

# CHANGES IN MATERNAL AND INFANT HEALTH OUTCOMES IN NEVADA BEFORE, DURING, AND AFTER THE COVID-19 PANDEMIC (2017-2023)

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## PURPOSE

To evaluate changes in preterm birth, infant mortality, stillbirth, and pregnancy-associated mortality in Nevada before, during, and after the COVID-19 pandemic to inform maternal and child health surveillance, policy, and program planning.

## EXECUTIVE SUMMARY

The COVID-19 pandemic disrupted healthcare delivery, social services, and daily life across Nevada, creating unprecedented challenges for pregnant people, infants, healthcare providers, and public health systems. Throughout the pandemic, concerns emerged regarding the potential effects of these disruptions on maternal and infant health. Delays in prenatal care, changes in healthcare utilization, increased psychosocial stress, and the direct and indirect impacts of COVID-19 infection all had the potential to influence pregnancy outcomes and maternal and infant mortality.

This report examines statewide trends for Nevada in three main important maternal and infant health outcomes before, during, and after the COVID-19 pandemic: preterm birth, infant mortality, and pregnancy-associated mortality. Stillbirth rates were included as a supplemental descriptive analysis. Annual trends from 2017 to 2023 were evaluated to provide historical context, while births and mortality records were grouped into three comparison periods: pre-pandemic (2017-2019), pandemic (2020-2021), and post-pandemic (2022-2023). This approach is consistent with prior public health analyses that examine overall program impacts across phases of the COVID-19 emergency rather than at specific inflection points.<sup>1, 2, 3</sup>

Several findings emerged from this analysis. Preterm birth prevalence increased modestly during the pandemic and remained slightly elevated through the post-pandemic period. After adjustment for maternal age, race and ethnicity, principal source of payment, infant sex, and birth month, births occurring during the pandemic, as defined above, experienced a 4% higher prevalence of preterm birth compared with the pre-pandemic period. Infant mortality also increased during the pandemic, with births occurring during 2020–2021 experiencing a 21% higher prevalence of infant mortality than births occurring before the pandemic. However, infant mortality was no longer significantly different when comparing pre-pandemic levels and the post-pandemic period.

Pregnancy-associated mortality demonstrated a similar pattern. Statewide pregnancy-associated mortality rates increased during the pandemic period, with aggregate analyses indicating a 62% higher rate during 2020–2021 compared with the pre-pandemic period. Rates remained elevated during 2022–2023 but were no longer statistically different from pre-pandemic levels. Individual-level analyses among pregnancies ending in live birth produced similar findings, providing additional evidence maternal mortality burden increased during the pandemic before returning toward baseline levels.

Although each outcome followed a unique trajectory, the overall findings indicate maternal and infant health in Nevada changed during the COVID-19 pandemic. The persistence of elevated preterm birth prevalence through 2023, combined with temporary increases in infant mortality and pregnancy-associated mortality, underscores the importance of maintaining robust maternal and child health surveillance systems capable of detecting

emerging trends during periods of pandemic. These findings provide a statewide assessment of maternal and infant health following the COVID-19 pandemic. Continued surveillance, timely linkage of maternal and infant health datasets, and ongoing investment in maternal and child health programs are essential for understanding long-term trends, identifying disproportionately affected populations, and supporting evidence-based public health decision-making in Nevada.

## BACKGROUND

The COVID-19 pandemic represented one of the most significant public health emergencies in recent history, affecting nearly every aspect of healthcare delivery and population health. Pregnant people and infants were among the populations potentially most affected by these disruptions because pregnancy requires continuous access to healthcare services before, during, and after delivery.<sup>4,5</sup> Throughout the pandemic, healthcare systems experienced unprecedented strain, outpatient services were modified or delayed, and public health resources were redirected to emergency response activities. Simultaneously, many families experienced increased financial instability, social isolation, housing insecurity, childcare challenges, and mental health stressors, all of which have been associated with maternal and infant health outcomes. While national studies have reported mixed findings, relatively little has been published describing how these outcomes changed in Nevada.<sup>6,7,8,9,10</sup>

This report examines three primary indicators representing different stages of the maternal and infant health continuum. Preterm birth serves as an important indicator of pregnancy and neonatal health and is associated with increased risks of infant morbidity and mortality.<sup>11</sup> Infant mortality reflects the health of infants during the first year of life and is widely recognized as a comprehensive indicator of maternal health, healthcare access, and community well-being.<sup>12</sup> Stillbirth provides an important measure of pregnancy by capturing fetal deaths that are not represented in measures limited to live births and was included as a supplemental outcome. Pregnancy-associated mortality captures deaths occurring during pregnancy or within one year following the end of pregnancy and provides critical insight into maternal health and healthcare system performance.<sup>13</sup>

To evaluate changes across these outcomes, annual trends were examined from 2017 through 2023 and grouped into three analytic periods representing the pre-pandemic (2017-2019), pandemic (2020-2021), and post-pandemic (2022-2023) phases of the COVID-19 emergency. Regression models were used to compare these periods while accounting for maternal demographic characteristics, and mortality datasets were linked with birth records when individual-level analyses were required. Together, these complementary analyses provide a comprehensive assessment of how maternal and infant health changed across Nevada during and following the COVID-19 pandemic.

## METHODS

### *Outcome Definitions*

Preterm birth was defined as a live birth occurring before 37 completed weeks of gestation. Infant mortality was defined as the death of a live-born infant before one year of age.

Stillbirth was defined as a fetal death occurring at 20 completed weeks of gestation or later. Pregnancy-associated death was defined as a death occurring during pregnancy or within one year following the end of pregnancy, regardless of cause. Pregnancy-associated death was distinguished from pregnancy-related death, which required determination that the death was caused by or aggravated by the pregnancy.

### ***Data Sources***

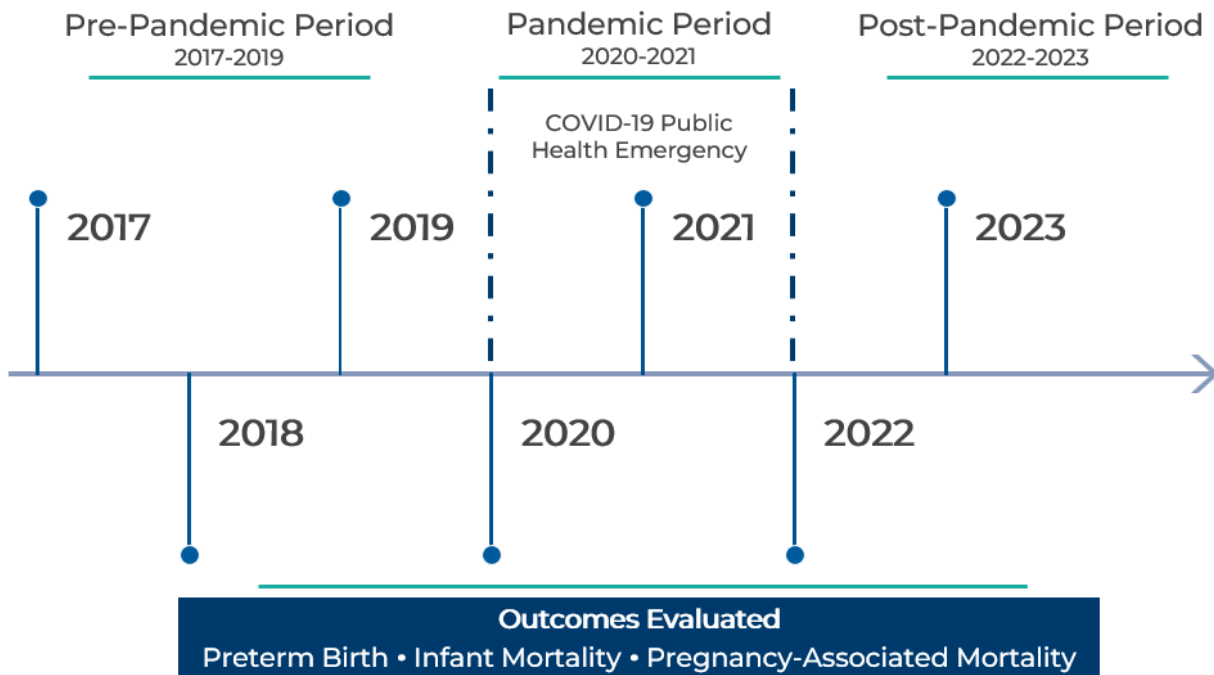
Nevada birth certificates were used to evaluate preterm birth. Birth and death records were gathered and prepared by the Office of Analytics (OOA). Infant mortality records and pregnancy-associated death records were linked to birth certificates when individual-level analyses were conducted. Aggregate pregnancy-associated mortality analyses included all pregnancy-associated deaths reported through statewide surveillance, regardless of pregnancy outcome. Pregnancy-associated mortality was selected as the maternal mortality outcome because it could be consistently identified using the available data. Pregnancy-related death (PRD), which required determining whether a death was caused by or related to the pregnancy, was not included because the dataset did not contain the official pregnancy-relatedness determination used in Nevada's maternal mortality reporting. Attempting to independently classify these deaths could result in misclassification and estimates that were not comparable with established state maternal mortality measures. To explore descriptive data on all maternal mortality outcomes, please explore the [Maternal Mortality Review Committee](#) reports. For preterm birth and infant mortality, all infants who are residents of Nevada were included in the analyses, while for pregnancy-associated deaths, all female residents of Nevada aged 10 to 60 were eligible for analysis.

Because birth certificates and mortality records do not share a common unique identifier, deterministic record linkage was used to match infant mortality and pregnancy-associated death records to birth certificates using shared demographic and birth characteristics. Records that could not be confidently matched, or pregnancy-associated deaths without a corresponding live birth record, were excluded from individual-level analyses. Aggregate pregnancy-associated mortality analyses included all reported pregnancy-associated deaths regardless of linkage status.

Stillbirth was included as a supplementary descriptive outcome to provide additional context on fetal and infant health during the study period. Unlike the individual-level analyses of preterm birth and infant mortality, available stillbirth data were aggregated. Therefore, adjusted regression analyses were not conducted. Annual and demographic-specific rates are presented to describe patterns over time and across population groups.

### ***Study Period***

The study period was divided into three analytic periods to evaluate maternal and infant health outcomes before, during, and after the COVID-19 pandemic.



*Figure 1. Study Timeline and COVID-19 Comparison Periods, Nevada, 2017-2023.*

The pre-pandemic period (2017-2019) included the three complete calendar years preceding the emergence of COVID-19 and provided a multi-year baseline against which subsequent outcomes could be compared. The pandemic period (2020-2021) represented the initial and most acute years of the COVID-19 public health response. The World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern on January 31<sup>st</sup>, 2020, and characterized COVID-19 as a pandemic on March 11<sup>th</sup>, 2020.<sup>14</sup> The post-pandemic period (2022-2023) was defined to characterize outcomes during the subsequent transition and recovery phase toward baseline public health practice. The U.S. federal COVID-19 Public Health Emergency formally ended on May 11<sup>th</sup>, 2023. The comparison of the COVID-19 period to a baseline additionally aligns with other studies.<sup>1, 2, 3</sup> Because the available maternal and infant health data were organized by month and calendar year rather than exact event dates, complete calendar years were used to create consistent comparison periods across outcomes.

### **Statistical Analysis**

Individual-level analyses used modified Poisson regression to estimate unadjusted and adjusted associations while accounting for maternal demographic characteristics. Infant mortality and pregnancy-associated death records were linked to birth certificates using deterministic multi-pass record linkage prior to analysis. Aggregate pregnancy-associated mortality rates were calculated using all reported pregnancy-associated deaths and annual live births. Annual trends were summarized using descriptive figures with 95% confidence intervals (CI). Stillbirth was included as a supplementary outcome and assessed

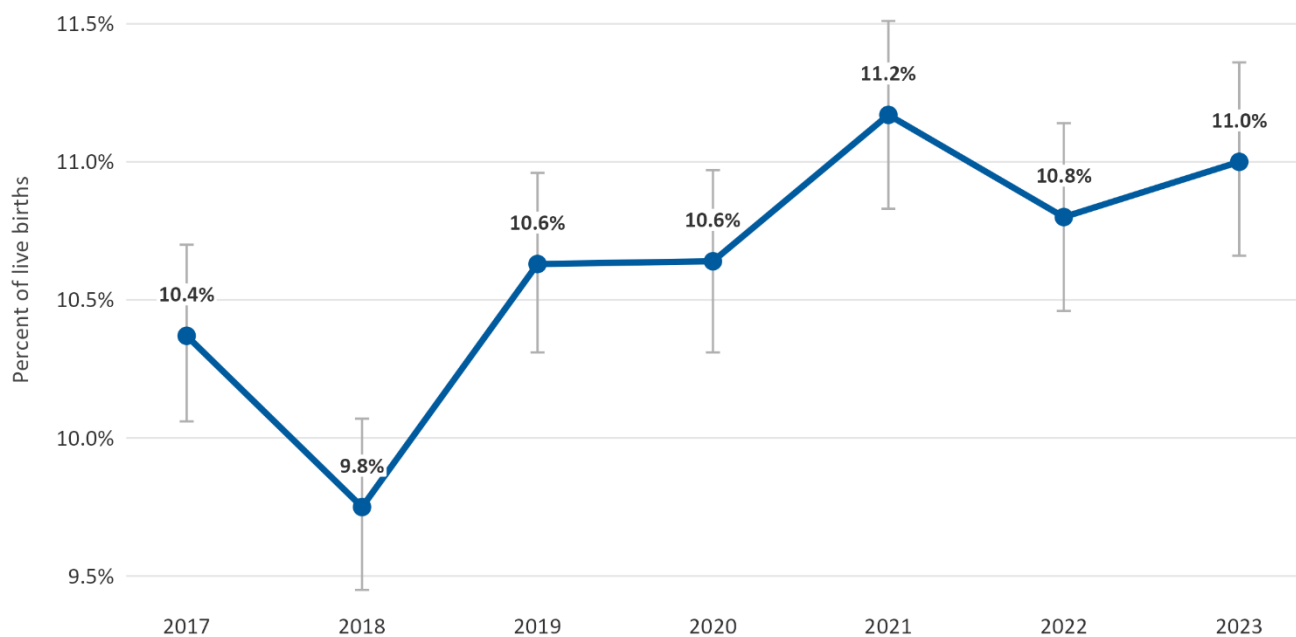
descriptively using annual and demographic-specific rates because individual-level data necessary for comparable adjusted regression analysis were not available.

## RESULTS

### Preterm Birth

#### Preterm Birth Prevalence

Nevada, 2017–2023



Error bars represent 95% confidence intervals.

Data Source: Nevada Vital Records

*Figure 2. Trends in Annual Preterm Birth Prevalence, Nevada, 2017-2023*

Annual preterm birth prevalence remained relatively stable throughout the study period but increased during the COVID-19 pandemic (Figure 2). Preterm birth prevalence was 10.4% in 2017, decreased to 9.8% in 2018, and then increased to 10.6% in both 2019 and 2020, peaking at 11.2% in 2021. Although prevalence declined slightly to 10.8% in 2022, it remained elevated at 11.0% in 2023. Confidence intervals overlapped across individual years, suggesting that annual fluctuations should be interpreted within the context of overall trends rather than as isolated changes.

Nevada's preterm birth trend was generally consistent with national patterns during the pandemic. Nationally, preterm births increased from 10.1% in 2020 to 10.5% in 2021, representing a 4% increase, before remaining relatively stable in 2022 and 2023.<sup>15, 16</sup> Nevada similarly experienced an increase during the early pandemic period, with preterm birth

prevalence reaching 11.2% in 2021. However, Nevada's annual prevalence remained above the national rate throughout the later study years, including 11.0% in Nevada compared with 10.4% nationally in 2023. These findings suggest that the pandemic-period increase observed in Nevada occurred within the context of a broader national increase in preterm birth, while also highlighting the importance of continued state-level monitoring.

| Table 1. Crude and Adjusted Prevalence Ratios for Preterm Birth by COVID-19 Period, Nevada <sup>o</sup> *                                                                                                                                 |                                           |                    |                                   |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------|-----------------------------------|-------------------------------|
| Comparison                                                                                                                                                                                                                                | Unadjusted Prevalence Ratio (PR) (95% CI) | Unadjusted P-Value | Adjusted PR (95% CI) <sup>†</sup> | Adjusted P-Value <sup>†</sup> |
| 2020-2021 vs. 2017-2019                                                                                                                                                                                                                   | 1.06 (1.03 – 1.09)                        | <0.01              | 1.04 (1.01 – 1.06)                | 0.01                          |
| 2022-2023 vs. 2017-2019                                                                                                                                                                                                                   | 1.06 (1.03 – 1.09)                        | <0.01              | 1.06 (0.99 -1.06)                 | 0.05                          |
| <sup>o</sup> Abbreviations: PR: Prevalence Ratio; CI: Confidence Interval<br>* Data Source: Nevada Vital Records<br><sup>†</sup> Confounders: Maternal Age, Maternal Race/Ethnicity, Principal Source of Payment, Infant Sex, Birth Month |                                           |                    |                                   |                               |

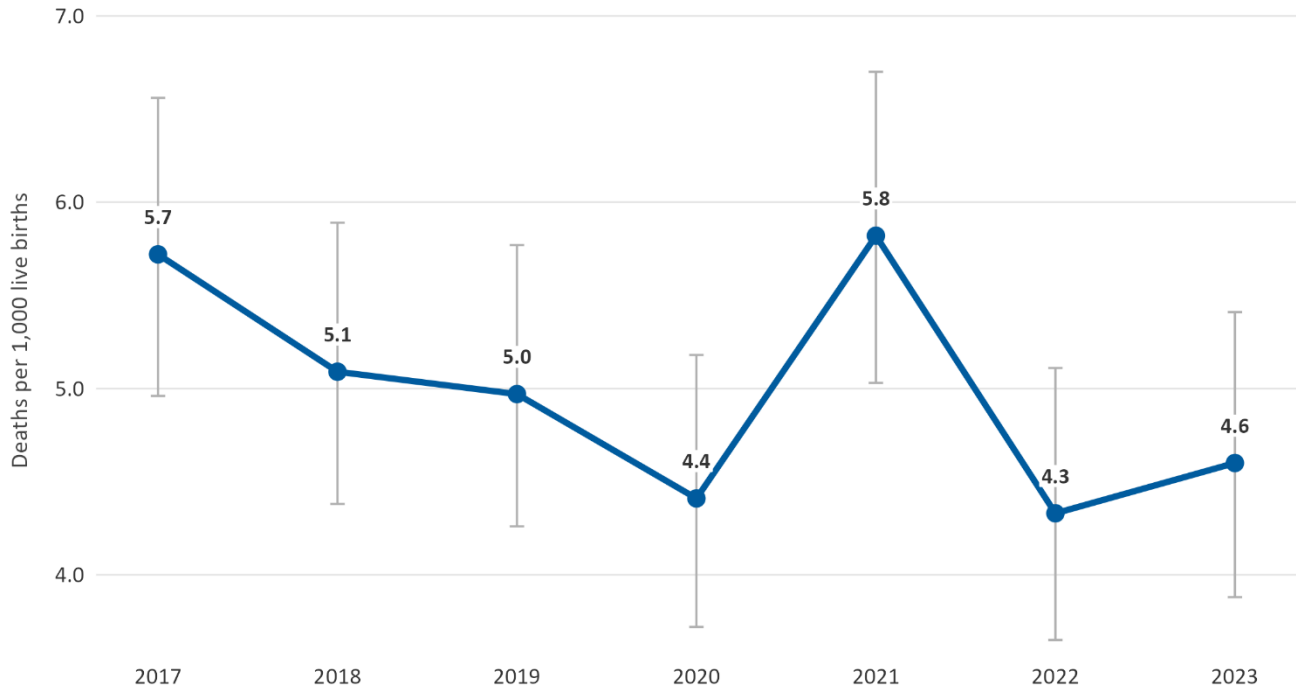
When years were grouped into three periods, preterm birth prevalence was significantly higher during the pandemic. After adjusting for maternal age, maternal race and ethnicity, principal source of payment, infant sex, and birth month, births occurring during 2020-2021 experienced a 4% higher prevalence of preterm birth compared with births during 2017-2019 (adjusted PR = 1.04; 95% CI: 1.01 – 1.06; p = 0.01). During the post-pandemic period, preterm birth prevalence remained modestly elevated (adjusted PR = 1.06). However, evidence for a sustained increase was weaker during the post-pandemic period than during the pandemic period.

These findings suggest that preterm birth increased modestly during the COVID-19 pandemic and remained slightly elevated through 2023, indicating factors associated with the pandemic may have had lasting effects of maternal and infant health or other trends influencing increasing rates of preterm births are confounding the association.

## Infant Mortality

### Infant Mortality Rate

Nevada, 2017–2023



Error bars represent 95% confidence intervals.

Data Source: Nevada Vital Records and Death Records

*Figure 3. Trends in Annual Infant Mortality Rate in Nevada, 2017-2023*

Annual infant mortality rates fluctuated throughout the study period (Figure 3). Rates declined from 5.17 deaths per 1,000 live births in 2017 to 4.4 deaths per 1,000 live births in 2020, increased to 5.8 deaths per 1,000 live births in 2021, then declined again to 4.3 and 4.6 deaths per 1,000 live births in 2022 and 2023, respectively. While annual variation was observed, confidence intervals overlapped over years, indicating that year-to-year differences should be interpreted with caution.

| Table 2. Crude and Adjusted Prevalence Ratios for Infant Mortality by COVID-19 Period, Nevada <sup>o</sup> *                                                                                                                                                |                        |                    |                                   |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------|-----------------------------------|-------------------------------|
| Comparison                                                                                                                                                                                                                                                  | Unadjusted PR (95% CI) | Unadjusted P-Value | Adjusted PR (95% CI) <sup>†</sup> | Adjusted P-Value <sup>†</sup> |
| 2020-2021 vs. 2017-2019                                                                                                                                                                                                                                     | 1.24 (1.09 – 1.42)     | <0.01              | 1.21 (1.06 – 1.39)                | <0.01                         |
| 2022-2023 vs. 2017-2019                                                                                                                                                                                                                                     | 1.09 (0.94 – 1.25)     | 0.25               | 1.09 (0.94 – 1.25)                | 0.26                          |
| <sup>o</sup> Abbreviations: PR: Prevalence Ratio; CI: Confidence Interval<br>* Data Source: Nevada Vital Records and Death Records<br><sup>†</sup> Confounders: Maternal Age, Maternal Race/Ethnicity, Principal Source of Payment, Infant Sex, Birth Month |                        |                    |                                   |                               |

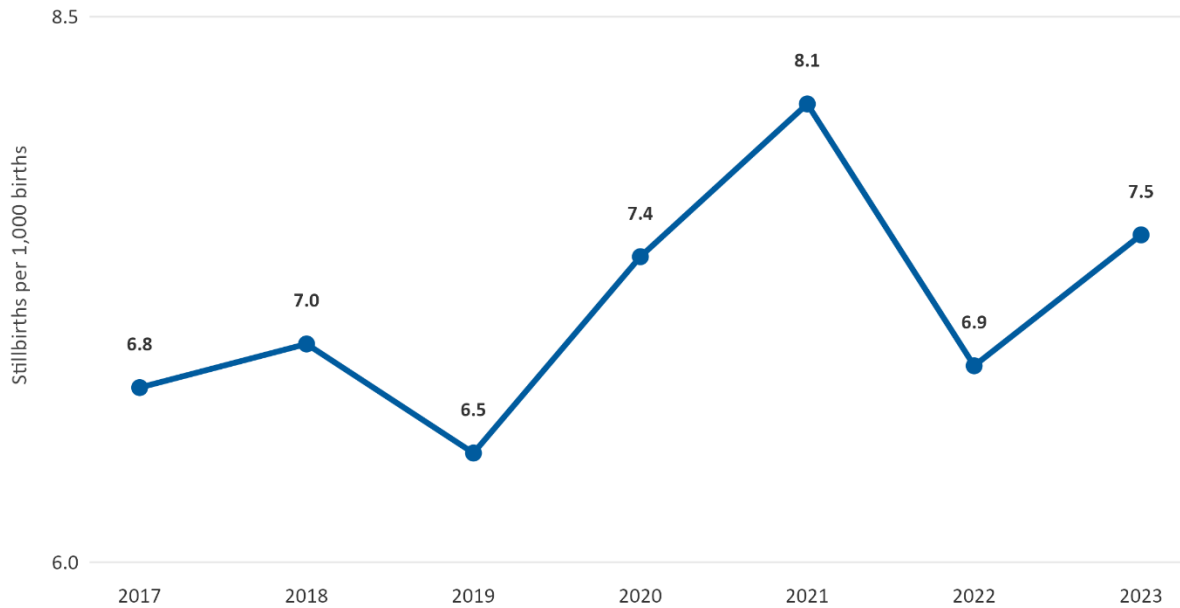
When years were grouped into pre-pandemic, pandemic, and post-pandemic periods, infant mortality was significantly higher during the pandemic. After adjusting for maternal age, maternal race and ethnicity, principal source of payment, infant sex, and birth month, births occurring during 2020-2021 experienced a 21% higher prevalence of infant mortality compared with births occurring during 2017-2019 (adjusted PR = 1.21; 95% CI: 1.06-1.39,  $p < 0.01$ ). Although infant mortality remained slightly elevated during the post-pandemic period, the difference was not statistically significant (adjusted PR = 1.09; 95% CI: 0.94-1.25;  $p = 0.26$ ).

Nevada's infant mortality pattern differed somewhat from the national trend. Nationally, infant mortality remained relatively stable between 2020 and 2021, at approximately 5.4 deaths per 1,000 live births, before increasing to approximately 5.6 per 1,000 in 2022.<sup>17, 18</sup> In Nevada, infant mortality instead peaked at 5.8 per 1,000 live births in 2021 before declining substantially in 2022. The adjusted analysis similarly identified significantly higher infant mortality during the 2020-2021 pandemic period compared with 2017-2019, while no significant difference remained during 2022-2023. These differences underscore the value of state-specific surveillance, as national trends may not fully reflect changes occurring within individual jurisdictions.

## Stillbirth

### Stillbirth Rate

Nevada, 2017-2023



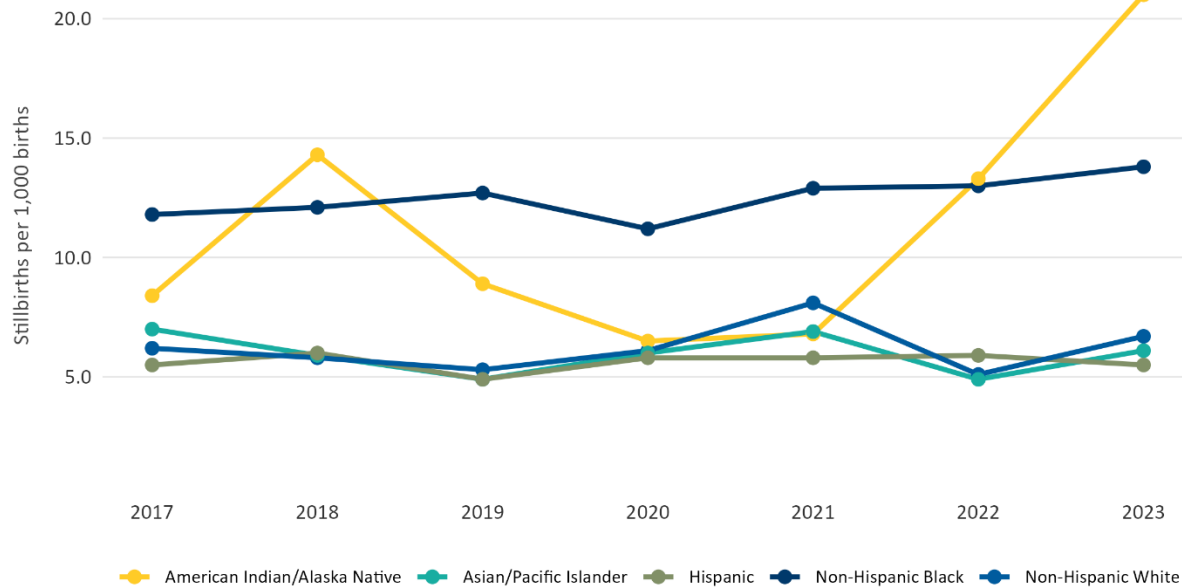
Data Source: Nevada Vital Records, Nevada Fetal Death Data

**Figure 4. Statewide Stillbirth Rates per 1,000 Births, Nevada, 2017-2023**

Stillbirth rates fluctuated over the study period, with the highest rates occurring during the pandemic period (Figure 4). Prior to the pandemic, the stillbirth rate ranged from 6.5 to 7.0 stillbirths per 1,000 births between 2017 and 2019. The rate increased to 7.4 per 1,000 births in 2020 and reach a study-period high of 8.1 in 2021. In 2022, the rate declined to 6.9 before increasing to 7.5 in 2023. Overall, the annual trend suggests an increase in stillbirth during the first two years of the COVID-19 pandemic, particularly in 2021. However, rates continued to fluctuate after this period. Because the stillbirth analysis was descriptive, statistical significance of these annual differences was not assessed.

## Stillbirth Rate by Race and Ethnicity

Nevada, 2017-2023



Data Source: Nevada Vital Records, Nevada Fetal Death Data

*Figure 5. Trends in Stillbirth Rates by Maternal Race and Ethnicity, Nevada, 2017-2023*

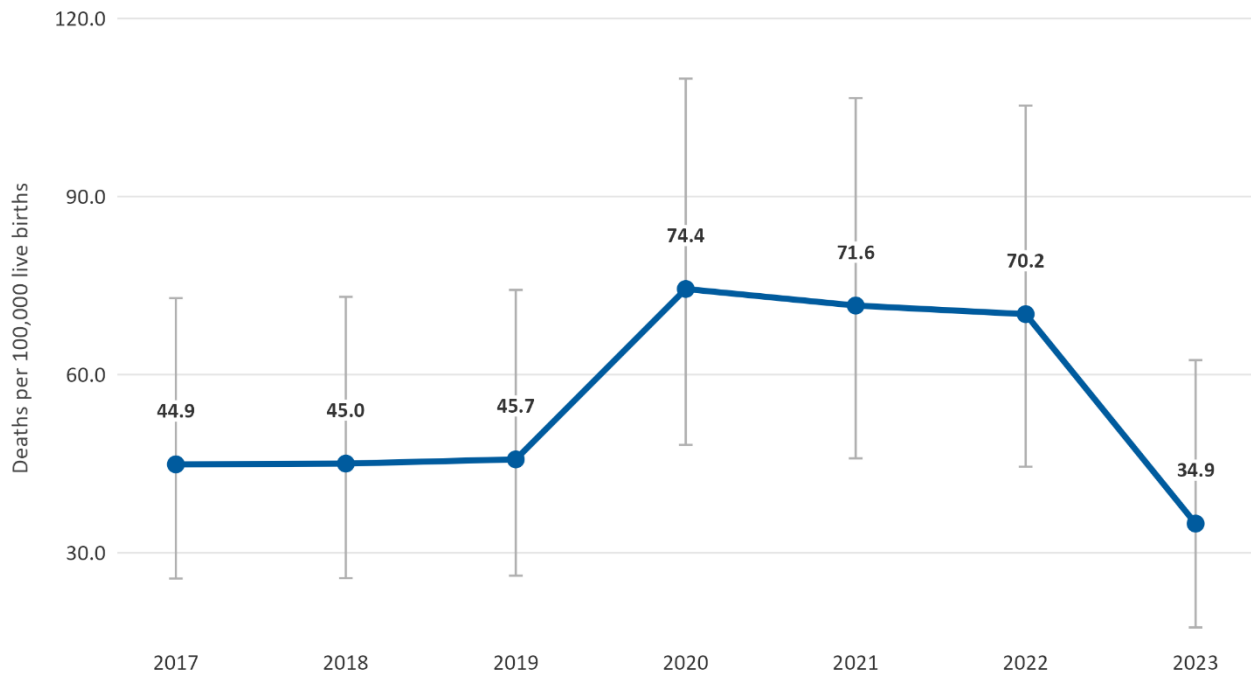
Stillbirth rates varied substantially by maternal race and ethnicity (Figure 5). Non-Hispanic Black individuals experienced consistently elevated stillbirth rates throughout the study period, with rates remaining above those observed among non-Hispanic White, Hispanic, and Asian/Pacific Islander individuals in each year. The non-Hispanic Black stillbirth rate also increased during the later years of the study period, from approximately 11 stillbirths per 1,000 births in 2020 to nearly 14 per 1,000 in 2023. Rates among non-Hispanic White, Hispanic, and Asian/Pacific Islander individuals were comparatively similar and generally remained between approximately 5 and 8 stillbirths per 1,000 births.

Stillbirth rates among American Indian/Alaska Native (AI/AN) individuals demonstrated substantial year-to-year variability, including higher rates in 2018, 2022, and 2023. However, these estimates were based on a small number of stillbirths and should be interpreted with caution. Consequently, large changes in annual AI/AN rates may reflect statistical instability associated with small numbers rather than sustained change in population-level risk.

## Pregnancy-Associated Mortality

### Pregnancy-Associated Death Rate

Nevada, 2017–2023



Error bars represent 95% confidence intervals.

Data Source: Nevada Vital Records and Death Records

*Figure 6. Trends in Pregnancy-Associated Mortality, Nevada, 2017-2023*

Pregnancy-associated mortality rates increased during the COVID-19 pandemic before declining in 2023 (Figure 6). Annual rates rose from 44.9-45.7 deaths per 100,000 live births during the pre-pandemic years (2017-2019) to 74.4 deaths per 100,000 live births in 2020, remaining elevated in 2021 (71.6) and 2022 (70.2) before declining to 34.9 deaths per 100,000 live births in 2023. Although annual rates fluctuated, confidence intervals were wide because pregnancy-associated deaths are relatively uncommon events, and year-to-year differences should therefore be interpreted with caution. More data regarding all maternal mortality outcomes can be explored further on the Nevada [Maternal Mortality Review Committee](#) website.

| Table 3. Rate Ratios for Pregnancy-Associated Mortality, Nevada, 2017-2023 <sup>o *</sup> |                          |         |
|-------------------------------------------------------------------------------------------|--------------------------|---------|
| Comparison                                                                                | Rate Ratio (RR) (95% CI) | P-Value |
| 2020-2021 vs. 2017-2019                                                                   | 1.62 (1.19 – 2.22)       | <0.01   |

|                                                                                                                                         |                    |      |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|
| 2022-2023 vs. 2017-2019                                                                                                                 | 1.20 (0.85 – 1.69) | 0.30 |
| <sup>o</sup> Abbreviations: RR: Rate Ratio; CI: Confidence Interval<br><sup>*</sup> Data Source: Nevada Vital Records and Death Records |                    |      |

When years were grouped into broader COVID-19 periods, pregnancy-associated mortality was significantly higher during the pandemic than before the pandemic. The statewide ratio of pregnancy-associated mortality during 2020-2021 was 62% higher than during 2017-2019 (RR = 1.62; 95% CI: 1.19 – 2.22;  $p < 0.01$ ). During the post-pandemic period, (2022-2023), pregnancy-associated mortality remained approximately 20% higher than the pre-pandemic period. However, this difference was not statistically significant (RR = 1.20; 95% CI: 0.85 – 1.69;  $p = 0.30$ ). The results presented here summarize statewide pregnancy-associated mortality using all reported pregnancy-associated deaths. A complementary individual-level analysis among pregnancies ending in live birth produced similar findings, with significantly higher odds of pregnancy-associated death during the pandemic but no significant difference during the post-pandemic period.

The increase in pregnancy-associated mortality observed in Nevada during the pandemic is consistent with national evidence of increased mortality among pregnancy and postpartum people. A national analysis found that the pregnancy-associated ratio increased by 35% between 2019 and the pandemic period in 2020,<sup>19</sup> with increases observed across several causes of death. Nevada similarly experienced a significant increase during the pandemic period, with the pregnancy-associated mortality rate being 62% higher during 2020-2021 than during 2017-2019. Although differences in study design and case ascertainment prevent direct comparison of magnitude of these estimates, both analyses suggest an increase mortality burden among pregnant and postpartum populations during the early COVID-19 pandemic.

National increases were also observed using the more restrictive pregnancy-related mortality definition, with pregnancy-related mortality rising from 29.0 per 100,000 live births before the pandemic to 36.7 during 2020 and 45.5 in 2021.<sup>20</sup> Although pregnancy-related and pregnancy-associated mortality are distinct measures and should not be directly compared, both national measures indicate worsening mortality among pregnancy and postpartum populations during the early pandemic.

These findings suggest pregnancy-associated mortality increased during the COVID-19 pandemic but generally returned toward pre-pandemic levels following the public health emergency. Continued surveillance is important to determine whether the decline observed in 2023 represents a sustained improvement or normal year-to-year variation in this relatively rare outcome.

## Overall Findings

| Outcome                        | Pandemic (2020-2021) | Post-Pandemic (2022-2023) |
|--------------------------------|----------------------|---------------------------|
| Preterm Birth                  | ↑ Significant        | ↑ Slightly Elevated       |
| Infant Mortality               | ↑ Significant        | No Significant Difference |
| Pregnancy-Associated Mortality | ↑ Significant        | No Significant Difference |

*Figure 7. Summary of Changes in Maternal and Infant Health Outcomes Before, During, and After the COVID-19 Pandemic*

Across the four outcomes examined, the most consistent pattern was a worsening of maternal and infant health indicators during the early COVID-19 pandemic, although the magnitude, statistical difference, and persistence of these changes differed by outcome. Preterm birth, infant mortality, pregnancy-associated mortality, and stillbirth increased during the last part of the 2020-2021 period. Infant mortality and pregnancy-associated mortality subsequently returned toward pre-pandemic levels, while preterm birth remained modestly elevated and stillbirth continued to fluctuate. These differences highlight the importance of examining multiple indicators across the maternal and infant health continuum rather than relying on a single outcome to characterize the potential effects of a major public health emergency.

Comparison with national surveillance data and published studies provides important context for determining whether changes observed in Nevada were unique to the state or occurred alongside broader changes in maternal and infant health across the United States.

## PUBLIC HEALTH IMPLICATIONS

The COVID-19 pandemic coincided with measurable changes in several maternal and infant health outcomes in Nevada, although the magnitude and persistence of these changes varied by outcome. Preterm birth prevalence remained modestly elevated through the post-pandemic period, while infant mortality and pregnancy-associated mortality increased during the pandemic but generally returned toward pre-pandemic levels thereafter. Collectively, these findings highlight the broad impact that public health emergencies may have on maternal and infant health and underscore the importance of maintaining resilient maternal and child health systems during periods of disruption.

Although this analysis was not designed to identify the specific mechanisms responsible for these changes, multiple factors likely contributed, including disruptions in healthcare delivery, delayed or reduced access to prenatal and postpartum care, changes in healthcare

utilization, increased psychosocial stress, and the direct and indirect effects of COVID-19 infection. These findings emphasize the need to strengthen systems supporting pregnant people and infants before, during, and after public health emergencies.

However, the results should also be considered with the context of longer-term trends in maternal and infant health. Preterm birth and infant mortality can vary over time due to changes in population characteristics, healthcare access and delivery, clinical practices, socioeconomic conditions, and other factors independent of the COVID-19 pandemic. Because this analysis focused on 2017-2023, it cannot determine the extent to which observed changes reflect pandemic-related effects versus longer-term underlying trends.

Continued investment in maternal and child health surveillance remains essential, real time spike check methodologies need to be employed for agile identification and response to possible changes in negative outcome burdens. Routine monitoring using preliminary data as opposed to waiting for final and using spike check methodologies every quarter for preterm birth, infant mortality, and pregnancy-associated mortality can help identify emerging trends, evaluate recovery following major public health events, and inform evidence-based policy and programmatic decision-making in real time. Strengthening timely data analytics analyses and prioritizing MCH surveillance, improving linkage across maternal and infant health data systems, and ensuring timely access to high-quality data will enhance Nevada's ability to identify disproportionately affected populations and respond to future public health challenges. Future analyses incorporating a longer historical period could help distinguish pandemic-period changes from longer-term secular trends in Nevada maternal and infant health outcomes.

## LIMITATIONS

Several limitations should be considered when interpreting these findings. First, this observational analysis cannot establish causality between the COVID-19 pandemic and changes in maternal or infant health outcomes. While temporal associations were observed, other unmeasured factors occurring during the study period may also have influenced these outcomes.

Second, adjusted models controlled for selected maternal demographic characteristics, but residual confounding is possible because information on additional factors, such as maternal comorbidities, prenatal care utilization, socioeconomic conditions, or COVID-19 infection status, was not included in these analyses. Thus, the relatively short pre-pandemic comparison period may not fully capture longer-term variability in the outcome measures. Further, stillbirth analyses were limited to aggregate data and therefore could not be adjusted for potential confounding factors or evaluated using the same individual-level regression methods as the primary outcomes.

Third, these analyses required linkage between surveillance datasets and birth certificates because a common unique identifier was unavailable. Although deterministic multi-pass linkage achieved high linkage success for all three outcomes, some records could not be linked and were excluded from individual-level analyses. Pregnancy-associated deaths associated with pregnancies that did not result in a live birth were included in the

aggregate surveillance analyses but could not be incorporated into the individual-level regression models.

Finally, pregnancy-associated mortality is a relatively rare outcome in Nevada. Consequently, annual estimates were based on a limited number of events, resulting in wider confidence intervals and reduced statistical power to detect modest changes over time. Readers should therefore interpret annual fluctuations cautiously and consider the broader period-based analyses when evaluating overall trends. Additionally, pregnancy-related mortality could not be evaluated because the official pregnancy-relatedness determination was unavailable in the analytic dataset. Therefore, maternal mortality findings reflect pregnancy-associated deaths and should not be interpreted as pregnancy-related mortality.

## CONCLUSION

This analysis provides an assessment of maternal and infant health outcomes in Nevada before, during, and after the COVID-19 pandemic. Across three key indicators, the pandemic period was associated with measurable changes in maternal and infant health. Preterm birth prevalence increased modestly during the pandemic and remained slightly elevated through 2023, while infant mortality and pregnancy-associated mortality were significantly higher during the pandemic but generally returned toward pre-pandemic levels during the post-pandemic period.

Although each outcome demonstrated a distinct pattern, the findings collectively suggest the COVID-19 pandemic coincided with meaningful changes in maternal and infant health across Nevada. These results reinforce the importance of timely surveillance, timely data integration, and sustained investment in maternal and child health programs to better understand long-term trends, identify emerging differences in burden, and strengthen preparedness for future public health emergencies.

This report provides a baseline for understanding the short and long-term effects of the COVID-19 pandemic on maternal and infant health in Nevada. As the state continues to implement maternal mortality reviews, fetal and infant mortality surveillance, and other maternal and child health surveillance systems, these findings can help inform program planning, use of spike checks and preliminary data, resource allocation, and future evaluation efforts. Continued collaboration among public health, healthcare, those with lived experience, and community partners will be key to improving health outcomes for Nevada's mothers and infants.

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