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Kindergarten measles vaccination coverage and the 2025–2026 measles resurgence in the United States: a state-level analysis of public surveillance data

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Abstract

Background

In November 2026, the United States lost the measles elimination status it had held since 2000. This study examined whether states with lower kindergarten measles, mumps and rubella (MMR) vaccination coverage had more measles during the 2025–2026 resurgence, and how coverage changed before, during and after the COVID-19 pandemic.

Methods

In this ecological study, kindergarten MMR coverage and non-medical exemptions (CDC SchoolVaxView, 2009–10 to 2025–26) were combined with state and county measles case counts, census population estimates and national data for Canada and Mexico. Associations were assessed with Spearman correlation and negative binomial regression.

Results

National coverage fell from 95.2% in 2019–20 to 92.4% in 2025–26, and non-medical exemptions rose from 2.2% to 4.0%. Coverage dropped in most states during the pandemic and did not recover afterward. Measles cases averaged 410 per year before the pandemic, 61 during it and 2,011 after it. Each 1-percentage-point decrease in coverage was associated with 15% more cases (incidence rate ratio 1.15, 95% CI 1.01–1.31), although the association was sensitive to the exclusion of single states and coverage did not predict large outbreaks. Of 8,025 cases with county data, 96.8% were locally acquired, and half occurred in 18 counties or health regions.

Conclusions

Kindergarten MMR coverage fell during the pandemic and has not recovered. States with lower coverage had more measles, and cases were concentrated in a few counties. Restoring coverage above 95% is needed to re-establish elimination.

Introduction

Measles is one of the most contagious infections known and remains an important cause of death among children. The World Health Organization (WHO) estimated that measles caused 95,000 deaths worldwide in 2024, mostly in children under five years of age, out of about 11 million infections [1]. The case fatality ratio varies widely between settings and is highest where malnutrition and poor access to care are common [2]. In high-income countries deaths are rarer, but children still develop pneumonia and encephalitis that require hospital care, and subacute sclerosing panencephalitis, a fatal complication

that appears years after infection, develops in about 1 in 1,367 children infected before the age of five [3]. The harm also extends beyond the illness itself. Measles wipes out a large part of the body's existing antibodies, and this “immune amnesia” has been linked to higher mortality from other infections for two to three years after recovery [4,5].

Two doses of MMR vaccine are about 96% effective in preventing measles [6], but because the virus spreads so easily, around 95% of the population needs to be immune to stop it from circulating [7]. Since the United States eliminated measles in 2000, most cases in the country have occurred in unvaccinated people, many of whom were unvaccinated by choice [8]. Earlier studies found that children with non-medical exemptions were many times more likely to catch measles than vaccinated children, and that high exemption rates also raised the risk for vaccinated people living in the same communities [9,10].

Kindergarten MMR coverage in the United States has declined since 2019–20, while non-medical exemptions have reached record levels [11]. In 2025, the country experienced its largest measles outbreaks in more than three decades, starting in West Texas, and the number of cases in 2026 was more than double that of 2025 [12]. In November 2026, the Pan American Health Organization (PAHO) concluded that measles had been spreading continuously for more than 12 months, and the United States lost its elimination status [13]. Canada had already lost its status, and Mexico reported more than 20,000 confirmed cases between 2025 and 2026 [14–16].

A modeling study published in 2025 predicted that measles could once again become endemic in the United States if state vaccination rates kept falling [17], and a 2026 analysis showed that states with more non-medical exemptions had lower kindergarten MMR coverage [18]. Neither study, however, looked at actual measles cases. To our knowledge, it has not yet been tested whether the states with lower coverage were the ones that saw more measles during the 2025–2026 resurgence. The aim of this study was therefore to describe how kindergarten MMR coverage and exemptions changed by state before, during and after the COVID-19 pandemic, to assess whether coverage and exemptions were associated with measles incidence in 2025–2026, and to describe how cases were distributed by county and how the United States compared with Canada and Mexico.

Methods

Study design and data sources

This ecological study used aggregated data that are freely available to the public. Kindergarten vaccination coverage and exemption data for the 2009–10 to 2025–26 school years were downloaded from the CDC SchoolVaxView dataset [11]. The main exposure was the percentage of kindergartners who had received two doses of MMR vaccine in the 2024–25 school year. This coverage was assessed in fall 2024, before the resurgence began in January 2025. Secondary exposures were the percentage of kindergartners with a non-medical exemption in 2024–25 and the change in MMR coverage between 2018–19 and 2024–25.

Confirmed measles cases among US residents by state for 2024, 2025 and 2026 were downloaded from the CDC measles cases and outbreaks page in November 2026 [12]. Cases reported separately for New York City were added to New York State, so counts of jurisdictions refer to the 50 states and the District of Columbia. State population estimates for July 1, 2025 were taken from the US Census Bureau (NST-EST2025-POP) [19]. County-level cases, including whether each case was imported or locally acquired, were obtained from the Johns Hopkins University US measles tracker [20]. National data for Canada and Mexico came from the Public Health Agency of Canada weekly monitoring reports, the daily outbreak report of the Mexican Secretaría de Salud and the PAHO measles bulletins [14–16,21], and the Canadian population was taken from Statistics Canada [23].

Data preparation

States that do not allow non-medical exemptions were given an exemption rate of 0% when no value was reported, which applied to California, Maine and New York. Montana and West Virginia did not report coverage for 2024–25 and were excluded from the main analysis, leaving 49 jurisdictions, including the District of Columbia. The outcome was the number of measles cases reported from January 2025 to November 2026, and incidence was expressed per 100,000 population.

Statistical analysis

To compare time periods, school years and calendar years were grouped into a pre-pandemic period (2015–16 to 2019–20 school years; 2015–2019 cases), a pandemic period (2020–21 to 2022–23; 2020–2022) and a post-pandemic period (2023–24 to 2025–26; 2023–2026). State coverage and exemptions at the end of each period (2019–20, 2022–23 and 2025–26) were compared with the Friedman test and pairwise Wilcoxon signed-rank tests, and the changes in coverage during and after the pandemic were correlated with measles incidence. Changes in state coverage and exemptions between 2018–19 and 2025–26 were also compared with the Wilcoxon signed-rank test.

Associations between coverage, exemptions and incidence were assessed with Spearman rank correlation. States were then grouped by their 2024–25 coverage (< 90%, 90–94.9% and ≥ 95%), and incidence was compared across the groups with the Kruskal–Wallis test. Negative binomial regression, with the logarithm of state population as an offset, was used to estimate incidence rate ratios (IRR) for each 1-percentage-point decrease in coverage, for each 1-percentage-point increase in non-medical exemptions, and for states below 95% coverage compared with states at or above 95%. Confidence intervals were calculated from the observed information matrix.

Because a few large outbreaks accounted for many of the cases, the coverage model was repeated after excluding Texas and South Carolina, after also excluding Pennsylvania and Utah, after excluding each state in turn (leave-one-out) and after adding West Virginia with its 2025–26 coverage. The exemption model was repeated without the three states with imputed values. As an alternative outcome, logistic regression was used to examine whether coverage was associated with a state reporting 50 or more

cases. County data were used to describe how concentrated the cases were and what proportion were imported. The comparison with Canada and Mexico was kept descriptive, because the three countries do not measure vaccination coverage in the same way.

The analyses were exploratory, and no adjustment was made for multiple comparisons. A two-sided p value below 0.05 was considered significant. Calculations were performed in Python 3.13 with pandas 3.0, NumPy 2.5 and SciPy 1.18, and the data and code are provided in Supplementary Information (Online Resource 1). Claude (Anthropic), a large language model, was used to help write the analysis code; the author checked the code and reproduced all results.

Results

Trends in kindergarten MMR coverage and exemptions

From 2009–10 to 2019–20, national two-dose MMR coverage among kindergartners stayed between 94.0% and 95.2%. It then declined to 92.4% in 2025–26 and has not been above 94% since 2020–21 (Fig. 1). Over the same period, non-medical exemptions increased from 2.2% in 2019–20 to 4.0% in 2025–26. Between 2018–19 and 2025–26, coverage fell in 39 of 47 states with data for both years (median 94.2% vs 91.5%; $p < 0.001$), and non-medical exemptions increased in 40 of 44 states (median 2.5% vs 5.0%; $p < 0.001$). The number of states with coverage below 90% rose from 2 to 18. The largest decreases were seen in Idaho (89.5% to 75.2%), Wisconsin (92.6% to 85.1%), South Dakota (96.2% to 89.3%) and Minnesota (92.6% to 85.7%). Notably, states with more non-medical exemptions in 2025–26 had lower coverage ($\rho = -0.76$, $p < 0.001$; $n = 45$), with each 1-percentage-point increase in exemptions corresponding to a 1.04-percentage-point decrease in coverage.

Comparison of pre-pandemic, pandemic and post-pandemic periods

The three periods are compared in Table 1. Before the pandemic, national coverage averaged 94.9%, and measles cases averaged 410 per year, most of them during the 2019 outbreaks. During the pandemic, coverage fell to an average of 93.3%, yet only 183 cases were reported over three years. After the pandemic, coverage fell further to an average of 92.5%, non-medical exemptions rose to an average of 3.5%, and 8,045 cases were reported between 2023 and November 2026, an average of 2,011 per year (Fig. 1).

In the 46 states with data for all three time points, median coverage fell from 94.6% in 2019–20 to 92.4% in 2022–23 and 91.3% in 2025–26 (Friedman test, $p < 0.001$). Coverage fell in 41 of 46 states during the pandemic ($p < 0.001$). After the pandemic, it continued to fall in 32 states and increased in only 13 ($p = 0.001$). As a result, the number of states below 95% rose from 26 to 34 and then 36, and the number below 90% from 3 to 11 and then 17. Median non-medical exemptions rose from 2.5% to 3.2% and then 4.9% ($p < 0.001$). States with larger decreases in coverage after the pandemic (2022–23 to 2024–25) had higher measles incidence in 2025–2026 ($\rho = -0.43$, $p = 0.003$; $n = 46$, states with coverage data for

2019–20, 2022–23 and 2024–25), and decreases during the pandemic (2019–20 to 2022–23) were also associated with incidence (ρ = −0.30, p = 0.043; same states).

Table 1
Kindergarten MMR coverage, non-medical exemptions and measles cases before, during and after the COVID-19 pandemic

School years (coverage)	**Pre-pandemic**	**Pandemic**	**Post-pandemic**
	2015–16 to 2019–20	**2020–21 to 2022–23**	**2023–24 to 2025–26**
Calendar years (cases)	2015–2019	2020–2022	2023–2026*
National MMR coverage, mean (range), %	94.9 (94.7–95.2)	93.3 (93.0–93.9)	92.5 (92.4–92.7)
National non-medical exemptions, mean, %	2.0	2.3	3.5
Median state MMR coverage at end of period, %†	94.6	92.4	91.3
States below 95% at end of period, n†	26	34	36
States below 90% at end of period, n†	3	11	17
Median state non-medical exemptions at end of period, %†	2.5	3.2	4.9
Measles cases, total	2,052	183	8,045
Measles cases per year, mean	410	61	2,011

2026 data to November. †46 states with coverage data for all three years (non-medical exemptions: 46 states with exemption data). Sources: CDC SchoolVaxView and CDC measles cases and outbreaks

Measles cases by state

From January 2025 to November 2026, 7,657 measles cases were reported among US residents (2,263 in 2025 and 5,394 in 2026), compared with 269 in 2024. The highest weekly count was in the week beginning January 11, 2026, with 296 cases. Cases were reported in 44 jurisdictions in 2025 and 46 in 2026, and five states (Pennsylvania, South Carolina, Texas, Utah and Wisconsin) accounted for 63% of all cases. Incidence was highest in Utah (20.5 per 100,000), followed by South Carolina (18.0), Pennsylvania (11.8), North Dakota (9.3) and Wisconsin (9.1).

Association between coverage and measles incidence

States with lower kindergarten MMR coverage in 2024–25 had higher measles incidence in 2025–2026 (ρ = −0.37, p = 0.009), as did states with more non-medical exemptions (ρ = 0.37, p = 0.009) and states with a larger decline in coverage since 2018–19 (ρ = −0.35, p = 0.014; n = 47) (Fig. 2). Incidence differed between the coverage groups (p = 0.042; Table 2). In states below 95% coverage, the pooled incidence was 2.9 per 100,000, compared with 0.64 per 100,000 in states at or above 95%, a crude ratio of 4.5; in the negative binomial model, the IRR was 5.36 (95% CI 2.11–13.62). Incidence did not rise steadily across the groups, however. It was slightly higher in states with 90–94.9% coverage than in states below 90%, because three of the four largest outbreaks occurred in Pennsylvania, South Carolina and Texas, where coverage was between 91% and 94%.

Table 2
Measles incidence, January 2025 to November 2026, by state kindergarten MMR coverage in 2024–25

MMR coverage, 2024–25	States, n	Cases, n	Pooled incidence per 100,000	Median state incidence per 100,000	States with ≥ 50 cases, n
< 90%	15	2,621	2.76	1.01	9
90–94.9%	24	4,374	2.96	0.82	10
≥ 95%	10	616	0.64	0.19	4
Total	49	7,611	2.25	0.78	23

Kruskal–Wallis test across the three groups, p = 0.042. Montana and West Virginia were excluded because 2024–25 coverage was not reported.

In the negative binomial regression, each 1-percentage-point decrease in MMR coverage was associated with 15% more cases (IRR 1.15, 95% CI 1.01–1.31; p = 0.032), and each 1-percentage-point increase in non-medical exemptions with 25% more cases (IRR 1.25, 95% CI 1.07–1.47; p = 0.006) (Table 3). The association with coverage remained after excluding Texas and South Carolina, after also excluding Pennsylvania and Utah, and after adding West Virginia (IRR 1.17, 95% CI 1.03–1.33). In the leave-one-out analysis, the IRR ranged from 1.11 to 1.19, but the association was no longer significant when Utah (p = 0.105), Wisconsin (p = 0.070), Connecticut (p = 0.056) or Maine (p = 0.050) was excluded. It remained significant when all four of the largest outbreak states were removed together, because Pennsylvania, South Carolina and Texas had high case counts despite relatively high coverage (91–93%), which weakened the association rather than strengthening it. The association with exemptions was similar after excluding the three states with imputed values (IRR 1.23, 95% CI 1.04–1.47) but was no longer significant after excluding the four largest outbreak states. Coverage was not associated with whether a state reported 50 or more cases (odds ratio 1.06 per 1-percentage-point decrease, 95% CI 0.92–1.23).

Table 3
Negative binomial regression of state measles cases, January 2025 to November 2026

Exposure and sample	States, n	IRR (95% CI)	p value
MMR coverage, per 1-point decrease: all states	49	1.15 (1.01–1.31)	0.032
Excluding Texas and South Carolina	47	1.15 (1.02–1.29)	0.018
Excluding Texas, South Carolina, Pennsylvania and Utah	45	1.12 (1.02–1.23)	0.021
Including West Virginia (2025–26 coverage)	50	1.17 (1.03–1.33)	0.017
Leave-one-out, range	48	1.11–1.19	0.011–0.105
Coverage below 95% vs at or above 95%	49	5.36 (2.11–13.62)	< 0.001
Non-medical exemptions, per 1-point increase: all states	49	1.25 (1.07–1.47)	0.006
Excluding states with imputed exemption values	46	1.23 (1.04–1.47)	0.019
Excluding Texas, South Carolina, Pennsylvania and Utah	45	1.14 (0.97–1.32)	0.103

IRR, incidence rate ratio. All models use the logarithm of the 2025 state population as an offset.

Some states with low coverage reported very few cases. Idaho, for example, had the lowest coverage in 2024–25 (78.5%) but an incidence of only 0.9 per 100,000, and Alaska (81.2%) reported 5 cases.

Distribution of cases by county

The Johns Hopkins dataset included 8,025 cases, about 4% more than the CDC total. Of these, 254 (3.2%) were imported and 7,771 (96.8%) were acquired locally. Although cases were reported in 516 counties or health regions, just 18 of them accounted for half of all cases, and the 33 areas with at least 50 cases accounted for 62.5% (Table 4). Imported cases made up a quarter of cases in areas with one or two cases, but only 13 of the 5,015 cases in areas with 50 or more. In 2025, cases were even more concentrated: five areas, led by Gaines County, Texas (414 cases), accounted for half of all cases. In 2026, cases were reported in 367 areas, compared with 233 in 2025, and 16 areas accounted for half, led by Spartanburg County, South Carolina (610) and Lancaster County, Pennsylvania (528).

Table 4
Distribution of measles cases by county or health region, 2025–2026

Cases per area	Areas, n	Cases, n (%)	Imported cases, n
1–2	213	277 (3.5)	69
3–9	180	923 (11.5)	109
10–49	90	1,810 (22.6)	63
≥ 50	33	5,015 (62.5)	13
Total	516	8,025 (100)	254

Source: Johns Hopkins University US measles tracker. Totals differ from CDC counts (by about 6% in 2026) because of differences in reporting dates and case definitions.

Comparison with Canada and Mexico

Of the three countries, the United States had the lowest incidence (Fig. 3). Canada reported 5,462 confirmed and probable cases in 2025 (13.1 per 100,000) and 1,127 in 2026; its multijurisdictional outbreak, which began in October 2024 and included 6,417 cases, was declared over in October 2026 [14]. Mexico reported 6,614 confirmed cases in 2025 (5.0 per 100,000) and 14,113 in 2026 (10.5 per 100,000), with cases in all 32 states and 50 deaths, most of them in Chihuahua (21) and Zacatecas (8) [15]. In the United States, incidence rose from 0.7 per 100,000 in 2025 to 1.6 in 2026.

Discussion

In this study, kindergarten MMR coverage in the United States fell during the COVID-19 pandemic and did not recover afterward, and the states with lower coverage and more non-medical exemptions had more measles during the 2025–2026 resurgence. States below the 95% threshold had about five times the incidence of states above it, although this estimate was imprecise. Almost all cases were acquired locally, and most of them were concentrated in a small number of counties.

Looking at the three periods side by side may help to explain why the resurgence happened when it did. During the pandemic, coverage fell in almost every state, yet very few measles cases were reported, possibly because international travel and social contact were reduced, and because less testing and reporting took place. The children who missed their vaccines during these years were therefore not exposed to the virus, and the number of susceptible children grew. In most states, coverage did not recover once schools reopened and travel returned to normal, and exemptions continued to rise. By 2025, a large number of under-vaccinated children had accumulated, and the resurgence began. Declines in coverage after the pandemic were at least as strongly associated with incidence as declines during it, which suggests that the lack of catch-up vaccination, and not only the disruption of the pandemic itself, contributed to the resurgence.

These findings build on the analysis by Hijano, which used SchoolVaxView data from 2016–17 to 2024–25 and found that each 1-percentage-point increase in exemptions was associated with a decrease of about 1.1 percentage points in state MMR coverage [18]. Our data for 2025–26 gave a very similar estimate of 1.04 percentage points. Hijano noted that outbreaks appeared to cluster in states with rising exemptions, but did not analyze measles cases. Several things have changed since that study was published. First, data for the 2025–26 school year show that the decline has not stopped: national coverage fell further to 92.4%, non-medical exemptions rose from 3.4% to 4.0%, and the number of states below 90% coverage increased to 18. Second, the outbreak grew considerably. When that analysis was written, about 2,200 cases had been reported for 2025 and about 1,200 for early 2026; by November 2026, the 2026 total had reached more than 5,300, more than twice the 2025 total, and cases had spread from 233 to 367 counties or health regions. Third, the United States lost its elimination status in November 2026, as reported in news coverage of the PAHO determination [13]. Finally, with case data covering almost two full years, this study was able to extend Hijano's work by examining measles cases directly. The association between lower coverage and higher incidence held after the largest outbreaks were excluded, although it was sensitive to the exclusion of single states.

These results are in line with earlier individual-level studies, which found that children with exemptions were far more likely to catch measles and that exemptions raised the risk for the surrounding community [9,10], as well as with a review showing that most US measles cases since elimination have occurred in unvaccinated people [8]. They are also consistent with the 2025 modeling study, which projected that measles could become endemic again over the coming decades if state coverage continued to fall [17]. The loss of elimination status within two years shows how quickly sustained transmission can return once coverage declines.

The association at the state level was moderate, and some states with low coverage had few cases. This is to be expected with measles. An outbreak needs both a susceptible population and an introduction of the virus, so a state with low coverage may escape an outbreak for some time simply because no case has arrived. Idaho, which had the lowest coverage in the country, is a clear example and should be regarded as a state at high risk rather than one that is protected. State averages also hide large differences within states. Half of all cases occurred in 18 counties or health regions, while most areas reported only a few cases. A state may therefore have an average coverage close to 95% and still contain communities where coverage is much lower. This may also explain why coverage was associated with the number of cases but not with whether a state had a large outbreak.

Of particular concern is the very small proportion of imported cases (3.2%). Between 2000 and 2024, the United States reported between 13 and 1,274 cases per year [12], and outbreaks were usually limited. In 2025–2026, imported cases were seen mainly in small clusters, while the large outbreaks were sustained by local transmission. This is what the loss of elimination looks like in practice.

The United States was not alone in this. Canada's outbreak, which began in New Brunswick in 2024, led to a much higher incidence in 2025 than in the United States, but it was declared over in October 2026

[14]. A recent review described how measles outbreaks in Canada after elimination were concentrated in under-vaccinated communities [22]. Mexico had the largest outbreak of the three countries, with more than 20,000 cases and 50 deaths [15], and PAHO has reported that the same D8 lineage has been circulating in at least ten countries in the region [16]. Because people travel frequently between these countries, measles control in any one of them depends on coverage in all of them.

Limitations

This study has several limitations. First, it is an ecological study, so associations at the state level cannot show that low coverage caused any particular outbreak, and they cannot be applied to individuals. The models were not adjusted for other factors, such as population density, travel or the presence of close-knit communities, and states are not fully independent of one another, since some outbreaks crossed state borders. A small number of large outbreaks accounted for most cases, and the association was no longer significant when Utah, Wisconsin, Connecticut or Maine was excluded. The period comparison is descriptive, and because the COVID-19 pandemic also affected surveillance, case counts in 2020–2022 may be underestimated. Second, kindergarten coverage reflects only one age group and does not describe immunity among older children and adults, who also contributed to the outbreaks. Third, SchoolVaxView methods vary between states, some states survey only part of their schools, and coverage was not reported for some states in some years. Fourth, the 2026 data are provisional and cover the year only up to November. Fifth, state-level data cannot capture differences between communities within a state, and county coverage data are not available in a consistent form for all states. Sixth, case counts from CDC and Johns Hopkins University differ by up to 6% because of differences in reporting dates and case definitions. Finally, the comparison with Canada and Mexico is descriptive.

Conclusions

Kindergarten MMR coverage in the United States fell during the COVID-19 pandemic and has not recovered since. It is now below the 95% threshold in most states, and the states with lower coverage experienced more measles during the 2025–2026 resurgence. Most cases were acquired locally and were concentrated in a small number of counties. Restoring coverage to at least 95%, identifying and working with the communities where coverage is low, and strengthening cooperation with Canada and Mexico will all be needed to re-establish measles elimination in the United States and across the Americas.

Declarations

Author contributions. S.J. designed the study, collected and analyzed the data, prepared the figures and wrote the manuscript.

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Data availability. All data used in this study are publicly available from the sources cited [11,12,14–16,19–21]. The compiled data are provided in Online Resource 1.

Code availability. The Python analysis code is provided in Online Resource 1.

Declarations

Ethics approval and consent to participate. Not applicable. The study used only aggregated, publicly available data with no individual-level information.

Consent for publication. Not applicable.

Competing interests. The author declares no competing interests.

Use of generative AI. Claude (Anthropic) was used to assist with writing the analysis code and with language editing. The author reviewed and verified all analyses and text and takes full responsibility for the content of the manuscript.

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Figures

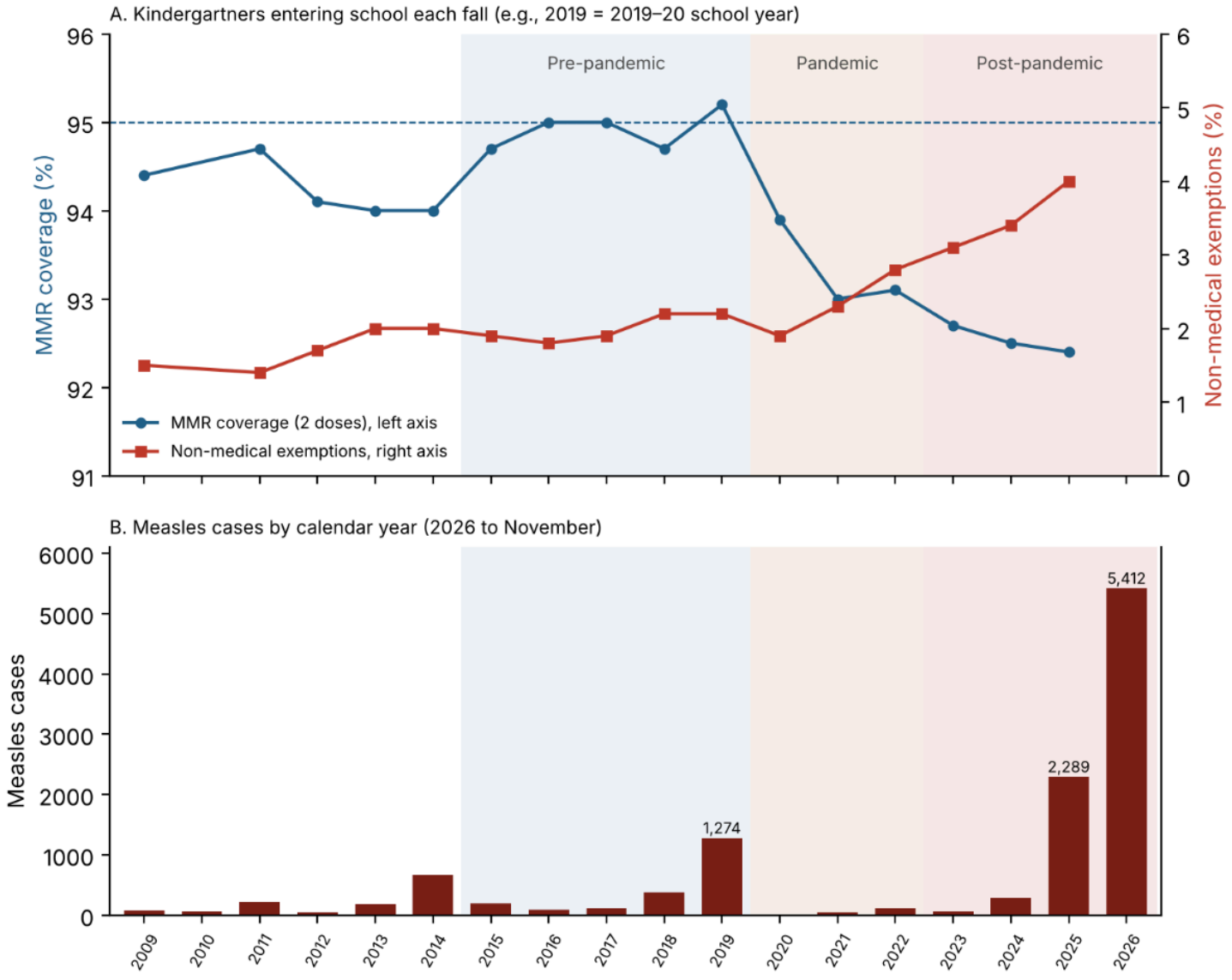


Figure 1

(A) Two-dose MMR vaccination coverage and non-medical exemptions among kindergartners by school year (shown by the fall in which the school year began; no national estimate was published for 2010–11). (B) Measles cases by calendar year, 2009–2026 (2026 to November). Shading marks the pre-

pandemic, pandemic and post-pandemic periods. The dashed line marks 95% coverage (left axis). Sources: CDC SchoolVaxView and CDC measles cases and outbreaks.

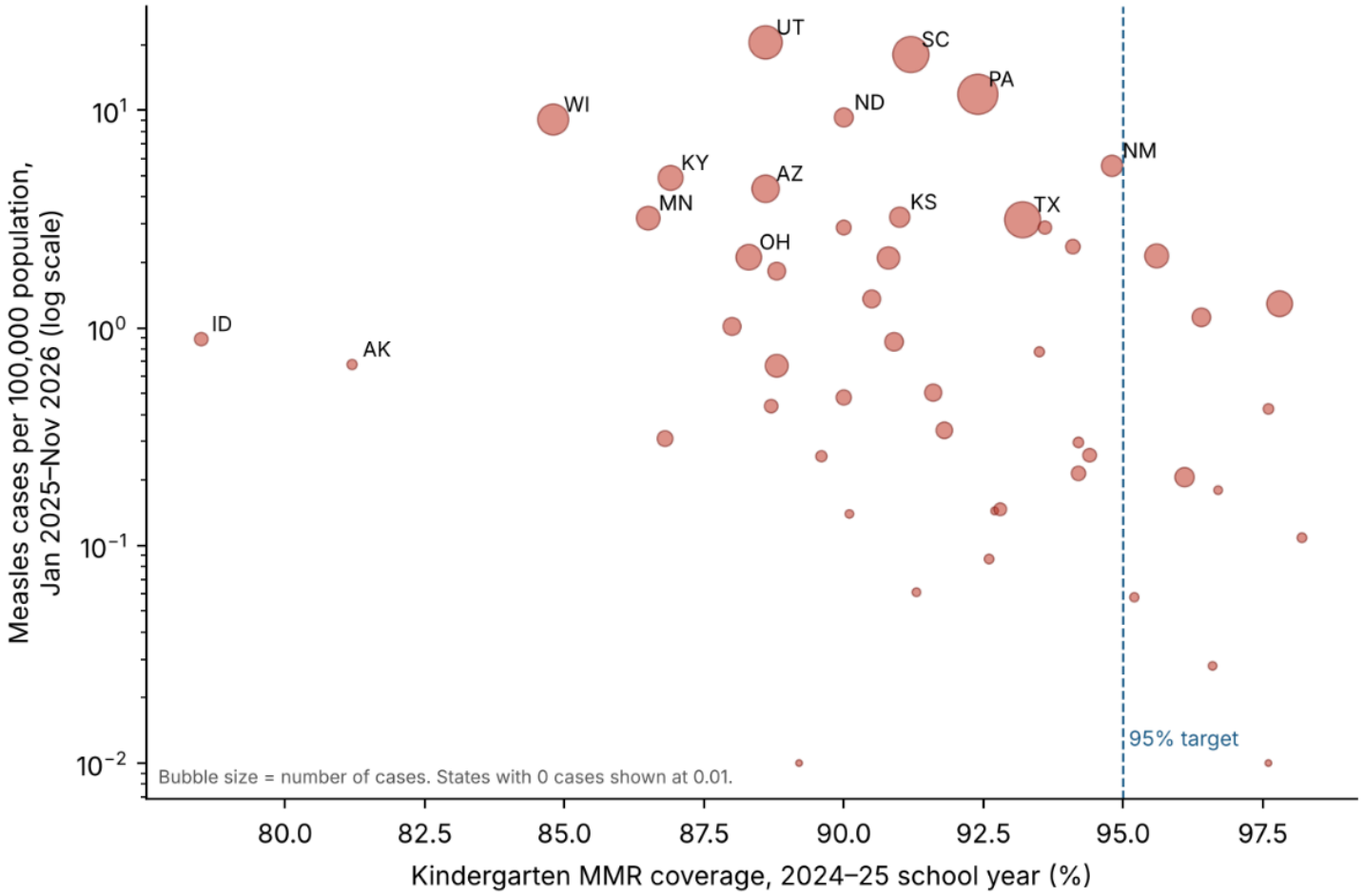


Figure 2

Kindergarten MMR coverage in 2024–25 and measles cases per 100,000 population from January 2025 to November 2026, by state. Bubble size reflects the number of cases. The dashed line marks 95% coverage.

Some states with low coverage reported very few cases. Idaho, for example, had the lowest coverage in 2024–25 (78.5%) but an incidence of only 0.9 per 100,000, and Alaska (81.2%) reported 5 cases.

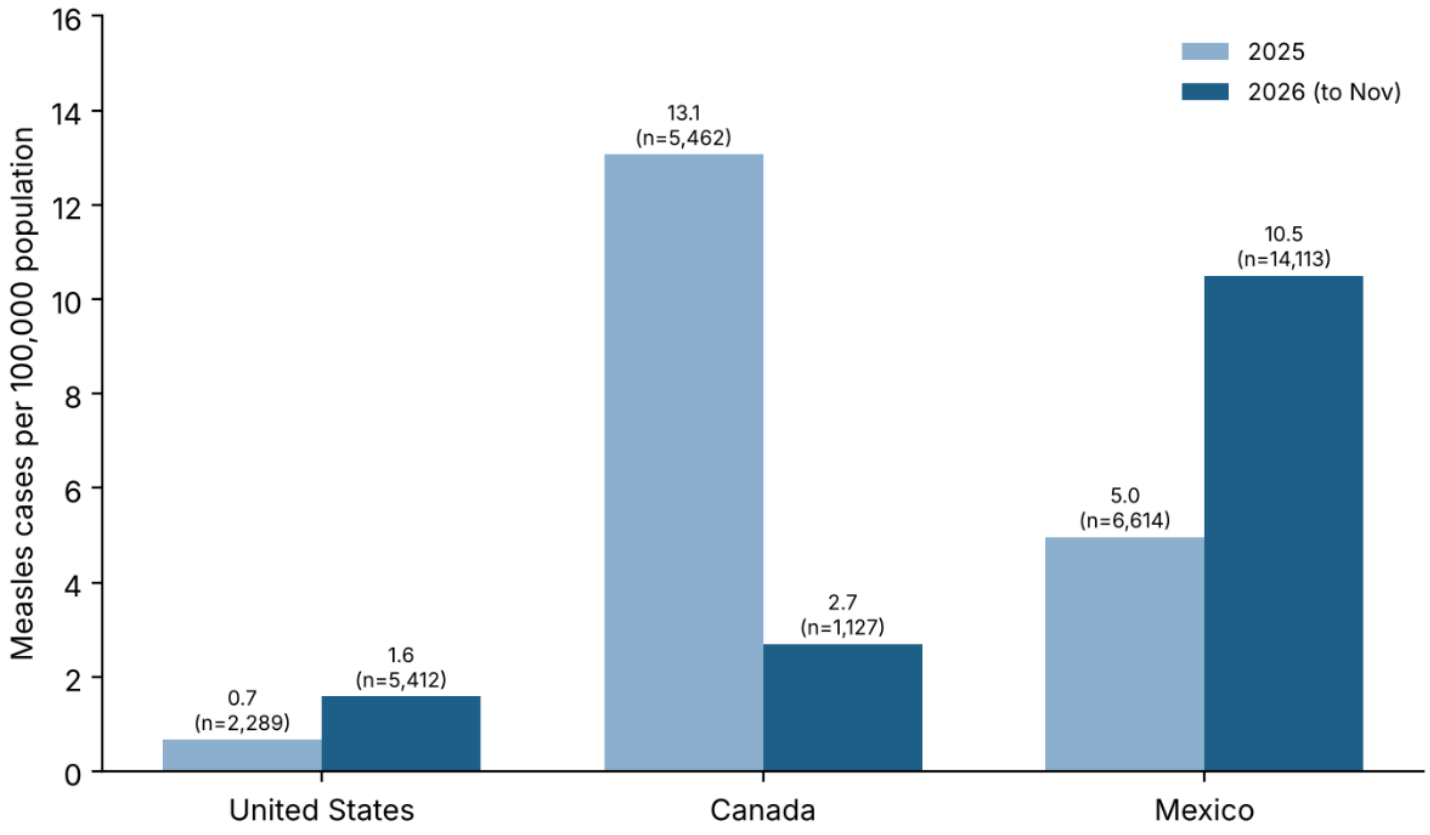


Figure 3

Measles cases per 100,000 population in the United States, Canada and Mexico, 2025 and 2026 (2026 data to November). Sources: CDC, Public Health Agency of Canada, Secretaría de Salud de México. Canadian counts include probable cases. Canadian rates use the Statistics Canada population estimate of 41,798,407 [23].

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- supp1.zip
- Supp2.xlsx