

ASSESSING PRENATAL TDAP VACCINATION RATES AMONG PREGNANT PEOPLE IN NEVADA, 2022

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EXECUTIVE SUMMARY

Purpose

Prenatal vaccination during pregnancy is an important part of maternity care, but maternal immunization rates across the country continue to be below national benchmarks¹. There is currently a gap in the analysis concerning specific prenatal Tdap vaccination rates amongst pregnant people in Nevada. This report serves to spotlight potential disparities, both in terms of geography and demographics, and offers a comprehensive assessment of Nevada's prenatal Tdap vaccination rates with national averages.

This report, written by the Nevada Department of Behavioral Health's (DPBH) Nevada State Immunization Program (NSIP), is intended to help both internal and external immunization partners better understand the current prenatal Tdap immunization landscape in Nevada. The report also serves as a guide for decision-making and strategic planning to improve prenatal vaccination rates and vaccine equity and ultimately help provide the opportunity for all Nevadans to live in optimal health and well-being.

KEY FINDINGS

This report explores births in Nevada in 2022 and the prenatal Tdap vaccination coverage among the birthing parents. There were 33,250 recorded births in Nevada during 2022. Approximately 40% of these births were to a Hispanic birthing parent. Carson City had the highest birth rate in Nevada in 2022 at 20 births per 1,000 people. Clark and Washoe counties made up approximately 90% of all births in Nevada.

In 2022, only 35% of birthing individuals in Nevada were vaccinated for prenatal Tdap. Among this group, 53.7% of them adhered to the recommended vaccination schedule administered between 27-36 weeks of pregnancy. When comparing prenatal Tdap rates by race and ethnicity, Black birthing parents had the lowest coverage rates at 26%. Moreover, the lowest vaccination rates within the state were observed in Clark and Storey counties.

When considering geographic distribution, the analysis revealed zip code disparities in vaccination rates among Nevada's urban counties of Clark and Washoe. Over 90% of pregnant individuals received their vaccination dose from either a hospital, pharmacy, OB-GYN, or women's care clinic. These findings highlight the importance of accessing health care facilities for perinatal Tdap vaccinations.

INTRODUCTION

The resurgence of pertussis is a growing concern, with an increase of outbreaks across the United States.² Infants face the highest vulnerability to contracting pertussis, and it's potentially life-threatening complications.³ To safeguard vulnerable infants until they can receive their own immunizations, public health efforts are focused on the significance of administering the tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine to pregnant people during the third trimester of each pregnancy. The efficacy of vaccination is highly effective in protecting infants against pertussis infection, with over 90% reduction in hospitalizations and 95% reduction of deaths due to pertussis in the first 2 to 3 months of life.⁴

The Centers for Disease Control and Prevention (CDC) estimates that only 44% of pregnant women in the United States received a prenatal Tdap dose between October 2021 and January 2022.⁵ This analysis is the first comprehensive look at prenatal Tdap vaccination rates amongst pregnant people in Nevada, and how Nevada rates compare to national prenatal Tdap vaccination rates. By identifying geographic and demographic disparities, outreach efforts can be focused towards these areas, increasing prenatal Tdap vaccination rates in an equitable manner.

Tetanus, Diphtheria, and Acellular Pertussis (Tdap)

Tetanus

Tetanus is a bacterial infection caused by the spores of *Clostridium tetani*. Tetanus spores are found in the environment, typically in soil, dust, and manure. Tetanus is not transmitted from person to person. Infection can lead to serious symptoms and complications.⁶ Symptoms of tetanus include jaw cramping (often called “lockjaw”), involuntary muscle spasms, trouble swallowing, and seizures. Serious complications involve bone fractures, difficulty breathing, and pulmonary embolism. Around 1 to 2 out of 10 cases are fatal.⁷

Diphtheria

Diphtheria is an infection caused by the bacterial toxin *Corynebacterium diphtheriae*. This toxin can be transmitted from person-to-person contact, usually through respiratory droplets emitted when coughing or sneezing. Transmission can also occur from touching infected sores or ulcers.⁸ Symptoms of diphtheria infection include weakness, sore throat, mild fever, and swollen neck glands. During infection, the bacterial toxin kills healthy tissues in the respiratory system, leaving behind a thick, gray layer of dead tissue. This “pseudo membrane” of dead tissue can obstruct the nose, tonsils, and throat, making it difficult to breathe and swallow.⁹

Pertussis

Pertussis, commonly referred to as whooping cough, is an infection caused by the bacteria *Bordetella pertussis*. The bacteria infect the respiratory tract and release toxins that can cause damage and swelling to the airway. Transmission occurs from person-to-person through respiratory droplets from sneezing or coughing.¹⁰ Early infection symptoms present similarly to a common cold: low-grade fever (less than 100.4°F), runny or stuffed-up nose, and a mild or occasional cough. One to two weeks after symptoms begin, an infected person may have rapid, violent, uncontrolled coughing fits. These coughing fits, called paroxysms, usually last 1 to 6 weeks but can occur for up to 10 weeks. Coughing fits lead to a “whoop” sound, which is a high-pitched noise infected persons make when they are able to breathe at the end of a fit. People may also vomit during or after a coughing fit and struggle to breathe. Many babies infected with pertussis may turn blue and experience life-threatening pauses in breathing.⁴

There has been an increase in the number of pertussis cases and outbreaks in the U.S.³ On average 1,000 infants are hospitalized, and between 5 to 15 infants die each year. Most of these deaths occur among infants who are less than two months old and too young to receive the childhood series of vaccinations. It is critical that a pregnant person receives a prenatal Tdap vaccine during each pregnancy between 27- and 36-weeks’ gestation to maximize antibody transfer to the infant.¹¹

Tdap Vaccine

The Tdap vaccine is a combination vaccine that protects against three (3) bacterial infections: tetanus, diphtheria, and acellular pertussis. It contains inactive, noninfectious bacterial products that induce a robust immune response.¹²

The uppercase 'T' refers to the vaccine containing a standard amount of tetanus antigen, while the lowercase 'd' and 'ap' refer to the vaccine containing a reduced dose of diphtheria and acellular pertussis antigens compared to the amounts used in the pediatric version (DTaP).¹¹ The 'acellular' in acellular pertussis refers to the vaccine containing parts of the pertussis bacteria instead of the whole bacterium.¹²

Since 2006, the Tdap vaccine has been recommended by the Advisory Committee on Immunization Practices (ACIP) as a routine vaccination for children seven years and older, adolescents, adults, and pregnant people.¹³ It is recommended that a pregnant person receives one (1) dose of Tdap during each pregnancy they experience. Since infants are unable to receive a DTaP dose until at least two months of age, a prenatal Tdap dose helps to protect the fetus from contracting the diseases covered by the Tdap vaccine and having severe, potentially life-threatening complications. The maternal antibody response to this vaccine results in a passive antibody transfer to the infant through the placenta.¹⁴

EQUITY STATEMENT

The Nevada State Immunization Program (NSIP) recognizes that people have diverse gender identities and strives to use gender-inclusive language in its publications, literature, and other printed and digital materials. In some instances, NSIP uses the word "woman" (and the pronouns "she" and "her") to describe individuals whose sex assigned at birth was female, whether they identify as female, male, or non-binary. As gender language continues to evolve in the scientific and medical communities, NSIP will reassess this usage and will make appropriate adjustments, as necessary. When describing or referencing study populations used in research, NSIP will use the gender terminology reported by the study investigators.

METHODOLOGY

Birth records in Nevada from January through December 2022 were obtained through the Nevada DPBH Office of Vital Records and analyzed by race/ethnicity, county of birth, and maternal age using SAS 9.4 (SAS Institute, Cary, NC). Graphs were generated using Microsoft Excel, and maps were generated using Tableau 2023.1.

Tdap vaccination data from NV WebIZ, Nevada's Immunization Information System (IIS), was provided by the Nevada DPBH Office of Analytics (OOA) for all 2022 birthing parents named by Vital Statistics. Any Nevada resident with a matching name and date of birth to the birth records given were pulled, and Tdap vaccination status from October 2021 through December 2022 was assessed. This data was also analyzed using SAS 9.4.

These two (2) datasets were then matched using an exact full name and date of birth match. Fuzzy matching was excluded because the only way to match these records is on these two fields, and matching was done in SAS rather than a specific matching software. There were 33,455 observations in the Vital Records 2022 births dataset. All records were used in the initial Nevada births analysis. Of these records, 32,507 records (97%) were matched to the Tdap vaccination dataset. Because most records were successfully matched, this was the final set of records that were used in the secondary analysis that examined Tdap vaccinations.

To remain consistent with other reports created by the program and OOA, all self-identified races and ethnicities were sorted into broader racial categories: Hispanic, American Indian and Alaskan Native (AIAN), Asian American and Pacific Islander (AAPI), Black, White, other, and unknown. Following CDC guidance and OOA best practices, if the birthing parent identified as Hispanic, that identity took precedence over all other racial/ethnic categories.

When analyzing age at birth, all maternal ages were separated into six categories: ≤ 17 , 18-25, 26-34, 35-39, 40+ years, and unknown. In county and race analyses, the median ages were used to compare groups to reduce the statistical influence of outliers. The median ages were compared to the national average maternal age upon first birth, 27.3 years, as a national median age was unable to be found.

County and ZIP code data shown is the birth parent's residential geographic data unless otherwise indicated.

The following sections contain data estimates and projections for the Nevada population in 2022, which come from the State Demographer and the Nevada Department of Taxation. As of the publication of this report, 2022 demographic numbers are projections of the population. The county birth rates were standardized to be out of 1,000 people to assist in the clarity of the data.

BIRTHS IN NEVADA, 2022

Geography

In total, there were 33,250 recorded births for the state of Nevada in 2022. Clark and Washoe counties made up approximately 90% of all births in Nevada.

Table 1. The 2022 recorded births in Nevada by county.

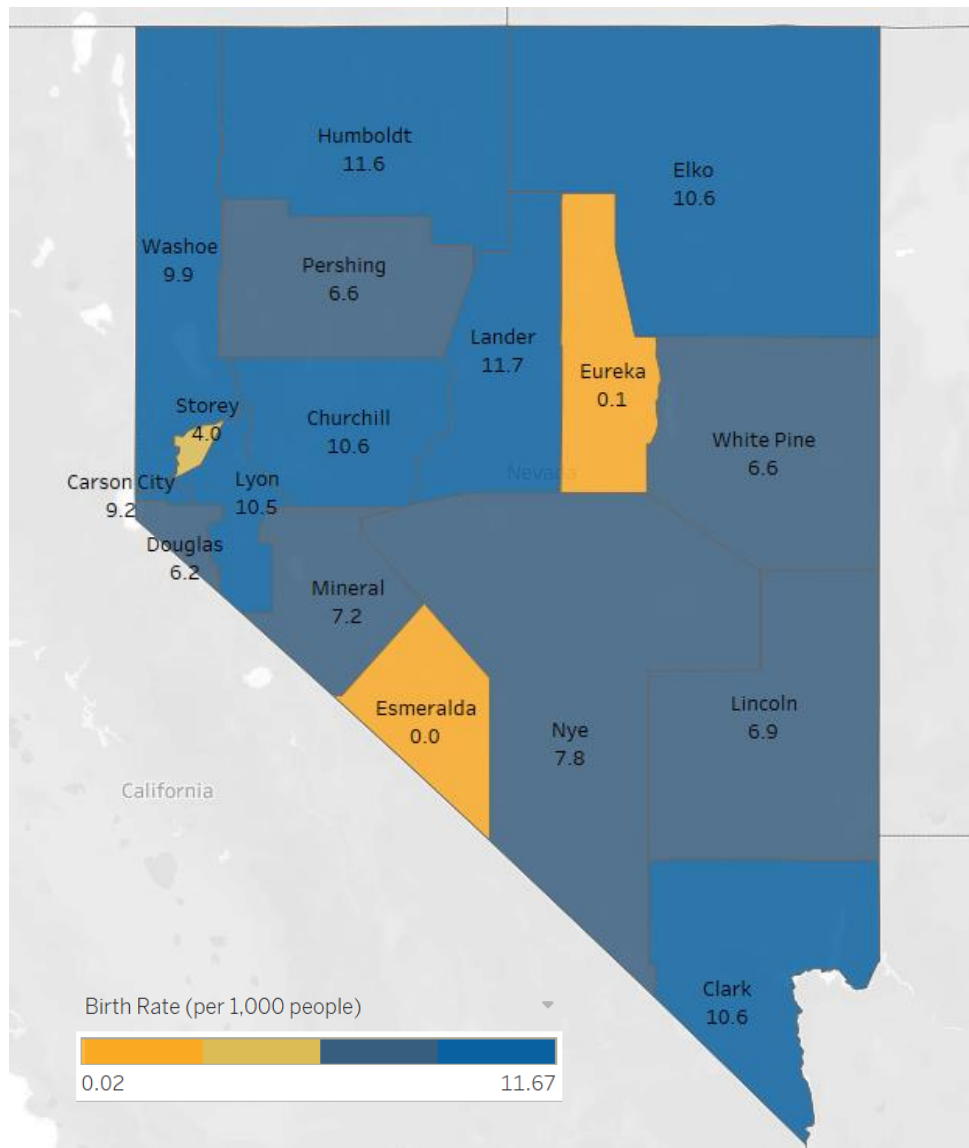
County	Number of Births in 2022
Carson City	511
Churchill	284
Clark	25,129
Douglas	308
Elko	582
Esmeralda	*
Eureka	13
Humboldt	204
Lander	73
Lincoln	35
Lyon	621
Mineral	35
Nye	387
Pershing	47
Storey	18
Washoe	4,932
White Pine	69
Total	33,250

*Counties with less than 10 recorded births have been suppressed.

Source: NV Office of Vital Records, 2023

The birth rate out of 1,000 was determined for each county and displayed on Figure 6. Counties denoted with an asterisk next to their name had 10 or fewer recorded births. The minimum birth rate required to maintain the U.S. population is 14.2 per 1,000, also called the replacement rate.¹⁶ As of 2021, the national birth rate is 11.0 per 1,000.¹³ Churchill, Clark, Humboldt, Lander, and Lyon counties had 2022 birth rates comparable to the national birth rate. With the exception of Humboldt and Lander counties, all Nevada counties currently have a birth rate lower than the replacement rate threshold.

Figure 1. The 2022 birth rate by county in Nevada per 1,000 people.



Source: NV Office of Vital Records, 2023

Demographics (Race/Ethnicity, Age)

The race/ethnicity demographics were analyzed both statewide and by the county in which the birth was recorded. Of the 33,250 births statewide, 39% were from a Hispanic birthing parent (Figure 1).

Figure 2. The percent breakdown of the race/ethnicity identities of birthing parents in Nevada, 2022.

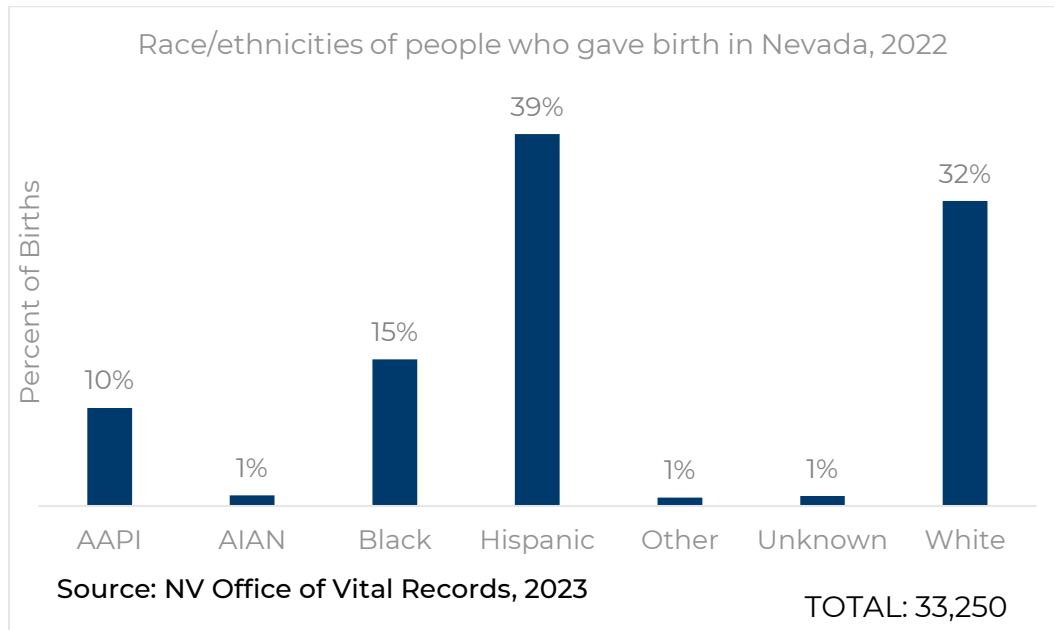


Figure 3 displays the results of the statewide analysis of maternal age. Around 53% of births were from birthing parents between the ages of 26-34. This result is consistent with the 2021 average national maternal age at first birth: 27.3 years.

Figure 3. The percent breakdown of the maternal age categories of birthing parents in Nevada, 2022.

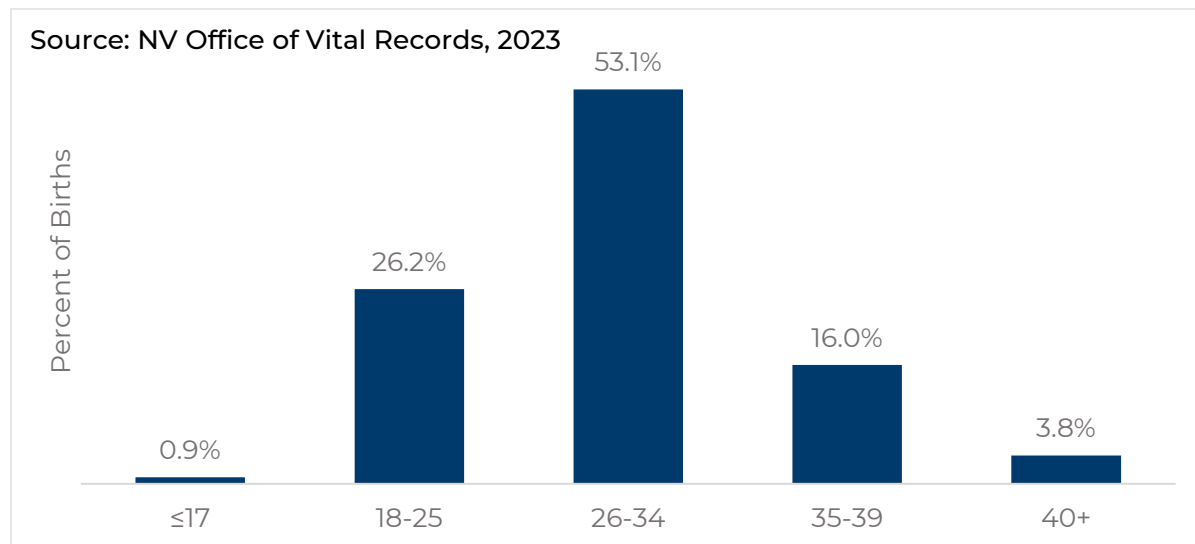


Figure 4 displays the results of the median maternal age by county in comparison to the 2021 national average maternal age at first birth, which is 27.3 years.¹⁵ Elko, Esmeralda, Humboldt, Mineral, Pershing, and White Pine counties had the lowest median maternal age of 27. Douglas County had the highest median maternal age of 31.

Figure 4. Comparison of median maternal ages in years by county in Nevada, 2022.

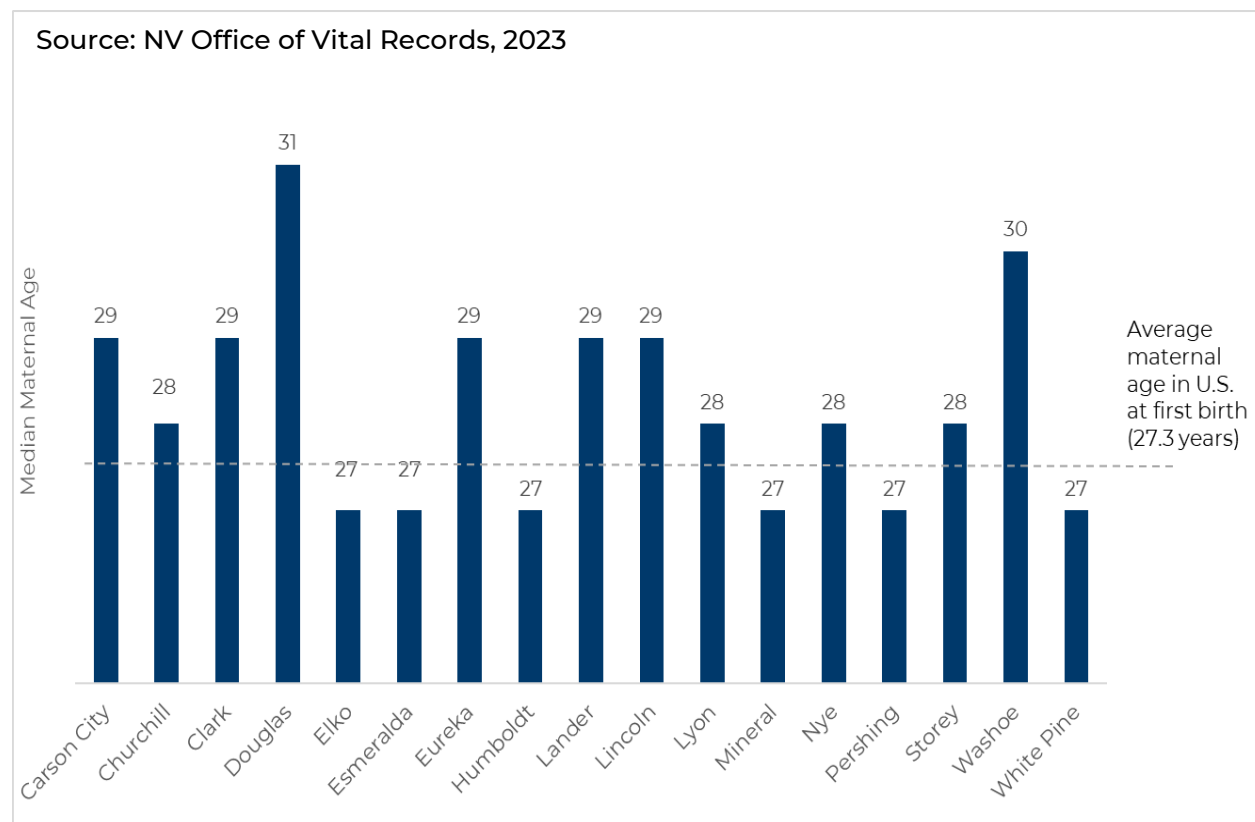
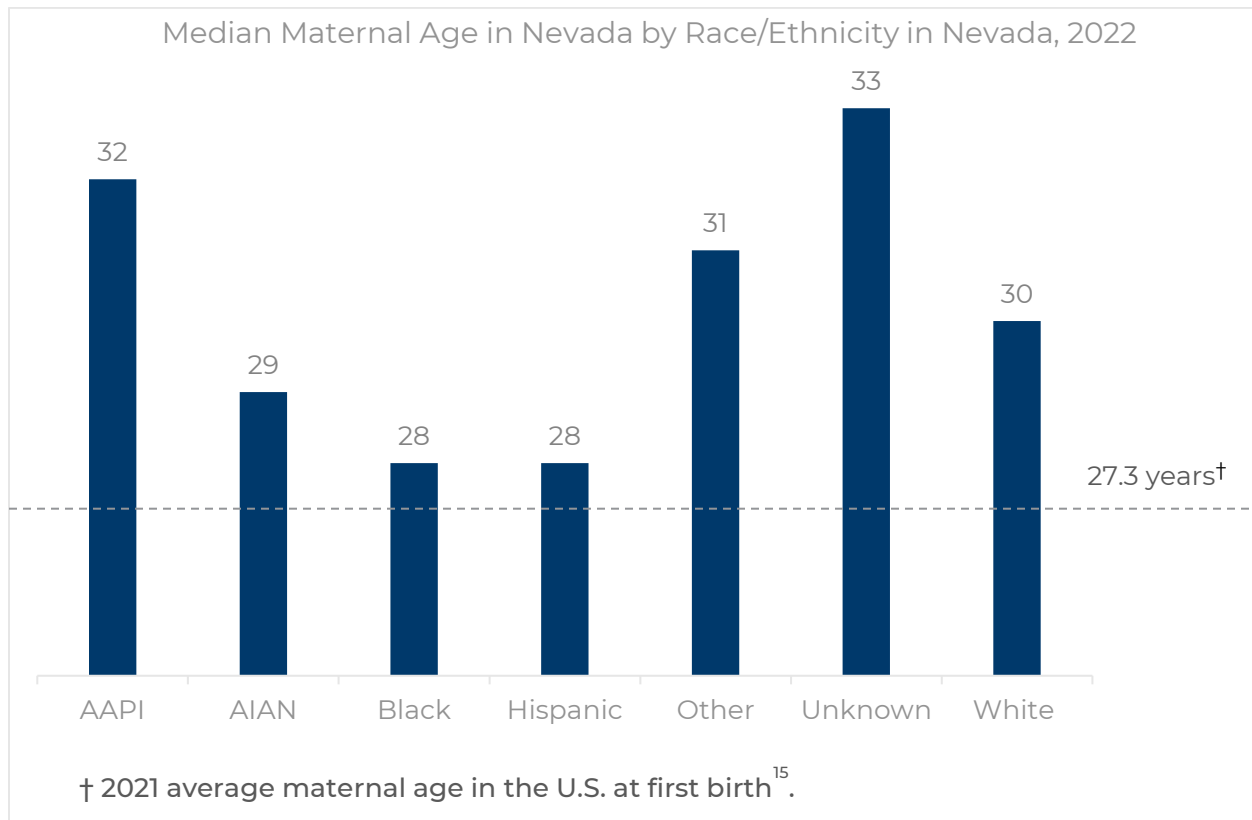


Figure 5 displays the results of median maternal age by race/ethnicity. All groups appear to have a higher median age than the 2021 national average maternal age of 27.3 years. Black and Hispanic individuals had the lowest median maternal age at 28. The racial/ethnic category with the highest median maternal age is AAPI at 32. There were 346 individuals with an unknown race and this category had the overall highest median maternal age at 33.

Figure 5. The 2022 median maternal age in Nevada by race/ethnicity.



Source: NV Office of Vital Records, 2023

KEY TAKEAWAYS

- 90% of all births in Nevada were to Clark or Washoe County residents.
- Lander County had the highest birth rate in Nevada in 2022 at 11.7 per 1,000 people.
- 40% of births in Nevada in 2022 were by a Hispanic parent.
- Approximately half (53%) of births were by a parent between the ages of 26 and 34.

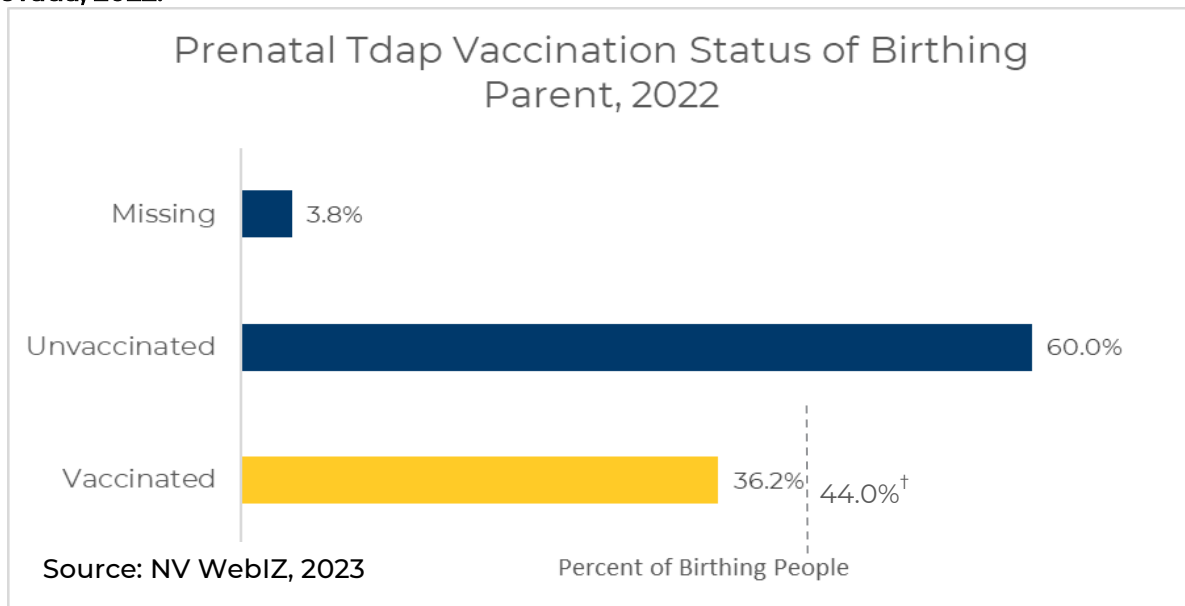
PRENATAL TDAP VACCINATIONS IN NEVADA, 2022

Introduction

Of the 33,250 Nevada residents recorded to have given birth in 2022, 32,398 individuals (97%) had a documented prenatal Tdap vaccination status ('vaccinated' or 'unvaccinated') in NV WebIZ. From this set, it was found that only 36.2% of individuals had a confirmed prenatal Tdap vaccination. This is lower than the CDC's 2021-2022 national prenatal Tdap vaccination estimate of 44%.⁵ It is important to note that the CDC national prenatal Tdap vaccination estimates are generated using self-reported data, while this analysis utilizes immunization record data submitted by healthcare providers. In general, more than 90% of a population needs to be vaccinated against a disease to help prevent transmission.¹⁷ There is a significant need to increase prenatal Tdap vaccine uptake in Nevada as well as nationwide.

Figure 7 shows the percentage breakdown of individuals who gave birth in 2022 by vaccination status. Individuals were determined to be 'Vaccinated' if they received a dose of prenatal Tdap between October 2021 through December 2022. This timeframe accounted for the recommended vaccination period for an individual who gave birth in early 2022. Individuals were considered 'Unvaccinated' if they did not receive a prenatal Tdap vaccination dose between October 2021 through December 2022. If an individual did not have an established vaccination record in NV WebIZ or their vaccination status could not be determined, they were classified as 'Missing'.

Figure 7. Percent breakdown of the prenatal Tdap vaccination status of birthing people in Nevada, 2022.



† CDC estimated 2021-2022 national prenatal Tdap vaccination rate³.

Figure 8 displays the results of the provider types utilized by individuals vaccinated for prenatal Tdap. Most individuals (over 90%) received their vaccination dose from either a hospital, pharmacy, OB-GYN or women's care clinic. Specific targeted outreach might be useful to these providers. A variety of different provider types gave at least one (1) administration of prenatal Tdap, indicating that it is important that all providers carry this vaccine even if they do not predominantly serve pregnant populations.

Figure 8. The percent breakdown of birthing people vaccinated for prenatal Tdap by the provider type that administered the vaccination.

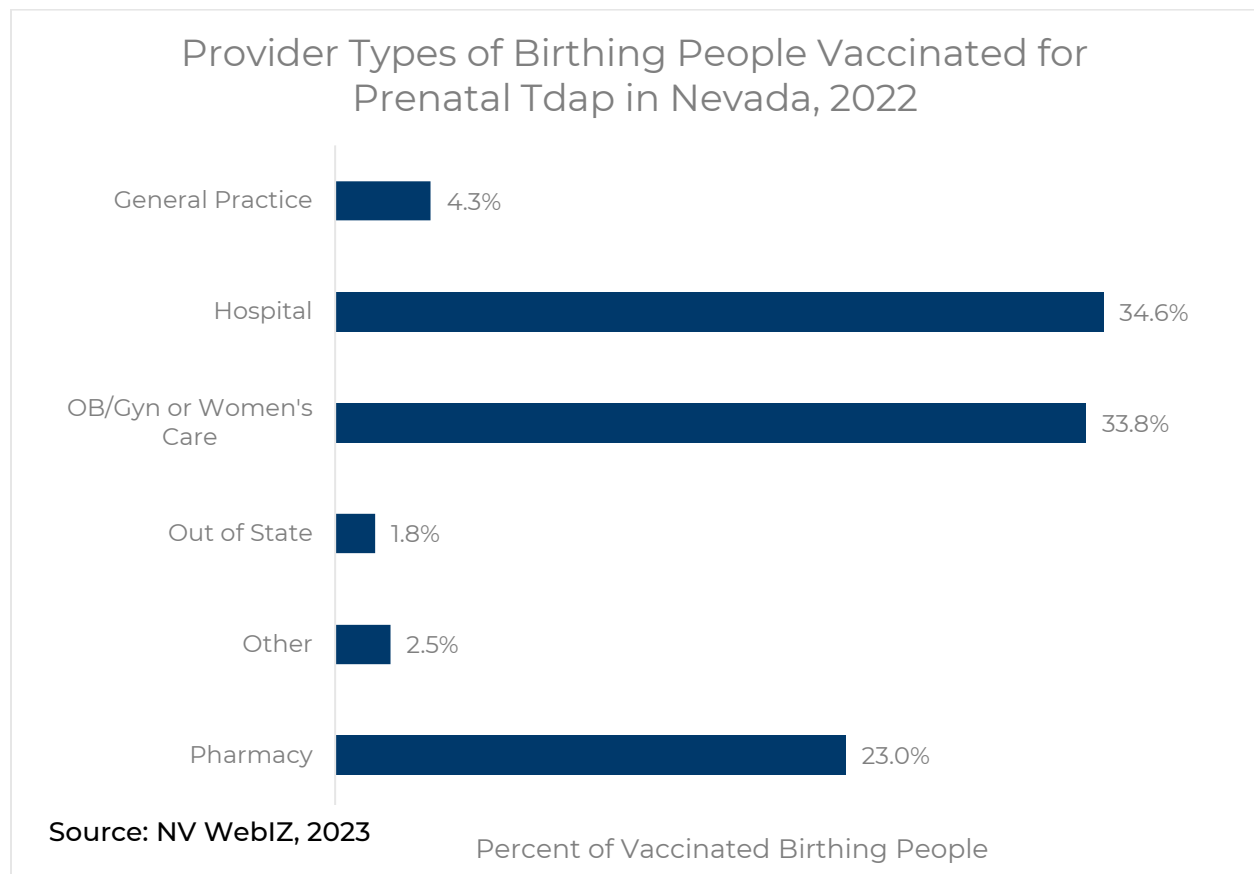


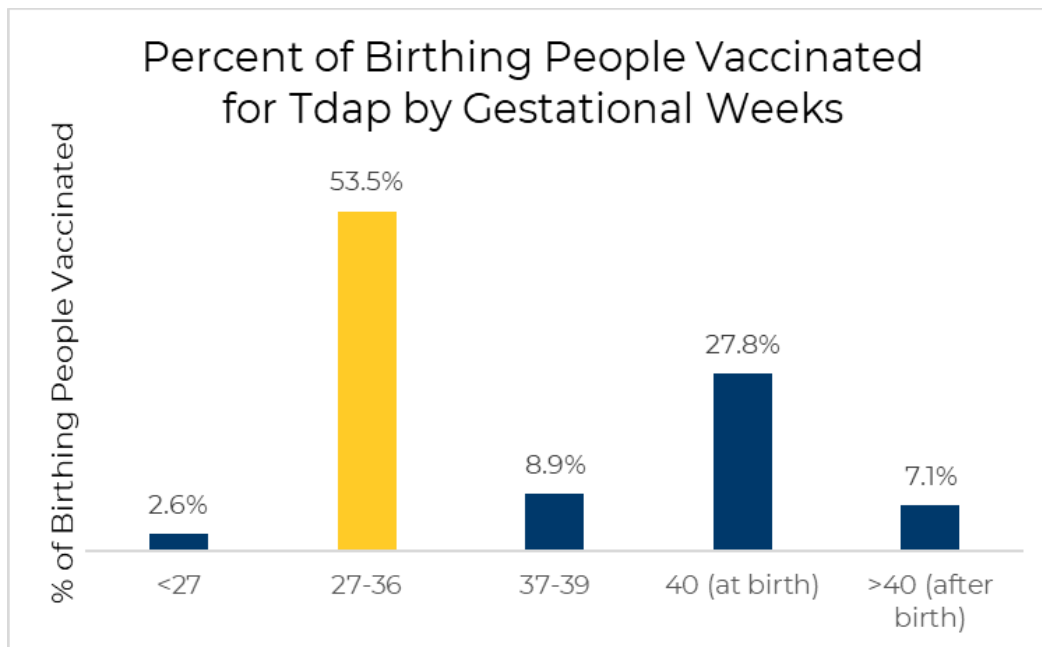
Figure 9 displays the results of birthing people vaccinated for prenatal Tdap by the gestational age of their fetus at the time of vaccination. All births were assumed to have the typical gestation period of 40 weeks. The gestational age was categorized by <27 weeks, 27-36 weeks, 37-39 weeks, 40 weeks (at birth) and >40 weeks (after birth). This categorization isolates the percentage of individuals vaccinated during the recommended timeframe of 27-36 weeks (highlighted in yellow on the graph). Vaccination in early gestation (<27 weeks) may be recommended if there is a pertussis outbreak or if a pregnant person is receiving

wound care. If a dose of prenatal Tdap is given in early pregnancy, it is not recommended that a pregnant person receive an additional dose between 27 and 36 weeks of gestation.⁹

Around half (53.5%) of individuals vaccinated were vaccinated between the recommended 27 to 36 weeks. Approximately 44% of individuals vaccinated were vaccinated in late gestation (37-39 weeks), at birth (40 weeks), or after birth (>40 weeks). The reason for this may be that the individuals were unaware of the prenatal Tdap vaccination recommendations and received the vaccine after birth to reduce disease transmission. While receiving the vaccine upon birth is not optimal and does not provide immediate protection to the infant, it can still reduce the risk of disease transmission.¹⁸

If a birthing parent does not receive a prenatal Tdap dose and is vaccinated after giving birth, a strategy used to protect infants from pertussis called 'cocooning' can be used, which involves vaccinating anyone in close contact with the infant. Cocooning is one part of a successful prevention strategy, and it can be very effective in preventing disease transmission when combined with a prenatal Tdap dose during the recommended interval.¹⁹

Figure 9. The percent breakdown of birthing people vaccinated for Tdap by the gestational week category in which they were vaccinated.



Source: NV WebIZ, 2023

Geography

Figure 10 displays counties by prenatal Tdap vaccination rate. Mineral, White Pine, Pershing, and Churchill counties had the highest vaccination rates, while Clark and Nye counties had the lowest vaccination rates. Eureka and Esmeralda counties were excluded due to having fewer than ten eligible residents in county.

Figure 10. The percent of birthing residents vaccinated for prenatal Tdap by county, 2022.

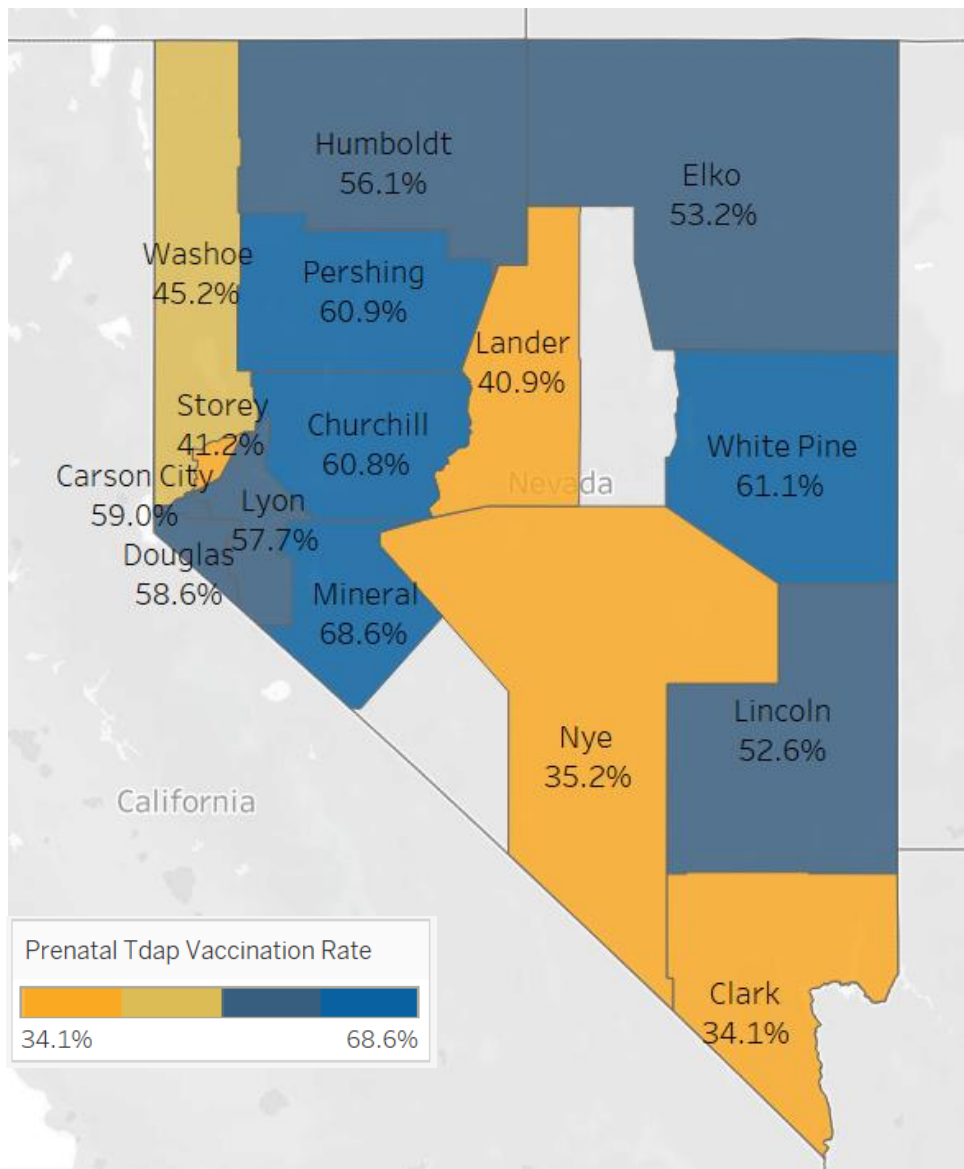
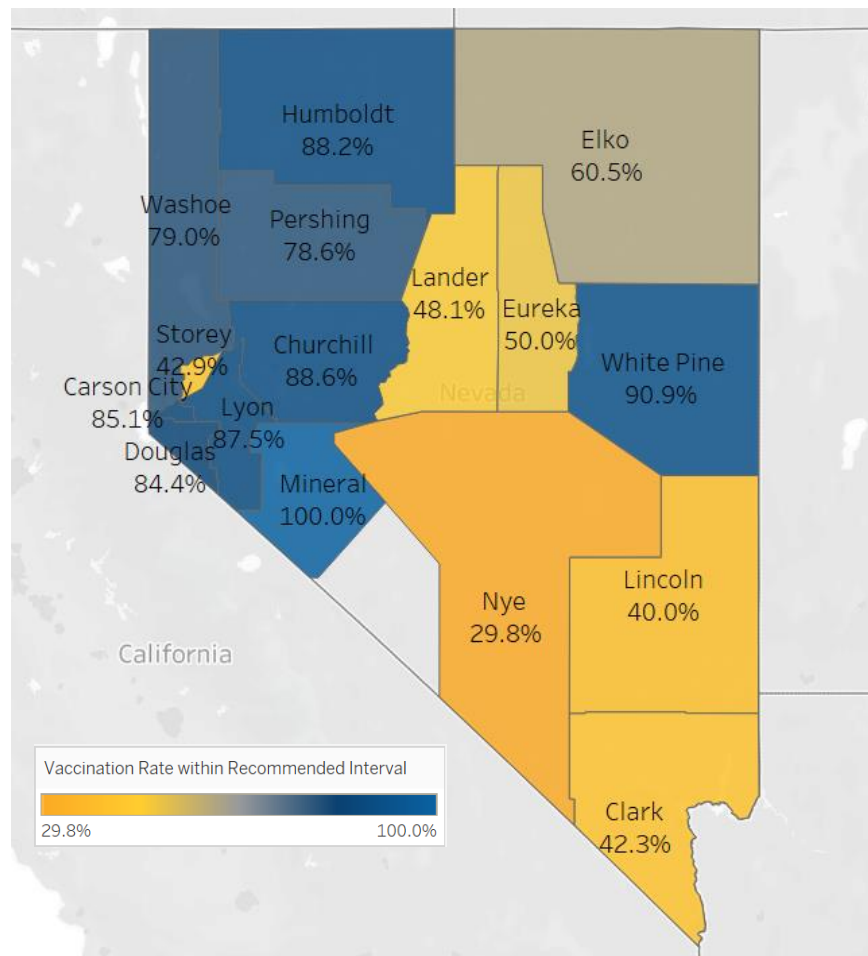


Figure 11 displays which counties had the highest percentage of residents who got vaccinated within the recommended interval of 27-36 weeks out of everyone who got vaccinated within the county. Nye County had the lowest vaccination rate within the correct interval, while Mineral County had the highest rate.

Figure 11. The percent of birthing residents vaccinated for prenatal Tdap within the correct interval, by county, 2022.



Source: NV WebIZ, 2023

For Clark and Washoe counties, ZIP code level data was examined to determine if any geographical disparities could be seen in prenatal Tdap administration. For the maps examining vaccination rates overall, ZIP codes with fewer than ten pregnant individuals were excluded. For the maps examining vaccination during the recommended time period, ZIP codes with fewer than ten vaccinated individuals were excluded.

Figure 12 displays the vaccination rates in Clark County by ZIP code for ZIP codes that had ten or more pregnant individuals residing in them. The urbanized, metropolitan areas had lower vaccination rates compared to the suburban, surrounding ZIP codes.

Figure 12. Percent of pregnant Tdap vaccinated individuals, Clark County, 2022

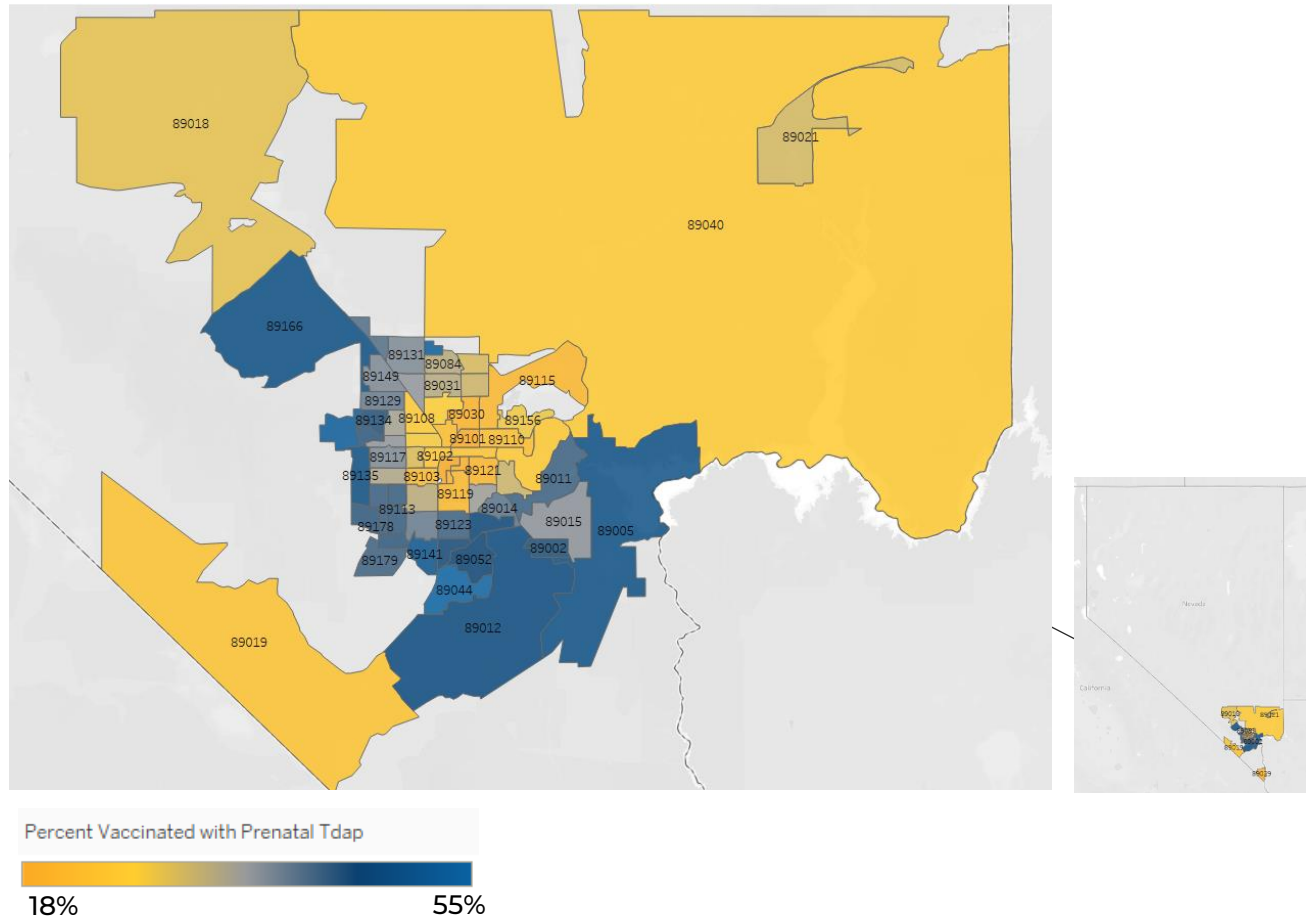


Table 2 illustrates the ZIP codes with the lowest vaccination rates by residents in Clark County. **Counties with less than ten birthing residents were excluded.** The 89109 ZIP code, located in the southeast portion of Las Vegas, had the lowest vaccination rate at 19%.

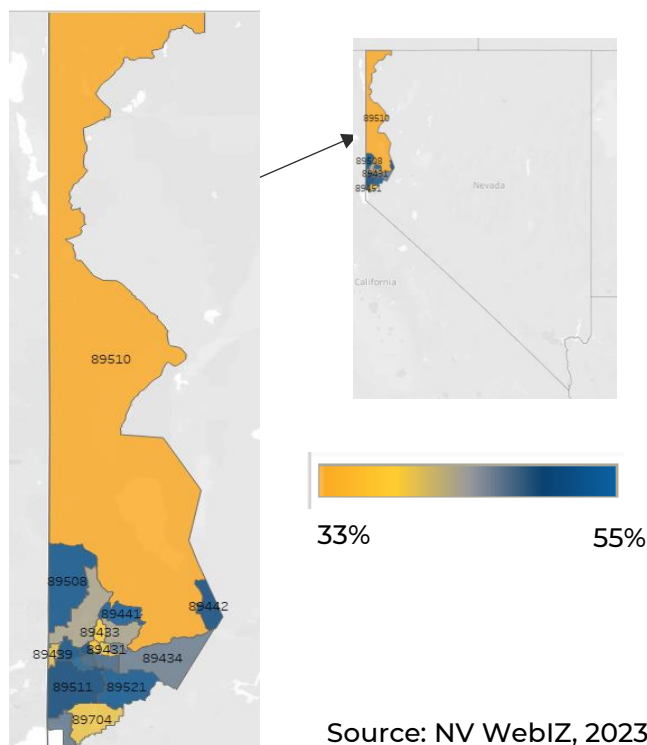
Table 2.10 ZIP codes with the lowest vaccination rates in Clark County, 2022.

	ZIP Code in Clark County	Prenatal Tdap Vaccination Rate
1.	89109	18.8%
2.	89101	19.1%
3.	89169	20.5%
4.	89030	20.7%
5.	89029	21.1%
6.	89121	21.8%
7.	89115	21.9%
8.	89119	22.5%
9.	89103	22.9%
10.	89106	23.3%

Source: NV WebIZ, 2023

Figure 13 displays the vaccination rates in Washoe County by ZIP code for ZIP codes that had 10 or more pregnant individuals residing in them.

Figure 13. Percent of pregnant Tdap vaccinated individuals, Washoe County, 2022



Source: NV WebIZ, 2023

Table 3 illustrates the ZIP codes with the lowest vaccination rates in Washoe County. The 89510 ZIP code had the lowest vaccination rate at only 33%. This ZIP code is in the Northwest portion of the state, in northern Reno.

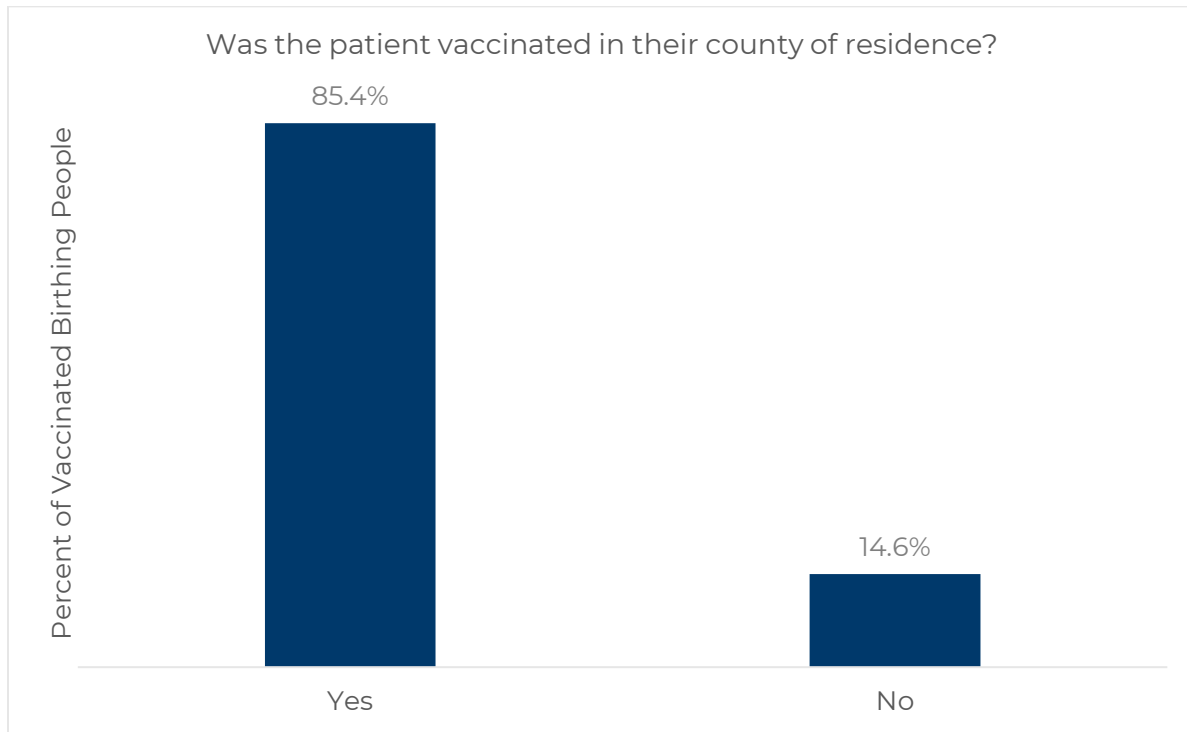
Table 3. 10 ZIP codes with the lowest vaccination rates in Washoe County, 2022.

	ZIP Code in Washoe County	Prenatal Tdap Vaccination Rate
1.	89510	33.3%
2.	89512	37.0%
3.	89433	38.7%
4.	89431	39.2%
5.	89704	39.5%
6.	89439	40.0%
7.	89436	42.8%
8.	89506	42.8%
9.	89434	45.5%
10.	89451	45.8%

Source: NV WebIZ, 2023

Figure 14 displays the results of the comparison between the county an individual received their prenatal Tdap dose and their county of residence. If the individual received their prenatal dose in the county they reside, they were marked “Yes.” If the individual received their prenatal Tdap dose in a different county than the one they reside, they were marked “No.” Most individuals (~85%) received their prenatal Tdap dose in the county they reside. Those who received their prenatal Tdap dose in a different county may not have had vaccine access in their county of residence, requiring travel to a different county.

Figure 14. The percent breakdown of birthing people vaccinated for prenatal Tdap inside their county of residence.



Source: NV WebIZ, 2023

Table 4 illustrates the counties with the highest percent of residents who traveled to a different county to receive a prenatal Tdap vaccination. Douglas County had the highest percent of vaccinated residents travel to another jurisdiction (Carson City) to receive a prenatal Tdap vaccination. This may be due to the close proximity of Douglas County to Carson City, and some residents may find the closest provider to be in the next jurisdiction over.

Table 4. The three highest percents of vaccinated individuals who traveled to a different county for a prenatal Tdap vaccination in Nevada, 2022.

Resident County	Vaccination County	Percent of Vaccinated Residents Who Traveled to Vaccination County
Douglas	Carson City	80%
Lyon	Washoe	40%
Lyon	Carson City	37%

Source: NV WebIZ, 2023

Demographics (Race/Ethnicity, Age)

Figure 15 displays the results of median maternal age by vaccination status. The median maternal age was used to account for outliers within the groups. The median maternal age for “Vaccinated” birthing parents was only slightly higher than the median age for “Unvaccinated” and “Missing” birthing parents.

Figure 15. Comparison of median maternal ages by prenatal Tdap vaccination status in Nevada, 2022.

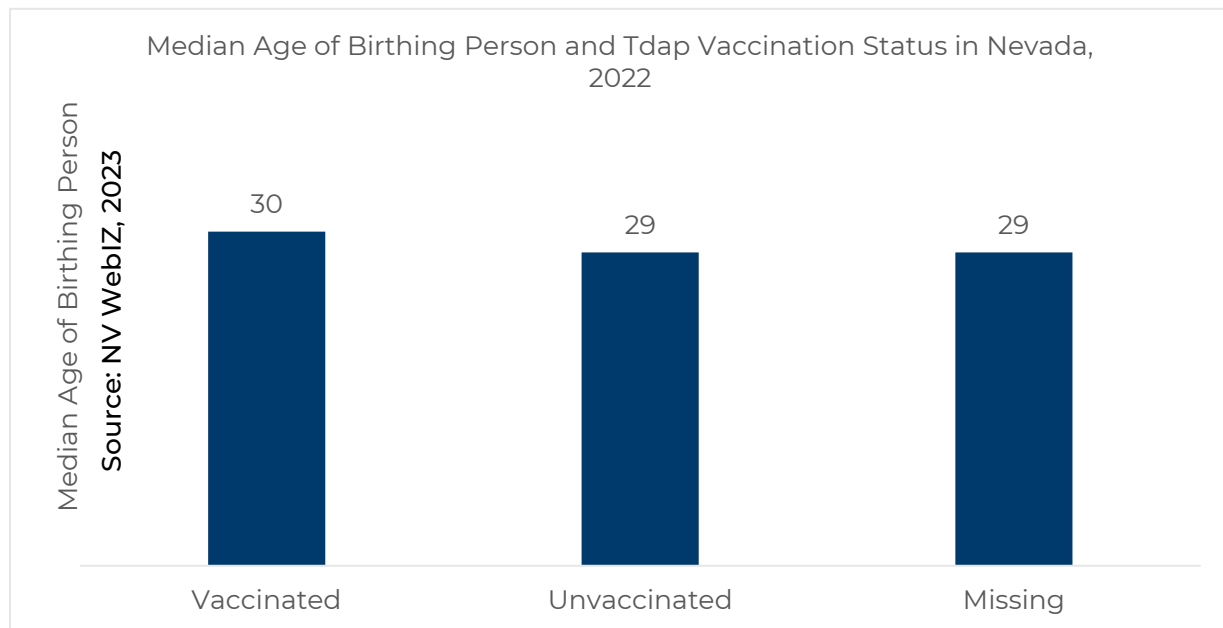
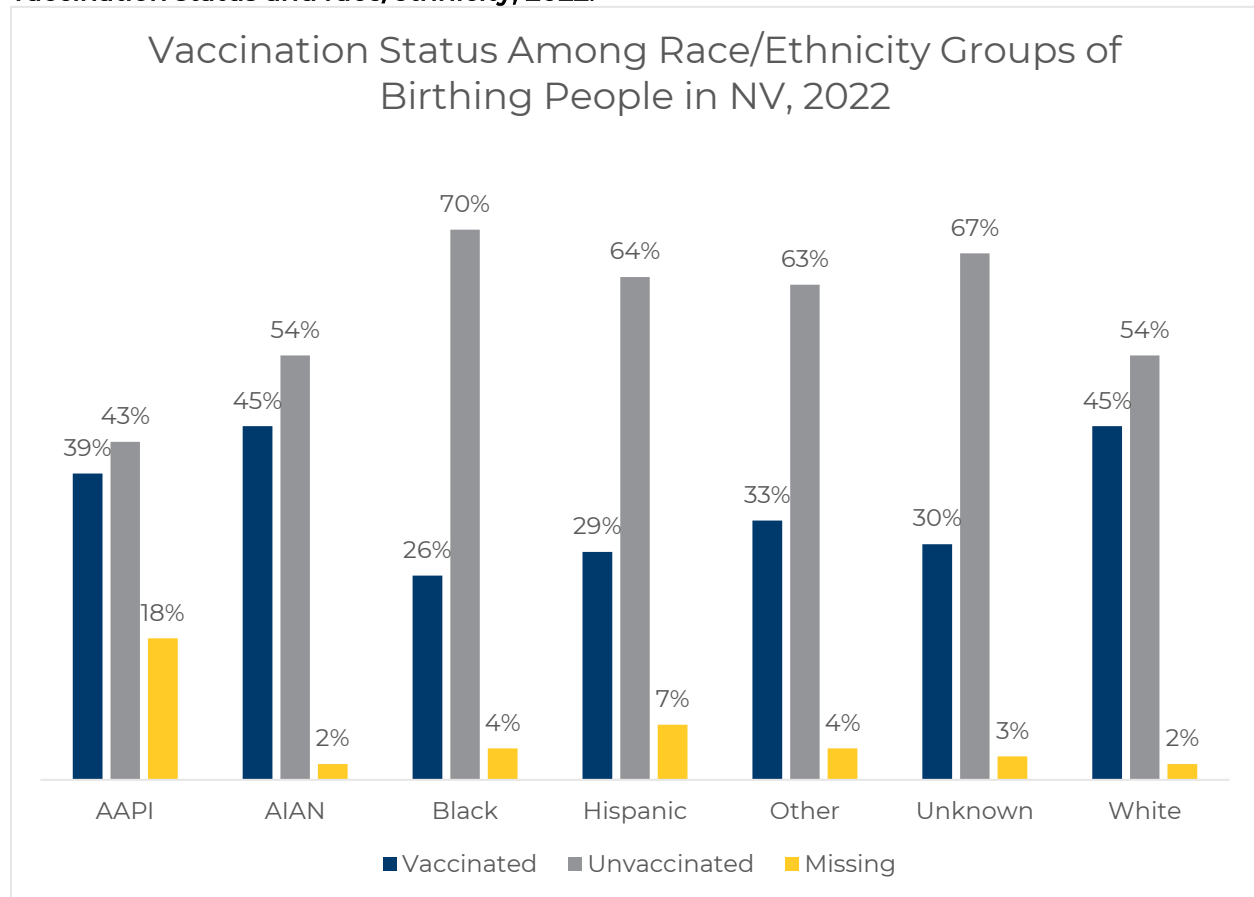


Figure 16 displays the results from the percent breakdown of birthing people in Nevada in 2022 by prenatal Tdap vaccination status and race/ethnicity. Black-birthing parents had the lowest vaccination rate at 26%, while white and AIAN-birthing parents had the highest vaccination rate at 45%. AAPI birthing parents had the highest rate of missing vaccination status at 18%.

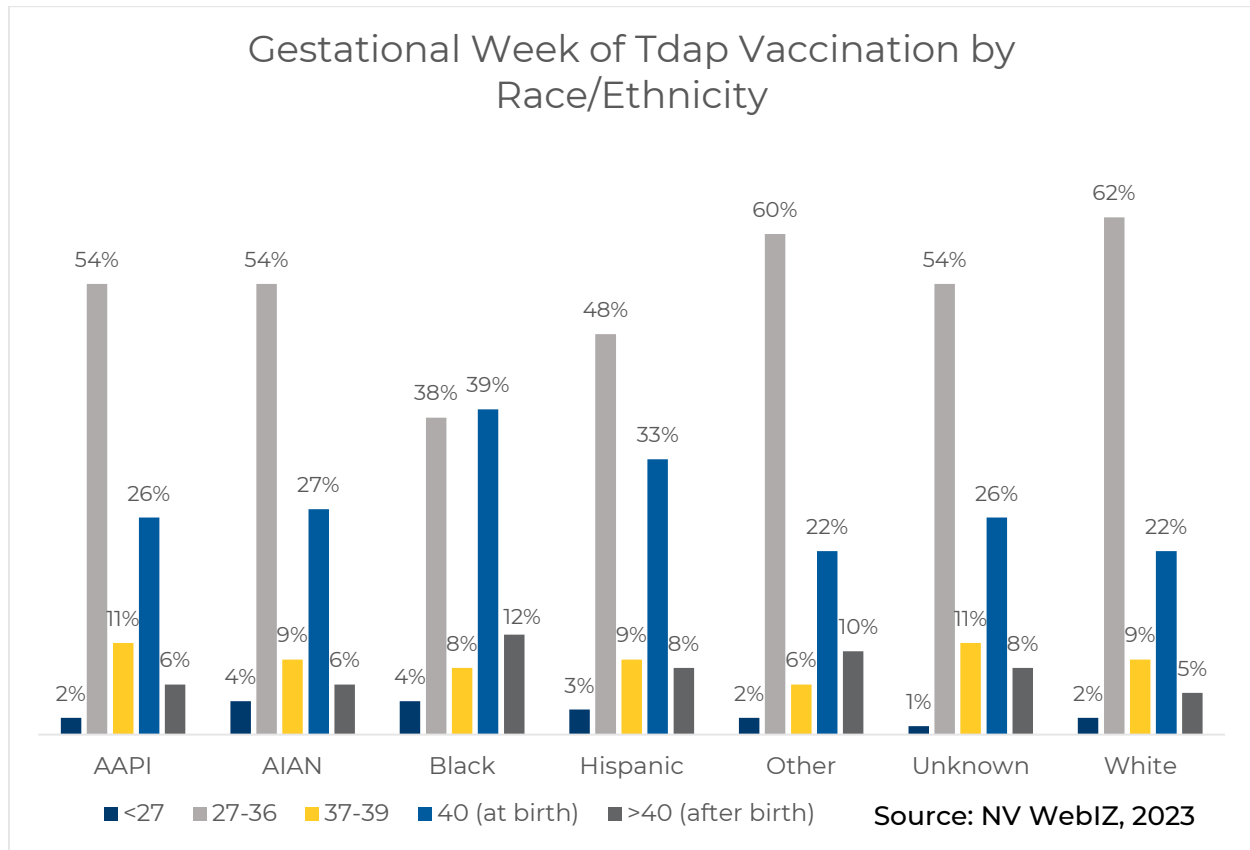
Figure 16. The percent breakdown of birthing people in Nevada by prenatal Tdap vaccination status and race/ethnicity, 2022.



Source: NV WebIZ, 2023

Figure 17 displays the results of the percent breakdown of vaccinated birthing parents in Nevada in 2022 by gestational week of vaccination and race/ethnicity. White birthing parents had the highest percentage of individuals vaccinated during the recommended time frame of 27-36 weeks at 62%. Black birthing parents had the lowest percentage of individuals vaccinated during the recommended time frame at 38%. Black birthing parents also had the highest percentage of individuals vaccinated upon giving birth at 39%.

Figure 17. The percent breakdown of vaccinated birthing people in Nevada by gestational week of Tdap vaccination and race/ethnicity, 2022.



KEY TAKEAWAYS

- Only 36.2% of individuals who gave birth in Nevada in 2022 were vaccinated for prenatal Tdap.
- Out of the individuals who gave birth that were vaccinated, only 53.5% were vaccinated during the recommended interval (27-36 weeks).
- Around 28% of individuals who gave birth were vaccinated for Tdap the same week they gave birth.
- Clark and Nye counties had the lowest prenatal Tdap vaccination rates in 2022.
- Geographic disparities in prenatal Tdap vaccination were seen at the ZIP code level in Clark and Washoe counties.
- Several rural counties had high vaccination coverage (>80%) despite known geographical challenges to vaccinating.
- Black birthing parents had the lowest prenatal Tdap vaccination rate in 2022 (26%).

- Vaccinated white individuals who gave birth had the highest vaccination rates during the recommended time frame (62%) while vaccinated Black individuals who gave birth had the lowest vaccination rates during the recommended time frame (38%).
- AIAN had the highest coverage among racial and ethnic groups (45%).
- Hospitals, obstetrics/gynecology/women's care practices, and pharmacies were the most frequent places where pregnant people got vaccinated.

DISCUSSION

There are many reasons why prenatal Tdap vaccination rates might remain low nationwide and in Nevada. Racial and ethnic disparities have been found in prenatal Tdap vaccination rates in Black pregnant individuals compared to other racial/ethnic groups.²⁰ Rural disparities have also been seen when it comes to prenatal Tdap vaccination rates nationwide.²¹ An analysis of National Health Interview Survey (NHIS) data from 2012 to 2018 showed that the strongest predictor of vaccination during pregnancy was having health insurance, followed by having a higher income and greater level of education.²²

According to published studies, key factors contributing to lower prenatal vaccination rates for pregnant individuals of color include attitudes and beliefs, knowledge, lack of access, trust in health care providers and vaccines, risk perception, and racial discrimination.²³ Black and Hispanic women were less confident in vaccine safety and efficacy and less likely to trust information from health care providers and public health authorities.²⁴ Black women also historically report a lower rate of being recommended or offered influenza vaccine during pregnancy.²⁵

Research has also shown that additional access to prenatal vaccines among rural residents is more limited in comparison to urban residents.²⁶ In addition to access, pregnant individuals residing in rural areas may experience transportation issues, financial hardships, lack of health insurance coverage, and provider shortages as barriers to getting vaccinated.²⁶ Noting that despite these barriers we did still see high instances of coverage in certain rural and frontier counties such as Carson City, Mineral, White Pine, Lyon, and Douglas.

Pregnancy care also offers unique opportunities to increase vaccination rates, as well as overall health for pregnant individuals. A provider recommendation is the most important predictor of vaccine uptake for pregnant people.²⁷ For most patients, office visits during pregnancy are frequent, with 12 to 14 visits recommended during a healthy pregnancy. Visits have tended to be monthly during the first 4 to 28 weeks, then every other week from 28 to 36 weeks gestation, and weekly thereafter, although COVID-19 created a shift towards telemedicine for some of these visits.²⁸ The first prenatal visit is usually the most comprehensive and allows for discussion of overall health, including vaccinations. Provider offices can also combine the 28-week glucose test for diabetes with an opportunity to give the Tdap vaccine.²⁷ If a patient refuses the vaccination the first time it is brought up, providers should reiterate messaging on vaccines, as one study found that 20% of pregnant people who received a prenatal influenza vaccine had previously refused

it.²⁹ Additionally, those pregnant for the first time are less likely to have confidence around vaccine knowledge and intention,²⁸ and reaching these individuals is vital.

Obstetrics providers have reported feeling unprepared to provide messaging for vaccine-hesitant patients.³⁰ In a survey of providers, the most effective messaging tactic was perceived to be stating that not getting vaccinated puts the fetus or newborn at risk.³¹ All providers that provide prenatal care, including doctors, midwives, doulas, nurses, pharmacists, etc. should be provided training and education on how to approach this conversation. Other effective vaccination uptake techniques for providers include stocking vaccines at the practice, standing orders for Tdap vaccination for all pregnant individuals, and group prenatal care visits.²⁸ Additional systemic strategies such as immunization information system quality assurance, technical assistance with immunization stakeholders, incentives, and overall health equity training should be employed in addition to provider education.²⁸

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