories.

2. Conclusions

The United States has maintained measles, rubella, and CRS elimination through high 2-dose coverage of MMR and maintaining robust public health surveillance and outbreak response capacity. Maintenance of elimination relies upon: (1) maintaining high 2-dose MMR coverage, including combating misinformation and rebuilding confidence in routine childhood vaccination; and (2) an ongoing commitment to maintain robust public health agencies at the national, state, and local level to sustain strong measles and rubella surveillance and outbreak response capabilities.

All authors attest they meet the ICMJE criteria for authorship.

CDC disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Data availability

Data will be made available on request.

References

- [1]. Durrheim DN, Andrus JK, Tabassum S, Githanga D, Kojouharova M, Talab N. Accelerating global measles and rubella eradication-saving millions of lives, preventing disability, and averting the next pandemic. *Vaccines (Basel)* 2024;12(6).
- [2]. O'Connor P, Masresha B, Pastor D, et al. Global status report for the verification of measles and rubella elimination, 2022. *Vaccines (Basel)* 2024;12(8).
- [3]. Tiller EC, Masters NB, Raines KL, et al. Notes from the field: measles outbreak - Central Ohio, 2022-2023. *MMWR Morb Mortal Wkly Rep* 2023;72(31):847–9. [PubMed: 37535476]
- [4]. Gressick K, Nham A, Filardo TD, et al. Measles outbreak associated with a migrant shelter - Chicago, Illinois, February-may 2024. *MMWR Morb Mortal Wkly Rep* 2024;73(19):424–9. [PubMed: 38753539]
- [5]. Mathis AD, Raines K, Masters NB, et al. Measles - United States, January 1, 2020-march 28, 2024. *MMWR Morb Mortal Wkly Rep* 2024;73(14):295–300. [PubMed: 38602886]
- [6]. Bolotin S, Lim G, Dang V, et al. The utility of measles and rubella IgM serology in an elimination setting, Ontario, Canada, 2009-2014. *PLoS One* 2017;12(8):e0181172. [PubMed: 28850604]
- [7]. Council of State and Territorial Epidemiologists. Update to Public Health Reporting and National Notification of Rubella in the United States. Accessed October 15. Available at, https://cdn.ymaws.com/www.cste.org/resource/resmgr/position_statements_files_2023/24-ID-10_Rubella.pdf; 2024.
- [8]. Bankamp B, Kim G, Hart D, et al. Global update on measles molecular epidemiology. *Vaccines (Basel)* 2024;12(7).
- [9]. Hill HA, Yankey D, Elam-Evans LD, et al. Decline in vaccination coverage by age 24 months and vaccination inequities among children born in 2020 and 2021 - National Immunization Survey-Child, United States, 2021-2023. *MMWR Morb Mortal Wkly Rep* 2024;73(38):844–53. [PubMed: 39325676]
- [10]. Centers for Disease Control and Prevention. SchoolVaxView: Vaccination Coverage and Exemptions among Kindergartners. Accessed October 15. Available at, <https://www.cdc.gov/schoolvaxview/data/index.html>; 2024.
- [11]. New York State Department of Health. About New York State MMR Vaccination Rates. Accessed October 15. Available at, <https://www.health.ny.gov/diseases/communicable/measles/vaccine/>; 2024.

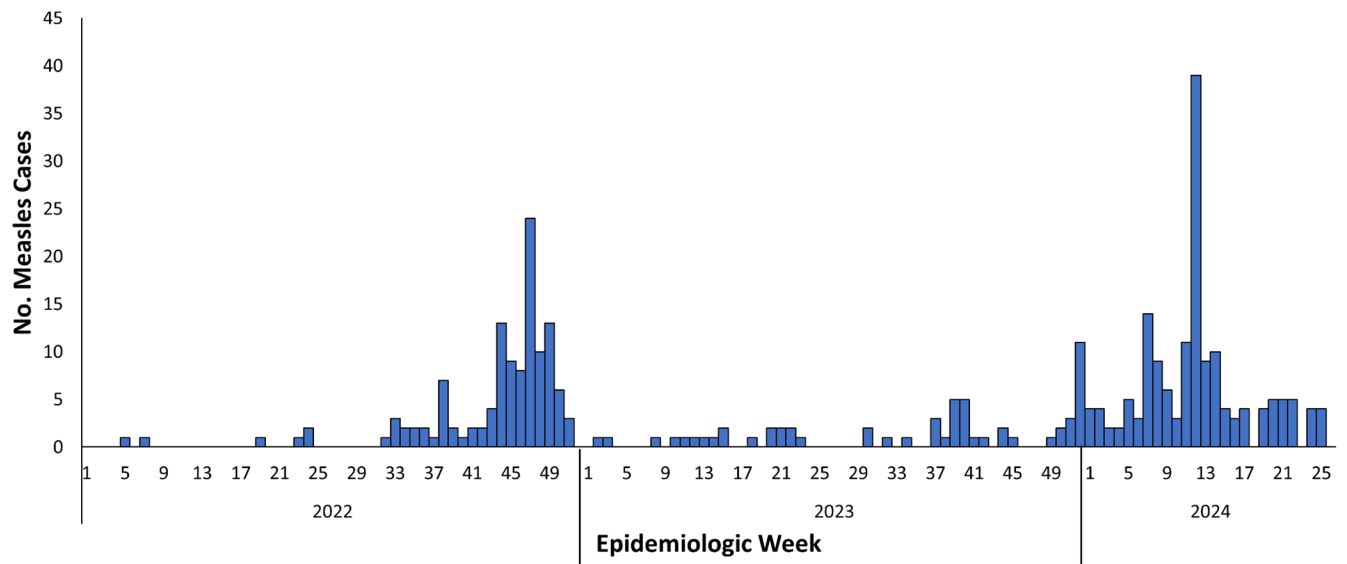


Fig. 1.
Confirmed measles cases in the United States during January 2022-June 2024 are shown by epidemiologic week.

Table 1
Characteristics of Confirmed Rubella Cases in the United States, January 2022–June 2024.

	Total no. (%) (N = 17)	Laboratory confirmation method	
		IgM positive no. (%) (n = 16)	PCR positive no. (%) (n = 1)
Vaccination status			
Vaccinated with 1 or more MMR doses	8 (47)	8 (50)	-
Unknown vaccination status	7 (41)	7 (44)	-
Unvaccinated	2 (12)	1 (6)	1 (100)
Clinical presentation			
Asymptomatic	6 (35)	6 (38)	-
Unknown symptoms	5 (29)	5 (31)	-
Symptomatic (rash, fever, or both)	6 (35)	5 (31)	1 (100)
Reason for testing			
Unknown reason for testing	7 (41)	7 (44)	-
Employment, school, prenatal, or other titer testing	6 (35)	6 (38)	-
Clinical suspicion of rubella	4 (24)	3 (19)	1 (100)

Abbreviations: IgM, immunoglobulin M; MMR, measles, mumps, and rubella; PCR, polymerase chain reaction.