RESULTS OF THE 2022 IMMUNIZATION STATUS SURVEY OF 24-MONTH-OLD CHILDREN IN TENNESSEE

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Acknowledgements

Birth data were provided by the Tennessee Department of Health, Office of Vital Records and Statistics. Immunization data were collected by county and regional health department nurses, immunization representatives and disease investigation staff. Data entry, analysis and reporting were conducted by staff of the Tennessee Vaccine-Preventable Diseases and Immunization Program. Survey data were collected using REDCap electronic data capture tools hosted at the Tennessee Department of Health. REDCap (Research Electronic Data Capture, http://projectredcap.org/) is a secure web-based application designed to support data capture.

Executive Summary

The 2022 Immunization Status Survey of 24-month-old Children (Immunization Status Survey) in Tennessee is conducted by the Tennessee Department of Health (TDH) Vaccine-Preventable Diseases and Immunization Program (VPDIP) and Tennessee's 13 Regional and Metro Health Departments. The purpose of this survey is to track progress toward achieving the national Healthy People objectives for immunization coverage with Advisory Committee on Immunization Practices (ACIP) routinely recommended early childhood vaccines.

This survey utilizes a retrospective cohort research design to determine the up-to-date (UTD) immunization rates for 24-month-old children born in Tennessee. The survey population is composed of random samples drawn from birth certificates of infants born in each of the 13 health department regions. The children sampled for the survey were born during the first quarter of 2020 and celebrated their second birthdays between January 1 and March 31, 2022. Identifying information was obtained from electronic birth records, and immunization history data were collected primarily via the statewide immunization registry, Tennessee Immunizations Information System (TennIIS).

Immunization rates for the 4:3:1:FS:3:1:FS series (4 DTaP, 3 Polio, 1 MMR, 3 Hib, 3 Hepatitis B, 1 Varicella, and 4 PCV) were based on the childhood immunization and catch-up schedules recommended by the ACIP in 2022. The results of the survey are aggregated to give regional and statewide statistics on immunization coverage rates in Tennessee and track the progress toward achieving a goal of 90% coverage with on-time immunization for each routinely recommended vaccine before age two years.

Each child's immunization record was reviewed to determine if they were UTD. If the child was not UTD, an effort was made by local public health staff to contact parents, guardians, and providers to obtain any missing immunization history data. If further follow-up revealed that the child was truly not UTD, the data collection process served as a reminder-recall system for parents and providers.

If all the 4:3:1:FS:3:1:FS series vaccination dates occurred before the child reached 24 months of age or if the series was completed according to the Centers for Disease Control and Prevention's (CDC) catch-up schedule guidance, the child was classified as UTD by 24 months. Children were excluded from the UTD by 24 months classification if at least one of the 4:3:1:FS:3:1:FS series dates occurred after the child reached 24 months of age and did not meet the catch-up schedule recommendations**.**

In 2022, the Tennessee statewide UTD immunization rate by 24 months was 77.1%, up from 74.8% in 2021 (Table 3, pg. 18). Historically, Tennessee has high vaccination rates, but has not yet achieved most Healthy People objectives for either 2020 or 2030. In 2022, Tennessee met four out of the 12 HP2020 objectives and one of the three HP2030 objectives. Tennessee ranks in the bottom 30% of states for the completion of 4:3:1:FS:3:1:FS series ranking 33rd in the nation and fifth out of eight in Region 4 of the United States Department of Health and Human Services (HHS), which includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and South Carolina.[1,2]

Additionally, there was considerable variation by region in the percent of children found to be UTD by 24 months (*with data collection)*, ranging from 64.3% in the Upper-Cumberland Region (UCR) to 92.3% in the Knox County Region (KKR). Caution should be taken when interpreting immunization rates for a region with a low response rate because children who are excluded from the study due to being unable-to-locate (UTL) could also be the least UTD. The greatest UTD by 24 months improvement was observed in Jackson Madison Region (JMR), which had a 13.1 percentage point increase from 2021 to 2022 (Table 8, pg. 38).

A preliminary immunization rate was calculated: UTD by 24 months *(as reported to TennIIS).* This rate represents the percentage of study participants whose vaccines were UTD by 24 months based only on the information found in TennIIS prior to the survey, *i.e.,* no follow up with parents or providers. In Tennessee, providers voluntarily report vaccine administration to TennIIS other than vaccines that are provided through a federally-funded program such as the Vaccines for Children (VFC) Program. For all 24-month-ld children in Tennessee, the UTD immunization rate based on TennIIS data alone was 8.9%, 0.8 percentage points lower than 2021 and 68.2 percentage points below the UTD by 24 months (*with data collection)* rate for 2022. This suggests that there is substantial underreporting to TennIIS by Tennessee healthcare providers.

The percentage of Tennessee children who received the fourth dose of DTaP by 24 months of age increased by 4 percentage points from 2021 to 2022. This rate continues to significantly lag behind the percentage of children who received the third dose by 24 months of age. Historically, Tennessee has not met the Healthy People 2020 (HP2020) objective for DTaP. In fact, 93.8% of children received three doses of DTaP by 24 months of age while only 81.3% received their fourth dose in 2021 (Figure 16, pg. 35). The third dose of DTaP can be given as early as 6 months of age; however, the fourth dose must be delayed until at least 12 months of age and 6 months after the third dose. These results suggest that patient outreach efforts specific to the fourth dose of DTaP may be helpful for parents after their child's one year check-up.

Although young children have increased risk of developing serious flu-related complications such as pneumonia, dehydration and death Tennessee children continue to be under vaccinated for influenza.[3] Therefore, promoting timely immunization practices with influenza vaccine are a high priority for VPDIP. Among the 2022 cohort, only 48.3% of 24-month-old children had achieved the HP2020 objective of two doses of influenza vaccine by 24 months of age, a decrease from 54.8% in 2021 (Table 3, pg. 18).

In addition to individual vaccine analysis, multiple risk factors and their potential effects on UTD status were evaluated. These risk factors include program enrollment, race, number of siblings, etc. Enrollment in a medical safety-net programs, TennCare and Women, Infants, and Children (WIC), was analyzed to determine if a child had ever been enrolled in one or both programs at any time Participants were assigned into categories based on their enrollment status (TennCare only, WIC only, or enrollment in both programs). The UTD rate by 24 months for children who were enrolled in WIC only (69.6%) was much lower than in any of the other categories, including those not enrolled in either program (Table 4, pg. 24).

The 2022 Immunization Status Survey report offers the people of Tennessee and its health regions a chance to study demographic and immunization history data simultaneously, so that evidence-based programs can be created to raise immunization rates across the state of Tennessee.

Definitions of Abbreviations

Organizations and Terminology

TDH: Tennessee Department of Health
VPDIP: Vaccine-Preventable Diseases and Immunization Program
ACIP: Advisory Committee on Immunization Practices
CDC: Centers for Disease Control and Prevention
FDA: Food and Drug Administration
HHS: United States Department of Health and Human Services
TennIIS: Tennessee Immunizations Information System
NIS: National Immunization Survey (CDC)
WIC: Women, Infants, and Children Program
VFC: Vaccines for Children
UTD: Up to Date
UTL: Unable to Locate

Vaccines

DTaP: diphtheria, tetanus, acellular pertussis vaccine
IPV: inactivated polio vaccine
HAV: hepatitis A vaccine
HBV: hepatitis B vaccine
HIB: *Haemophilus influenzae,* type B vaccine
MMR: measles, mumps, rubella vaccine
VAR: varicella (chickenpox) vaccine
PCV: pneumococcal conjugate vaccine
4:3:1:FS:3:1:FS: Combined Full Series (DTaP, IPV, MMR, HIB, HBV, VAR, and PCV)
FLU: seasonal influenza vaccine
RTV: rotavirus vaccine

Public Health Regions

Rural, multi-county regions

I. WTR: West Tennessee Region
II. SCR: South Central Region
III. MCR: Mid-Cumberland Region
IV. UCR: Upper Cumberland Region
V. SER: Southeast Region
VI. ETR: East Tennessee Region
VII. NER: Northeast Region

Metropolitan, single county regions

I. MSR: Memphis-Shelby County Region
II. JMR: Jackson-Madison County Region
III. NDR: Nashville-Davidson County Region
IV. CHR: Chattanooga-Hamilton County Region
V. KKR: Knoxville-Knox County Region
VI. SUL: Sullivan County Region

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SECTION I

Introduction

An annual Immunization Status Survey of 24-month-old Children in Tennessee is conducted by the Tennessee Department of Health's (TDH) Vaccine-Preventable Diseases and Immunization Program (VPDIP) to track progress toward achieving at least 90% on-time immunization with each routinely recommended vaccine antigen for before age two years. The survey is composed of random samples drawn from birth certificates of infants born in each of the 13 health department regions, which are aggregated to give statewide and regional statistics on immunization coverage rates in Tennessee.

Safety and Efficacy of Immunizations

The United States has the safest and most effective vaccine supply in its history. Prior to licensure, rigorous clinical trials are carried out by the vaccine manufacturers and reviewed by the Food and Drug Administration (FDA). Vaccines are recommended only when proven to be safe, effective, and beneficial. After licensure, vaccines continue to be monitored for rare adverse reactions. Most vaccinated children never experience an adverse reaction. The most frequently reported adverse reactions are minor and include soreness at injection site, a rash, or a mild fever that subsides within one to two days.[3]

Vaccines help the body build immunity against disease. Because of the success of vaccines, many diseases that were historically commonplace have become rare or have been eliminated from the United States. By vaccinating a child, benefits also extend to others. Individuals who cannot develop immunity from vaccines, have medical conditions that do not allow them to be vaccinated, and babies who are too young to be vaccinated rely on the immunity of those around them to protect them from serious infectious diseases.[4]

Value of Immunizations

Timely routine vaccination of children protects community health, prevents outbreaks, and saves money and lives. The federal Vaccines for Children (VFC) Program, implemented in 1994, assures affordable access to all routine vaccines for children who are without private insurance coverage. In Tennessee, over 600 providers across the state are enrolled as VFC providers and there is at least one VFC provider in each of Tennessee's 95 counties. CDC has reported that the routine vaccines given to U.S. children born between 1994 and 2018 **will prevent an average of 419 million childhood illnesses and prevent the premature death of 936,00 of these children over their lifetimes.**[5] Additionally, CDC calculates that vaccination of each U.S. birth cohort according to the current immunization schedule yields a net savings of nearly $406 billion in direct medical costs and $1.9 trillion in total costs to society.[6] With roughly two percent of the U.S. population living in Tennessee, this suggests Tennessee has benefitted from the prevention of approximately 8.4 million cases of disease in the past decade, with ***annual savings*** **of $8.1 billion in direct medical costs and $38 billion in total costs to society.**

In Tennessee, unvaccinated and under-vaccinated children have comprised substantial proportions of reported vaccine-preventable infections such as measles, mumps, and pertussis (whooping cough). Most children who die each year from seasonal influenza are unvaccinated.[7,8] These diseases not only place Tennesseans at risk for significant morbidity and mortality, but also create significant fiscal burden upon the State. Even small outbreaks place tremendous strain upon our public health system and divert attention from other critical public health initiatives.

Vaccines Assessed

This survey assesses vaccine completion according to the Advisory Committee on Immunization Practices' (ACIP) recommendations for protection against ten serious illnesses before the age of 24 months: diphtheria, tetanus, pertussis (combined as DTaP), poliomyelitis (IPV), measles, mumps, rubella (combined as MMR), *Haemophilus* influenza type B (HIB), hepatitis B (HBV), varicella (VAR), and *Streptococcus pneumoniae* or "pneumococcus" (PCV). Combined, these are known as the 4:3:1:FS:3:1:FS series.[9] Additionally, this survey analyzes completion of hepatitis A (HAV), rotavirus (RTV), and seasonal influenza (Flu) vaccines.

Table 1. ACIP List of Diseases to Prevent through Vaccination of Children < 24 Months of Age

Disease(s)	Possible complications of disease
Diphtheria, Tetanus, Pertussis (DTaP)	*Diphtheria*: upper airway obstruction, pneumonia, respiratory failure, death
	Tetanus: spasms of respiratory and skeletal muscles, death
	Pertussis: severe, long-term cough, vomiting, breathlessness, death in infants
Poliomyelitis (IPV)	Paralysis, death
Measles, Mumps, Rubella (MMR)	*Measles:* ear infections, pneumonia, cardiac and neurologic problems, encephalitis, death
	Mumps: decreased fertility, meningitis, arthritis, hearing impairment
	Rubella: arthritis, encephalitis, birth defects
***Haemophilus influenzae* type B (HIB)**	Pneumonia, meningitis, neurologic problems, death
Hepatitis B (HBV)	Fulminant hepatitis, jaundice, liver cancer, cirrhosis, premature death
Varicella (VAR/Chickenpox)	Rash illness, severe disease in immunocompromised, birth defects, encephalitis, death
Pneumococcus (PCV)	Ear infections, pneumonia, meningitis, blood stream infections, death
Hepatitis A (HAV)	fever, nausea, jaundice, death
Influenza (Flu)	secondary pneumonia, exacerbation of chronic diseases, hospitalizations, death
Rotavirus (RTV)	dehydration, hospitalization, death

Vaccine Completion Logic

Complete on-time immunization in this survey is defined as having received four doses of DTaP vaccine, three doses of IPV vaccine, one dose of MMR vaccine, three *or* four doses of HIB vaccine (depending on brand received *or* any child clinically considered complete based on the CDC's "catch-up" schedule), three doses of HBV vaccine, one dose of VAR vaccine and four doses of PCV vaccine (*or* any child clinically considered complete based on the CDC's "catch-up" schedule).

This survey accounts for the vaccine brand, if known, and classifies a child as complete only if the appropriate number of doses have been administered. If any documented HIB dose was given as the four-dose product, then only receipt of four doses was considered as a complete series. In the absence of documentation of vaccination brand, receipt of four doses of HIB is classified as series completion. Likewise, if any documented RTV dose was given as the three-dose product, then only receipt of three doses was considered as a complete series. In the absence of documentation of vaccination brand, three doses of RTV are classified as series completion. This methodology change accounts for both the vaccine schedule and vaccine brand to ensure that only children who have received the vaccine on the correct schedule and with the correct brand are considered complete. As a result, point estimates for HIB and RTV coverage rates are lower than previous estimates, but also more accurate and more consistent with methods used by the CDC.

In 2019, additional analyses were included to account for the HIB and PCV catch-up schedules. Prior to 2019, counts of vaccinations were used to calculate series completion for both HIB and PCV. However, this method inaccurately captured completion for these vaccines due to the unique vaccination schedules that exist when a child receives their first dose after the recommended age, but prior to 24 months. By assessing completion based upon requirements for the age of first vaccination, HIB and PCV completeness more accurately mirrors ACIP forecasting and clinical decision-making.

Table 2. Catch-Up Guidance for PCV and HIB, Centers for Disease Control and Prevention[10]

Age at Dose 1	Age at Dose 2	Age at Dose 3	**Recommendation**
PCV			
< 12 months old	< 12 months old	< 12 months old	**Needs 4th dose 8 weeks later**
< 12 months old	Between 7-11 months old		**Needs 3rd dose 8 weeks later**
> 12 months old			**Needs 2nd dose 8 weeks later**
24-25 months			**No additional dose needed**
HIB			
< 12 months old	< 12 months old	< 12 months old	**Needs 4th dose 8 weeks later**
< 12 months old	Between 12-14 months old		**Needs 3rd dose 8 weeks later**
< 12 months old	> 15 months old		**No additional dose needed**
Between 12-14 months			**Needs 2nd dose 8 weeks later**
> 15 months old			**No additional dose needed**

Special Vaccine Considerations

Hepatitis A vaccine (HAV)
HAV is a two-dose series, starting on or after the first birthday. As the recommended dose spacing is six months, children who have only one dose by the second birthday are still on schedule. For this reason, this survey reports 24-month-old children as up-to-date with one dose of HAV. HAV will not be compared to HP2020 objectives in this report, as the HP2020 objective reflects completion of the 2-dose series. Tennessee experienced a multi-state epidemic of acute hepatitis A that began in 2017 and spanned more than two and a half years. Over the course of the outbreak, 3,149 Tennesseans were infected, 1,923 were hospitalized, and 28 died because of their illness.

Hepatitis B vaccine (HBV) birth dose
HBV birth dose is one dose of HBV vaccine, given between 24 hours and three days of life. In 2016, CDC revised its guidance to recommend routine administration of a hepatitis B birth dose within 24 hours of life (rather than prior to hospital discharge). This survey utilizes the maximum number of days past birth (3 days) to evaluate HBV birth dose. This method also aligns with the HP2020 objective for HBV birth dose which is also classified as one dose of HBV within 3 days of life. Birth dose hepatitis B is a key strategy to eliminate transmission of the hepatitis B virus from an infected mother to her infant. The Vaccine Preventable Diseases and Immunizations Program (VPDIP) manages the cases of more than one hundred infants who are exposed to the hepatitis B virus through their infected mothers each year. These infants are at high risk of chronic liver disease and early death, which can be avoided with appropriate vaccination.

Influenza vaccine (Flu)
Influenza vaccine (Flu) is given annually to children aged six months and older; two doses should be given during a child's first influenza season. Because protection is conferred only after two doses for this populations, this survey measures the proportion of children who have received two or more doses by their second birthday. Many children who die each year from influenza failed to receive an annual influenza vaccination.

Haemophilus influenzae type B vaccine (HIB)
HIB is either a three or four-dose series, starting on or after the second month of life. Two HIB schedules exist, depending upon the vaccine used. The full series (FS) of the Merck© product requires three doses; the FS of the Sanofi Pasteur© product requires four doses. Any mixed-brand schedule requires four doses. Any child receiving one or more doses of the 4-dose HIB product must have received four doses before the 25th month of life to be considered complete and on-time. This classification by HIB products administered reduces the degree of overestimation of on-time completion demonstrated by past reports. Since the introduction of the HIB vaccine in 1987, the annual incidence of invasive Hib disease in children aged younger than 5 years old decreased by 99%.[11] In 2022, Tennessee had fewer than 5 reported cases of invasive *Haemophilus influenzae* type b (HIB) statewide.

Rotavirus vaccine (RTV)
RTV is either a two or three-dose series, starting on or after the second month of life. As with HIB vaccine, two rotavirus vaccine products are available with different dosing schedules. Rotateq© (Merck), requires three doses; Rotarix© (GSK) requires two doses. Mixed brand schedules require three doses. RTV is unique among vaccines as the series must be initiated no later than 15 weeks of age and no doses should be given after eight months of age. Prior to the introduction of the vaccine in 2006, RTV was the leading cause of leading cause of severe diarrhea among infants and young children. Each year, the vaccine prevents an estimated 40,000 to 50,000 hospitalizations among U.S. infants and young children.[12]

Healthy People 2020 objectives

Healthy People 2020 (HP2020) objectives were established by the federal Department of Health and Human Services (HHS) to provide national targets for population health that were to be achieved prior to January 1, 2020. These objectives included vaccine coverage rates among children 19-35 months of age and were tracked nationally through the National Immunization Survey (NIS). Although HP2020 ended, TDH continues to strive to reach or exceed each of these targets as quickly as possible and maintain those high rates of immunization coverage among children.

The following objectives for the percentage of children immunized between 19-35 months of age were established by HP2020 and are relevant comparisons to the results of this survey:

- 80% complete the 4:3:1:FS:3:1:FS series
- 90% complete each individual vaccine included in the 4:3:1:FS:3:1:FS series
- 80% complete rotavirus vaccination with two or more doses
- 70% complete influenza vaccination with two or more doses
- 85% of all children receive their first dose of hepatitis B vaccine within three days of life

Healthy People 2030 Objectives

Healthy People 2030 (HP2030) objectives are established by the federal Department of Health and Human Services (HHS) to provide national targets for population health to be achieved prior to January 1, 2030. These objectives include vaccine coverage rates among children 2 years of age and are tracked nationally through the National Immunization Survey (NIS). TDH aims to reach or exceed each of these targets as quickly as possible and maintain those high rates of immunization coverage among children.

The following objectives for the percentage of children immunized by 2 years of age have been established by HP2030 and are relevant comparisons to the results of this survey:

- 90% complete DTaP vaccination with four or more doses
- 90.8% complete MMR vaccination with one or more doses
- ≤1.3% of children receive 0 doses of recommended vaccinations

Although HP2030 has established new objectives, Tennessee did not meet all objectives of HP2020 and will continue to use relevant HP2020 objectives as comparison measures in this report.

Methods

Survey Design

The annual Immunization Status Survey of 24-month-old Children in Tennessee utilizes a retrospective cohort research design to determine the up-to-date (UTD) immunization rates for 24-month-old children born in the state of Tennessee. The survey is composed of targeted random samples drawn from birth certificates of 1,574 (comprised of approximately 121 children from each of the 13 health department regions) infants born during the first quarter of 2020 in Tennessee. These children celebrated their second birthdays between January 1 and March 31, 2022. Identifying information was obtained from electronic birth records and immunization data were collected primarily via the Tennessee Immunization Information System (TennIIS). Immunization rates for the 4:3:1:FS:3:1:FS vaccine series (4 DTaP, 3 Polio, 1 MMR, 3 Hib, 3 Hepatitis B, 1 Varicella and 4 PCV vaccine doses) were based on the childhood immunization and catch-up schedules recommended by the Advisory Committee on Immunization Practices (ACIP) and Centers for Disease Control and Prevention (CDC) in 2022.

During the three-month data collection period, each immunization date was compared to the child's birth date to determine whether it was administered before or after 24 months of age and if it was a valid administered vaccine according to the ACIP vaccine schedule. If all of the 4:3:1:FS:3:1:FS vaccine dates occurred before the child reached 24 months of age or if the series was completed according to the CDC's catch-up schedule guidance, the child was classified as up-to-date by 24 months. Children were excluded from the up-to-date by 24 months classification if at least one of the 4:3:1:FS:3:1:FS dates occurred after the child reached 24 months of age and did not meet the ACIP on-time or CDC catch-up schedule recommendations.

A rate was calculated, up-to-date (UTD) by 24 months (*as reported to TennIIS*), served to ascertain how accurately TennIIS data reflect UTD immunization rates by 24 months of age, without parent/provider contact. Immunization rates of the UTD by 24 months (*with data collection*) were calculated for the entire sample and health region–specific samples. The UTD immunization rates were also calculated for demographic subgroups within these samples.

Target Population and Sample Selection

A random sample of 1,574 children born between January 1 and March 31, 2020, was selected to represent all children born in Tennessee in 2020 (approximately 81,188 live births). The sample was stratified by health jurisdiction to generate regional estimates. The sample size per region depends on the number of children born in that region and the racial demographic represented in that region.

Data Collection

Passive Data Collection

Data pertaining to the survey sample was requested from: electronic birth records supplied by Tennessee Department of Health, Office of Vital Records and Statistics, the Tennessee Women, Infants, and Children Supplemental Nutrition Program (WIC) and TennIIS.

Information from electronic birth records was used for sample selection and as a source of demographic data. The type of information obtained on each child *included*:

- Child's first, middle and last name
- Child's sex, race, ethnicity, and date of birth
- Mother's residential county
- Mother's first and last name
- Father's first and last name
- Mother's level of education, marital status, and age at delivery
- Father's level of education and age at delivery

The WIC enrollment variable was determined for each child by matching each child's name and date of birth with WIC enrollment data. Children enrolled in WIC for any amount of time during the first 24 months of life were designated as "enrolled in WIC". If a child was only ever enrolled in WIC, the "Program Enrollment" variable was determined to be "WIC Only."[1] The TennCare (Medicaid) enrollment variable was determined for each child by matching each child's name and date of birth with TennCare enrollment data. Children enrolled in TennCare for any amount of time during the first 24 months of life were designated as "enrolled in TennCare". If a child was only ever enrolled in TennCare, the "Program Enrollment" variable was determined to be "TennCare Only." If a child was found to have ever been enrolled in TennCare and

[1] Infants in WIC have immunization records reviewed at WIC visits. Targeted education and telephone follow-up are the primary tools used to encourage catch-up immunization of WIC infants.

WIC, the "Program Enrollment" variable was determined to be "TennCare and WIC Enrollment."

The "Vaccination Source" variable was determined based on the location where each individual vaccine was administered. If a child received vaccines exclusively in private provider offices, the child was classified as "Private Medical Provider Only." If a child received vaccines exclusively in public clinics, the child was classified as "Health Department Only." If a child received vaccines in both private provider offices and public clinics, the child was classified as "Both Private Medical Provider and Health Department." If a vaccination source was unable to be determined, it was defined as "Unknown Vaccination Source." Vaccinations given before 28 days of age were typically administered in hospital; they are considered as "Private Medical Provider" in provider type calculations.

Active Data Collection

An electronic web-based data collection system called REDCap was used to collect information for each child in the sample. The sampling frame, determined from birth records, was imported into REDCap to review immunization histories from TennIIS. TennIIS follows the recommended schedule of childhood immunizations approved by the ACIP to determine complete vaccine histories. The REDCap data collection system contains six distinct sections to be completed by the public health data collectors: Demographics (child), Demographics (parents), TennCare and WIC Status, Survey Eligibility and Exemption Status, Providers and Immunization History, Notes. Data collection was carried out by county and regional public health nurses. An initial immunization history check was performed by a VPDIP epidemiologist via TennIIS data to determine the up-to-date (UTD) status of the sample. If a child was UTD at this point, the child was noted as "Complete, Based on Initial TennIIS Records," and no longer required follow-up. If a child was not UTD at this point, the data collection process was passed to the regional staff, with the dates found in TennIIS already entered in the REDCap system. Data collectors used the following protocol:

Step 1: Search for immunization records

Data collectors reviewed TennIIS records or health department records for additional immunization history. If the child's immunization record was still incomplete, the data collectors proceeded to Steps 2 and 3.

Step 2: Contact the parent(s) and/or guardian(s)

Data collectors used contact information from the birth certificate, or any updated information found at the health department, provider's office or in TennIIS to contact the child's parent/guardian. Parents were then contacted by phone and/or by letter and asked to provide an immunization history or the location of immunization information for their child (*i.e.,* the name of the doctor or clinic office). In some cases, representatives made home visits. If parents disclosed that they chose not to vaccinate their children for any reason, the child was classified as "Refused Vaccination" and further grouped into refusal reason categories based on information received from the parent. The reasons for vaccine refusal are separated into three categories: religious, philosophical, or medical.

Step 3: Contact private physician(s)

Data collectors contacted private physicians by phone or fax and requested the child's immunization history.

Step 4: Data checked for accuracy

Using the REDCap system, data collectors completed follow up on all children by the end of the three-month data collection period. All completed records were reviewed by a VPDIP epidemiologist throughout the process. Attempts were made to resolve any unclear information before data cleaning.

Data Analysis

Up-to-date (UTD) immunization rates were calculated using each individual vaccine date for each participant. An immunization was classified as given prior to the 24-month birthday if the difference between the dose date and the child's date of birth was equal to or less than 24 months; this was the case even for dates that were not originally found in the child's TennIIS record. For a child to be considered UTD by 24 months, all the doses in the 4:3:1:FS:3:1:FS series had to be given within 24 months of the child's birth date or had to meet the CDC catch-up conditions by 24 months. Statewide immunization rates are calculated, as well as rates for the six major metropolitan counties and seven rural regions. County rates within the rural regions are not calculated due to the small number of children sampled in each county. Completion of on-time immunization in the 2022 survey of Tennessee 24-month-old children is defined as receipt of four doses of diphtheria, tetanus, and acellular pertussis (DTaP) vaccine, three doses of inactivated polio virus (IPV) vaccine, one dose of

measles, mumps, and rubella (MMR) vaccine, three *or* four doses of *Haemophilus influenza* type b (HIB) vaccine (depending on brand received) *or* any child clinically considered complete for HIB based on the CDC's "catch-up" schedule, three doses of hepatitis B (HBV) vaccine, one dose of varicella (VAR) vaccine and four doses of pneumococcal conjugate (PCV) vaccine *or* any child considered complete for PCV based on the CDC's "catch-up" schedule. Combined, these are known as the 4:3:1:FS:3:1:FS series. Additionally, this survey analyzes hepatitis A vaccine (HAV), rotavirus vaccine (RTV), and seasonal influenza (Flu) vaccines. Since the sampling frame is stratified by region, not every child has the same probability of being selected for the sample. To account for this, sampling weights were calculated based on the total number of births in each region and were applied when calculating rate estimates. Margins of error are provided for most rate estimates. The margin of error is the 95% confidence interval range, for example, 77.1 ± 2.2 represents the confidence interval (74.6, 79.3) for the statewide UTD by 24 months estimate of 77.1%. Ninety-five percent confidence intervals (CI) are displayed as grey bands on the graphs in this report to permit readers to visualize the statistical significance (or absence of significance) of differences in point estimates ($p < 0.05$). Significance testing for differences in rates was performed using Statistical Analysis System (SAS), utilizing a 2-sample t-test for difference of means.

Limitations

The following describe important limitations of the study that should be considered when interpreting its findings:

A. There were five limitations related to sampling:

1) Since the study sample is randomly selected from children born in Tennessee between January and March 2020, it could not account for variations that may routinely occur in other months of the year.

2) Limiting the sample to children born in three months does not form the basis of a surveillance system capable of detecting changes in the health care system.

3) There may be children in the eligible sample who were erroneously included in the eligible sample and listed as unable-to-locate. Examples of this type of error would be cases where a child died, was adopted, or was part of a military family, but the child's ineligibility related to these circumstances never became known to the public health data collectors because the child could not be found.

4) The survey is designed to allow valid statistical comparisons of the populations in each of the 13 health department regions; however, the sample size within multi-county regions is too small for meaningful results at the county level or useful comparisons among subpopulations within a region.

5) For the seven multi-county TDH regions (Northeast [NER], East Tennessee [ETR], Southeast [SER], Upper Cumberland [UCR], South Central [SCR], Mid-Cumberland [MCR], West Tennessee [WTR]) in this survey, children were chosen in different proportions from the counties that make up each region. There is no consistent pattern for choosing these participants from year to year. Results are presented as the summation of all counties in that region; therefore, use of the results of this survey for county-level estimates is not appropriate.

B. Response rates for each region are included on the first and second pages of all regional reports. Response rate is calculated by subtracting the number of "Unable to Locate" children by the number of eligible participants and then dividing by the number of eligible participants. Caution should be taken when interpreting immunization rates for a region with a low response rate. The reason for this necessary caution is that the children who are unable-to-locate (UTL) could also be the least up-to-date (UTD). However, we cannot use their immunization history without knowing that it is current, so they must be excluded. Table 2 (pg. 13) shows how the response rate was calculated for the state sample; this same method was used for each of the health department region samples.

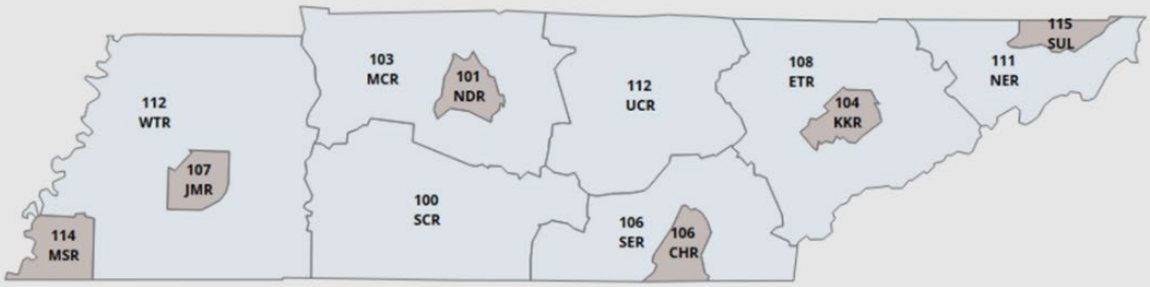
SECTION II

Statewide Results

Figure 1-A: Location of Tennessee in the U.S. Department of Health & Human Services Region 4 States

Figure 1-B: Sampling (N) of Tennessee, 2022

Figure 1-C: Sampling (N) of Tennessee Health Regions, 2022



Immunization Rates

The up-to-date (UTD) immunization rates as reported to TennIIS by 24 months, and by the end of data collection were calculated using the ACIP's 4:3:1:FS:3:1:FS vaccination schedule and catch-up schedule. Individual antigen vaccination rates were calculated using the same ACIP guidance. The estimate for the percent UTD for the combination series and individual antigens are displayed in Table 3 along with the accompanying margin of error. Rates that decreased are shown in red in Table 3 and Figure 2. Significant differences ($p<0.05$) between the 2021 and 2022 rates are ***italicized and bolded*** in Table 3.

Statewide, the UTD immunization rate as reported to TennIIS was 8.9%, which was lower than the 2021 rate (9.4%). The UTD immunization rate by end of data collection was 77.1%, which was higher than the 2021 rate (74.8%).

Most vaccine specific rates changed significantly from the previous year. The rates for Rotavirus, Full Series, and HBV birth dose were the only vaccinations where a significant difference was not observed. The UTD immunization rates and rates by individual antigen from 2017 to 2022 are show in Figure 2.

Immunization Administration

Statewide, 34,146 vaccine doses were administered to the study cohort; 32,499 (95.2%) were administered by private providers, 901 (2.6%) were administered by public health providers, and 746 (2.2%) were administered by an unconfirmed source.

Table 3: Immunization Rates by Series and Vaccine Antigen, Tennessee, 2022

	2021 (n=1439) (%)	2022 (n=1399) (%)	Increase/ Decrease (2021 to 2022)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	9.4 ± 1.5	8.9 ± 1.5 ↓	- 0.5
UTD immunization rate* (with data collection)	74.8 ± 2.2	77.1 ± 2.2 ↑	+ 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	77.3 ± 2.2	***81.3 ± 2.0*** ↑	**+ 3.9**
IPV (3 DOSES)	89.8 ± 1.6	***92.9 ± 1.3*** ↑	**+ 3.1**
MMR (1 DOSE)	87.5 ± 1.7	***91.0 ± 1.5*** ↑	**+ 3.5**
HBV (3 DOSES)	91.2 ± 1.5	***93.9 ± 1.3*** ↑	**+ 2.6**
HBV, Birth Dose	81.8 ± 2.0	82.8 ± 2.1 ↑	+ 1.0
Hib (Full Series)	73.9 ± 2.3	***79.6 ± 2.1*** ↑	**+ 5.8**
VAR (1 DOSE)	87.6 ± 1.7	***90.3 ± 1.6*** ↑	**+ 2.7**
PCV (Full Series)	77.5 ± 2.2	***82.1 ± 2.0*** ↑	**+ 4.6**
Full Series (4:3:1:FS:3:1:FS)	74.8 ± 2.2	77.1 ± 2.2 ↑	+ 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	86.9 ± 1.8	***90.6 ± 1.5*** ↑	**+ 3.7**
RTV (Full Series)	76.2 ± 2.2	77.7 ± 2.2 ↑	+ 1.5
FLU (2 Doses)	54.8 ± 2.6	***48.3 ± 2.6*** ↓	**- 6.4**

* Includes children up-to-date by ACIP-recommended catch-up schedule
Red font indicated a rate decrease since 2021
Italicized and bolded font indicates a significant difference with 2021 rate

Figure 2 shows Tennessee's trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each antigen assessed. Tennessee children have not met the HP2020 objective for DTaP, HIB, PCV, RTV, or Influenza anytime in the past six years.

Figure 2: Immunization Rates (%) by Series and Vaccine Antigen, Tennessee, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

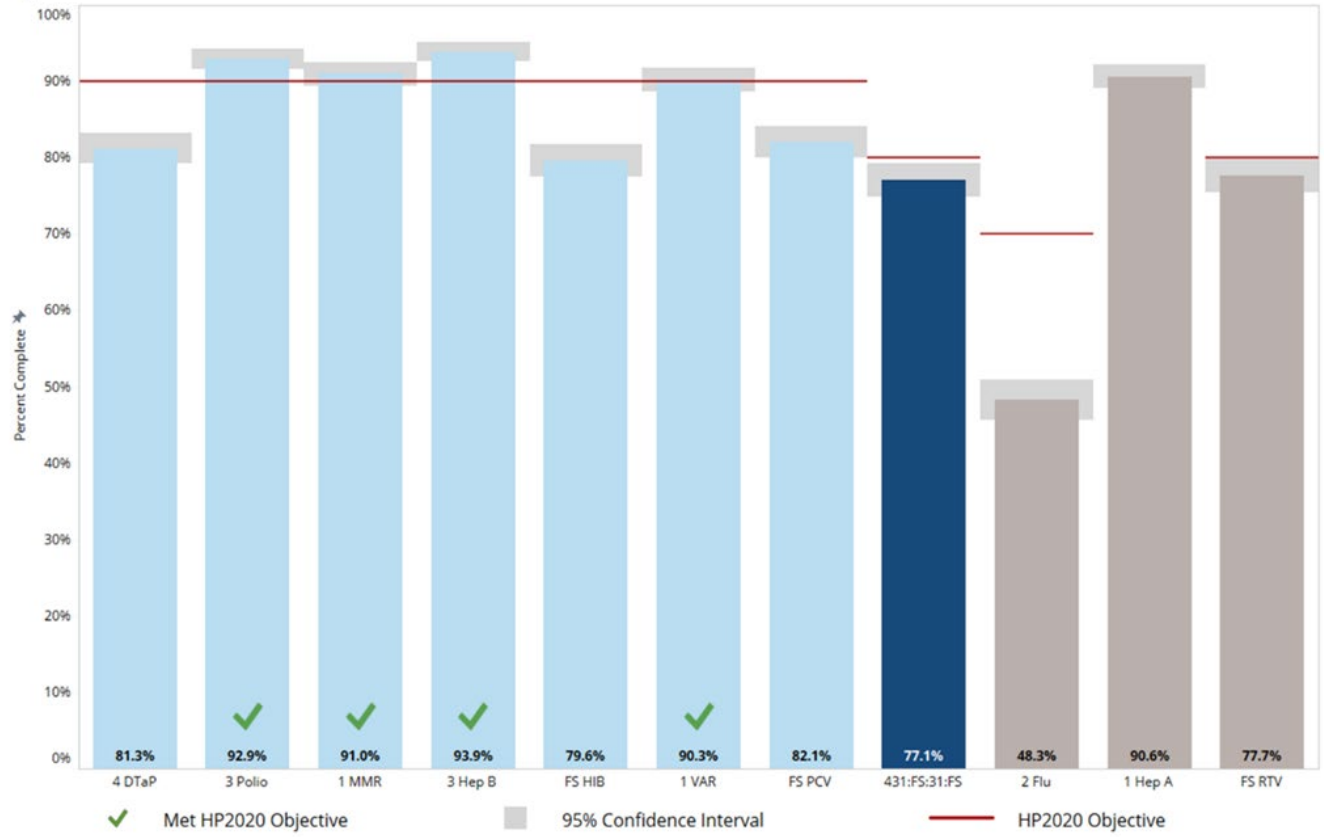
Progress Towards Healthy People Objectives

Since 2010 , Tennessee has only meet the HP2020 objective of 80% completion of the 4:3:1:FS:3:1:FS series twice, once 2018 and again in 2020. The state also failed to meet this objective for 2022 with the 4:3:1:FS:3:1:FS series completion being 77.1%, represented by the navy bar in Figure 3. In 2022, Tennessee met four out of the twelve individual vaccine HP2020 objectives (Polio, MMR, Hep B, and Varicella) and one of two vaccine specific HP2030 objectives. The third HP2030 objective is to limit the percentage of children who receive zero doses of recommended vaccines by age two years to 1.3%. Which Tennessee also failed to meet with a rate of children with no vaccines at 1.6%.

The HP2020 objective for HAV is based on completion of the two-dose series; however, Tennessee only measures one dose of HAV because children who receive the first dose by their second birthday must wait at least six months before receiving the second dose. As a result, the survey rate is not comparable to the HAV HP2020 objective.

The overall statewide coverage estimate for the full, recommended 4:3:1:FS:3:1:FS series is shown in Figure 3. The light blue bars represent the individual antigens that make up the 4:3:1:FS:3:1:FS series, the navy bar is the 4:3:1:FS:3:1:FS series, and the dark grey bars represent the additional antigens assessed in the survey. The red lines represent HP2020 objectives for each antigen assessed and the lighter grey bands represent the 95% Confidence Intervals (CI).

Figure 3. Percent of 24-month Old Children With UTD 431:FS:31:FS, Tennessee, 2022



2022 Sample Population

Ineligibility & Participation Refusal

Of the 1,574 children originally sampled for the survey, 80 children were determined to be ineligible for the survey and 23 children had guardians refuse survey participation. Ineligibility is defined as children who moved out of the state, for whom the birth record was sealed (*e.g.,* through adoption or placement in foster care), and children who had died. After these children were removed from the survey, 1,471 eligible children were retained.

Unable to Locate (UTL)

Of the 1,471 eligible children included in the survey, 72 had incomplete information in the Tennessee Immunization Information System (TennIIS) and could neither be located nor confirmed as having moved out of state. Overall, 4.9% (72/1471) of eligible children were unable to be located for survey participation. Due to the inability to accurately assess the immunization status of these children due to incomplete records, they were removed from the survey.

Final Sample Size & Response Rate

The final sample size for the survey was 1,399, 88.9% (1399/1574) of the original sampled children and 95.1% (1399/1471) of the eligible sampled children. The response rate to the 2022 immunization status survey 95.1%. The 2022 response rate was lower than previous years with 2021 having a response rate of 96.3% (1439/1495).

Table 4-A: Survey Sampling, Tennessee, 2022

	2021		2022	
Original sample (n)	1592		**1574**	
Ineligible (n)	83	(5.2%)	**80**	**(5.1%)**
Refused Participation (n)	14	(0.9%)	**23**	**(1.5%)**
Eligible sample (n)	1495		**1471**	
Unable to locate† (n)	56	(3.5%)	**72**	**(4.6%)**
Final sample (n)	1439		**1399**	
Response Rate (%)*	96.3		**95.1**	

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 4-B: Sample Size & Response Rate by Region, Tennessee, 2022

Region	Original Sample	Ineligible (N)	Refused Participation (N)	Eligible Sample (N)	%	UTL	%	Final Sample (N)	Response Rate (%)
MSR	121	5	1	115	95.04	1	0.9	114	99.1
WTR	121	6	-	115	95.04	3	2.6	112	97.4
JMR	120	4	9	107	89.17	-	-	107	100.0
SCR	120	7	4	109	90.83	9	8.3	100	91.7
MCR	122	5	-	117	95.90	14	12.0	103	88.0
NDR	121	7	-	114	94.21	13	11.4	101	88.6
UCR	121	3	-	118	97.52	6	5.1	112	94.9
SER	121	10	1	110	90.91	4	3.6	106	96.4
CHR	121	11	4	106	87.60	-	-	106	100.0
ETR	121	4	-	117	96.69	9	7.7	108	92.3
KKR	122	7	2	113	92.62	9	8.0	104	92.0
NER	121	6	2	113	93.39	2	1.8	111	98.2
SUL	122	5	-	117	95.90	2	1.7	115	98.3
STATE	1574	80	23	1471	93.46	72	4.9	1399	95.1

Vaccine Refusals

There were 31 (2.1%) documented vaccine refusals reported among the final records kept for analysis (n=1399) after removal of ineligible children, parents who refused survey participation, and children who were unable to be located. (Table 4-C). Fourteen parents claimed religious reasons, sixteen claimed philosophical reasons, and one claimed medical reasons. Regionally, vaccine-refusals ranged from 0.9% to 6.5% of the sampled populations. Eight of the 31 children whose parents refused vaccines were partially immunized (ranging from 1-21 total doses). Parents of four of the eight partially immunized children cited religious reasons and four cited philosophical reasons for refusal of vaccines.

In 2022, vaccine refusals decreased from 3.0% to 2.1% (31/1399). The percentage of children who did not receive one or more vaccinations due to medical reasons remained consistently low (<1.0%), while religious and philosophical refusals have continued to fluctuate. In 2022, 1.0% (n=14) of refusals were religious refusals and 1.1% (n=16) were philosophical. A year over year comparison of UTD children and children whose guardians refused vaccines can be shown in Figure 4-A. Figure 4-B is a year over year breakdown of the 2022 refusals by refusal type. Table 4-C contains a regional breakdown of 2022 refusals by refusal type.

Tennessee TCA 1200-14-01-29 describes minimum immunization requirements for attending childcare, pre-school, and public school. The state's immunization requirements follow the current schedule published by the Centers for Disease Control and Prevention (CDC) and endorsed by the American Academy of Pediatrics (AAP) and American Academy of Family Physicians (AAFP). All 50 states have legislation requiring specified vaccines for students, including for attendance at childcare centers.

Table 4-C: Vaccine Refusal by Region, Tennessee, 2022

Region	Survey Sample (N)	Refused Vaccination (N)	%	Religious	%	Philosophical	%	Medical	%
MSR	114	4	3.5	1	0.9	3	2.6	-	-
WTR	112	-	-	-	-	-	-	-	-
JMR	107	1	0.9	1	0.9	-	-	-	-
SCR	100	2	2.0	4	4.0	1	1.0	-	-
MCR	103	-	-	-	-	-	-	-	-
NDR	101	-	-	-	-	-	-	-	-
UCR	112	6	5.4	-	-	6	5.4	-	-
SER	106	1	0.9	1	0.9	-	-	1	0.9
CHR	106	5	4.7	4	3.8	-	-	-	-
ETR	108	7	6.5	-	-	6	5.6	-	-
KKR	104	1	1.0	2	1.9	-	-	-	-
NER	111	2	1.8	2	1.8	-	-	-	-
SUL	115	2	1.7	-	-	-	-	-	-
STATE	1399	31	2.1	14	1.0	16	1.1	1	0.1

Figure 4-A: Six-Year Comparison of UTD Children vs Refusals, Tennessee, 2022

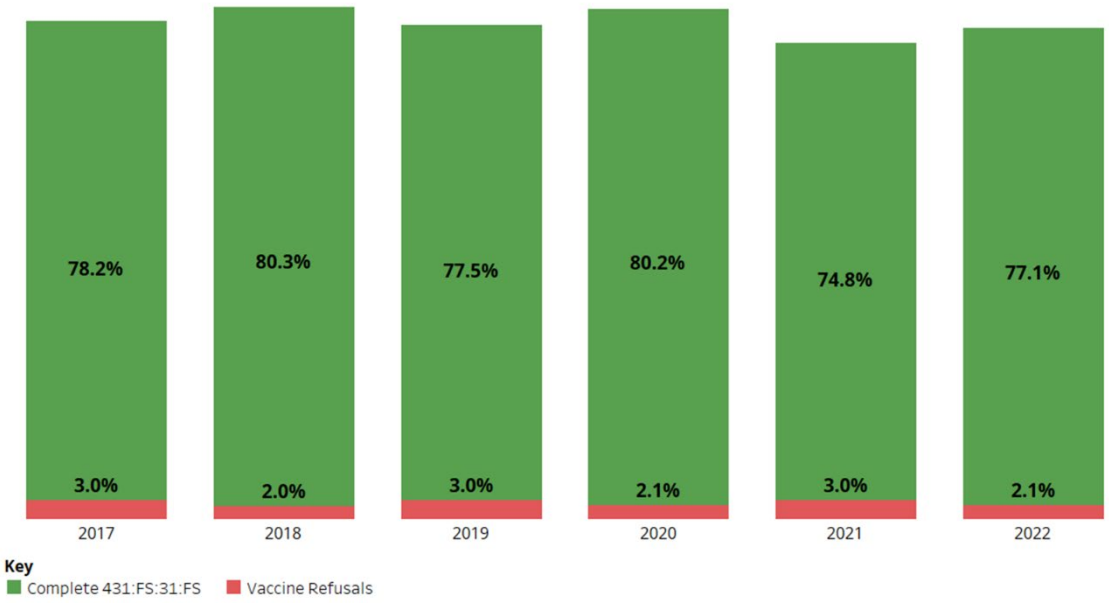
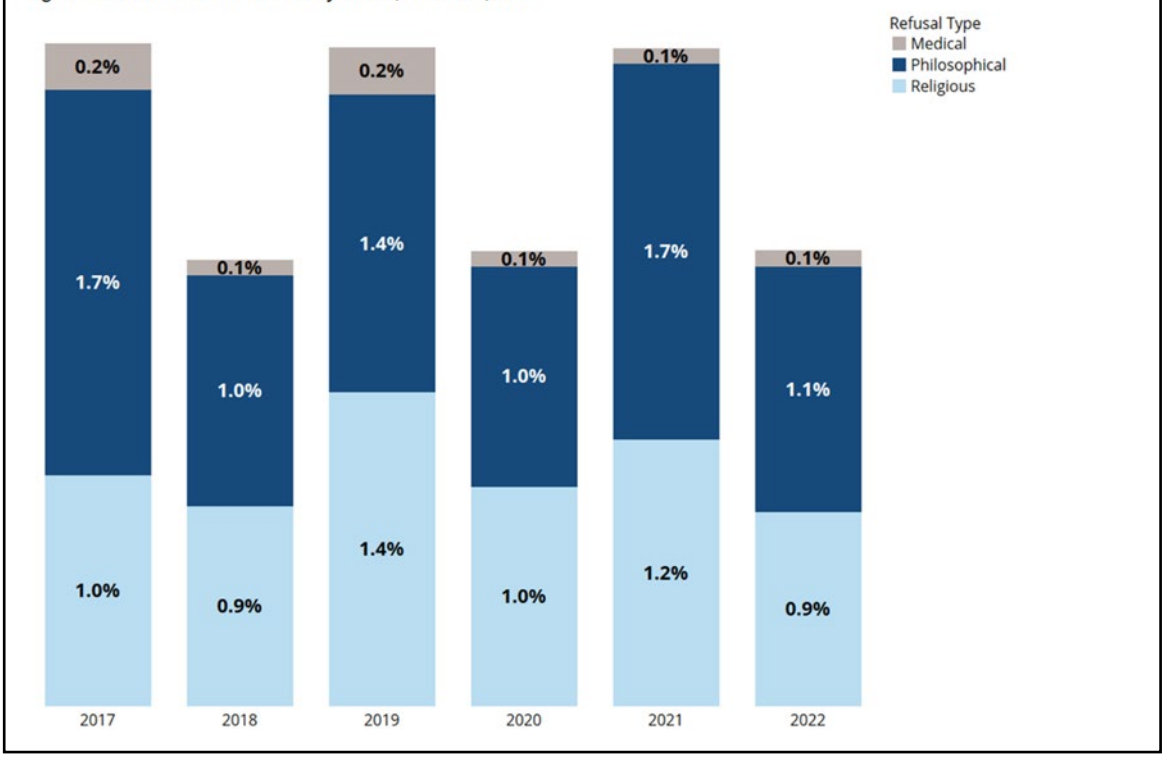


Figure 4-B: Six Year Trend of Refusals by Reason, Tennessee, 2022



Demographics

The demographic breakdown of the survey sample alongside the UTD immunization rates by demographic groups are displayed in Table 4-D. Significant differences (p<0.05) in UTD by 24-month rates between demographic subgroups are ***italicized and bolded***. NOTE: Brackets are used to indicate significantly different results between subgroups.

Groups with statistically significant differences (p-value < 0.05) in UTD by 24-month rates were:

- Ethnicity
- Siblings
- Vaccination Source
- Father Age
- Parent Education (Mother and Father)
- Marriage Status

Table 4-D: Survey Demographics and Immunization Rates, Tennessee, 2022

Group	Subgroup	Sample (n=1399)		UTD n=1399 (%)		
Race						
	Black	196	14.0%	**74.5**	±	**6.2**
	White	1167	83.4%	77.5	±	2.4
	Other	36	2.6%	77.8	±	14.3
Ethnicity						
	Hispanic	153	10.9%	83.7	±	5.9
	Non-Hispanic	1246	89.1%	76.2	±	2.4
Sex						
	Male	719	51.4%	77.3	±	3.1
	Female	680	48.6%	76.8	±	3.2
Siblings						
	0	566	40.5%	84.8	±	3.0
	1	468	33.5%	78.2	±	3.8
	2+	365	26.1%	63.6	±	5.0
Vaccination Source						
	Private Medical Provider	1288	92.1%	79.0	±	2.2
	Health Department	18	1.3%	50.0	±	25.6
	Both	59	4.2%	***81.4***	±	***10.2***
	Missing	34	2.4%	11.8	±	11.4
Program Enrollment						
	TennCare Only	126	9.0%	77.0	±	7.5
	WIC Only	224	16.0%	69.6	±	6.1
	Both (TennCare + WIC)	414	29.6%	74.2	±	4.2
	Not Enrolled	635	45.4%	81.6	±	3.0

Group	Subgroup	Sample (n=1399)		UTD n=1399 (%)		
Mother Age						
	≤24	438	31.3%	75.3	±	4.1
	25-34	807	57.7%	77.2	±	2.9
	≥35	154	11.0%	81.2	±	6.3
Father Age						
	≤24	252	18.0%	75.8	±	5.3
	25-34	680	48.6%	77.9	±	3.1
	≥35	274	19.6%	***83.6***	±	***4.5***
	Unknown	193	13.8%	66.3	±	6.7
Mother Education						
	< High School Diploma/ GED	174	12.4%	71.3	±	6.8
	High School Diploma/ GED	419	30.0%	71.8	±	4.3
	> High School Diploma/ GED	799	57.1%	81.1	±	2.7
	Unknown	7	0.5%	71.4	±	45.1
Father Education						
	< High School Diploma/ GED	145	10.4%	80.0	±	6.6
	High School Diploma/ GED	419	30.0%	72.3	±	4.3
	> High School Diploma/ GED	621	44.4%	83.1	±	3.0
	Unknown	214	15.3%	66.8	±	6.4
Marriage Status						
	Married	742	53.0%	79.9	±	2.9
	Unmarried	656	46.9%	73.8	±	3.4
	Unknown	1	0.1%	0.0	±	0.0

* Includes children up-to-date by ACIP-recommended catch-up schedule

Italicized and bolded font indicates a significant difference with 2021 rate

Brackets [ ] indicate a significant difference between subgroups

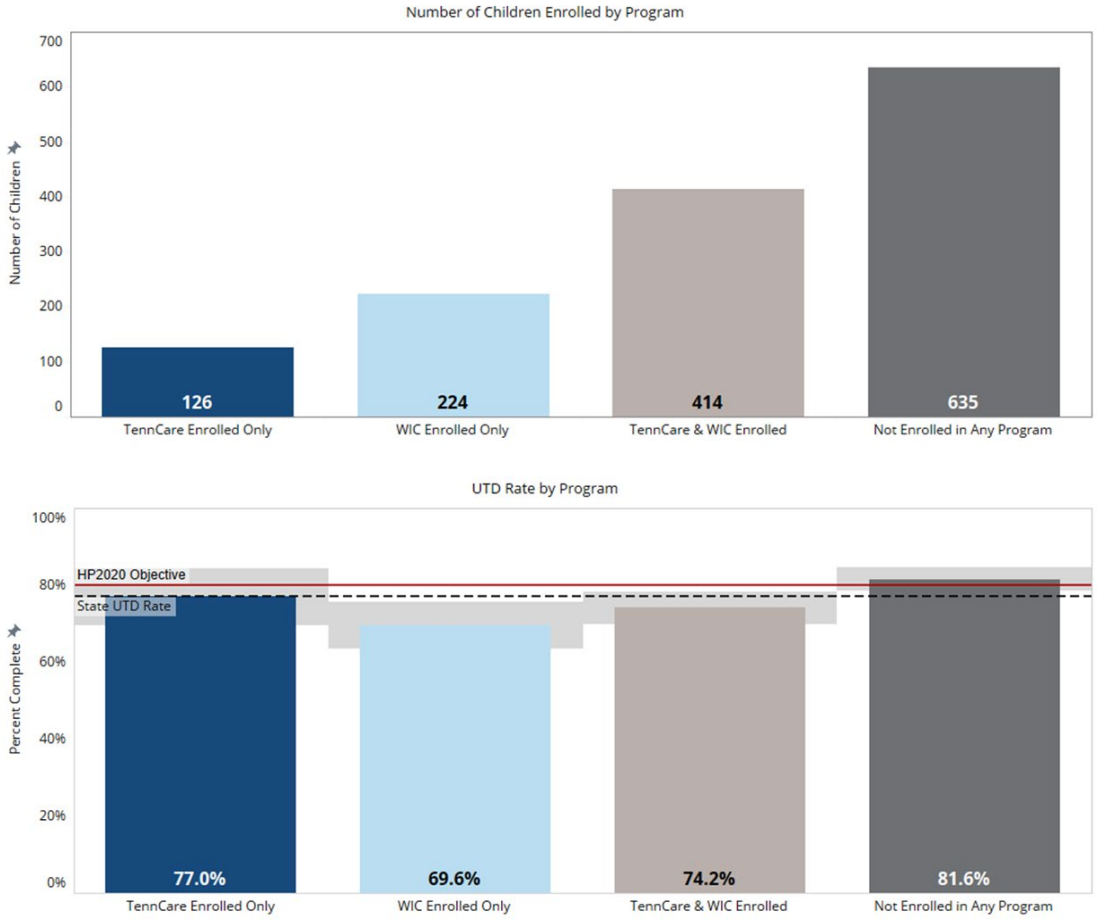
Risk Factor Analysis

Many risk factors can compound to affect a child's likelihood to attain UTD vaccination status. These risk factors include safety net program enrollment, immunization source, number of siblings, age at first vaccination, race, and many more factors that are not evaluated in this survey. It is important to note that in this section no one risk factor can completely explain why a child may or may not be UTD. In 2022, children immunized in health departments were more likely to have risk factors for failure to receive immunizations compared to children who were only immunized by private medical providers. This data can be seen in Table 5 and Table 6.

Program Enrollment

Of the 1,399 children included in this survey, 126 (9.0%) were enrolled in TennCare only, 224 (16.0%) were enrolled in WIC only, 414 (29.6%) were enrolled in both programs, and 635 (45.4%) were not enrolled in any programs. Children were more likely to be up-to-date (UTD) if they were not enrolled in any program (81.6%) or enrolled in TennCare only (77.0%) and less likely to be UTD if they were only enrolled in WIC (69.6%) or in both TennCare and WIC (74.2%). In 2022, children who were covered by TennCare and WIC had 4:3:1:FS:3:1:FS series completion rates that were not significantly different ($p<0.05$) from their non-enrolled peers. This data can be seen in Table 4-D and Figure 5.

Figure 5: Comparison of UTD Children by Program Enrollment, Tennessee, 2022



Immunization Source

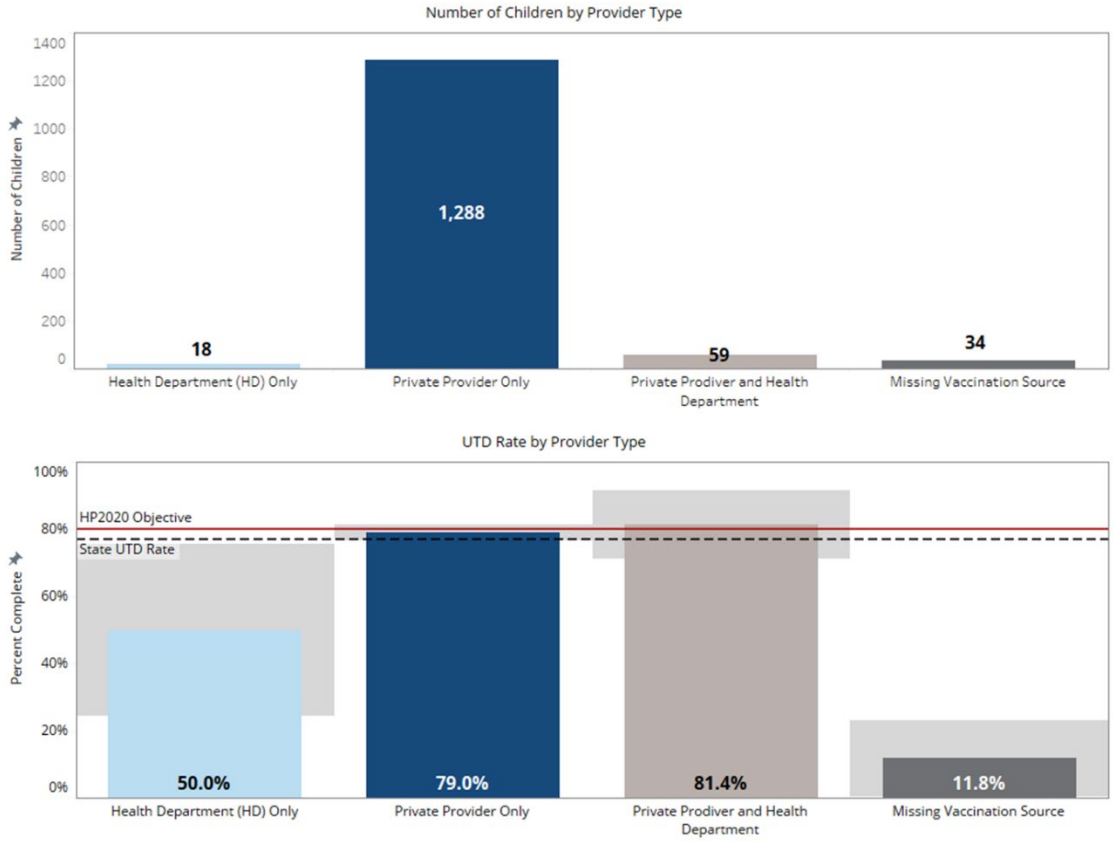
Of the children sampled, 1288 (92.1%) were immunized by a private medical provider, 18 (1.3%) children sampled were immunized by a health department only, 59 (4.2%) children sampled were immunized by both a private provider and a health department, and 34 (2.4%) children sampled had records that were missing an immunization source. Children who received vaccines exclusively from a private medical provider were statistically significantly ($p<0.05$) more likely to be UTD (79.0%) compared to children vaccinated by a health department only (53.6%), by a combination of private provider and health department (82.0%) or by those missing a vaccination source (7.6%). This data can be seen in Table 4-D, Table 5, and Figure 6.

Table 5. Prevalence of Risk Factors for Delayed Immunizations, by Provider Type

	Black Race	2+ Siblings	Age at First Immunization (Greater than 4 Months)*	Any Rick Factor
Immunized Exclusively by Health Department	11.1% (2/18)	61.1% (11/18)	16.7% (3/18)	66.7% (12/18)
Immunized Exclusively by Private Medical Provider	13.9% (179/1288)	24.5% (315/1288)	2.6% (34/1288)	35.6% (459/1288)
Immunized Exclusively by Health Department and Private Medical Provider	18.6% (11/59)	42.4% (25/59)	5.1% (3/59)	52.8% (31/59)

* excluding RTV and birth dose of Hep B

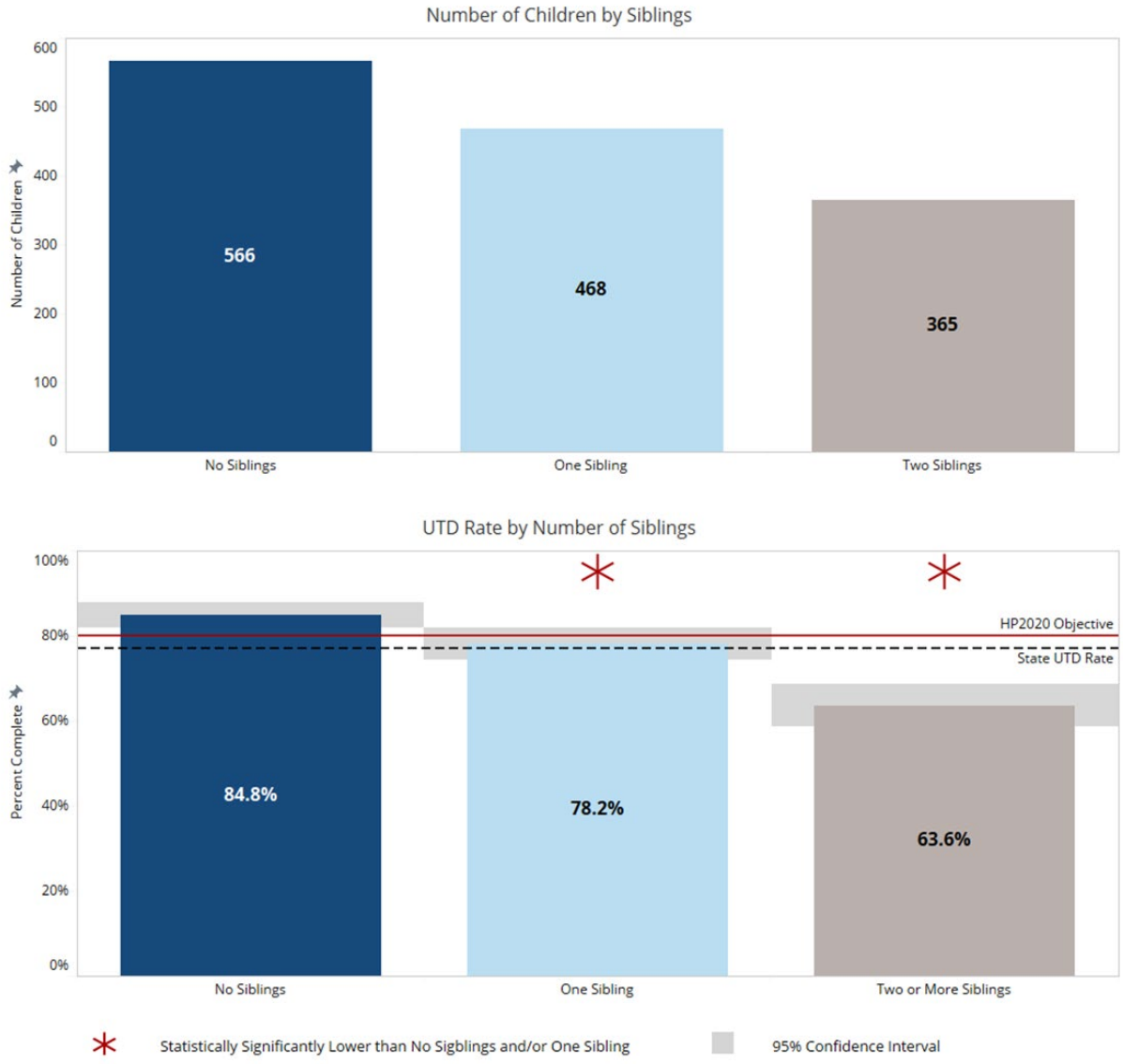
Figure 6: Comparison of Children UTD by Immunization Provider Type, Tennessee, 2022



Impact of Siblings on Immunization Completion

Of the 1,399 children included in the survey, 566 (40.5%) had no siblings, 468 (33.5%) had one sibling, and 365 (26.1%) had two or more siblings. As the number of siblings increased, there was a statistically significant decrease in the percentage of children who were complete for the 4:3:1:FS:3:1:FS series. While 84.8% children with no siblings were complete, only 78.2% one sibling and 63.6% with two or more siblings achieved series completion (Figure 7).

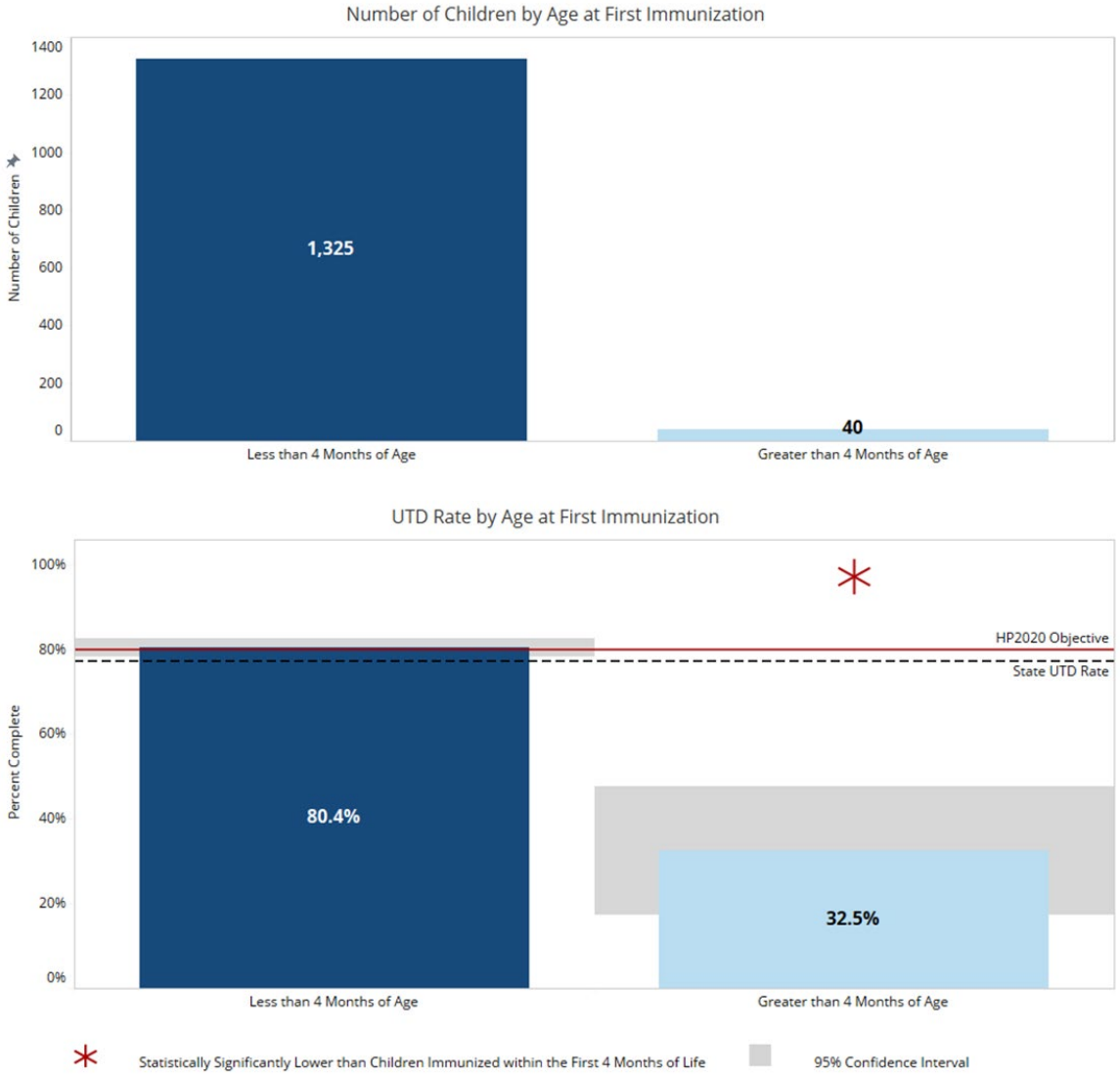
Figure 7. Comparison of UTD Children with Zero, One, or Two or More Siblings, Tennessee, 2022



Impact of Age at First Immunization on Immunization Completion

Of the children surveyed, 94.7% (n=1,325) began immunizations prior to 4 months of age and 80.4% of those children were completely immunized for the 4:3:1:FS:3:1:FS series by 24 months of age, compared to only 32.5% (n=40) of the 40 children who received immunizations after 4 months of age. This suggests that children who do not receive immunizations prior to 4 months of age are at higher risk of remaining under vaccinated at age 2 years (Figure 8).

Figure 8. Comparison of UTD Children by Age at First Immunization, Tennessee, 2022



Immunization Rates by Program Enrollment

The difference in UTD immunization rate by 24 months between TennCare and WIC-enrolled children and those not enrolled in any program are shown in Table 6-A for each health region. Statewide, there was no significant difference found between program enrollees and non-enrollees. Children enrolled in WIC had the lowest UTD by 24 months immunization rate (69.9%) compared to children not enrolled in any program (81.6%), children enrolled in TennCare only (77.0%), and children enrolled in both TennCare and WIC (74.2%).

Table 6-A: UTD Immunization Rate by 24 Month By Program Enrollment Groups, Tennessee, 2022

Region	(N)	Immunization Rate for Children not Enrolled in Any Program	(N)	Immunization Rate for Children Enrolled in TennCare and WIC	(N)	Immunization Rate for Children Enrolled in TennCare	(N)	Immunization Rate for Children Enrolled in WIC	(N)
MSR	114	76.8%	56	74.4%	39	62.5%	8	54.6%	11
WTR	112	68.9%	45	68.9%	45	-	0	68.2%	22
JMR	107	87.8%	41	75.5%	53	63.6%	11	100.0%	2
SCR	100	83.3%	24	75.5%	49	70.59	17	80.0%	10
MCR	103	84.1%	69	100.0%	3	-	0	80.7%	31
NDR	101	86.5%	96	-	0	50	2	-	0
UCR	112	60.0%	50	83.3%	18	100	1	60.5%	43
SER	106	75.0%	36	72.2%	18	0	2	72.0%	50
CHR	106	88.6%	44	56.3%	32	68.0%	25	60.0%	5
ETR	108	91.7%	36	80.4%	51	80.0%	5	75.0%	16
KKR	104	91.7%	60	-	0	93.2%	44	-	0
NER	111	95.5%	22	70.8%	72	75	8	88.9%	9
SUL	115	75.0%	56	85.3%	34	100	3	59.1%	22
TENNESSEE	**1399**	**81.6%**	**635**	**74.2%**	**414**	**77.0%**	**126**	**69.9%**	**224**

Statewide Results and Healthy People Comparison

The Healthy People initiative is designed to guide national health promotion and disease prevention efforts to improve the health of the nation. Released by the United States Department of Health and Human Services (HHS) every decade since 1980, Healthy People identifies science-based objectives with targets to monitor progress and focus action.

Healthy People 2020 (HP2020) included 12 immunization-related objectives. Implementation across the nation began in 2010 with the expectation that the objectives would be achieved by 2020. In 2020, new HP2030 objectives, including three immunization-related objectives, were developed. Results of the state attainment of HP2020 and HP2030 objectives can be seen in Table 6-B. In Table 6-B HP2020 attainment is denote by green fill while HP2030 attainment is denoted by **bold text**.

Table 6-B: Results of Immunization Status Survey Compared to Healthy People 2020 and 2030 Objectives, Tennessee, 2022

Antigen	TN 2022 (24 months)	HP2020 Objective (19-35 months)	HP2030 Objective (24 months)
Diphtheria, Tetanus, Pertussis (DTaP)	81.3%	90%	90%
Poliomyelitis (Polio)	92.9%	90%	-
Measles, Mumps, Rubella (MMR)	**91.0%**	90%	90.8%
Hepatitis B (HBV)	93.9%	90%	-
Hepatitis B, birth dose	81.1%	85%	-
Haemophilus influenzae, type B (HIB)	79.6%	90%	-
Varicella (VAR)	90.3%	90%	-
Pneumococcus (PCV)	82.1%	90%	-
Full Series	77.1%	80%	-
Hepatitis A (HAV)*	90.6%	-	-
Rotavirus (RTV)	77.7%	80%	-
Influenza (Flu)	48.3%	70%	-

Indicates value is above HP2020 objective

Bold text indicates value is above HP2030 objective

*Hepatitis A is excluded from HP2020 objective comparisons as Tennessee measures receipt of one dose, while the HP2020 objective goal references two doses

Racial Disparity

The 2022 survey population included 196 non-Hispanic Black children and 1,167 Non-Hispanic White children. Due to small sample size, children of other races (n= 36) and Hispanic ethnicity (n=153) were excluded from this analysis. The final sample for racial analysis consisted of 1,363 children. **Non-Hispanic Black children were less likely to be fully immunized for all twelve of the recommended CDC vaccinations. This gap was larger in DTaP, Polio, 4:31:FS:3:1:FS, Influenza, and RTV compared to their Non-Hispanic White peers.**

Completion of the full childhood series (4:3:1:FS:3:1:FS) has been consistently lower for non-Hispanic Black children than non-Hispanic White children. The series completion rate was 3.0% lower among non-Hispanic Black children (74.5%) when compared to non-Hispanic White children (77.5%). Additionally, in 2022, 33.2% of non-Hispanic Black children received at least two doses of influenza vaccine compared to 50.4% of non-Hispanic White children.

Figure 9: Comparison of Immunization Rates by Series and Vaccine Antigen by Race, Tennessee, 2022

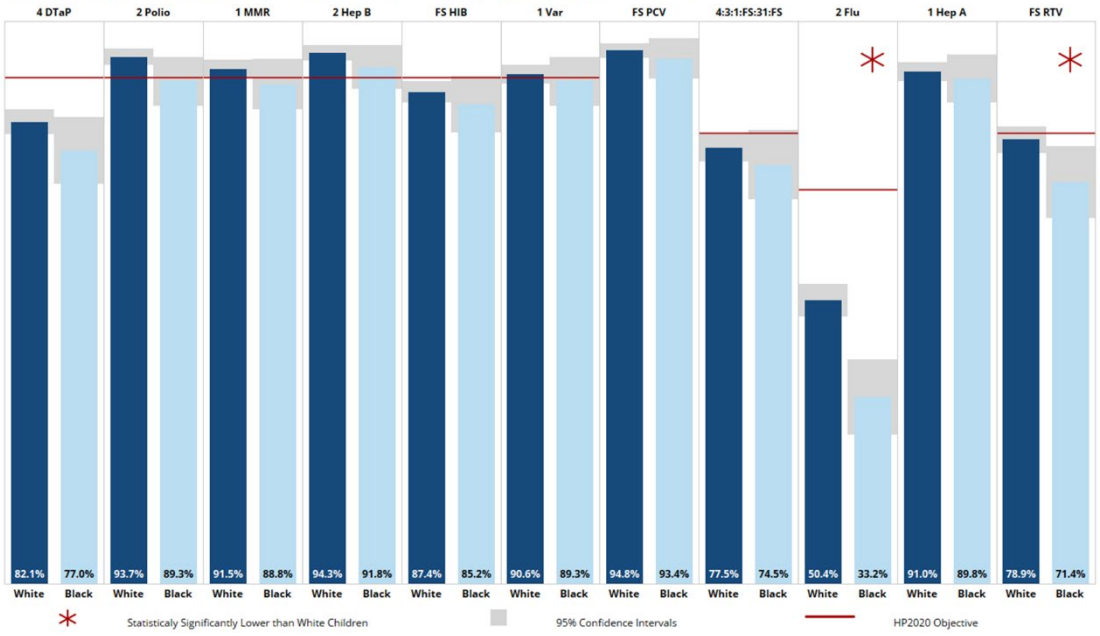
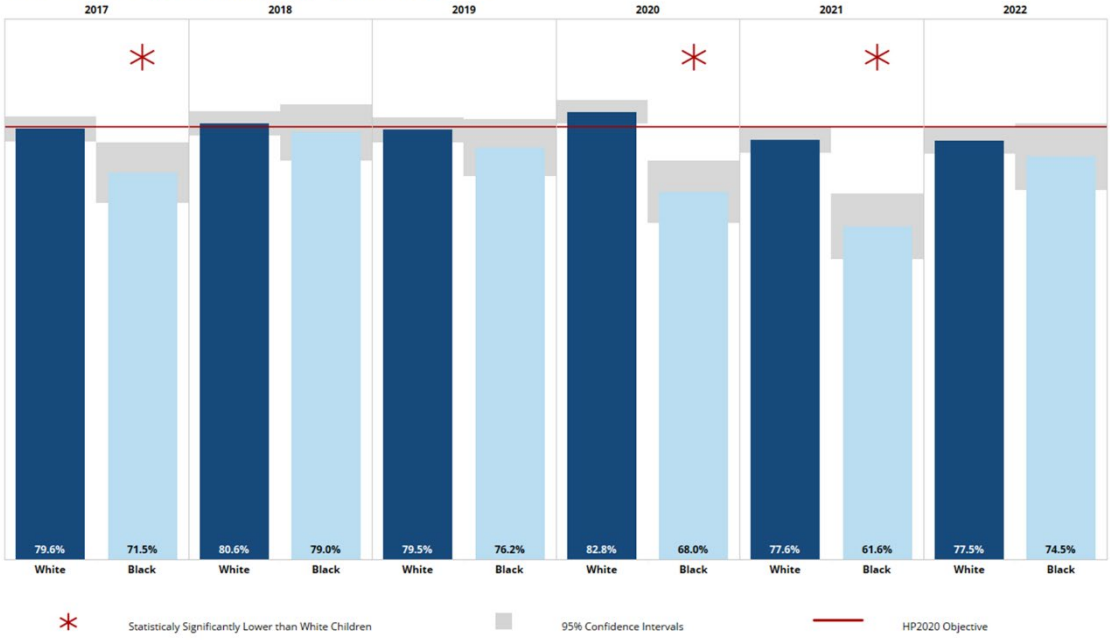


Figure 10: Comparison of UTD Children by Race, Tennessee, 2017-2022



Seasonal Influenza Vaccination

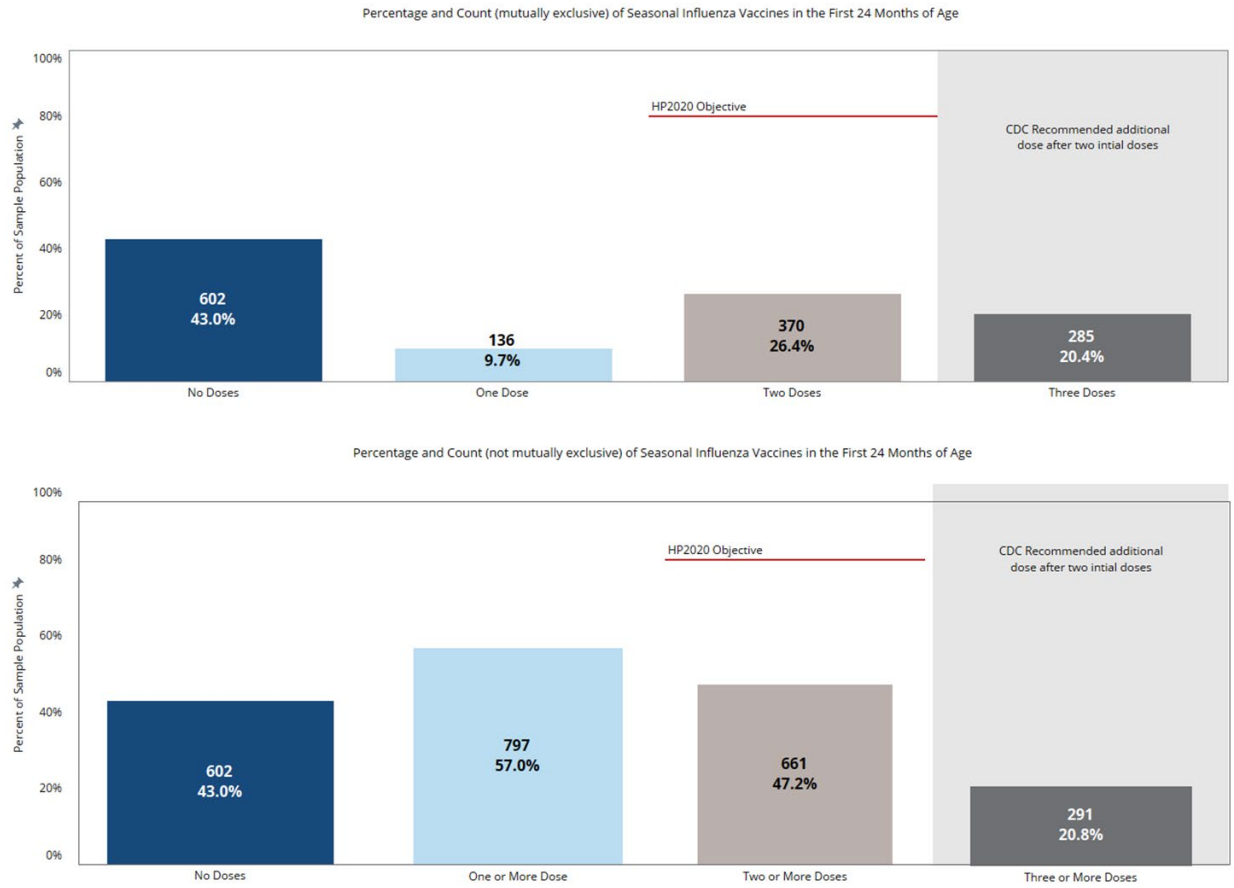
Impact on Pediatric Morbidity and Mortality

Children younger than 2 years old are at high risk of developing serious flu-related complications. These complications include pneumonia, dehydration, exacerbation of chronic illnesses (such as asthma), brain dysfunction (encephalopathy), and death. During the 2020-2021 flu season, only one child was reported as dying from influenza within the United States, this is the lowest reported influenza related death rate in a decade. The CDC contributes the low death rate to COVID-19 mitigation measures such as wearing face masks, staying home, hand washing, school closures, reduced travel, increased ventilation of indoor spaces, and physical distancing, Additionally, a record number of influenza vaccine doses (193.8 million doses) were distributed in the U.S. during 2020-2021.[13]

The annual seasonal influenza vaccine helps save lives and reduce severe illness. Despite its benefits, influenza vaccine remains the least administered of the recommended immunizations in Tennessee. Only 57.0% of all children surveyed in 2022 had at least one dose of seasonal influenza vaccine, 47.2% had two doses, and 20.8% received the recommended three doses of influenza vaccine prior to the second birthday. Missed influenza vaccinations increase the risk of morbidity and mortality among Tennesseans of all ages.

Figure 11 shows the number of flu vaccines received per child. Flu vaccine is given annually to children aged six months and older; two doses should be given during a child's first influenza season to confer protection. This survey measures the proportion of children who have received two or more doses by their second birthday. However, an additional dose after the initial two dose series of flu vaccine is recommended for children annually until age seven to be fully covered. As seen in Figure 11, children in Tennessee are extremely under-vaccinated for influenza. Many children who die each year from influenza failed to receive an annual influenza vaccination.

Figure 11: Percentage and Count of Seasonal Influenza Vaccines in the First 24 Months of Age, Tennessee, 2022

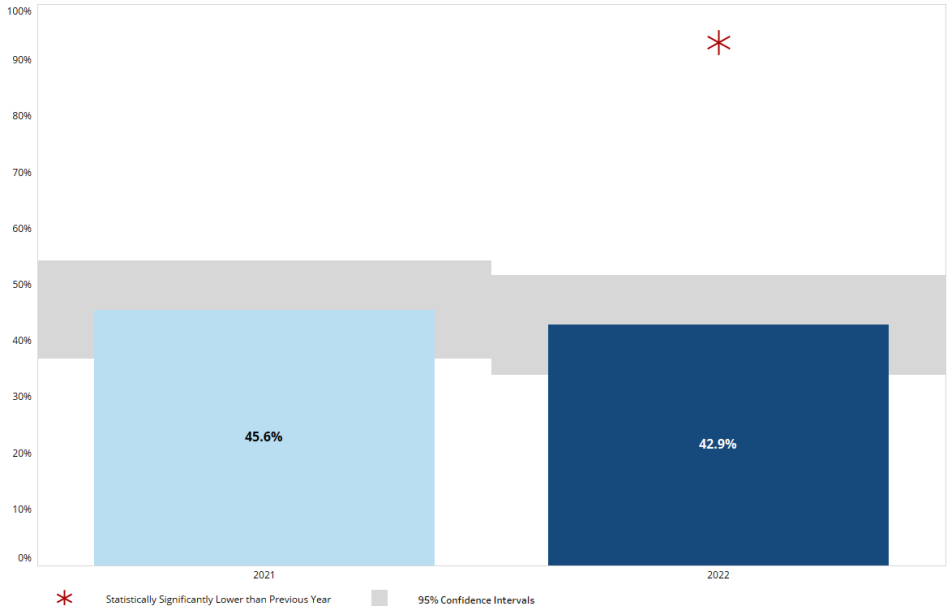


Seasonal Influenza Vaccination

Seasonal Influenza Vaccine in First Year of Life

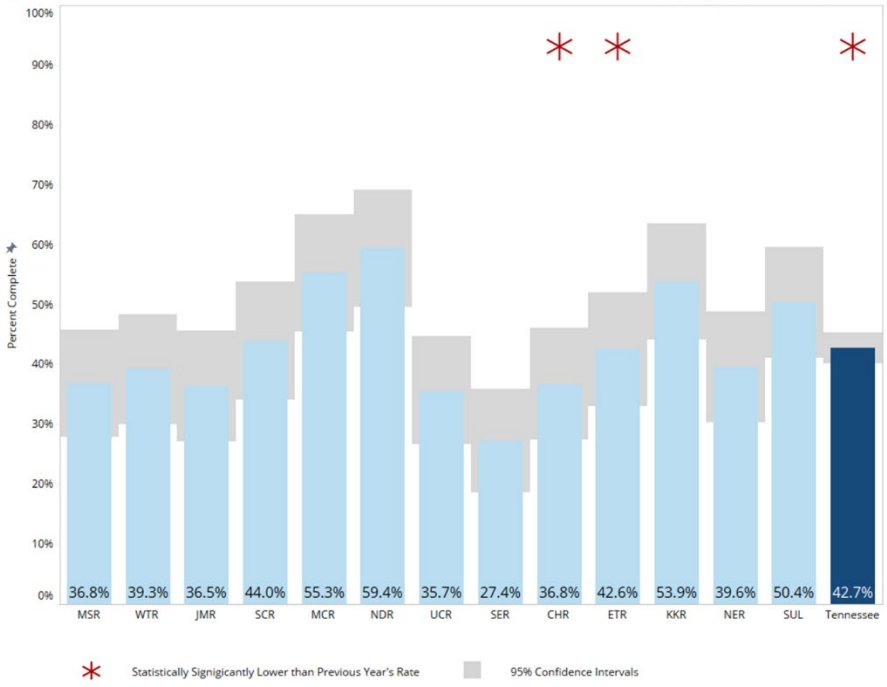
Of the 1,399 children surveyed, 42.7% received their first flu vaccine between 6 months and one year of age. In 2022, there statistically significantly fewer children who received their first dose of influenza vaccine between 6 months and one year of age compared to 2021.

Figure 12. Statewide Percentage of Children with One Dose of Seasonal Influenza Vaccine, Tennessee, 2021-2022



Flu data stratified by region can be seen in Figure 13. Chattanooga-Hamilton County Region (36.8%) and East Tennessee Region (42.6%) were health department regions where there are statistically significantly fewer children who received their first dose of influenza vaccine between 6 months and one year of age compared to 2021.

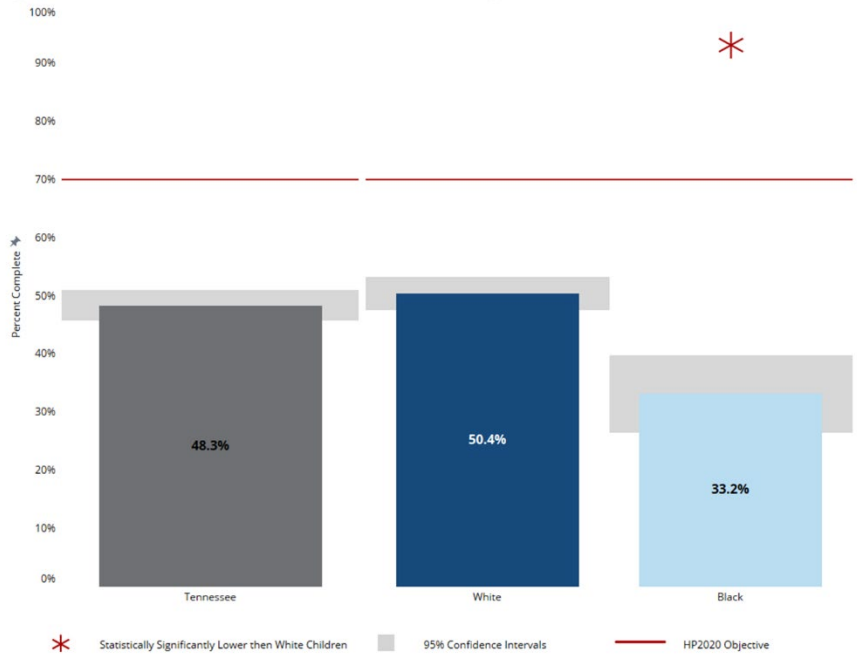
Figure 13. Rate of Children Who Received First Dose of Influenza Vaccine in First Year of Life, by Region, Tennessee, 2022



Seasonal Influenza Vaccine & Racial Disparity

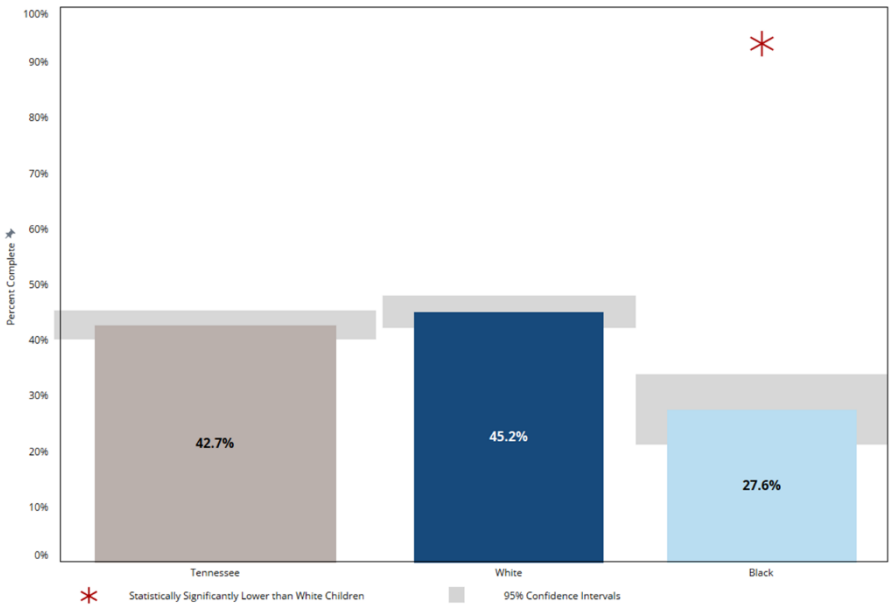
Influenza remains the individual vaccine with the lowest completion rate and most significant racial disparity. This difference has been documented annually since the first assessment of influenza coverage rates in 2007. In 2022, 33.2% of non-Hispanic Black received at least two doses of influenza vaccine compared to 50.4% of non-Hispanic White children (Figure 14). The causes are likely multifactorial and account for a 17.2% difference in completion rate non-Hispanic Black and non-Hispanic White children. Strategies to address the protection of this population are needed.

Figure 14. Rate of Children with Two-Doses of Seasonal Influenza Vaccine, by Race, Tennessee, 2022



ACIP recommends all children over the age of 6 months receive annual influenza vaccine. Of the 1,399 surveyed children, 42.7% received their first dose between 6 months and one year of age. Non-Hispanic White children were more likely to receive their first dose of influenza vaccine before their first birthday than non-Hispanic Black children (45.2% compared to 27.6%, respectively) (Figure 15).

Figure 15. Statewide Percentage of Children with One Dose of Seasonal Influenza Vaccine, by Race, Tennessee, 2022

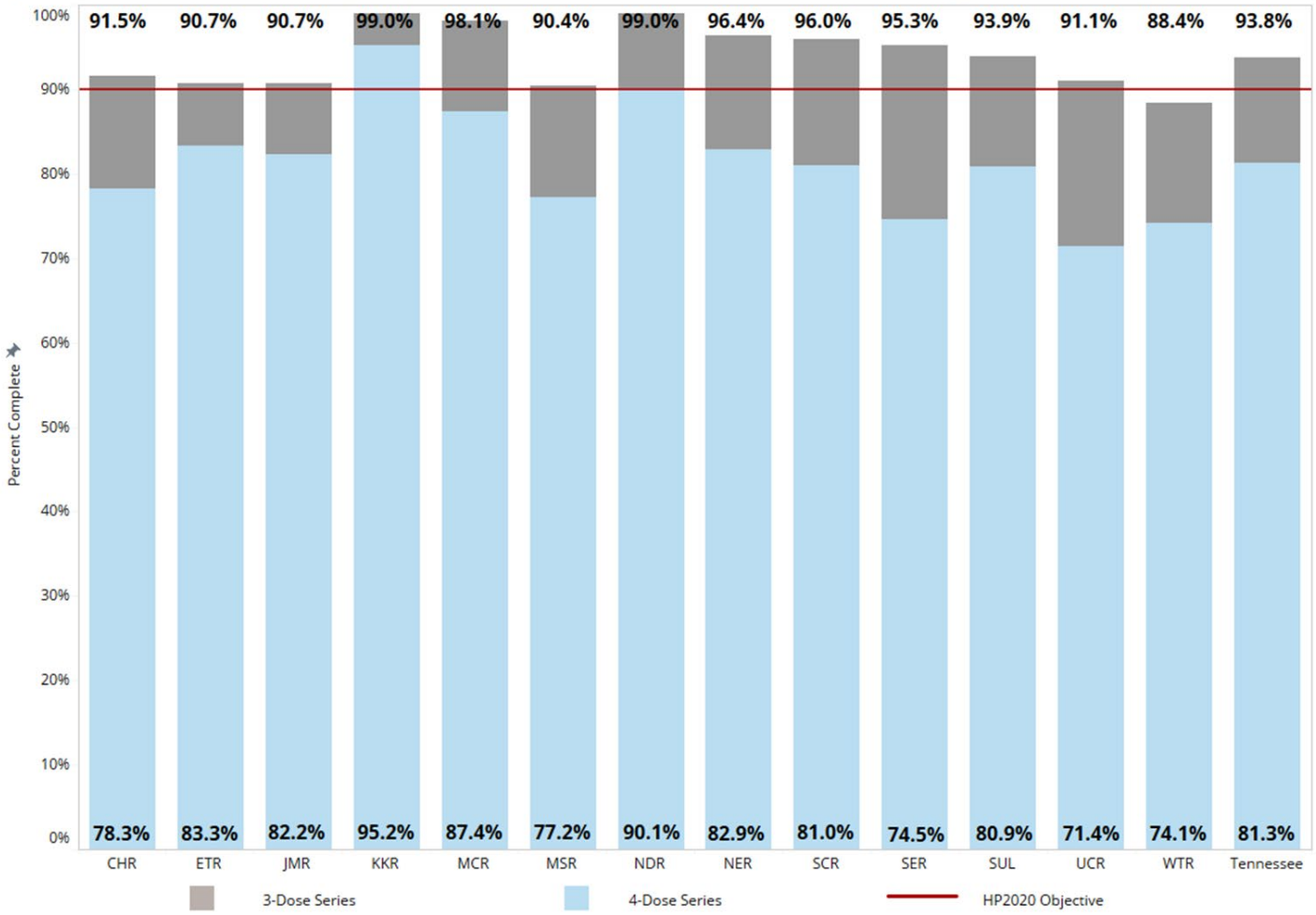


Opportunities for Improvement

Fourth DTaP

Figure 16 compares the regional percentages of children immunized with three and four doses of DTaP vaccine. The complete DTaP immunization rate for Tennessee was 81.3%; however, 93.9% of children had at least three doses of DTaP. The regional differences between receipt of three doses of DTaP vaccine compared to receipt of four doses of DTaP vaccine ranges from 3.9% to 20.8%. For a child to be properly protected against diphtheria, tetanus, and pertussis, a fourth dose of DTaP is necessary between 15-18 months of age. If all children who received three doses of DTaP received their fourth dose, Tennessee's coverage would increase by 12.6% and surpassed the HP2020 objective for DTaP immunization (90%).

Figure 16. Percentage of Children with Complete Diphtheria, Tetanus, Pertussis (DTaP) Three Dose vs Four Dose Series by Health Department Region, TN, 2022



CDC Catch-up vs ACIP schedule

In 2019, TDH implemented analysis for the CDC's alternative "catch-up" vaccine schedule to account for children whose vaccinations had been delayed but were still complete before 24 months. Specifically, a change in logic to determine series completion was made to account for children who began HIB or PCV vaccination outside of the ACIP-recommended age but prior to 24 months. This alternative vaccination timing is often referred to as a "catch-up" schedule.

In 2022, 285 (20.4%) of the 1,399 children surveyed were vaccinated according to a catch-up schedule. Of these, 108 (37.9%) were considered complete for HIB vaccine (Figure 17). Of the 251 (17.9%) children vaccinated with PCV after the ACIP recommended age, 184 (73.3%) were considered complete for PCV vaccine (Figure 18).

Figure 17. Percentage of Children with Complete HIB Series, by ACIP & CDC Schedule, by Region, Tennessee, 2022

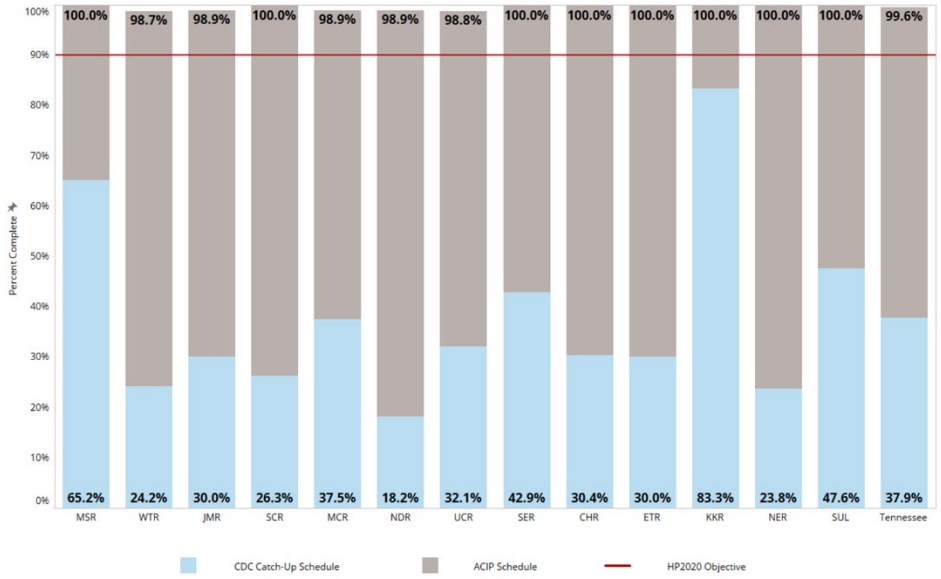
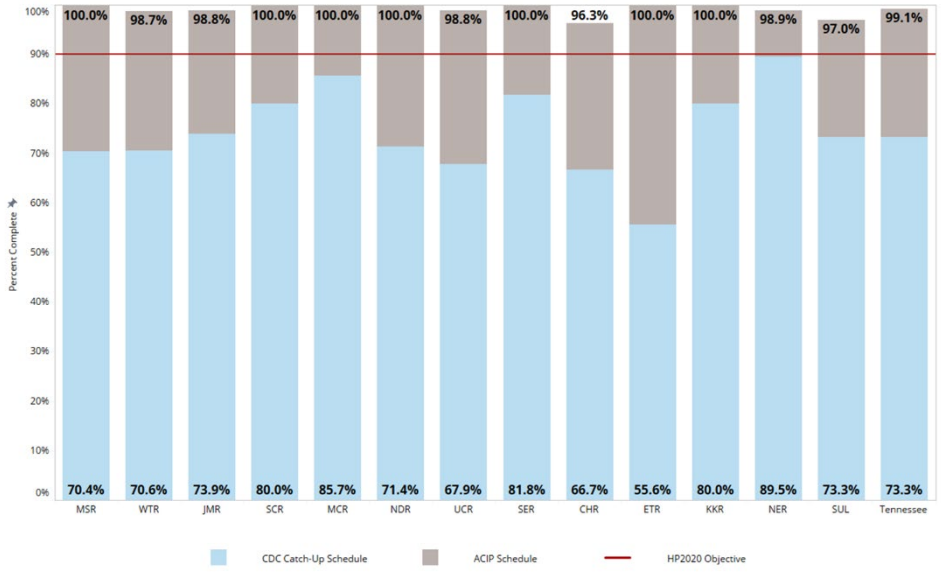


Figure 18. Percentage of Children with Complete PCV Series, by AVIP and CDC Schedule, Region, Tennessee, 2022



Regional Immunization Rates

State-wide, the UTD immunization coverage rate by 24 months was 77.1%. This rate varied per region ranging from 64.3% to 92.3%. The five regions with the highest UTD immunization rates by 24 months are shown in green, while the five regions with the lowest UTD immunization rates by 24 months are shown in red (Figure 19 and Table 7).

Response rates for each region are included on the second page of all regional reports (Section III). Caution should be taken when interpreting immunization rates for a region with a low response rate because children who were classified as unable-to-locate could also be the least UTD but must be excluded.

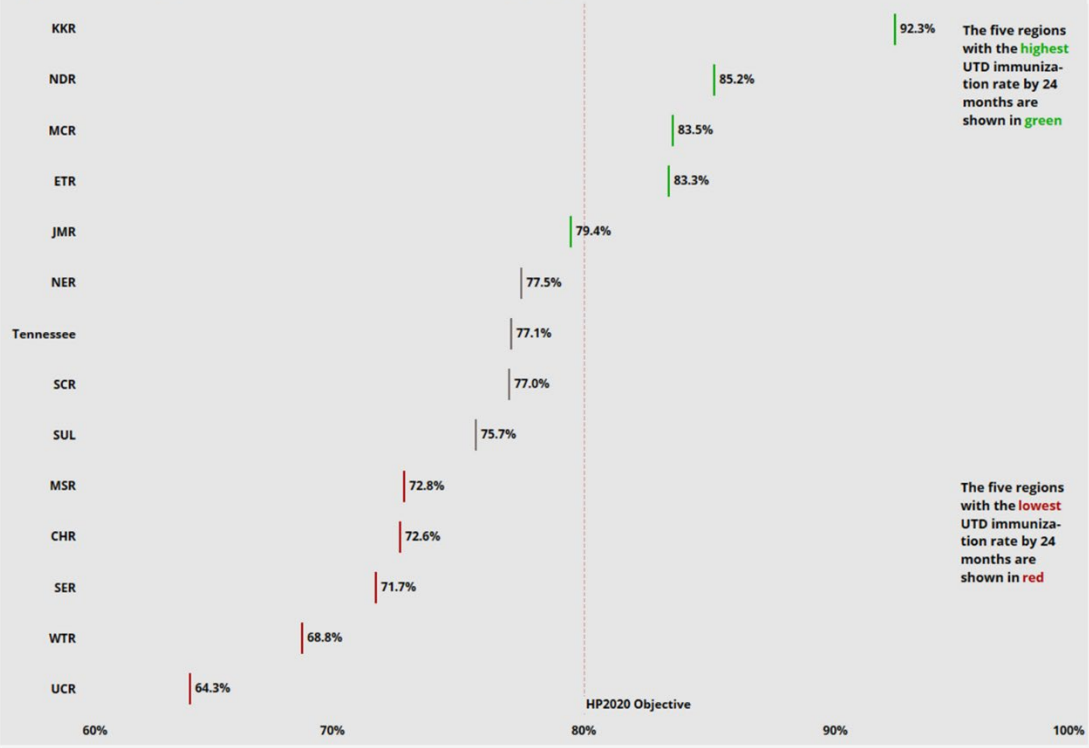
The difference between coverage rates as reported to TennIIS alone compared to UTD at 24 months of age after manual investigation can also be noted in the regional reports in Section III. This difference suggests that many providers do not report all administered vaccines to TennIIS, which is expected in the setting of a voluntary reporting system. Encouraging physician practices to voluntarily report complete immunization events and to utilize TennIIS for immunization documentation would improve the ability of the statewide immunization registry to inform providers and public health about immunization practices across the state.

Table 7: UTD Immunization Rates by Region, Tennessee, 2022

Region	Survey Sample Size (N)	UTD TennIIS Alone (%)	UTD by End of Survey (%)
MSR (Memphis-Shelby County Region)	114	2.6 ± 3.0	72.8 ± 8.3
WTR (West Tennessee Region)	112	4.5 ± 3.9	68.8 ± 8.7
JMR (Jackson-Madison County Region)	107	15.9 ± 7.0	79.4 ± 7.8
SCR (South Central Region)	100	7.0 ± 5.1	77.0 ± 8.4
MCR (Mid-Cumberland Region)	103	9.7 ± 5.8	83.5 ± 7.3
NDR (Nashville-Davidson County Region)	101	27.7 ± 8.9	85.2 ± 7.1
UCR (Upper Cumberland Region)	112	12.5 ± 6.2	64.3 ± 9.0
SER (Southeast Region)	106	8.5 ± 5.4	71.7 ± 8.7
CHR (Chattanooga-Hamilton County Region)	106	8.5 ± 5.4	72.6 ± 8.6
ETR (East Tennessee Region)	108	12.0 ± 6.2	83.3 ± 7.1
KKR (Knoxville-Knox County Region)	104	2.9 ± 3.3	92.3 ± 5.2
NER (Northeast Region)	111	0.0 ± 0.0	77.5 ± 7.9
SUL (Sullivan County Region)	115	5.2 ± 4.1	75.7 ± 8.0
Tennessee	**1399**	**8.9 ± 1.5**	**77.1 ± 2.2**

The five regions with the highest UTD immunization rates by 24 months are shown in green
The five regions with the lowest UTD immunization rates by 24 months are shown in red

Figure 19: UTD by 24 Months Immunization Rates by Region, Tennessee, 2022



Immunization Success Measures by Region

This study is conducted at the state level and allows for uniform data analysis covering all 13 health regions in Tennessee. Individual vaccine measures can indicate an individual health region's success in achieving high UTD rates by 24 months of age among their childhood population.

Please refer to Table 8 for a list of these success measures and the first, second, and third-placing health regions as applicable to each measure.

The top portion of the table addresses the regions who have the highest immunization coverage rates and response rates as well as one-year increases. The lower portion of the table addresses the vaccine antigen-specific coverage rates by 24 months and only includes 2022 results.

Region Immunization Champions are those ranking in the top three for any of the categories.

Table 8: Health Department Region Immunization Champions, 2022

Category	Region with Highest Rate	Region with 2nd Highest Rate	Region with 3rd Highest Rate	State
Highest Response Rate	**CHR/JMR** 100.0%	**MSR** 99.1%	**SUL** 98.3%	95.1%
Highest UTD immunization rate* (based on TennIIS alone)	**NDR** 27.2%	**JMR** 15.9%	**UCR** 12.5%	8.9%
Highest UTD immunization rate* (by end of data collection)	**KKR** 92.3%	**NDR** 85.2%	**ETR** 83.3%	77.1%
Greatest Increase in UTD by 24 months from 2021 to 2022	**JMR** 13.1%	**MSR** 12.5%	**SCR** 10.6%	2.2%
Highest Coverage DTaP (4 Doses)	**KKR** 95.2%	**NDR** 90.1%	**MCR** 87.4%	81.3%
Highest Coverage IPV (3 DOSES)	**NDR** 99.0%	**KKR** 98.1%	**MCR** 97.1%	92.9%
Highest Coverage MMR (1 DOSE)	**NDR** 98.0%	**KKR** 95.2%	**NER** 94.6%	91.0%
Highest Coverage HBV (3 DOSES)	**KKR/MCR** 98.1%	**NER** 97.3%	**NDR/SCR** 97.0%	93.9%
Highest Coverage HBV, Birth Dose	**SER** 91.5%	**SCR** 90.0%	**KKR** 86.5%	81.1.%
Highest Coverage Hib (Full Series)	**KKR** 94.2%	**NDR** 89.1%	**MCR** 84.5%	79.6%
Highest Coverage VAR (1 DOSE)	**NDR** 97.0%	**KKR** 95.2%	**NER** 94.6%	90.3%
Highest Coverage PCV (Full Series)	**KKR** 95.2%	**NDR** 93.1%	**SUL** 87.0%	82.1%
Highest Coverage Full Series 431:FS:314:FS	**KKR** 92.3%	**NDR** 85.2%	**MCR** 83.5%	77.1%
Highest Coverage HAV (1 DOSE)	**KKR** 96.2%	**NDR** 95.1%	**SUL** 93.9%	90.6%
Highest Coverage RTV (Full Series)	**KKR** 91.4%	**SCR** 91.0%	**MCR** 87.4%	77.7%
Highest Coverage FLU (2 Doses)	**NDR** 80.2%	**KKR** 64.4%	**MCR** 63.1%	48.3%

Summary of Key Findings

Below is the summary of coverage rates relative to Health People (HP) 2020 and 2030 objectives:

Measurement	TN 2022 (24 Months)	HP2020 Objective (19-35 months)	HP2030 Objective (24 months)
Complete 4:3:1:FS:3:1:4 Series	77.1%	80%	N/A
Each vaccine in 4:3:1:FS:3:1:4 (DTaP, IPV, MMR, Hib, HBV, VAR, PCV)	**Exceeded Goal:** 3 doses of IPV (92.9%) **1 dose of MMR (91.0%)** 3 doses of HBV (92.9%) 1 dose of Varicella (90.3%) **Below Goal:** 4 doses of DTaP (81.3%) Full series of HIB (79.6%) Full series of PCV (82.1%)	90% rate for each of the 7 antigens	90% rate for DTaP 90.8% rate for MMR
Hepatitis A vaccine	1 dose HAV (86.9%) *not comparable to HP2020*	N/A	N/A
Influenza vaccine	47.2% with 2 doses 20.8% with 3 doses	70% appropriately immunized	N/A
Rotavirus vaccine	77.7%	80% with 2 doses	N/A
Hepatitis B birth dose	81.1%	85%	N/A
3 doses DTaP vs 4 doses of DTaP	93.8% with 3 doses 81.3% with 4 doses	N/A	N/A
HIB Completion ACIP vs CDC Catch-Up	99.6% (ACIP) 37.9% (Catch-Up)	N/A	N/A
PCV Completion ACIP vs CDC Catch-Up	99.1% (ACIP) 73.3% (Catch-Up)	N/A	N/A

Indicates value met HP2020 objective

Bold text indicates value is above HP2030 objective

Tennessee's statewide completion of the 4:3:1:FS:1:3:FS full series would exceed the HP2020 coverage goal of 80% if the children sampled in this survey had received an additional immunization visit in their second year of life to receive a fourth dose of DTaP vaccine. As the fourth dose may be administered as early as age 12 months if at least 6 months has elapsed since the third dose, a recommendation to administer the fourth dose at the 12-month visit should be considered to achieve the HP2020 coverage goal.

- Hepatitis B has remained above the HP2020 objective of 90% as seen in the previous decade. This is potentially due to the initiation of the vaccine series administered by hospital staff within 24 hours of birth.
- Tennessee did not reach 80% coverage for the 4:3:1:FS:3:1:FS at any point in the past decade nor did it meet the goal in 2022.
- Black children were less likely than white children to be completely immunized according to CDC recommendations.
- In 2022, parents of 2.1% of the surveyed children reported refusing some or all immunizations, compared to 3.0% in 2021.
- In 2021, 1.6% of Tennessee children received zero doses of recommended vaccines, failing to meet the HP2030 objective of limiting the percentage of children who receive zero doses of recommended vaccines by age two years to 1.3%.

Discussion

Overall, vaccination rates among children in Tennessee remain high. However, the threat of previously eliminated vaccine-preventable diseases across the United States demonstrates the importance of continued vigilance. Ensuring that medically eligible children can be fully vaccinated on-time and according to the Centers for Disease Control and Prevention (CDC) recommended childhood immunization schedule is critical.

The results from this report suggest that recent efforts to improve coverage rates may be succeeding. The improvement seen in 2022 did not yet return overall vaccine coverage to where it was prior to 2020. Tennessee currently only meets four of the twelve HP2020 objectives and one of the three HP2030 targets for 24-month-old children. While vaccination rates among children in Tennessee increased in recent years prior to the COVID-19 pandemic, the pandemic has had a considerable negative impact on the vaccination rate of children. Efforts must be made to provide vaccinations to children who have fallen behind with routine childhood vaccinations for Tennessee to minimize outbreak risk of highly infectious, vaccine-preventable, diseases. Providers are encouraged to recall patients who have missed vaccinations and provide vaccinations at every opportunity, regardless of the reason for an office visit. Efforts around immunization education, addressing vaccine hesitancy and countering vaccine misinformation, are important. Delayed vaccine schedules and missed vaccinations increase risk for morbidity and mortality from vaccine-preventable disease for all Tennesseans.

As seen in the survey, most parents in Tennessee vaccinate their children on time and according to the CDC recommendations. Of the 1,399 children surveyed, only 2.1% (n=31) reported objection or refusals. Religious reasons were cited by 1.0% of parents, philosophical reasons were cited by 1.1% of parents, and medical reasons were cited by 0.1% of parents. As Tennessee law allows only religious and medical exemptions in lieu of complete immunization as required for public school entry, philosophical objections often transition to complete vaccination or the declaration of religious exemption prior to school entry.

3 Critical Elements for Vaccination

Three elements are critical to ensuring that every medically eligible child in Tennessee is fully immunized on-time and according to the CDC's recommended childhood vaccination schedule:

1. Continued parental and community education about the safety, efficacy, and critical importance of childhood immunization and the severity of the diseases they prevent
2. Ready access to, and provision of, immunizations at every opportunity
3. Reliable and readily accessible immunization records that ensure immunizations are provided on-time while avoiding duplication

4 Key Strategies for Improving Immunization Rates Among 24-month-old Children

1. **Parental and community education and messaging around the safety, efficacy, and critical importance of childhood immunizations**
    - Parents should seek credible sources of vaccine information and the advice of their child's medical provider when seeking information about vaccines.
    - Public health and healthcare providers should provide strong and credible messages that "vaccines are safe, vaccines are effective, and vaccines save lives".

2. **Ready access to, and provision of, vaccinations at every opportunity**
    - Maintain the federally funded Vaccines for Children (VFC) Program to ensure that children who are covered by TennCare or otherwise lack insurance coverage for vaccines can receive them free of charge through a statewide network of healthcare providers and local departments of health. Expansion of this network of VFC Providers will provide more opportunities to vaccinate children.
    - Medical providers should review vaccine records and administer missing vaccinations at every opportunity.
    - The Tennessee Immunization Information System (TennIIS) is built to evaluate UTD status with the ACIP forecast schedule for each patient. Physicians should utilize TennIIS to identify gaps in immunizations, especially DTaP and Flu, at every opportunity.

3. **Reliable and readily accessible vaccination records that ensure vaccinations are provided on-time while avoiding duplication**
    - Continue to promote the Tennessee Immunization Information System, "TennIIS" (www.TennesseeIIS.gov). TennIIS is an online immunization registry that is available to all immunizing providers, including hospitals, clinics, and pharmacies, and includes a suite of tools which may help to improve immunization rates among children and adults.
    - Promote standards implemented in 2017 requiring clinics participating in the federal Vaccines for Children (VFC) Program to report all immunizations administered to children under 19 years of age to TennIIS. This enables providers to use system features designed to improve patient immunization services, such as vaccine forecasting, practice-based patient reminders and immunization coverage rate reports.
    - Remind all vaccinating providers to report all administered vaccination to TennIIS. Reporting all immunizations to an Immunization Information System (IIS) such as TennIIS improves healthcare by establishing a permanent immunization record that is available to all healthcare providers. TennIIS is linked to the electronic health record (EHR) systems of hundreds of medical facilities and pharmacies statewide, allowing for seamless electronic immunization record reporting from those systems.
    - Promote TennIIS to medical providers for a validated immunization certificate, which families use for daycare, school, college entry, and employment requirements. Provider participation in TennIIS is critical to build these lifelong records and to ensuring all Tennesseans are appropriately vaccinated.

4. ***Policy***
    - Educate decision-makers about the impact of non-medical exemptions on immunization rates. States without non-medical exemptions have higher overall immunization rates than states which allow non-medical exemptions.
    - Provide updated provider guidance and recommendations helps to optimize each visit and ensure that children are completely protected from vaccine preventable diseases in a safe and timely schedule.

5 Recommendations to Improve Immunization Coverage in 24-month-old Children in Tennessee

The following recommendations may improve on-time immunization of Tennessee children:

1. Vaccination records should be examined for completeness at every medical visit, regardless of the reason for the visit, and vaccinations should be provided at every opportunity. Given the significant reduction in vaccinations provided to children during the COVID-19 pandemic, it is critical to the health of all Tennesseans to ensure every child is fully vaccinated, according to the CDC recommended childhood vaccination schedule.
2. Medical providers should implement strategies that alert parents when their children are due or overdue for booster doses of DTaP, HIB and PCV. Most children who fell short of complete immunization could have achieved series completion with just one additional immunization visit prior to the second birthday. Minority children are especially vulnerable to missing immunizations.
3. Parents and providers should strictly adhere to the early infant schedule of immunizations at 2-, 4-, and 6-months. Doing so will enable providers to administer the 4th DTaP and all other needed immunizations as early as the first birthday, maximizing the number of opportunities to immunize children on time.
4. All vaccinating providers should enroll in, and report vaccinations to, TennIIS for every patient. The Tennessee Immunization Information System (TennIIS) maintains patient immunization records and special tools which may assist providers in improving the quality of their immunization services. User guides and other TennIIS resources available through the training information posted at www.TennesseeIIS.gov may assist providers in recognizing opportunities to immunize their patients such as:
    - TennIIS provides individual patient forecasting of immunizations due, based upon the patient's immunization history.
    - TennIIS can generate patient reminders using manual, auto dialer, text, or other reminder methods. This feature assists providers in reminding patients of immunization appointments and recalling children who are due or overdue for immunizations.
    - Medical practices may run their own practice-level immunization coverage reports based on their active patients in TennIIS. Coaching on the use of these reports is available in the training section of the TennIIS website.

- There are more than 8,300 private medical provider offices enrolled in TennIIS. All immunizing providers should enroll and report immunizations to TennIIS. This will allow for more accurate shared clinical decision making and the most complete immunization record for Tennesseans.

5. All parents, especially those enrolled in WIC and TennCare, should continue to receive immunization education, immunization record review, and immunization administration at every opportunity.

References

1. CDC. Vaccination Coverage by Age 24 Months Among Children Born in 2015 and 2016 – National immunization Survey-Child, United States, 2016-2018. Morbidity and Mortality Weekly Report, 68(41);913-918.
2. America's Health Rankings analysis of CDC, Behavioral Risk Factor Surveillance System, United Health Foundation, AmericasHealthRankings.org, Accessed 2023.
3. CDC. Protect against flu: Caregivers of infants and young children. Centers for Disease Control and Prevention. 2022 Sep 21.
4. CDC. Ensuring the Safety of Vaccines in the United States. Centers for Disease Control and Prevention. 2013 Feb 01.
5. CDC. Parent's Guide to Childhood Immunizations; Part 3: More About Vaccines. Centers for Disease Control and Prevention: 22-29.
6. CDC. Benefits from Immunization During the Vaccines for Children Program Era — United States, 1994–2013. Morbidity and Mortality Weekly Report. 63(16);352-355.
7. CDC. Ten Great Public Health Achievements – United States 2001—2011. Morbidity and Mortality Weekly Report. 60(19);619-623.
8. Pradke, V., Bednarczyk, R., et al. Association between Vaccine Refusal and Vaccine-Preventable Diseases in the United States: A Review of Measles and Pertussis. JAMA. 2016 Mar 15; 315(11):1149-1158.
9. Flannery, B., Reynolds, S., et al. Influenza Vaccination Effectiveness against Pediatric Deaths: 2010-2014. Pediatrics. 2017, May; 139(5):e20164244.
10. American Academy of Pediatrics. Recommended Child and Adolescent Immunization Schedule for ages 19 years or younger, United States, 2019. Centers for Disease Control and Prevention. https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html
11. CDC. Haemophilus influenzae Disease (Including Hib). Surveillance. 2022 Mar 4.
12. CDC. Rotavirus. Rotavirus in the U.S. 2021 Mar 26.
13. CDC. Influenza (Flu) Home. 2020-21 Flu Season Summary FAQ. 2021 Oct 25.

Section III

Heath Region Results

Memphis-Shelby County Region (MSR)

Figure 20-A: Location of Memphis-Shelby County Region (MSR)

Figure 20-B: Sampling per County, MSR, 2022

Final Sample Determination

The initial 2022 sample for MSR consisted of 121 children born between January and March of 2020 (Table 9-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for MSR was 114. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used from analysis but there was a higher response rate in 2022.

Immunization Rates

In MSR, the up-to-date (UTD) immunization rate by 24 months of age was 72.8%, which was higher than the 2021 rate (60.3%) and the state average (77.1%) (Table 9-B). The UTD immunization rate as reported to TennIIS was 2.6%, lower than the 2021 rate (5.0%) and lower than the state rate (8.9%). All MSR vaccination rates for 2022 are higher than the 2021 rates.

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 9-B and Figure 20-C). Most notably Full Series and PCV in MSR increase more than 12% and 16%, respectively, in 2022. In Table 9-B, ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in DTaP, VAR, PCV, and Full Series between 2021 and 2022 rates.

Immunization Administration

Of the 2,666 vaccines doses administered to the MSR children, 2,586 (99.0%) were administered by private providers, 11 (0.4%) were administered by public health providers and 69 (2.6%) were administered by an unknown source.

Table 9-A: 24-Month-Old Survey Sampling, MSR, 2021

	2021	**2022**	State 2022
Original sample (n)	128	**121**	1574
Ineligible (n)	2 (1.6%)	**5** (4.1%)	80 (5.1%)
Refused Participation (n)	1 (0.8%)	**1** (0.8%)	23 (1.5%)
Eligible sample (n)	125	**115**	1471
Unable to locate† (n)	4 (3.2%)	**1** (0.9%)	72 (4.9%)
Final sample (n)	121	**114**	1399
Response Rate (%)*	96.8	**99.1**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.
* Repsonse Rate (%) is the number of survey responses from eligible children

Table 9-B: Immunization Rates by Series and Vaccine Antigen, MSR, 2022

	2021 (n=121) (%)	**2022 (n=114) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	5.0 ± 3.9	2.6 ± 3.0 ↓	8.9 ± 1.5
UTD immunization rate* (with data collection)	60.3 ± 8.8	***72.8*** ± ***8.3*** ↑	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	62.0 ± 8.8	***77.2*** ± ***7.8*** ↑	81.3 ± 2.0
IPV (3 DOSES)	81.8 ± 7.0	89.5 ± 5.7 ↑	92.9 ± 1.3
MMR (1 DOSE)	79.3 ± 7.3	88.6 ± 5.9 ↑	91.0 ± 1.5
HBV (3 DOSES)	81.8 ± 7.0	90.4 ± 5.5 ↑	93.9 ± 1.3
HBV (Birth Dose)	66.9 ± 8.5	67.5 ± 8.7 ↑	82.8 ± 2.1
Hib (Full Series)	56.2 ± 9.0	59.7 ± 9.1 ↑	79.6 ± 2.1
VAR (1 DOSE)	77.7 ± 7.5	***87.7*** ± ***6.1*** ↑	90.3 ± 1.6
PCV (Full Series)	59.5 ± 8.9	***76.3*** ± ***7.9*** ↑	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	60.3 ± 8.8	***72.8*** ± ***8.3*** ↑	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	78.5 ± 7.4	87.7 ± 6.1 ↑	90.6 ± 1.5
RTV (Full Series)	57.9 ± 8.9	69.3 ± 8.6 ↑	77.7 ± 2.2
FLU (2 Doses)	37.2 ± 8.7	42.1 ± 9.2 ↑	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule
Red font indicates a rate decrease since 2021
Italicized and bolded font indicates a significant difference ($p < 0.05$) with 2021 rate

Figure 20-C shows the MSR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each antigen assessed. MSR children have not met the HP2020 objective for DTaP, HIB, PCV, Influenza or RTV anytime in the past six years.

Figure 20-C: Immunization Rates (%) by Series and Vaccine Antigen, MSR, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Findings

The demographic breakdown of the MSR sample alongside the UTD immunization rates by demographic groups are shown in Table 9-C and 9-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for MSR.

Table 9-C: Risk Factors and Immunization Rates, MSR, 2022

		Demographic Breakdown			UTD Immunization Rates			
		MSR¥ (n=114)		State¥ (n=1399)	MSR n=114 (%)			STATE n=1399 (%)
Group	Subgroup							
Race+*								
	Black	62	54.4%	196 14.0%	75.8	±	11.0	74.5 ± 6.2
	White	47	41.2%	1167 83.4%	68.1	±	13.8	77.5 ± 2.4
	Other	5	4.4%	36 2.6%	sample size is too small to generate estimates			77.8 ± 14.3
Ethnicity+*								
	Hispanic	15	13.2%	153 10.9%	73.3	±	25.4	83.7 ± 5.9
	Non-Hispanic	99	86.8%	1246 89.1%	72.7	±	8.9	76.2 ± 2.4
Sex*								
	Male	60	52.6%	719 51.4%	78.3	±	10.7	77.3 ± 3.1
	Female	54	47.4%	680 48.6%	66.7	±	13.0	76.8 ± 3.2
Siblings*								
	0	48	42.1%	566 40.5%	81.3	±	11.5	84.8 ± 3.0
	1	43	37.7%	468 33.5%	72.1	±	14.0	78.2 ± 3.8
	2+	23	20.2%	365 26.1%	56.5	±	21.9	63.6 ± 5.0
Vaccination Source								
	Private Medical Provider	111	97.4%	1288 92.1%	73.9	±	8.3	79.0 ± 2.2
	Health Department	0	0.0%	18 1.3%	sample size is too small to generate estimates			50.0 ± 25.6
	Both	2	1.8%	59 4.2%	sample size is too small to generate estimates			81.4 ± 10.2
	Unknown Source	1	0.9%	34 2.4%	sample size is too small to generate estimates			11.8 ± 11.4
Program Enrollment								
	TennCare Only	8	7.0%	126 9.0%	sample size is too small to generate estimates			77.0 ± 7.5
	WIC Only	11	9.7%	224 16.0%	54.6	±	35.1	69.6 ± 6.1
	Both (TennCare + WIC)	39	34.2%	414 29.6%	74.4	±	14.3	74.2 ± 4.2
	Not Enrolled	56	49.1%	635 45.4%	76.8	±	11.4	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 9-D: Parent Demographics and Immunization Rates, MSR, 2022

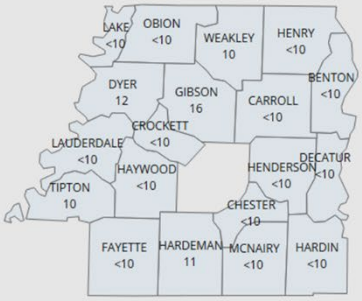
		Demographic Breakdown			UTD Immunization Rates			
		MSR¥ (n=114)		State¥ (n=1399)	MSR n=114 (%)			STATE n=1399 (%)
Group	Subgroup							
Mother Age*								
	≤24	35	30.7%	438 31.3%	71.4	±	15.8	75.3 ± 4.1
	25-34	63	55.3%	807 57.7%	71.4	±	11.5	77.2 ± 2.9
	≥35	16	14.0%	154 11.0%	81.3	±	21.5	81.2 ± 6.3
Father Age*								
	≤24	15	13.2%	252 18.0%	86.7	±	19.5	75.8 ± 5.3
	25-34	47	41.2%	680 48.6%	63.8	±	14.3	77.9 ± 3.1
	≥35	26	22.8%	274 19.6%	92.3	±	11.0	83.6 ± 4.5
	Unknown	26	22.8%	193 13.8%	61.5	±	20.0	66.3 ± 6.7
Mother Education*								
	< High School Diploma/ GED	17	14.9%	174 12.4%	52.9	±	26.5	71.3 ± 6.8
	High School Diploma/ GED	32	28.1%	419 30.0%	75.0	±	15.9	71.8 ± 4.3
	> High School Diploma/ GED	65	57.0%	799 57.1%	76.9	±	10.5	81.1 ± 2.7
	Unknown	0	0.0%	7 0.5%	sample size is too small to generate estimates			71.4 ± 45.1
Father Education*								
	< High School Diploma/ GED	7	6.1%	145 10.4%	sample size is too small to generate estimates			80.0 ± 6.6
	High School Diploma/ GED	27	23.7%	419 30.0%	70.4	±	18.4	72.3 ± 4.3
	> High School Diploma/ GED	52	45.6%	621 44.4%	82.7	±	10.6	83.1 ± 3.0
	Unknown	28	24.6%	214 15.3%	60.7	±	19.3	66.8 ± 6.4
Marriage Status*								
	Married	45	39.5%	742 53.0%	75.6	±	13.1	79.9 ± 2.9
	Unmarried	69	60.5%	656 46.9%	71.0	±	11.0	73.8 ± 3.4
	Unknown	0	0.0%	1 0.1%	sample size is too small to generate estimates			0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

West Tennessee Region

Figure 21-A: Location of West Tennessee Region (WTR)

Figure 21-B: Sampling per County, WTR, 2022



Final Sample Determination

The initial 2022 sample for WTR consisted of 121 children born between January and March of 2020 (Table 10-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for WTR was 112. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a larger sample was used for analysis and there was a higher response rate in 2022.

Immunization Rates

In WTR, the up to date (UTD) immunization rate by 24 months of age was 68.8%, which was lower than the 2021 rate (74.8%) and the state average (77.1%) (Table 10-B). The UTD immunization rate as reported to TennIIS was 4.5%, higher than the 2021 rate (7.2%) but lower than the state rate (8.9%). All WTR vaccination rates for 2022 are lower than the 2021 rates except for HBV (Birth Dose) and Flu.

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 10-B). Most notably, Full Series, HBV, and PCV all decreased more that 5% in 2022. In Table 10-B, figures in red indicate a decrease in most vaccines between 2021 and 2022 rates. There were no rates with significant differences (*p<0.05*) between the 2021 rates and 2022 rates in WTR.

Immunization Administration

Of the 2,615 vaccines doses administered to the WTR children, 2,407 (92.0%) were administered by private providers, 164 (6.3%) were administered by public health providers and 44 (1.7%) were administered by an unknown source.

Table 10-A: 24-Month-Old Survey Sampling, WTR, 2022

	2021	**2022**	State 2022
Original sample (n)	121	**121**	1574
Ineligible (n)	5 (4.1%)	**6 (5.0%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**0 (0.0%)**	23 (1.5%)
Eligible sample (n)	116	**115**	1471
Unable to locate† (n)	5 (4.3%)	**3 (2.6%)**	72 (4.9%)
Final sample (n)	111	**112**	1399
Response Rate (%)*	95.7	**97.4**	95.1

† Children are classified as "Unable to Locate" if every conceivable effort was made to locate and communicate with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 10-B: Immunization Rates by Series and Vaccine Antigen, WTR, 2022

	2021 (n=111) (%)	**2022 (n=112) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	7.2 ± 4.9	4.5 ± 3.9 ↓	8.9 ± 1.5
UTD immunization rate* (with data collection)	74.8 ± 8.2	68.8 ± 8.7 ↓	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	75.7 ± 8.1	74.1 ± 8.2 ↓	81.3 ± 2.0
IPV (3 DOSES)	91.0 ± 5.4	88.4 ± 6.0 ↓	92.9 ± 1.3
MMR (1 DOSE)	91.0 ± 5.4	87.5 ± 6.2 ↓	91.0 ± 1.5
HBV (3 DOSES)	94.6 ± 4.3	89.3 ± 5.8 ↓	93.9 ± 1.3
HBV, Birth Dose	85.6 ± 6.6	85.7 ± 6.6 ↑	82.8 ± 2.1
Hib (Full Series)	71.2 ± 8.6	70.5 ± 8.6 ↓	79.6 ± 2.1
VAR (1 DOSE)	91.0 ± 5.4	87.5 ± 6.2 ↓	90.3 ± 1.6
PCV (Full Series)	74.8 ± 8.2	69.6 ± 8.7 ↓	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	74.8 ± 8.2	68.8 ± 8.7 ↓	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	90.1 ± 5.7	86.6 ± 6.4 ↓	90.6 ± 1.5
RTV (Full Series)	72.1 ± 8.5	71.4 ± 8.5 ↓	77.7 ± 2.2
FLU (2 Doses)	38.7 ± 9.2	39.3 ± 9.2 ↑	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Figure 21-C shows the WTR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each antigen assessed. WTR children have not met the HP2020 objective for DTaP, HIB, PCV, or Flu anytime in the past six years.

Figure 21-C: Immunization Rates (%) by Series and Vaccine Antigen, WTR, 2017-2022

HP2020 Objective

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the WTR sample alongside the UTD immunization rates by demographic groups are shown in Table 10-C and 10-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for WTR.

Table 10-C: Risk Factors and Immunization Rates, WTR, 2022

		Demographic		UTD Immunization Rates	
		WTR¥ (n=112)	State¥ (n=1399)	WTR n=112 (%)	STATE n=1399 (%)
Race[*+]					
	Black	24 21.4%	196 14.0%	70.8 ± 19.6	74.5 ± 6.2
	White	86 76.8%	1167 83.4%	68.6 ± 10.0	77.5 ± 2.4
	Other	2 1.8%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity[*]					
	Hispanic	8 7.1%	153 10.9%	sample size is too small to generate estimates	83.7 ± 5.9
	Non-Hispanic	104 92.9%	1246 89.1%	66.4 ± 9.2	76.2 ± 2.4
Sex[*]					
	Male	55 49.1%	719 51.4%	65.5 ± 13.0	77.3 ± 3.1
	Female	57 50.9%	680 48.6%	71.9 ± 12.0	76.8 ± 3.2
Siblings[*]					
	0	39 34.8%	566 40.5%	76.9 ± 13.8	84.8 ± 3.0
	1	37 33.0%	468 33.5%	75.7 ± 14.5	78.2 ± 3.8
	2+	36 32.1%	365 26.1%	52.8 ± 17.1	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	95 84.8%	1288 92.1%	71.6 ± 9.2	79.0 ± 2.2
	Health Department	4 3.6%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	8 7.1%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	5 4.5%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	0 0.0%	126 9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	22 19.6%	224 16.0%	68.2 ± 21.1	69.6 ± 6.1
	Both (TennCare + WIC)	45 40.2%	414 29.6%	68.9 ± 14.1	74.2 ± 4.2
	Not Enrolled	45 40.2%	635 45.4%	68.9 ± 14.1	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 10-D: Parent Demographics and Immunization Rates, WTR, 2022

		Demographic		UTD Immunization Rates	
		WTR¥ (n=112)	State¥ (n=1399)	WTR n=112 (%)	STATE n=1399 (%)
Mother Age[*]					
	≤24	41 36.6%	438 31.3%	68.3 ± 14.9	75.3 ± 4.1
	25-34	62 55.4%	807 57.7%	66.1 ± 12.1	77.2 ± 2.9
	≥35	9 8.0%	154 11.0%	sample size is too small to generate estimates	81.2 ± 6.3
Father Age[*]					
	≤24	31 27.7%	252 18.0%	71.0 ± 16.9	75.8 ± 5.3
	25-34	46 41.1%	680 48.6%	60.9 ± 14.7	77.9 ± 3.1
	≥35	18 16.1%	274 19.6%	88.9 ± 16.1	83.6 ± 4.5
	Unknown	17 15.2%	193 13.8%	64.7 ± 25.3	66.3 ± 6.7
Mother Education[*]					
	< High School Diploma/ GED	13 11.6%	174 12.4%	92.3 ± 16.8	71.3 ± 6.8
	High School Diploma/ GED	46 41.1%	419 30.0%	60.9 ± 14.7	71.8 ± 4.3
	> High School Diploma/ GED	53 47.3%	799 57.1%	69.8 ± 12.8	81.1 ± 2.7
	Unknown	0 0.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education[*]					
	< High School Diploma/ GED	16 14.3%	145 10.4%	75.0 ± 23.8	80.0 ± 6.6
	High School Diploma/ GED	38 33.9%	419 30.0%	65.8 ± 15.8	72.3 ± 4.3
	> High School Diploma/ GED	39 34.8%	621 44.4%	69.2 ± 15.2	83.1 ± 3.0
	Unknown	19 17.0%	214 15.3%	68.4 ± 23.0	66.8 ± 6.4
Marriage Status[*]					
	Married	50 44.6%	742 53.0%	66.0 ± 13.6	79.9 ± 2.9
	Unmarried	62 55.4%	656 46.9%	71.0 ± 11.6	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Jackson-Madison County Region

Figure 22-A: Location of Jackson-Madison County Region (JMR)

Figure 22-B: Sampling per County, JMR, 2022

Final Sample Determination

The initial 2022 sample for JMR consisted of 121 children born between January and March of 2020 (Table 11-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for WTR was 112. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a larger sample was used for analysis and there was a higher response rate in 2022.

Immunization Rates

In JMR, the up to date (UTD) immunization rate by 24 months of age was 79.4%, which was higher than the 2021 rate (66.4%) and the state average (77.1%) (Table 11-B). The UTD immunization rate as reported to TennIIS was 15.9%, higher than the 2021 rate (15.5%) and higher than the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 11-B). Most notably Full Series and PCV in JMR increase more than 17% and 14%, respectively in 2022. In Table 11-B, figures in red indicate a decrease in IPV, HBV, HBV (birth dose), and Flu between 2021 and 2022 rates and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in DTaP, Hib, and Full series between 2021 and 2022 rates.

Immunization Administration

Of the 2,601 vaccines doses administered to the JMR children, 2,299 (88.4%) were administered by private providers, 145 (5.6%) were administered by public health providers and 157 (6.0%) were administered by an unknown source.

Table 11-A: 24-Month-Old Survey Sampling, JMR, 2022

	2021	**2022**	State 2022
Original sample (n)	121	**120**	1574
Ineligible (n)	6 (5.0%)	**4 (3.3%)**	80 (5.1%)
Refused Participation (n)	1 (0.8%)	**9 (7.5%)**	23 (1.5%)
Eligible sample (n)	114	**107**	1471
Unable to locate† (n)	4 (3.3%)	**0 (0.0%)**	72 (4.9%)
Final sample (n)	110	**107**	1399
Response Rate (%)*	96.5	**100.0**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children.

Table 11-B: Immunization Rates by Series and Vaccine Antigen, JMR, 2022

	2021 (n=110) (%)	**2022 (n=107) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	15.5 ± 6.9	15.9 ± 7.0 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	66.4 ± 9.0	*79.4* ± *7.8* ↑	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	68.2 ± 8.8	***82.2*** ± ***7.4*** ↑	81.3 ± 2.0
IPV (3 DOSES)	90.9 ± 5.5	89.7 ± 5.9 ↓	92.9 ± 1.3
MMR (1 DOSE)	86.4 ± 6.5	88.8 ± 6.1 ↑	91.0 ± 1.5
HBV (3 DOSES)	91.8 ± 5.2	90.7 ± 5.6 ↓	93.9 ± 1.3
HBV, Birth Dose	88.2 ± 6.1	79.4 ± 7.8 ↓	82.8 ± 2.1
Hib (Full Series)	63.6 ± 9.1	***81.3*** ± ***7.5*** ↑	79.6 ± 2.1
VAR (1 DOSE)	86.4 ± 6.5	88.8 ± 6.1 ↑	90.3 ± 1.6
PCV (Full Series)	71.8 ± 8.5	78.5 ± 7.9 ↑	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	66.4 ± 9.0	***79.4*** ± ***3.9*** ↑	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	85.5 ± 6.7	88.8 ± 6.1 ↑	90.6 ± 1.5
RTV (Full Series)	70.0 ± 8.7	74.8 ± 8.4 ↑	77.7 ± 2.2
FLU (2 Doses)	40.9 ± 9.3	40.2 ± 9.4 ↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Figure 22-C shows the JMR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. JMR children have not met the HP2020 objective for DTaP, HIB, RTV or Flu anytime in the past six years.

Figure 22-C: Immunization Rates (%) by Series and Vaccine Antigen, JMR, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the JMR sample alongside the UTD immunization rates by demographic groups are shown in Table 11-C and 11-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for JMR.

Table 11-C: Risk Factors and Immunization Rates, JMR, 2022

		Demographic		UTD Immunization Rates	
		JMR¥ (n=107)	State¥ (n=1399)	JMR (n=107) (%)	STATE n=1399 (%)
Group	Subgroup				
Race*+					
	Black	**31 29.0%**	196 14.0%	**67.7 ± 17.4**	74.5 ± 6.2
	White	**75 70.1%**	1167 83.4%	**84.0 ± 8.5**	77.5 ± 2.4
	Other	**1 0.9%**	36 2.6%	**sample size is too small to generate estimates**	77.8 ± 14.3
Ethnicity*+					
	Hispanic	**10 9.4%**	153 10.9%	**80.0 ± 30.2**	83.7 ± 5.9
	Non-Hispanic	**97 90.7%**	1246 89.1%	**79.4 ± 8.2**	76.2 ± 2.4
Sex*					
	Male	**52 48.6%**	719 51.4%	**80.8 ± 11.1**	77.3 ± 3.1
	Female	**55 51.4%**	680 48.6%	**78.2 ± 11.3**	76.8 ± 3.2
Siblings*					
	0	**41 38.3%**	566 40.5%	**90.2 ± 9.5**	84.8 ± 3.0
	1	**31 29.0%**	468 33.5%	**87.1 ± 12.5**	78.2 ± 3.8
	2+	**35 32.7%**	365 26.1%	**60.0 ± 17.1**	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	**91 85.1%**	1288 92.1%	**79.1 ± 8.5**	79.0 ± 2.2
	Health Department	**1 0.9%**	18 1.3%	**sample size is too small to generate estimates**	50.0 ± 25.6
	Both	**13 12.2%**	59 4.2%	**100.0 ± 0.0**	81.4 ± 10.2
	Unknown Source	**2 1.9%**	34 2.4%	**sample size is too small to generate estimates**	11.8 ± 11.4
Program Enrollment					
	TennCare Only	**11 10.3%**	126 9.0%	**63.6 ± 33.9**	77.0 ± 7.5
	WIC Only	**2 1.9%**	224 16.0%	**sample size is too small to generate estimates**	69.6 ± 6.1
	Both (TennCare + WIC)	**53 49.5%**	414 29.6%	**75.5 ± 12.0**	74.2 ± 4.2
	Not Enrolled	**41 38.3%**	635 45.4%	**87.8 ± 10.5**	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
\+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 11-D: Parent Demographics and Immunization Rates, JMR, 2022

		Demographic		UTD Immunization Rates	
		JMR¥ (n=107)	State¥ (n=1399)	JMR (n=107) (%)	STATE n=1399 (%)
Group	Subgroup				
Mother Age*					
	≤24	**30 28.0%**	438 31.3%	**73.3 ± 16.8**	75.3 ± 4.1
	25-34	**63 58.9%**	807 57.7%	**81.0 ± 10.0**	77.2 ± 2.9
	≥35	**14 13.1%**	154 11.0%	**85.7 ± 21.0**	81.2 ± 6.3
Father Age*					
	≤24	**20 18.7%**	252 18.0%	**70.0 ± 22.0**	75.8 ± 5.3
	25-34	**54 50.5%**	680 48.6%	**83.3 ± 10.3**	77.9 ± 3.1
	≥35	**16 15.0%**	274 19.6%	**81.3 ± 21.5**	83.6 ± 4.5
	Unknown	**17 15.9%**	193 13.8%	**76.5 ± 22.5**	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	**11 10.3%**	174 12.4%	**72.7 ± 31.4**	71.3 ± 6.8
	High School Diploma/ GED	**23 21.5%**	419 30.0%	**73.9 ± 19.4**	71.8 ± 4.3
	> High School Diploma/ GED	**73 68.2%**	799 57.1%	**82.2 ± 9.0**	81.1 ± 2.7
	Unknown	**0 0.0%**	7 0.5%	**sample size is too small to generate estimates**	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	**3 2.8%**	145 10.4%	**sample size is too small to generate estimates**	80.0 ± 6.6
	High School Diploma/ GED	**28 26.2%**	419 30.0%	**71.4 ± 17.8**	72.3 ± 4.3
	> High School Diploma/ GED	**55 51.4%**	621 44.4%	**87.3 ± 9.1**	83.1 ± 3.0
	Unknown	**21 19.6%**	214 15.3%	**71.4 ± 21.1**	66.8 ± 6.4
Marriage Status*					
	Married	**51 47.7%**	742 53.0%	**90.2 ± 8.5**	79.9 ± 2.9
	Unmarried	**56 52.3%**	656 46.9%	**69.6 ± 12.4**	73.8 ± 3.4
	Unknown	**0 0.0%**	1 0.1%	**sample size is too small to generate estimates**	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

South Central Region

Figure 23-A: Location of South Central Region (SCR)

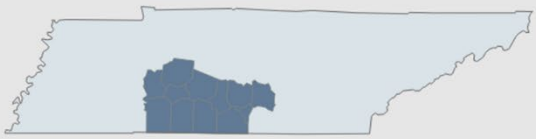
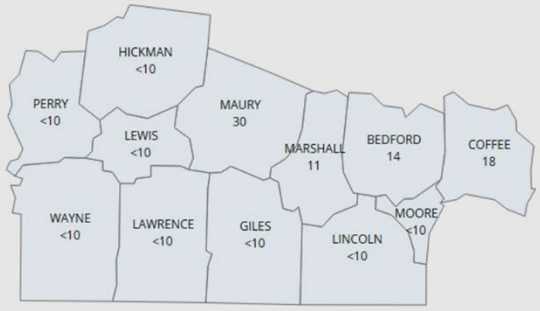


Figure 23-B: Sampling per County, SCR, 2022



Final Sample Determination

The initial 2022 sample for SCR consisted of 120 children born between January and March of 2020 (Table 12-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for SCR was 100. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Table 12-A: 24-Month-Old Survey Sampling, SCR, 2022

	2021	**2022**	State 2022
Original sample (n)	124	**120**	1574
Ineligible (n)	2 (1.6%)	**7** (5.8%)	80 (5.1%)
Refused Participation (n)	2 (1.6%)	**4** (3.3%)	23 (1.5%)
Eligible sample (n)	120	**109**	1471
Unable to locate† (n)	7 (5.8%)	**9** (7.5%)	72 (4.9%)
Final sample (n)	113	**100**	1399
Response Rate (%)*	94.2	**91.7**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children.

Immunization Rates

In SCR, the up to date (UTD) immunization rate by 24 months of age was 77.0%, which was higher than the 2021 rate (66.4%) but lower than the state average (77.1%) (Table 12-B). The UTD immunization rate as reported to TennIIS was 7.0%, lower than the 2021 rate (13.3%) and state rate (8.9%). All SCR vaccination rates for 2022 are higher than the 2021 rates.

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 12-B). Most notably RTV and HBV in SCR increase more than 18% and 15%, respectively in 2022. In Table 12-B, ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in DTaP, IPV, MMR, HBV, HBV birth dose, PCV, HAV, and RTV between 2021 and 2022 rates.

Table 12-B: Immunization Rates by Series and Vaccine Antigen, SCR, 2022

	2021 (n=113) (%)	**2022 (n=100) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	13.3 ± 6.4	7.0 ± 5.1 ↓	8.9 ± 1.5
UTD immunization rate* (with data collection)	66.4 ± 8.8	77.0 ± 8.4 ↑	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	68.1 ± 8.7	***81.0*** ± ***7.8*** ↑	81.3 ± 2.0
IPV (3 DOSES)	81.4 ± 7.3	***95.0*** ± ***4.4*** ↑	92.9 ± 1.3
MMR (1 DOSE)	77.9 ± 7.8	***90.0*** ± ***6.0*** ↑	91.0 ± 1.5
HBV (3 DOSES)	81.4 ± 7.4	***97.0*** ± ***3.4*** ↑	93.9 ± 1.3
HBV, Birth Dose	77.9 ± 7.8	***90.0*** ± ***6.0*** ↑	82.8 ± 2.1
Hib (Full Series)	69.9 ± 8.6	81.0 ± 7.8 ↑	79.6 ± 2.1
VAR (1 DOSE)	80.5 ± 7.4	90.0 ± 6.0 ↑	90.3 ± 1.6
PCV (Full Series)	69.9 ± 8.6	***85.0*** ± ***7.1*** ↑	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	66.4 ± 4.5	77.0 ± 8.4 ↑	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	78.8 ± 7.7	***92.0*** ± ***5.4*** ↑	90.6 ± 1.5
RTV (Full Series)	72.6 ± 8.4	***91.0*** ± ***5.7*** ↑	77.7 ± 2.2
FLU (2 Doses)	40.7 ± 9.2	44.0 ± 9.9 ↑	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Immunization Administration

Of the 2,503 vaccines doses administered to the SCR children, 2,418 (96.6%) were administered by private providers, 76 (3.0%) were administered by public health providers and 9 (0.4%) were administered by an unknown source.

Figure 23-C shows the SCR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. SCR children have not met the HP2020 objective for DTaP, HIB, PCV or Flu anytime in the past six years.

Figure 23-C: Immunization Rates (%) by Series and Vaccine Antigen, SCR, 2017-2022

HP2020 Objective

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the SCR sample alongside the UTD immunization rates by demographic groups are shown in Table 12-C and 12-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for SCR.

Table 12-C: Risk Factors and Immunization Rates, SCR, 2022

		Demographic		UTD Immunization Rates	
		SCR¥	State¥	SCR (n=100) (%)	STATE n=1399 (%)
Group	Subgroup	(n=100)	(n=1399)		
Race*+					
	Black	9 9.0%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	90 90.0%	1167 83.4%	77.8 ± 30.2	77.5 ± 2.4
	Other	1 1.0%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity*+					
	Hispanic	12 12.0%	153 10.9%	83.3 ± 24.7	83.7 ± 5.9
	Non-Hispanic	88 88.0%	1246 89.1%	79.4 ± 8.2	76.2 ± 2.4
Sex*					
	Male	52 52.0%	719 51.4%	69.2 ± 13.0	77.3 ± 3.1
	Female	48 48.0%	680 48.6%	85.4 ± 10.4	76.8 ± 3.2
Siblings*					
	0	40 40.0%	566 40.5%	87.5 ± 10.7	84.8 ± 3.0
	1	41 41.0%	468 33.5%	73.2 ± 14.2	78.2 ± 3.8
	2+	19 19.0%	365 26.1%	63.2 ± 23.9	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	91 91.0%	1288 92.1%	75.8 ± 9.0	79.0 ± 2.2
	Health Department	2 2.0%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	7 7.0%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	0 0.0%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	17 17.0%	126 9.0%	70.6 ± 24.2	77.0 ± 7.5
	WIC Only	10 10.0%	224 16.0%	80.0 ± 30.2	69.6 ± 6.1
	Both (TennCare + WIC)	49 49.0%	414 29.6%	75.5 ± 12.5	74.2 ± 4.2
	Not Enrolled	24 24.0%	635 45.4%	83.3 ± 16.1	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information

* Information was collected from birth certificate at time of delivery

+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 12-D: Parent Demographics and Immunization Rates, SCR, 2022

		Demographic		UTD Immunization Rates	
		SCR¥	State¥	SCR (n=100) (%)	STATE n=1399 (%)
Group	Subgroup	(n=100)	(n=1399)		
Mother Age*					
	≤24	35 35.0%	438 31.3%	80.0 ± 13.9	75.3 ± 4.1
	25-34	56 56.0%	807 57.7%	76.8 ± 11.4	77.2 ± 2.9
	≥35	9 9.0%	154 11.0%	sample size is too small to generate estimates	81.2 ± 6.3
Father Age*					
	≤24	19 19.0%	252 18.0%	84.2 ± 18.1	75.8 ± 5.3
	25-34	56 56.0%	680 48.6%	76.8 ± 11.4	77.9 ± 3.1
	≥35	13 13.0%	274 19.6%	76.9 ± 26.5	83.6 ± 4.5
	Unknown	12 12.0%	193 13.8%	66.7 ± 31.3	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	17 17.0%	174 12.4%	88.2 ± 17.1	71.3 ± 6.8
	High School Diploma/ GED	33 33.0%	419 30.0%	81.8 ± 13.9	71.8 ± 4.3
	> High School Diploma/ GED	50 50.0%	799 57.1%	70.0 ± 13.2	81.1 ± 2.7
	Unknown	0 0.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	10 10.0%	145 10.4%	100.0 ± 0.0	80.0 ± 6.6
	High School Diploma/ GED	38 38.0%	419 30.0%	73.7 ± 14.7	72.3 ± 4.3
	> High School Diploma/ GED	37 37.0%	621 44.4%	75.7 ± 14.5	83.1 ± 3.0
	Unknown	15 15.0%	214 15.3%	73.3 ± 25.4	66.8 ± 6.4
Marriage Status*					
	Married	44 44.0%	742 53.0%	81.8 ± 11.9	79.9 ± 2.9
	Unmarried	56 56.0%	656 46.9%	73.2 ± 12.0	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

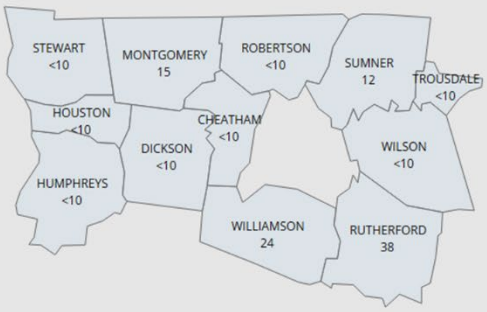
¥ Percentages may not add up to 100% due to missing participant information

* Information was collected from birth certificate at time of delivery

Mid-Cumberland Region

Figure 24-A: Location of Mid-Cumberland Region (MCR)

Figure 24-B: Sampling per County, MCR, 2022



Final Sample Determination

The initial 2022 sample for MCR consisted of 122 children born between January and March of 2020 (Table 13-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for MCR was 103. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Immunization Rates

In MCR, the up to date (UTD) immunization rate by 24 months of age was 83.5%, which was higher than the 2021 rate (75.5%) and the state average (77.1%) (Table 13-B). The UTD immunization rate as reported to TennIIS was 9.7%, higher than the 2021 rate (9.1%) and state rate (8.9%). All MCR vaccination rates for 2022 are higher than the 2021 rates except for Flu.

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 13-B). Most notably RTV and OPV in MCR increase more than 13% and 10%, respectively in 2022. In Table 13-B, figures in red indicate a decrease in Flu between 2021 and 2022 rates and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in IPV, HBV, and RTV between 2021 and 2022 rates.

Immunization Administration

Of the 2,643 vaccines doses administered to the MCR children, 2,560 (96.9%) were administered by private providers, 1 (0.1%) were administered by public health providers and 82 (3.0%) were administered by an unknown source.

Table 13-A: 24-Month-Old Survey Sampling, MCR, 2021

	2021	**2022**	State 2022
Original sample (n)	123	**122**	1574
Ineligible (n)	10 (8.1%)	**5 (4.1%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**0 (0.0%)**	23 (1.5%)
Eligible sample (n)	113	**117**	1471
Unable to locate† (n)	3 (2.7%)	**14 (12.0%)**	72 (4.6%)
Final sample (n)	110	**103**	1399
Response Rate (%)*	97.3	**88.0**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 13-B: Immunization Rates by Series and Vaccine Antigen, MCR, 2022

	2021 (n=110) (%)	**2022 (n=103) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	9.1 ± 5.5	9.7 ± 5.8 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	75.5 ± 8.2	83.5 ± 7.3 ↑	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	80.0 ± 7.6	87.4 ± 6.5 ↑	81.3 ± 2.0
IPV (3 DOSES)	86.4 ± 6.5	***97.1 ± 3.3*** ↑	92.9 ± 1.3
MMR (1 DOSE)	84.6 ± 6.9	91.3 ± 5.5 ↑	91.0 ± 1.5
HBV (3 DOSES)	88.2 ± 6.1	***98.1 ± 2.7*** ↑	93.9 ± 1.3
HBV, Birth Dose	77.3 ± 8.0	79.6 ± 7.9 ↑	82.8 ± 2.1
Hib (Full Series)	74.6 ± 8.3	84.5 ± 7.1 ↑	79.6 ± 2.1
VAR (1 DOSE)	86.4 ± 6.5	92.2 ± 5.3 ↑	90.3 ± 1.6
PCV (Full Series)	79.1 ± 7.7	86.4 ± 6.7 ↑	82.1 ± 2.0
Full SERIES 431:FS:314	75.5 ± 8.2	83.5 ± 7.3 ↑	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	84.6 ± 6.9	92.2 ± 5.3 ↑	90.6 ± 1.5
RTV (Full Series)	73.6 ± 8.4	***87.4 ± 6.5*** ↑	77.7 ± 2.2
FLU (2 Doses)	63.6 ± 9.1	63.1 ± 9.5 ↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule
Red font indicates a rate decrease since 2021
Italicized and bolded font indicates a significant difference with 2021 rate

Figure 24-C shows the MCR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. MCR children have not met the HP2020 objective for DTaP, HIB, or PCV anytime in the past six years.

Figure 24-C: Immunization Rates (%) by Series and Vaccine Antigen, MCR, 2017-2022

HP2020 Objective

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the MCR sample alongside the UTD immunization rates by demographic groups are shown in Table 13-C and 13-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for MCR.

Table 13-C: Risk Factors and Immunization Rates, MCR, 2022

		Demographic				UTD Immunization Rates	
		MCR¥		State¥		MCR n=103	STATE n=1399
Group	Subgroup	(n=103)		(n=1399)		(%)	(%)
Race*+							
	Black	14	13.6%	196	14.0%	85.7 ± 21.0	74.5 ± 6.2
	White	84	81.6%	1167	83.4%	82.1 ± 8.4	77.5 ± 2.4
	Other	5	4.9%	36	2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity*+							
	Hispanic	14	13.6%	153	10.9%	78.6 ± 24.6	83.7 ± 5.9
	Non-Hispanic	89	86.4%	1246	89.1%	75.2 ± 11.3	76.2 ± 2.4
Sex*							
	Male	53	51.5%	719	51.4%	86.8 ± 9.4	77.3 ± 3.1
	Female	50	48.5%	680	48.6%	80.0 ± 11.5	76.8 ± 3.2
Siblings*							
	0	45	43.7%	566	40.5%	84.4 ± 11.0	84.8 ± 3.0
	1	38	36.9%	468	33.5%	84.2 ± 12.1	78.2 ± 3.8
	2+	20	19.4%	365	26.1%	80.0 ± 19.2	63.6 ± 5.0
Vaccination Source							
	Private Medical Provider	103	100.0%	1288	92.1%	93.5 ± 7.3	79.0 ± 2.2
	Health Department	0	0.0%	18	1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	0	0.0%	59	4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	0	0.0%	34	2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment							
	TennCare Only	0	0.0%	126	9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	31	30.1%	224	16.0%	80.7 ± 14.7	69.6 ± 6.1
	Both (TennCare + WIC)	3	2.9%	414	29.6%	sample size is too small to generate estimates	74.2 ± 4.2
	Not Enrolled	69	67.0%	635	45.4%	84.1 ± 8.9	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 13-D: Parent Demographics and Immunization Rates, MCR, 2022

		Demographic				UTD Immunization Rates	
		MCR¥		State¥		MCR n=103	STATE n=1399
Group	Subgroup	(n=103)		(n=1399)		(%)	(%)
Mother Age*							
	≤24	28	27.2%	438	31.3%	89.3 ± 12.2	75.3 ± 4.1
	25-34	59	57.3%	807	57.7%	79.7 ± 10.6	77.2 ± 2.9
	≥35	16	15.5%	154	11.0%	87.5 ± 18.2	81.2 ± 6.3
Father Age*							
	≤24	19	18.5%	252	18.0%	89.5 ± 15.2	75.8 ± 5.3
	25-34	48	46.6%	680	48.6%	81.3 ± 11.5	77.9 ± 3.1
	≥35	26	25.2%	274	19.6%	84.6 ± 14.9	83.6 ± 4.5
	Unknown	10	9.7%	193	13.8%	81.8 ± 27.2	66.3 ± 6.7
Mother Education*							
	< High School Diploma/ GED	9	8.7%	174	12.4%	91.7 ± 18.3	71.3 ± 6.8
	High School Diploma/ GED	22	21.4%	419	30.0%	81.8 ± 17.5	71.8 ± 4.3
	> High School Diploma/ GED	71	68.9%	799	57.1%	83.1 ± 8.9	81.1 ± 2.7
	Unknown	1	1.0%	7	0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*							
	< High School Diploma/ GED	12	11.7%	145	10.4%	75.7 ± 14.5	80.0 ± 6.6
	High School Diploma/ GED	25	24.3%	419	30.0%	76.0 ± 18.0	72.3 ± 4.3
	> High School Diploma/ GED	55	53.4%	621	44.4%	85.5 ± 9.6	83.1 ± 3.0
	Unknown	11	10.7%	214	15.3%	80.0 ± 30.2	66.8 ± 6.4
Marriage Status*							
	Married	56	54.4%	742	53.0%	87.5 ± 8.9	79.9 ± 2.9
	Unmarried	47	45.6%	656	46.9%	78.7 ± 12.1	73.8 ± 3.4
	Unknown	0	0.0%	1	0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Nashville-Davidson County Region

Figure 25-A: Location of Nashville-Davidson County Region (NDR)

Figure 25-B: Sampling per County, NDR, 2022

Final Sample Determination

The initial 2022 sample for MCR consisted of 121 children born between January and March of 2020 (Table 14-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for NDR was 101. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Immunization Rates

In NDR, the up to date (UTD) immunization rate by 24 months of age was 85.2%, which was higher than the 2021 rate (80.0%) and the state average (77.1%) (Table 14-B). The UTD immunization rate as reported to TennIIS was 27.7%, higher than the 2021 rate (23.8%) and state rate (8.9%). All NDR vaccination rates for 2022 are higher than the 2021 rates except for RTV.

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 14-B). Most notably PCV and DTaP in NDR increase more than 10% and 6%, respectively in 2022. In Table 14-B, figures in red indicate a decrease in RTV and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in PCV between 2021 and 2022 rates.

Immunization Administration

Of the 2,652 vaccines doses administered to the NDR children, 2,413 (91.0%) were administered by private providers, 34 (1.3%) were administered by public health providers and 205 (7.7%) were administered by an unknown source.

Table 14-A: 24-Month-Old Survey Sampling, NDR, 2022

	2021	**2022**	State 2022
Original sample (n)	121	**121**	1574
Ineligible (n)	8 (6.6%)	**7 (5.8%)**	80 (5.1%)
Refused Participation (n)	5 (4.1%)	**0 (0.0%)**	23 (1.5%)
Eligible sample (n)	108	**114**	1471
Unable to locate† (n)	3 (2.8%)	**13 (11.4%)**	72 (4.6%)
Final sample (n)	105	**101**	1399
Response Rate (%)	97.2	**88.6**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 14-B: Immunization Rates by Series and Vaccine Antigen, NDR, 2022

	2021 (n=105) (%)	**2022 (n=101) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	23.8 ± 8.3	27.7 ± 8.9 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	80.0 ± 7.8	85.2 ± 7.1 ↑	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	83.8 ± 7.2	90.1 ± 5.9 ↑	81.3 ± 2.0
IPV (3 DOSES)	94.3 ± 4.5	99.0 ± 2.0 ↑	92.9 ± 1.3
MMR (1 DOSE)	92.4 ± 5.2	98.0 ± 2.8 ↑	91.0 ± 1.5
HBV (3 DOSES)	97.1 ± 3.2	97.0 ± 3.4 ↑	93.9 ± 1.3
HBV, Birth Dose	83.8 ± 7.2	86.1 ± 6.9 ↑	82.8 ± 2.1
Hib (Full Series)	83.8 ± 7.2	89.1 ± 6.2 ↑	79.6 ± 2.1
VAR (1 DOSE)	93.3 ± 4.9	97.0 ± 3.4 ↑	90.3 ± 1.6
PCV (Full Series)	82.9 ± 7.3	***93.1 ± 5.0*** ↑	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	80.0 ± 7.8	85.2 ± 7.1 ↑	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	94.3 ± 4.5	95.1 ± 4.3 ↑	90.6 ± 1.5
RTV (Full Series)	88.6 ± 6.2	86.1 ± 6.9 ↓	77.7 ± 2.2
FLU (2 Doses)	77.1 ± 8.2	80.2 ± 7.9 ↑	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Figure 25-C shows the NDR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. NDR children have not met the HP2020 objective for HIB anytime in the past six years.

Figure 25-C: Immunization Rates (%) by Series and Vaccine Antigen, NDR, 2017-2022

HP2020 Objective

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the NDR sample alongside the UTD immunization rates by demographic groups are shown in Table 14-C and 14-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for NDR.

Table 14-C: Risk Factors and Immunization Rates, NDR, 2022

		Demographic Breakdown				UTD Immunization Rates	
		NDR¥		State¥		NDR n=101	STATE n=1399
Group	Subgroup	(n=101)		(n=1399)		(%)	(%)
Race*+							
	Black	**18**	**17.8%**	196	14.0%	**88.9 ± 16.1**	74.5 ± 6.2
	White	**80**	**79.2%**	1167	83.4%	**85.0 ± 8.0**	77.5 ± 2.4
	Other	**3**	**3.0%**	36	2.6%	**sample size is too small to generate estimates**	77.8 ± 14.3
Ethnicity*+							
	Hispanic	**31**	**30.7%**	153	10.9%	**80.7 ± 14.7**	83.7 ± 5.9
	Non-Hispanic	**70**	**69.3%**	1246	89.1%	**87.1 ± 8.0**	76.2 ± 2.4
Sex*							
	Male	**52**	**51.5%**	719	51.4%	**90.4 ± 8.3**	77.3 ± 3.1
	Female	**49**	**48.5%**	680	48.6%	**79.6 ± 11.7**	76.8 ± 3.2
Siblings*							
	0	**49**	**48.5%**	566	40.5%	**91.8 ± 8.0**	84.8 ± 3.0
	1	**29**	**28.7%**	468	33.5%	**89.7 ± 11.8**	78.2 ± 3.8
	2+	**23**	**22.8%**	365	26.1%	**65.2 ± 21.1**	63.6 ± 5.0
Vaccination Source							
	Private Medical Provider	**94**	**93.1%**	1288	92.1%	**86.2 ± 7.1**	79.0 ± 2.2
	Health Department	**1**	**1.0%**	18	1.3%	**sample size is too small to generate estimates**	50.0 ± 25.6
	Both	**1**	**1.0%**	59	4.2%	**sample size is too small to generate estimates**	81.4 ± 10.2
	Unknown Source	**5**	**5.0%**	34	2.4%	**sample size is too small to generate estimates**	11.8 ± 11.4
Program Enrollment							
	TennCare Only	**2**	**2.0%**	126	9.0%	**sample size is too small to generate estimates**	77.0 ± 7.5
	WIC Only	**3**	**3.0%**	224	16.0%	**sample size is too small to generate estimates**	69.6 ± 6.1
	Both (TennCare + WIC)	**0**	**0.0%**	414	29.6%	**sample size is too small to generate estimates**	74.2 ± 4.2
	Not Enrolled	**96**	**95.1%**	635	45.4%	**86.5 ± 7.0**	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 14-D: Parent Demographics and Immunization Rates, NDR, 2022

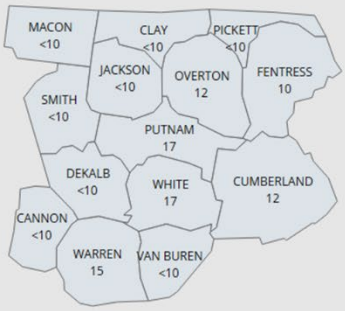
		Demographic Breakdown				UTD Immunization Rates	
		NDR¥		State¥		NDR n=101	STATE n=1399
Group	Subgroup	(n=101)		(n=1399)		(%)	(%)
Mother Age*							
	≤24	**16**	**15.8%**	438	31.3%	**87.5 ± 18.2**	75.3 ± 4.1
	25-34	**65**	**64.4%**	807	57.7%	**93.1 ± 9.4**	77.2 ± 2.9
	≥35	**20**	**19.8%**	154	11.0%	**90.0 ± 14.4**	81.2 ± 6.3
Father Age*							
	≤24	**8**	**7.9%**	252	18.0%	**sample size is too small to generate estimates**	75.8 ± 5.3
	25-34	**49**	**48.5%**	680	48.6%	**79.6 ± 11.7**	77.9 ± 3.1
	≥35	**32**	**31.7%**	274	19.6%	**96.9 ± 6.4**	83.6 ± 4.5
	Unknown	**12**	**11.9%**	193	13.8%	**75.0 ± 28.7**	66.3 ± 6.7
Mother Education*							
	< High School Diploma/ GED	**20**	**19.8%**	174	12.4%	**80.0 ± 19.2**	71.3 ± 6.8
	High School Diploma/ GED	**12**	**11.9%**	419	30.0%	**91.7 ± 18.3**	71.8 ± 4.3
	> High School Diploma/ GED	**67**	**66.3%**	799	57.1%	**86.6 ± 8.4**	81.1 ± 2.7
	Unknown	**2**	**2.0%**	7	0.5%	**sample size is too small to generate estimates**	71.4 ± 45.1
Father Education*							
	< High School Diploma/ GED	**18**	**17.8%**	145	10.4%	**88.9 ± 16.1**	80.0 ± 6.6
	High School Diploma/ GED	**17**	**16.8%**	419	30.0%	**82.4 ± 20.2**	72.3 ± 4.3
	> High School Diploma/ GED	**53**	**52.5%**	621	44.4%	**88.7 ± 8.8**	83.1 ± 3.0
	Unknown	**13**	**12.9%**	214	15.3%	**69.2 ± 29.2**	66.8 ± 6.4
Marriage Status*							
	Married	**62**	**61.4%**	742	53.0%	**85.5 ± 9.0**	79.9 ± 2.9
	Unmarried	**39**	**38.6%**	656	46.9%	**84.6 ± 11.9**	73.8 ± 3.4
	Unknown	**0**	**0.0%**	1	0.1%	**sample size is too small to generate estimates**	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Upper-Cumberland Region

Figure 26-A: Location of Upper-Cumberland Region (UCR)

Figure 26-B: Sampling per County, UCR, 2022



Final Sample Determination

The initial 2022 sample for UCR consisted of 121 children born between January and March of 2020 (Table 15-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for UCR was 112. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Immunization Rates

In UCR, the up to date (UTD) immunization rate by 24 months of age was 64.3%, which was higher than the 2021 rate (67.3%) and the state average (77.1%) (Table 15-B). The UTD immunization rate as reported to TennIIS was 12.5%, higher than the 2021 rate (9.7%) and state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 15-B). Most notably HBV, birth dose and HIB in UCR decreased more that 12% and increased more than 13%, respectively in 2022. In Table 15-B, figures in red indicate a decrease in HBV (birth dose), Flu, and Full Series and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in HBV (birth dose) and HIB between 2021 and 2022 rates.

Immunization Administration

Of the 2,599 vaccines doses administered to the UCR children, 2,393 (92.1%) were administered by private providers, 132 (5.1%) were administered by public health providers and 74 (2.8%) were administered by an unknown source.

Table 15-A: 24-Month-Old Survey Sampling, UCR, 2022

	2021	**2022**	State 2022
Original sample (n)	121	**121**	1574
Ineligible (n)	2 (1.7%)	**3 (2.5%)**	80 (5.1%)
Refused Participation (n)	1 (0.8%)	**0 (0.0%)**	23 (1.5%)
Eligible sample (n)	118	**118**	1471
Unable to locate† (n)	5 (4.2%)	**6 (5.1%)**	72 (4.6%)
Final sample (n)	113	**112**	1399
Response Rate (%)*	95.8	**94.9**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 15-B: Immunization Rates by Series and Vaccine Antigen, UCR, 2022

	2021 (n=113) (%)	**2022 (n=112) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	9.7 ± 5.6	12.5 ± 6.2 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	67.3 ± 8.5	64.3 ± 9.0 ↓	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	70.8 ± 8.5	71.4 ± 8.5 ↑	81.3 ± 2.0
IPV (3 DOSES)	82.3 ± 7.1	91.1 ± 5.4 ↑	92.9 ± 1.3
MMR (1 DOSE)	82.3 ± 7.1	87.5 ± 6.2 ↑	91.0 ± 1.5
HBV (3 DOSES)	88.5 ± 6.0	89.3 ± 5.8 ↑	93.9 ± 1.3
HBV, Birth Dose	88.5 ± 6.0	***75.9 ± 8.0*** ↓	82.8 ± 2.1
Hib (Full Series)	61.1 ± 9.1	***75.0 ± 8.1*** ↑	79.6 ± 2.1
VAR (1 DOSE)	83.2 ± 7.0	82.1 ± 7.2 ↓	90.3 ± 1.6
PCV (Full Series)	71.7 ± 8.4	75.0 ± 8.1 ↑	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	67.3 ± 8.5	64.3 ± 9.0 ↓	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	79.7 ± 7.5	85.7 ± 6.6 ↑	90.6 ± 1.5
RTV (Full Series)	70.8 ± 8.5	75.9 ± 8.0 ↑	77.7 ± 2.2
FLU (2 Doses)	46.0 ± 9.3	41.1 ± 9.3 ↓	48.3 ± 2.6

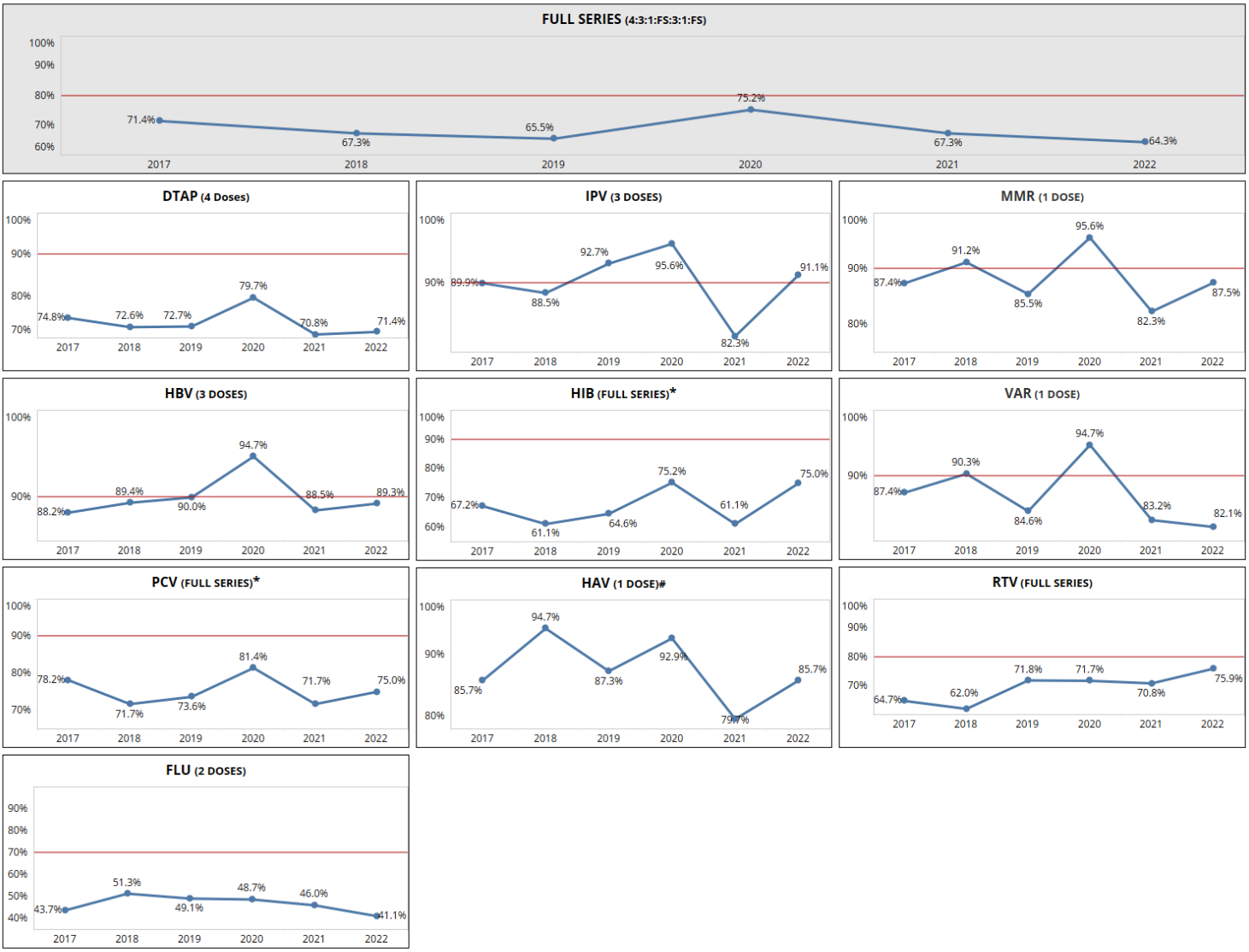
* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Figure 26-C shows the UCR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. UCR children have not met the HP2020 objective for DTaP, HIB, PCV, RTV, Flu or Full Series anytime in the past six years.

Figure 26-C: Immunization Rates (%) by Series and Vaccine Antigen, UCR, 2017-2022



HP2020 Objective

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the UCR sample alongside the UTD immunization rates by demographic groups are shown in Table 15-C and 15-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for UCR.

Table 15-C: Risk Factors and Immunization Rates, UCR, 2022

		Demographic		UTD Immunization Rates	
Group	Subgroup	UCR¥ (n=112)	State¥ (n=1399)	UCR n=112 (%)	STATE n=1399 (%)
Race**					
	Black	2 1.8%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	108 96.4%	1167 83.4%	64.8 ± 9.2	77.5 ± 2.4
	Other	2 1.8%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity+**					
	Hispanic	7 6.3%	153 10.9%	sample size is too small to generate estimates	83.7 ± 5.9
	Non-Hispanic	105 93.8%	1246 89.1%	63.8 ± 9.3	76.2 ± 2.4
Sex*					
	Male	64 57.1%	719 51.4%	62.5 ± 12.2	77.3 ± 3.1
	Female	48 42.9%	680 48.6%	66.7 ± 13.8	76.8 ± 3.2
Siblings*					
	0	37 33.0%	566 40.5%	70.3 ± 15.5	84.8 ± 3.0
	1	35 31.3%	468 33.5%	62.9 ± 16.8	78.2 ± 3.8
	2+	40 35.7%	365 26.1%	60.0 ± 15.9	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	98 87.5%	1288 92.1%	70.4 ± 9.2	79.0 ± 2.2
	Health Department	7 6.3%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	1 0.9%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	6 5.4%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	1 0.9%	126 9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	43 38.4%	224 16.0%	60.5 ± 15.2	69.6 ± 6.1
	Both (TennCare + WIC)	18 16.1%	414 29.6%	83.3 ± 19.1	74.2 ± 4.2
	Not Enrolled	50 44.6%	635 45.4%	60.0 ± 14.1	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 15-D: Parent Demographics and Immunization Rates, UCR, 2022

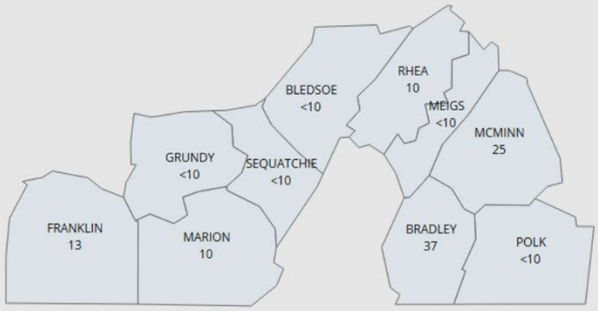
		Demographic		UTD Immunization Rates	
Group	Subgroup	UCR¥ (n=112)	State¥ (n=1399)	UCR n=112 (%)	STATE n=1399 (%)
Mother Age*					
	≤24	38 33.9%	438 31.3%	60.5 ± 16.3	75.3 ± 4.1
	25-34	61 54.5%	807 57.7%	65.6 ± 12.3	77.2 ± 2.9
	≥35	13 11.6%	154 11.0%	69.2 ± 29.0	81.2 ± 6.3
Father Age*					
	≤24	22 19.6%	252 18.0%	50.0 ± 22.7	75.8 ± 5.3
	25-34	54 48.2%	680 48.6%	72.2 ± 12.3	77.9 ± 3.1
	≥35	23 20.5%	274 19.6%	69.6 ± 20.4	83.6 ± 4.5
	Unknown	13 11.6%	193 13.8%	46.2 ± 31.4	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	14 12.5%	174 12.4%	42.9 ± 29.7	71.3 ± 6.8
	High School Diploma/ GED	47 42.0%	419 30.0%	59.6 ± 14.6	71.8 ± 4.3
	> High School Diploma/ GED	50 44.6%	799 57.1%	76.0 ± 12.3	81.1 ± 2.7
	Unknown	0.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	15 13.4%	145 10.4%	60.0 ± 28.1	80.0 ± 6.6
	High School Diploma/ GED	45 40.2%	419 30.0%	60.0 ± 14.9	72.3 ± 4.3
	> High School Diploma/ GED	37 33.0%	621 44.4%	78.4 ± 13.9	83.1 ± 3.0
	Unknown	15 13.4%	214 15.3%	46.7 ± 28.6	66.8 ± 6.4
Marriage Status*					
	Married	70 62.5%	742 53.0%	62.9 ± 11.6	79.9 ± 2.9
	Unmarried	42 37.5%	656 46.9%	66.7 ± 14.9	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Southeast Region

Figure 27-A: Location of Southeast Region (SER)

Figure 27-B: Sampling per County, SER, 2022



Final Sample Determination

The initial 2022 sample for SER consisted of 121 children born between January and March of 2020 (Table 16-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for SER was 106. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Table 16-A: 24-Month-Old Survey Sampling, SER, 2022

	2021	2022	State 2022
Original sample (n)	121	**121**	1574
Ineligible (n)	8 (6.6%)	**10 (8.3%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**1 (0.8%)**	23 (1.5%)
Eligible sample (n)	113	**110**	1471
Unable to locate† (n)	2 (1.8%)	**4 (3.6%)**	72 (4.6%)
Final sample (n)	111	**106**	1399
Response Rate (%)*	98.2	**96.4**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Immunization Rates

In SER, the up to date (UTD) immunization rate by 24 months of age was 71.7%, which was lower than the 2021 rate (81.1%) but higher than the state average (77.1%) (Table 16-B). The UTD immunization rate as reported to TennIIS was 8.5%, higher than the 2021 rate (6.3%) but lower than the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 16-B). Most notably Flu and Full Series 4:3:1:FS:3:1:FS in SER decreased more that 17% and 9%, respectively in 2022. In Table 16-B, figures in red indicate a decrease in DTaP, HIB, PCV, RTV, Flu and Full Series and ***italicized and bolded*** figures indicate a significant difference (p<0.05) in Flu between 2021 and 2022 rates.

Table 16-B: Immunization Rates by Series and Vaccine Antigen, SER, 2022

	2021 (n=111) (%)	2022 (n=106) (%)	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	6.3 ± 4.6	8.5 ± 5.4 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	81.1 ± 7.4	71.7 ± 8.7 ↓	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	82.9 ± 7.1	74.5 ± 8.4 ↓	81.3 ± 2.0
IPV (3 DOSES)	93.7 ± 4.6	94.3 ± 4.5 ↑	92.9 ± 1.3
MMR (1 DOSE)	90.1 ± 5.7	93.4 ± 4.8 ↑	91.0 ± 1.5
HBV (3 DOSES)	94.6 ± 4.3	96.2 ± 3.7 ↑	93.9 ± 1.3
HBV, Birth Dose	85.6 ± 6.6	91.5 ± 5.4 ↑	82.8 ± 2.1
Hib (Full Series)	81.1 ± 7.4	80.2 ± 7.7 ↓	79.6 ± 2.1
VAR (1 DOSE)	89.2 ± 5.9	91.5 ± 5.4 ↑	90.3 ± 1.6
PCV (Full Series)	85.6 ± 6.6	79.3 ± 7.9 ↓	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	81.1 ± 7.4	71.7 ± 8.7 ↓	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	91.0 ± 5.4	91.5 ± 5.4 ↑	90.6 ± 1.5
RTV (Full Series)	75.7 ± 8.1	70.8 ± 8.8 ↓	77.7 ± 2.2
FLU (2 Doses)	40.5 ± 9.3	***23.6 ± 8.2*** ↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Immunization Administration

Of the 2,569 vaccines doses administered to the SER children, 2,449 (95.3%) were administered by private providers, 108 (4.2%) were administered by public health providers and 12 (0.5%) were administered by an unknown source.

Figure 27-C shows the SER trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. SER children have not met the HP2020 objective for Flu anytime in the past six years.

Figure 27-C: Immunization Rates (%) by Series and Vaccine Antigen, SER, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the SER sample alongside the UTD immunization rates by demographic groups are shown in Table 16-C and 16-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for SER.

Table 16-C: Risk Factors and Immunization Rates, SER, 2022

		Demographic		UTD Immunization Rates	
		SER¥	State¥	SER n=106	STATE n=1399
Group	Subgroup	(n=106)	(n=1399)	(%)	(%)
Race*+					
	Black	6 5.7%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	97 91.5%	1167 83.4%	72.2 ± 9.1	77.5 ± 2.4
	Other	3 2.8%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity*+					
	Hispanic	10 9.4%	153 10.9%	90.0 ± 22.6	83.7 ± 5.9
	Non-Hispanic	96 90.6%	1246 89.1%	69.8 ± 9.3	76.2 ± 2.4
Sex*					
	Male	51 48.1%	719 51.4%	76.5 ± 12.1	77.3 ± 3.1
	Female	55 51.9%	680 48.6%	67.3 ± 12.8	76.8 ± 3.2
Siblings*					
	0	35 33.0%	566 40.5%	85.7 ± 12.2	84.8 ± 3.0
	1	28 26.4%	468 33.5%	78.6 ± 16.2	78.2 ± 3.8
	2+	43 40.6%	365 26.1%	55.8 ± 15.5	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	97 91.5%	1288 92.1%	72.2 ± 9.1	79.0 ± 2.2
	Health Department	0 0.0%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	8 7.6%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	1 0.9%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	2 1.9%	126 9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	50 47.2%	224 16.0%	72.0 ± 12.9	69.6 ± 6.1
	Both (TennCare + WIC)	18 17.0%	414 29.6%	72.2 ± 22.9	74.2 ± 4.2
	Not Enrolled	36 34.0%	635 45.4%	75.0 ± 14.9	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information

* Information was collected from birth certificate at time of delivery

+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 16-D: Parent Demographics and Immunization Rates, SER, 2022

		Demographic		UTD Immunization Rates	
		SER¥	State¥	SER n=106	STATE n=1399
Group	Subgroup	(n=106)	(n=1399)	(%)	(%)
Mother Age*					
	≤24	38 35.9%	438 31.3%	68.4 ± 15.5	75.3 ± 4.1
	25-34	62 58.5%	807 57.7%	72.6 ± 11.4	77.2 ± 2.9
	≥35	6 5.7%	154 11.0%	sample size is too small to generate estimates	81.2 ± 6.3
Father Age*					
	≤24	23 21.7%	252 18.0%	65.2 ± 21.1	75.8 ± 5.3
	25-34	47 44.3%	680 48.6%	80.9 ± 11.7	77.9 ± 3.1
	≥35	12 11.3%	274 19.6%	58.3 ± 32.7	83.6 ± 4.5
	Unknown	24 22.6%	193 13.8%	66.7 ± 20.3	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	20 18.9%	174 12.4%	60.0 ± 23.5	71.3 ± 6.8
	High School Diploma/ GED	38 35.9%	419 30.0%	71.1 ± 15.1	71.8 ± 4.3
	> High School Diploma/ GED	46 43.4%	799 57.1%	76.1 ± 12.8	81.1 ± 2.7
	Unknown	2 1.9%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	14 13.2%	145 10.4%	85.7 ± 21.0	80.0 ± 6.6
	High School Diploma/ GED	42 39.6%	419 30.0%	64.3 ± 15.1	72.3 ± 4.3
	> High School Diploma/ GED	26 24.5%	621 44.4%	80.8 ± 16.2	83.1 ± 3.0
	Unknown	24 22.6%	214 15.3%	66.7 ± 20.3	66.8 ± 6.4
Marriage Status*					
	Married	48 45.3%	742 53.0%	72.9 ± 13.0	79.9 ± 2.9
	Unmarried	58 54.7%	656 46.9%	70.7 ± 12.1	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information

* Information was collected from birth certificate at time of delivery

Chattanooga-Hamilton County Region

Figure 28-A: Location of Chattanooga-Hamiton County Region (CHR)

Figure 28-B: Sampling per County, CHR, 2022

Final Sample Determination

The initial 2022 sample for CHR consisted of 121 children born between January and March of 2020 (Table 17-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for CHR was 106. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis but there was a higher response rate in 2022.

Table 17-A: 24-Month-Old Survey Sampling, CHR, 2022

	2021	**2022**	State 2022
Original sample (n)	125	**121**	1574
Ineligible (n)	6 (4.8%)	**11 (9.1%)**	80 (5.1%)
Refused Participation (n)	4 (3.2%)	**4 (3.3%)**	23 (1.5%)
Eligible sample (n)	115	**106**	1471
Unable to locate† (n)	4 (3.5%)	**0 (0.0%)**	72 (4.9%)
Final sample (n)	111	**106**	1399
Response Rate (%)*	96.5	**100.0**	95.1

† Children are classified as "Unable to Locate" if every conceivable effort was made to locate and communicate with the child's guadian and/or the child's provider was either unknown or

* Repsonse Rate (%) is the number of survey responses from eligible children.

Immunization Rates

In CHR, the up to date (UTD) immunization rate by 24 months of age was 72.6%, which was lower than the 2021 rate (80.2%) but higher than the state average (77.1%) (Table 17-B). The UTD immunization rate as reported to TennIIS was 8.5%, higher than the 2021 rate (7.2%) but lower than the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 17-B). Most notably Flu and RTV in CHR decreased more that 20% and 11%, respectively in 2022. In Table 17-B, figures in red indicate a decrease in all vaccines and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in MMR and Flu between 2021 and 2022 rates.

Table 17-B: Immunization Rates by Series and Vaccine Antigen, CHR, 2022

	2021 (n=111) (%)	**2022 (n=106) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	7.2 ± 4.9	8.5 ± 5.4 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	80.2 ± 7.5	72.6 ± 8.6 ↓	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	82.9 ± 7.1	78.3 ± 8.0 ↓	81.3 ± 2.0
IPV (3 DOSES)	96.4 ± 3.5	89.6 ± 5.9 ↓	92.9 ± 1.3
MMR (1 DOSE)	94.6 ± 4.3	***86.8 ± 6.6*** ↓	91.0 ± 1.5
HBV (3 DOSES)	95.5 ± 3.9	90.6 ± 5.7 ↓	93.9 ± 1.3
HBV, Birth Dose	77.5 ± 7.9	79.3 ± 7.9 ↑	82.8 ± 2.1
Hib (Full Series)	82.0 ± 7.3	78.3 ± 8.0 ↓	79.6 ± 2.1
VAR (1 DOSE)	94.6 ± 4.3	87.7 ± 6.3 ↓	90.3 ± 1.6
PCV (Full Series)	81.1 ± 7.4	77.4 ± 8.1 ↓	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	80.2 ± 7.5	72.6 ± 8.6 ↓	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	93.7 ± 4.6	87.7 ± 6.3 ↓	90.6 ± 1.5
RTV (Full Series)	81.1 ± 7.4	69.8 ± 8.9 ↓	77.7 ± 2.2
FLU (2 Doses)	70.3 ± 8.6	***50.0 ± 9.7*** ↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Immunization Administration

Of the 2,542 vaccines doses administered to the CHR children, 2,472 (97.2%) were administered by private providers, 38 (1.5%) were administered by public health providers and 32 (1.3%) were administered by an unknown source.

Figure 28-C shows the CHR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. CHR children have not met the HP2020 objective for DTaP, HIB, or PCV anytime in the past six years.

Figure 28-C: Immunization Rates (%) by Series and Vaccine Antigen, CHR, 2017-2022

HP2020 Objective

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the CHR sample alongside the UTD immunization rates by demographic groups are shown in Table 17-C and 17-D

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for CHR.

Table 17-C: Risk Factors and Immunization Rates, CHR, 2022

		Demographic Breakdown				UTD Immunization Rates	
Group	Subgroup	CHR¥ (n=106)		State¥ (n=1399)		CHR n=106 (%)	STATE n=1399 (%)
Race*+							
	Black	**16**	**15.1%**	196	14.0%	**56.3 ± 27.3**	74.5 ± 6.2
	White	**87**	**82.1%**	1167	83.4%	**77.0 ± 9.0**	77.5 ± 2.4
	Other	**3**	**2.8%**	36	2.6%	**sample size is too small to generate estimates**	77.8 ± 14.3
Ethnicity*							
	Hispanic	**15**	**14.2%**	153	10.9%	**86.7 ± 19.5**	83.7 ± 5.9
	Non-Hispanic	**91**	**85.9%**	1246	89.1%	**70.3 ± 9.6**	76.2 ± 2.4
Sex*							
	Male	**62**	**58.5%**	719	51.4%	**75.8 ± 11.0**	77.3 ± 3.1
	Female	**44**	**41.5%**	680	48.6%	**68.2 ± 14.3**	76.8 ± 3.2
Siblings*							
	0	**43**	**40.6%**	566	40.5%	**79.1 ± 12.7**	84.8 ± 3.0
	1	**31**	**29.3%**	468	33.5%	**71.0 ± 16.9**	78.2 ± 3.8
	2+	**32**	**30.2%**	365	26.1%	**65.6 ± 17.4**	63.6 ± 5.0
Vaccination Source							
	Private Medical Provider	**100**	**94.4%**	1288	92.1%	**76.0 ± 8.5**	79.0 ± 2.2
	Health Department	**1**	**0.9%**	18	1.3%	**sample size is too small to generate estimates**	50.0 ± 25.6
	Both	**1**	**0.9%**	59	4.2%	**sample size is too small to generate estimates**	81.4 ± 10.2
	Unknown Source	**4**	**3.8%**	34	2.4%	**sample size is too small to generate estimates**	11.8 ± 11.4
Program Enrollment							
	TennCare Only	**25**	**23.6%**	126	9.0%	**68.0 ± 19.7**	77.0 ± 7.5
	WIC Only	**5**	**4.7%**	224	16.0%	**sample size is too small to generate estimates**	69.6 ± 6.1
	Both (TennCare + WIC)	**32**	**30.2%**	414	29.6%	**56.3 ± 18.2**	74.2 ± 4.2
	Not Enrolled	**44**	**41.5%**	635	45.4%	**88.6 ± 9.8**	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites
# Sample size is too small to generate estimates

Table 17-D: Parent Demographics and Immunization Rates, CHR, 2022

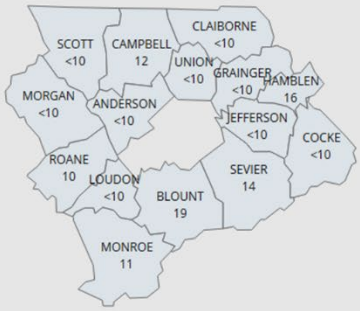
		Demographic Breakdown				UTD Immunization Rates	
Group	Subgroup	CHR¥ (n=106)		State¥ (n=1399)		CHR n=106 (%)	STATE n=1399 (%)
Mother Age*							
	≤24	**31**	**29.3%**	438	31.3%	**77.4 ± 15.6**	75.3 ± 4.1
	25-34	**61**	**57.6%**	807	57.7%	**72.1 ± 11.6**	77.2 ± 2.9
	≥35	**14**	**13.2%**	154	11.0%	**64.3 ± 28.7**	81.2 ± 6.3
Father Age*							
	≤24	**17**	**16.0%**	252	18.0%	**76.5 ± 22.5**	75.8 ± 5.3
	25-34	**49**	**46.2%**	680	48.6%	**77.6 ± 12.1**	77.9 ± 3.1
	≥35	**26**	**24.5%**	274	19.6%	**76.9 ± 17.4**	83.6 ± 4.5
	Unknown	**14**	**13.2%**	193	13.8%	**42.9 ± 29.7**	66.3 ± 6.7
Mother Education*							
	< High School Diploma/ GED	**13**	**12.3%**	174	12.4%	**76.9 ± 26.5**	71.3 ± 6.8
	High School Diploma/ GED	**22**	**20.8%**	419	30.0%	**50.0 ± 22.7**	71.8 ± 4.3
	> High School Diploma/ GED	**71**	**67.0%**	799	57.1%	**78.9 ± 9.7**	81.1 ± 2.7
	Unknown	**0**	**0.0%**	7	0.5%	**sample size is too small to generate estimates**	71.4 ± 45.1
Father Education*							
	< High School Diploma/ GED	**14**	**13.2%**	145	10.4%	**78.6 ± 24.6**	80.0 ± 6.6
	High School Diploma/ GED	**23**	**21.7%**	419	30.0%	**69.6 ± 20.4**	72.3 ± 4.3
	> High School Diploma/ GED	**53**	**50.0%**	621	44.4%	**79.3 ± 11.3**	83.1 ± 3.0
	Unknown	**16**	**15.1%**	214	15.3%	**50.0 ± 27.5**	66.8 ± 6.4
Marriage Status*							
	Married	**57**	**53.8%**	742	53.0%	**82.5 ± 10.2**	79.9 ± 2.9
	Unmarried	**49**	**46.2%**	656	46.9%	**61.2 ± 14.1**	73.8 ± 3.4
	Unknown	**0**	**0.0%**	1	0.1%	**sample size is too small to generate estimates**	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

East Tennessee Region

Figure 29-A: Location of East Tennessee Region (ETR)

Figure 29-B: Sampling per County, ETR, 2022



Final Sample Determination

The initial 2022 sample for ETR consisted of 121 children born between January and March of 2020 (Table 18-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for ETR was 108. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Immunization Rates

In ETR, the up to date (UTD) immunization rate by 24 months of age was 83.3%, which was higher than the 2021 rate (76.3%) and the state average (77.1%) (Table 18-B). The UTD immunization rate as reported to TennIIS was 812.0%, lower than the 2021 rate (13.2%) and the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 18-B). Most notably Flu in ETR decreased more that 17% but Full Series 4:3:1:FS:3:1FS increased by 7% in 2022. In Table 18-B, figures in red indicate a decrease in IPV, HBV (birth dose), RTV, and Flu and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in Flu between 2021 and 2022 rates.

Immunization Administration

Of the 2,542 vaccines doses administered to the CHR children, 2,472 (97.2%) were administered by private providers, 38 (1.5%) were administered by public health providers and 32 (1.3%) were administered by an unknown source.

Table 18-A: 24-Month-Old Survey Sampling, ETR, 2022

	2021	**2022**	State 2022
Original sample (n)	122	**121**	1574
Ineligible (n)	3 (2.5%)	**4 (3.3%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**0 (0.0%)**	23 (1.5%)
Eligible sample (n)	119	**117**	1471
Unable to locate† (n)	5 (4.2%)	**9 (7.7%)**	72 (4.6%)
Final sample (n)	114	**108**	1399
Response Rate (%)*	95.8	92.3	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 18-B: Immunization Rates by Series and Vaccine Antigen, ETR, 2022

	2021 (n=114) (%)	**2022 (n=108) (%)**	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	13.2 ± 6.3	12.0 ± 6.2 ↓	8.9 ± 0.8
UTD immunization rate* (with data collection)	76.3 ± 7.9	83.3 ± 7.1 ↑	77.1 ± 1.1
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	79.8 ± 7.5	83.3 ± 7.1 ↑	81.3 ± 1.0
IPV (3 DOSES)	91.2 ± 5.3	89.8 ± 5.8 ↓	92.9 ± 0.7
MMR (1 DOSE)	87.7 ± 6.1	88.9 ± 6.0 ↑	91.0 ± 0.8
HBV (3 DOSES)	91.2 ± 5.3	91.7 ± 5.3 ↑	93.9 ± 0.6
HBV, Birth Dose	86.0 ± 6.5	82.4 ± 7.3 ↓	82.8 ± 1.0
Hib (Full Series)	75.4 ± 8.0	81.5 ± 7.4 ↑	79.6 ± 1.1
VAR (1 DOSE)	86.0 ± 6.5	88.0 ± 6.2 ↑	90.3 ± 0.8
PCV (Full Series)	82.5 ± 7.1	83.3 ± 7.1 ↑	82.1 ± 1.0
Full Series (4:3:1:FS:3:1:FS)	76.3 ± 7.9	83.3 ± 7.1 ↑	77.1 ± 1.1
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	86.0 ± 6.5	88.0 ± 6.2 ↑	90.6 ± 0.8
RTV (Full Series)	80.7 ± 7.4	80.6 ± 7.6 ↓	77.7 ± 1.1
FLU (2 Doses)	65.8 ± 8.8	***48.2 ± 9.6*** ↓	48.3 ± 1.3

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Figure 29-C shows the ETR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. ETR children have not met the HP2020 objective for DTaP, HIB, PCV, or Flu anytime in the past six years.

Figure 29-C: Immunization Rates (%) by Series and Vaccine Antigen, ETR, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the ETR sample alongside the UTD immunization rates by demographic groups are shown in Table 18-C and 18-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for ETR.

Table 18-C: Risk Factors and Immunization Rates, ETR, 2022

		Demographic		UTD Immunization Rates	
Group	Subgroup	ETR¥ (n=108)	State¥ (n=1399)	ETR n=108 (%)	STATE n=1399 (%)
Race**					
	Black	2 1.9%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	101 93.5%	1167 83.4%	83.2 ± 7.4	77.5 ± 2.4
	Other	5 4.6%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity+**					
	Hispanic	12 11.1%	153 10.9%	91.7 ± 18.3	83.7 ± 5.9
	Non-Hispanic	96 88.9%	1246 89.1%	82.3 ± 7.8	76.2 ± 2.4
Sex*					
	Male	54 50.0%	719 51.4%	75.9 ± 11.8	77.3 ± 3.1
	Female	54 50.0%	680 48.6%	90.7 ± 8.0	76.8 ± 3.2
Siblings*					
	0	49 45.4%	566 40.5%	85.7 ± 10.2	84.8 ± 3.0
	1	35 32.4%	468 33.5%	94.3 ± 8.1	78.2 ± 3.8
	2+	24 22.2%	365 26.1%	62.5 ± 20.9	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	94 87.0%	1288 92.1%	90.4 ± 6.1	79.0 ± 2.2
	Health Department	1 0.9%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	6 5.6%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	7 6.5%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	5 4.6%	126 9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	16 14.8%	224 16.0%	75.0 ± 23.8	69.6 ± 6.1
	Both (TennCare + WIC)	51 47.2%	414 29.6%	80.4 ± 11.3	74.2 ± 4.2
	Not Enrolled	36 33.3%	635 45.4%	91.7 ± 9.5	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 18-D: Parent Demographics and Immunization Rates, ETR, 2022

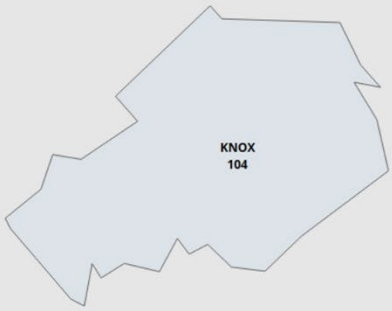
		Demographic		UTD Immunization Rates	
Group	Subgroup	ETR¥ (n=115)	State¥ (n=1399)	ETR n=115 (%)	STATE n=1399 (%)
Mother Age*					
	≤24	43 39.8%	438 31.3%	83.7 ± 11.5	75.3 ± 4.1
	25-34	60 55.6%	807 57.7%	83.3 ± 9.7	77.2 ± 2.9
	≥35	5 4.6%	154 11.0%	sample size is too small to generate estimates	81.2 ± 6.3
Father Age*					
	≤24	24 22.2%	252 18.0%	87.5 ± 14.3	75.8 ± 5.3
	25-34	59 54.6%	680 48.6%	83.1 ± 9.9	72.3 ± 4.3
	≥35	16 14.8%	274 19.6%	81.3 ± 21.5	83.6 ± 4.5
	Unknown	9 8.3%	193 13.8%	sample size is too small to generate estimates	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	13 12.0%	174 12.4%	69.2 ± 29.0	71.3 ± 6.8
	High School Diploma/ GED	43 39.8%	419 30.0%	81.4 ± 12.1	71.8 ± 4.3
	> High School Diploma/ GED	52 48.2%	799 57.1%	88.5 ± 9.0	81.1 ± 2.7
	Unknown	0 0.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	18 16.7%	145 10.4%	77.8 ± 21.3	80.0 ± 6.6
	High School Diploma/ GED	36 33.3%	419 30.0%	96.1 ± 11.9	72.3 ± 4.3
	> High School Diploma/ GED	45 41.7%	621 44.4%	84.4 ± 11.0	83.1 ± 3.0
	Unknown	9 8.3%	214 15.3%	sample size is too small to generate estimates	66.8 ± 6.4
Marriage Status*					
	Married	63 58.3%	742 53.0%	79.4 ± 10.3	79.9 ± 2.9
	Unmarried	44 40.7%	656 46.9%	88.6 ± 9.8	73.8 ± 3.4
	Unknown	1 0.9%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Knoxville-Knox County Region

Figure 30-A: Location of Knoxville-Knox County Region (KKR)

Figure 30-B: Sampling per County, KKR, 2022



Final Sample Determination

The initial 2022 sample for ETR consisted of 121 children born between January and March of 2020 (Table 18-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for ETR was 108. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Immunization Rates

In ETR, the up to date (UTD) immunization rate by 24 months of age was 83.3%, which was higher than the 2021 rate (76.3%) and the state average (77.1%) (Table 18-B). The UTD immunization rate as reported to TennIIS was 812.0%, lower than the 2021 rate (13.2%) and the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 18-B). Most notably Flu in ETR decreased more that 17% but Full Series 4:3:1:FS:3:1FS increased by 7% in 2022. In Table 18-B, figures in red indicate a decrease in HBV (birth dose)and Flu and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in DTaP, IPV, Hib, PCV, HAV and Full Series between 2021 and 2022 rates.

Immunization Administration

Of the 2,674 vaccines doses administered to the CHR children, 2,632 (98.4%) were administered by private providers, 35 (1.3%) were administered by public health providers and 7 (0.3%) were administered by an unknown source.

Table 19-A: 24-Month-Old Survey Sampling, KKR, 2022

	2021	**2022**	State 2022
Original sample (n)	122	**122**	1574
Ineligible (n)	9 (7.4%)	**7 (5.7%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**2 (1.6%)**	23 (1.5%)
Eligible sample (n)	113	**113**	1471
Unable to locate† (n)	3 (2.7%)	**9 (8.0%)**	72 (4.9%)
Final sample (n)	110	**104**	1399
Response Rate (%)*	97.3	**92.0**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 19-B: Immunization Rates by Series and Vaccine Antigen, KKR, 2022

	2021 (n=110) (%)	**2022 (n=104) (%)**		State 2022 (n=1399) (%)
Up to Date (UTD):				
UTD immunization rate* (based on TennIIS alone)	0.9 ± 1.8	2.9 ± 3.3	↑	8.9 ± 1.5
UTD immunization rate* (by end of data collection)	82.7 ± 7.2	***92.3*** ± ***5.2***	↑	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)				
DTaP (4 Doses)	83.6 ± 7.0	***95.2*** ± ***4.2***	↑	81.3 ± 2.0
IPV (3 DOSES)	91.8 ± 5.2	***98.1*** ± ***2.7***	↑	92.9 ± 1.3
MMR (1 DOSE)	90.0 ± 5.7	95.2 ± 4.2	↑	91.0 ± 1.5
HBV (3 DOSES)	92.7 ± 4.9	98.1 ± 2.7	↑	93.9 ± 1.3
HBV, Birth Dose	89.1 ± 5.9	86.5 ± 6.7	↓	82.8 ± 2.1
Hib (Full Series)	80.0 ± 7.6	***94.2*** ± ***4.6***	↑	79.6 ± 2.1
VAR (1 DOSE)	90.0 ± 5.7	95.2 ± 4.2	↑	90.3 ± 1.6
PCV (Full Series)	81.8 ± 7.3	***95.2*** ± ***4.2***	↑	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	82.7 ± 7.2	***92.3*** ± ***5.2***	↑	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)				
HAV (1 DOSE)	87.3 ± 6.3	***96.2*** ± ***3.8***	↑	90.6 ± 1.5
RTV (Full Series)	82.7 ± 7.2	91.4 ± 5.5	↑	77.7 ± 2.2
FLU (2 Doses)	69.1 ± 8.8	64.4 ± 9.4	↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference ($p < 0.05$) with 2021 rate

Figure 30-C shows the KKR trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. KKR children have not met the HP2020 objective for Flu anytime in the past six years.

Figure 30-C: Immunization Rates (%) by Series and Vaccine Antigen, KKR, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the KKR sample alongside the UTD immunization rates by demographic groups are shown in Table 19-C and 19-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for KKR.

Table 19-C: Risk Factors and Immunization Rates, KKR, 2022

		Demographic		UTD Immunization Rates	
Group	Subgroup	KKR¥ (n=104)	State¥ (n=1399)	KKR n=104 (%)	STATE n=1399 (%)
Race[*+]					
	Black	7 6.7%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	94 90.4%	1167 83.4%	91.5 ± 5.8	77.5 ± 2.4
	Other	3 2.9%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity[*+]					
	Hispanic	12 11.5%	153 10.9%	83.3 ± 24.7	83.7 ± 5.9
	Non-Hispanic	92 88.5%	1246 89.1%	93.5 ± 5.1	76.2 ± 2.4
Sex[*]					
	Male	48 46.2%	719 51.4%	95.8 ± 5.9	77.3 ± 3.1
	Female	56 53.9%	680 48.6%	89.3 ± 8.4	76.8 ± 3.2
Siblings[*]					
	0	51 49.0%	566 40.5%	92.2 ± 7.6	84.8 ± 3.0
	1	35 33.7%	468 33.5%	97.1 ± 5.8	78.2 ± 3.8
	2+	18 17.3%	365 26.1%	83.3 ± 19.1	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	100 96.2%	1288 92.1%	93.0 ± 5.1	79.0 ± 2.2
	Health Department	0 0.0%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	3 2.9%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	1 1.0%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	44 42.3%	126 9.0%	93.2 ± 7.8	77.0 ± 7.5
	WIC Only	0 0.0%	224 16.0%	sample size is too small to generate estimates	69.6 ± 6.1
	Both (TennCare + WIC)	0 0.0%	414 29.6%	sample size is too small to generate estimates	74.2 ± 4.2
	Not Enrolled	60 57.7%	635 45.4%	91.7 ± 7.2	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 19-D: Parent Demographics and Immunization Rates, KKR, 2022

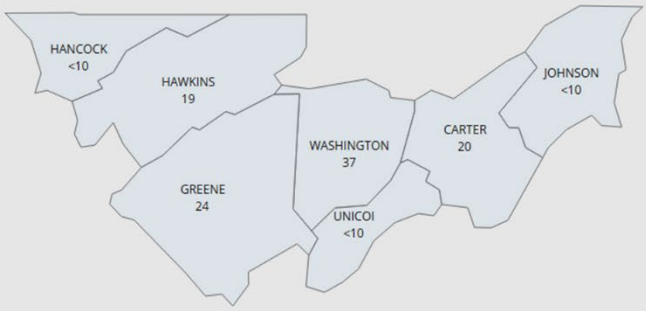
		Demographic		UTD Immunization Rates	
Group	Subgroup	KKR¥ (n=104)	State¥ (n=1399)	KKR n=104 (%)	STATE n=1399 (%)
Mother Age[*]					
	≤24	26 25.0%	438 31.3%	92.3 ± 11.0	75.3 ± 4.1
	25-34	61 58.7%	807 57.7%	91.8 ± 7.1	77.2 ± 2.9
	≥35	17 16.4%	154 11.0%	94.1 ± 12.5	81.2 ± 6.3
Father Age[*]					
	≤24	16 15.4%	252 18.0%	100.0 ± 0.0	75.8 ± 5.3
	25-34	50 48.1%	680 48.6%	88.0 ± 9.3	77.9 ± 3.1
	≥35	27 26.0%	274 19.6%	96.3 ± 7.6	83.6 ± 4.5
	Unknown	11 10.6%	193 13.8%	90.9 ± 20.3	66.3 ± 6.7
Mother Education[*]					
	< High School Diploma/ GED	5 4.8%	174 12.4%	sample size is too small to generate estimates	71.3 ± 6.8
	High School Diploma/ GED	27 26.0%	419 30.0%	88.9 ± 12.7	71.8 ± 4.3
	> High School Diploma/ GED	71 68.3%	799 57.1%	94.4 ± 5.5	81.1 ± 2.7
	Unknown	1 1.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education[*]					
	< High School Diploma/ GED	5 4.8%	145 10.4%	sample size is too small to generate estimates	80.0 ± 6.6
	High School Diploma/ GED	19 18.3%	419 30.0%	89.5 ± 15.2	72.3 ± 4.3
	> High School Diploma/ GED	68 65.4%	621 44.4%	92.7 ± 6.4	83.1 ± 3.0
	Unknown	12 11.5%	214 15.3%	91.7 ± 18.3	66.8 ± 6.4
Marriage Status[*]					
	Married	70 67.3%	742 53.0%	92.9 ± 6.2	79.9 ± 2.9
	Unmarried	34 32.7%	656 46.9%	91.2 ± 10.1	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Northeast Region

Figure 31-A: Location of Northeast Region (NER)

Figure 31-B: Sampling per County, NER, 2022



Final Sample Determination

The initial 2022 sample for ETR consisted of 121 children born between January and March of 2020 (Table 20-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for ETR was 108. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a smaller sample was used for analysis and there was a lower response rate in 2022.

Immunization Rates

In ETR, the up to date (UTD) immunization rate by 24 months of age was 83.3%, which was higher than the 2021 rate (76.3%) and the state average (77.1%) (Table 20-B). The UTD immunization rate as reported to TennIIS was 812.0%, lower than the 2021 rate (13.2%) and the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 20-B). Most notably Flu in ETR decreased more that 17% but Full Series 4:3:1:FS:3:1FS increased by 7% in 2022. In Table 20-B, ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in RTV and Flu between 2021 and 2022 rates.

Immunization Administration

Of the 2,682 vaccines doses administered to the NER children, 2,620 (97.7%) were administered by private providers, 58 (2.2%) were administered by public health providers and 4 (0.1%) were administered by an unknown source.

Table 20-A: 24-Month-Old Survey Sampling, NER, 2022

	2021	**2022**	State 2022
Original sample (n)	122	**121**	1574
Ineligible (n)	12 (9.8%)	**6 (5.0%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**2 (1.7%)**	23 (1.5%)
Eligible sample (n)	110	**113**	1471
Unable to locate† (n)	6 (5.5%)	**2 (1.8%)**	72 (4.9%)
Final sample (n)	104	**111**	1399
Response Rate (%)*	94.5	**98.2**	95.1

† Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 20-B: Immunization Rates by Series and Vaccine Antigen, NER, 2022

	2021 (n=104) (%)	**2022 (n=111) (%)**		State 2022 (n=1399) (%)
Up to Date (UTD):				
UTD immunization rate* (as reported to TennIIS)	6.7 ± 4.9	***0.0*** **±** ***0.0***	↓	8.9 ± 1.5
UTD immunization rate* (with data collection)	78.9 ± 8.0	77.5 ± 7.9	↓	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)				
DTaP (4 Doses)	80.8 ± 7.7	82.9 ± 7.1	↑	81.3 ± 2.0
IPV (3 DOSES)	94.2 ± 4.6	94.6 ± 4.3	↑	92.9 ± 1.3
MMR (1 DOSE)	90.4 ± 5.8	94.6 ± 4.3	↑	91.0 ± 1.5
HBV (3 DOSES)	97.1 ± 3.3	97.3 ± 3.1	↑	93.9 ± 1.3
HBV, Birth Dose	79.8 ± 7.9	76.6 ± 8.0	↓	82.8 ± 2.1
Hib (Full Series)	80.8 ± 7.7	81.1 ± 7.4	↑	79.6 ± 2.1
VAR (1 DOSE)	89.4 ± 6.0	94.6 ± *4.3*	↑	90.3 ± 1.6
PCV (Full Series)	84.6 ± 7.1	82.9 ± 7.1	↓	82.1 ± 2.0
Full Series (4:3:1:FS:3:1:FS)	78.9 ± 8.0	77.5 ± 7.9	↓	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)				
HAV (1 DOSE)	90.4 ± 5.8	93.7 ± 4.6	↑	90.6 ± 1.5
RTV (Full Series)	89.4 ± 6.0	***79.3*** **±** ***7.7***	↓	77.7 ± 2.2
FLU (2 Doses)	56.7 ± 9.7	***43.2*** **±** ***9.4***	↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference ($p < 0.05$) with 2021 rate

Figure 31-C shows the NER trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. NER children have not met the HP2020 objective for DTaP, HIB, PCV, or Flu anytime in the past six years.

Figure 31-C: Immunization Rates (%) by Series and Vaccine Antigen, NER, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the NER sample alongside the UTD immunization rates by demographic groups are shown in Table 20-C and 20-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for NER.

Table 20-C: Risk Factors and Immunization Rates, NER, 2022

		Demographic		UTD Immunization Rates	
Group	Subgroup	NER¥ (n=111)	State¥ (n=1399)	NER n=111 (%)	STATE n=1399 (%)
Race*+					
	Black	3 2.7%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	107 96.4%	1167 83.4%	76.6 ± 8.2	77.5 ± 2.4
	Other	1 0.9%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity*+					
	Hispanic	5 4.5%	153 10.9%	sample size is too small to generate estimates	83.7 ± 5.9
	Non-Hispanic	106 95.5%	1246 89.1%	76.4 ± 8.2	76.2 ± 2.4
Sex*					
	Male	57 51.4%	719 51.4%	75.4 ± 11.5	77.3 ± 3.1
	Female	54 48.7%	680 48.6%	79.6 ± 11.1	76.8 ± 3.2
Siblings*					
	0	46 41.4%	566 40.5%	89.1 ± 9.3	84.8 ± 3.0
	1	39 35.1%	468 33.5%	69.2 ± 15.2	78.2 ± 3.8
	2+	26 23.4%	365 26.1%	69.2 ± 19.0	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	105 94.6%	1288 92.1%	79.1 ± 7.9	79.0 ± 2.2
	Health Department	1 0.9%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	4 3.6%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	1 0.9%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	8 7.2%	126 9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	9 8.1%	224 16.0%	sample size is too small to generate estimates	69.6 ± 6.1
	Both (TennCare + WIC)	72 64.9%	414 29.6%	70.8 ± 10.8	74.2 ± 4.2
	Not Enrolled	22 19.8%	635 45.4%	95.5 ± 9.5	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 210D: Parent Demographics and Immunization Rates, NER, 2022

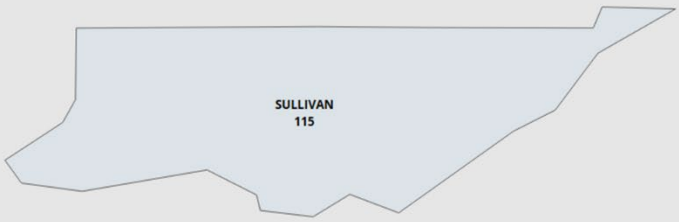
		Demographic		UTD Immunization Rates	
Group	Subgroup	NER¥ (n=111)	State¥ (n=1399)	NER n=111 (%)	STATE n=1399 (%)
Mother Age*					
	≤24	42 37.8%	438 31.3%	69.1 ± 14.6	75.3 ± 4.1
	25-34	61 55.0%	807 57.7%	85.3 ± 9.2	77.2 ± 2.9
	≥35	8 7.2%	154 11.0%	sample size is too small to generate estimates	81.2 ± 6.3
Father Age*					
	≤24	19 17.1%	252 18.0%	73.7 ± 21.8	75.8 ± 5.3
	25-34	55 49.6%	680 48.6%	81.8 ± 10.5	77.9 ± 3.1
	≥35	20 18.0%	274 19.6%	80.0 ± 19.2	83.6 ± 4.5
	Unknown	17 15.3%	193 13.8%	64.7 ± 25.3	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	8 7.2%	174 12.4%	sample size is too small to generate estimates	71.3 ± 6.8
	High School Diploma/ GED	46 41.4%	419 30.0%	69.9 ± 13.8	71.8 ± 4.3
	> High School Diploma/ GED	57 51.4%	799 57.1%	86.0 ± 9.3	81.1 ± 2.7
	Unknown	0 0.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	4 3.6%	145 10.4%	sample size is too small to generate estimates	80.0 ± 6.6
	High School Diploma/ GED	44 39.6%	419 30.0%	72.7 ± 13.7	72.3 ± 4.3
	> High School Diploma/ GED	44 39.6%	621 44.4%	86.4 ± 10.6	83.1 ± 3.0
	Unknown	19 17.1%	214 15.3%	63.2 ± 23.9	66.8 ± 6.4
Marriage Status*					
	Married	59 53.2%	742 53.0%	81.4 ± 10.2	79.9 ± 2.9
	Unmarried	52 46.9%	656 46.9%	73.1 ± 12.5	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

Sullivan County Region

Figure 32-A: Location of Sullivan County Region (SUL)

Figure 32-B: Sampling per County, SUL, 2022



Final Sample Determination

The initial 2022 sample for SUL consisted of 122 children born between January and March of 2020 (Table 21-A). After removing children who were determined to be ineligible, declined participation and were unable to be reached, the final sample size for SUL was 115. The response rate was calculated by dividing the number of participants in the final sample by the eligible sample. Compared to the previous year, a larger sample was used for analysis and there was a higher response rate in 2022.

Immunization Rates

In SUL, the up to date (UTD) immunization rate by 24 months of age was 75.7%, which was lower than the 2021 rate (85.9%) but higher than the state average (77.1%) (Table 21-B). The UTD immunization rate as reported to TennIIS was 5.2%, higher than the 2021 rate (4.7%) but lower than the state rate (8.9%).

The vaccine-specific rates demonstrate multiple significant differences when compared to the previous year and to the state overall (Table 21-B). Most notably, Flu and RTV in SUL decreased more that 16% and 13%, respectively, in 2022. In Table 21-B, figures in red indicate a rate decrease in most vaccines between 2021 and 2022 and ***italicized and bolded*** figures indicate a significant difference ($p<0.05$) in RTV and Flu rates between 2021 and 2022.

Immunization Administration

Of the 2,794 vaccines doses administered to the SUL children, 2,741 (98.1%) were administered by private providers, 26 (0.9%) were administered by public health providers and 27 (1.0%) were administered by an unknown source.

Table 21-A: 24-Month-Old Survey Sampling, SUL, 2022

	2021	2022	State 2022
Original sample (n)	121	**122**	1574
Ineligible (n)	10 (8.3%)	**5 (4.1%)**	80 (5.1%)
Refused Participation (n)	0 (0.0%)	**0** (0.0%)	23 (1.5%)
Eligible sample (n)	111	**117**	1471
Unable to locate[†] (n)	5 (4.5%)	**2 (1.7%)**	72 (4.6%)
Final sample (n)	106	**115**	1399
Response Rate (%)*	95.5	**98.3**	95.1

[†] Children are classified as "Unable to Locate" after multiple attempts were unsuccesful in locating and communicating with the child's guadian and/or the child's provider was either unknown or also unable to locate the guardian.

* Repsonse Rate (%) is the number of survey responses from eligible children

Table 21-B: Immunization Rates by Series and Vaccine Antigen, SUL, 2022

	2021 (n=106) (%)	2022 (n=115) (%)	State 2022 (n=1399) (%)
Up to Date (UTD):			
UTD immunization rate* (as reported to TennIIS)	4.7 ± 4.1	5.2 ± 4.1 ↑	8.9 ± 1.5
UTD immunization rate* (with data collection)	85.9 ± 6.8	75.7 ± 8.0 ↓	77.1 ± 2.2
ACIP Recommended Vaccine Sereis (By 24 Months of Age)			
DTaP (4 Doses)	88.7 ± 6.1	80.9 ± 7.3 ↓	81.3 ± 2.0
IPV (3 DOSES)	93.4 ± 4.8	93.0 ± 4.7 ↓	92.9 ± 1.3
MMR (1 DOSE)	92.5 ± 5.1	93.0 ± 4.7 ↓	91.0 ± 1.5
HBV (3 DOSES)	93.4 ± 4.8	95.7 ± 3.8 ↑	93.9 ± 1.3
HBV, Birth Dose	78.3 ± 8.0	75.7 ± 8.0 ↓	82.8 ± 2.1
Hib (Full Series)	84.0 ± 7.1	81.7 ± 7.2 ↓	79.6 ± 2.1
VAR (1 DOSE)	93.4 ± 4.8	92.2 ± 5.0 ↓	90.3 ± 1.6
PCV (Full Series)	84.9 ± 6.9	87.0 ± 6.3 ↑	82.1 ± 2.0
Full Series 4:3:1:FS:3:1:FS	85.9 ± 6.8	75.7 ± 8.0 ↓	77.1 ± 2.2
Additional Vaccines of Interest (By 24 Months of Age)			
HAV (1 DOSE)	92.5 ± 5.1	93.9 ± 4.4 ↑	90.6 ± 1.5
RTV (Full Series)	79.3 ± 7.9	***66.1 ± 8.8*** ↓	77.7 ± 2.2
FLU (2 Doses)	68.9 ± 9.0	***52.2 ± 9.3*** ↓	48.3 ± 2.6

* Includes children up-to-date by ACIP-recommended catch-up schedule

Red font indicates a rate decrease since 2021

Italicized and bolded font indicates a significant difference with 2021 rate

Figure 32-C shows the SUL trend for each individual vaccine series over the six years. The red lines represent HP2020 objectives for each series and vaccine antigen assessed. SUL children have not met the HP2020 objective for DTaP, HIB, or Flu anytime in the past six years.

Figure 32-C: Immunization Rates (%) by Series and Vaccine Antigen, SUL, 2017-2022

* Notable increase in HIB and PCV immunization rates in 2019 and 2020 are likely due to inclusion of children on CDC's catch-up schedule.
\# HAV is not compared to HP2020 objectives as the HP2020 objective reflects completion of the two-dose series and this survey reflects completion of one dose.

Demographic Information

The demographic breakdown of the SUL sample alongside the UTD immunization rates by demographic groups are shown in Table 21-C and 21-D.

Due to small sample sizes and inherent limitations of the data, significant differences in the UTD rates between the demographic subgroups in are not reported for SUL.

Table 21-C: Risk Factors and Immunization Rates, SUL, 2022

		Demographic		UTD Immunization Rates	
		SUL¥	State¥	SUL	STATE
Group	Subgroup	(n=115)	(n=1399)	n=115 (%)	n=1399 (%)
Race*+					
	Black	2 1.7%	196 14.0%	sample size is too small to generate estimates	74.5 ± 6.2
	White	111 96.5%	1167 83.4%	75.7 ± 8.1	77.5 ± 2.4
	Other	2 1.7%	36 2.6%	sample size is too small to generate estimates	77.8 ± 14.3
Ethnicity*+					
	Hispanic	2 1.7%	153 10.9%	sample size is too small to generate estimates	83.7 ± 5.9
	Non-Hispanic	113 98.3%	1246 89.1%	75.2 ± 8.1	76.2 ± 2.4
Sex*					
	Male	59 51.3%	719 51.4%	78.0 ± 10.9	77.3 ± 3.1
	Female	56 48.7%	680 48.6%	73.2 ± 12.0	76.8 ± 3.2
Siblings*					
	0	43 37.4%	566 40.5%	83.7 ± 11.5	84.8 ± 3.0
	1	46 40.0%	468 33.5%	73.1 ± 18.3	78.2 ± 3.8
	2+	26 22.3%	365 26.1%	69.6 ± 13.8	63.6 ± 5.0
Vaccination Source					
	Private Medical Provider	109 94.8%	1288 92.1%	76.2 ± 8.1	79.0 ± 2.2
	Health Department	0 0.0%	18 1.3%	sample size is too small to generate estimates	50.0 ± 25.6
	Both	5 4.4%	59 4.2%	sample size is too small to generate estimates	81.4 ± 10.2
	Unknown Source	1 0.9%	34 2.4%	sample size is too small to generate estimates	11.8 ± 11.4
Program Enrollment					
	TennCare Only	3 2.6%	126 9.0%	sample size is too small to generate estimates	77.0 ± 7.5
	WIC Only	22 19.1%	224 16.0%	59.1 ± 22.3	69.6 ± 6.1
	Both (TennCare + WIC)	34 29.6%	414 29.6%	85.3 ± 12.5	74.2 ± 4.2
	Not Enrolled	56 48.7%	635 45.4%	75.0 ± 11.7	81.6 ± 3.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery
+ Does not distinguish between Hispanic whites and non-Hispanic whites

Table 21-D: Parent Demographics and Immunization Rates, SUL, 2022

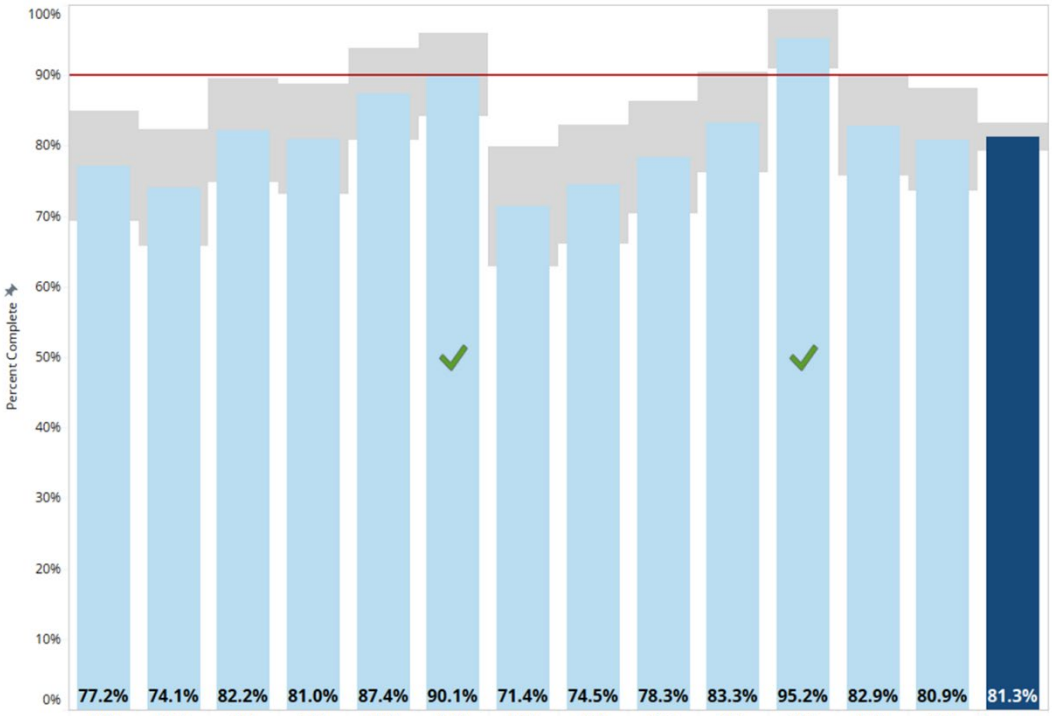
		Demographic		UTD Immunization Rates	
		SUL¥	State¥	SUL	STATE
Group	Subgroup	(n=115)	(n=1399)	n=115 (%)	n=1399 (%)
Mother Age*					
	≤24	35 30.4%	438 31.3%	74.3 ± 15.2	75.3 ± 4.1
	25-34	73 63.5%	807 57.7%	75.3 ± 10.1	77.2 ± 2.9
	≥35	7 6.1%	154 11.0%	sample size is too small to generate estimates	81.2 ± 6.3
Father Age*					
	≤24	19 16.5%	252 18.0%	63.2 ± 23.9	75.8 ± 5.3
	25-34	66 57.4%	680 48.6%	80.3 ± 9.9	77.9 ± 3.1
	≥35	19 16.5%	274 19.6%	79.0 ± 20.2	83.6 ± 4.5
	Unknown	11 9.6%	193 13.8%	63.6 ± 33.9	66.3 ± 6.7
Mother Education*					
	< High School Diploma/ GED	14 12.2%	174 12.4%	71.4 ± 27.1	71.3 ± 6.8
	High School Diploma/ GED	28 24.2%	419 30.0%	67.9 ± 18.4	71.8 ± 4.3
	> High School Diploma/ GED	73 63.5%	799 57.1%	79.5 ± 9.5	81.1 ± 2.7
	Unknown	0 0.0%	7 0.5%	sample size is too small to generate estimates	71.4 ± 45.1
Father Education*					
	< High School Diploma/ GED	9 7.8%	145 10.4%	sample size is too small to generate estimates	80.0 ± 6.6
	High School Diploma/ GED	37 32.2%	419 30.0%	75.7 ± 14.5	72.3 ± 4.3
	> High School Diploma/ GED	57 49.6%	621 44.4%	79.0 ± 10.9	83.1 ± 3.0
	Unknown	12 10.4%	214 15.3%	66.7 ± 31.3	66.8 ± 6.4
Marriage Status*					
	Married	67 58.3%	742 53.0%	79.1 ± 10.0	79.9 ± 2.9
	Unmarried	48 41.7%	656 46.9%	70.8 ± 13.3	73.8 ± 3.4
	Unknown	0 0.0%	1 0.1%	sample size is too small to generate estimates	0.0 ± 0.0

¥ Percentages may not add up to 100% due to missing participant information
* Information was collected from birth certificate at time of delivery

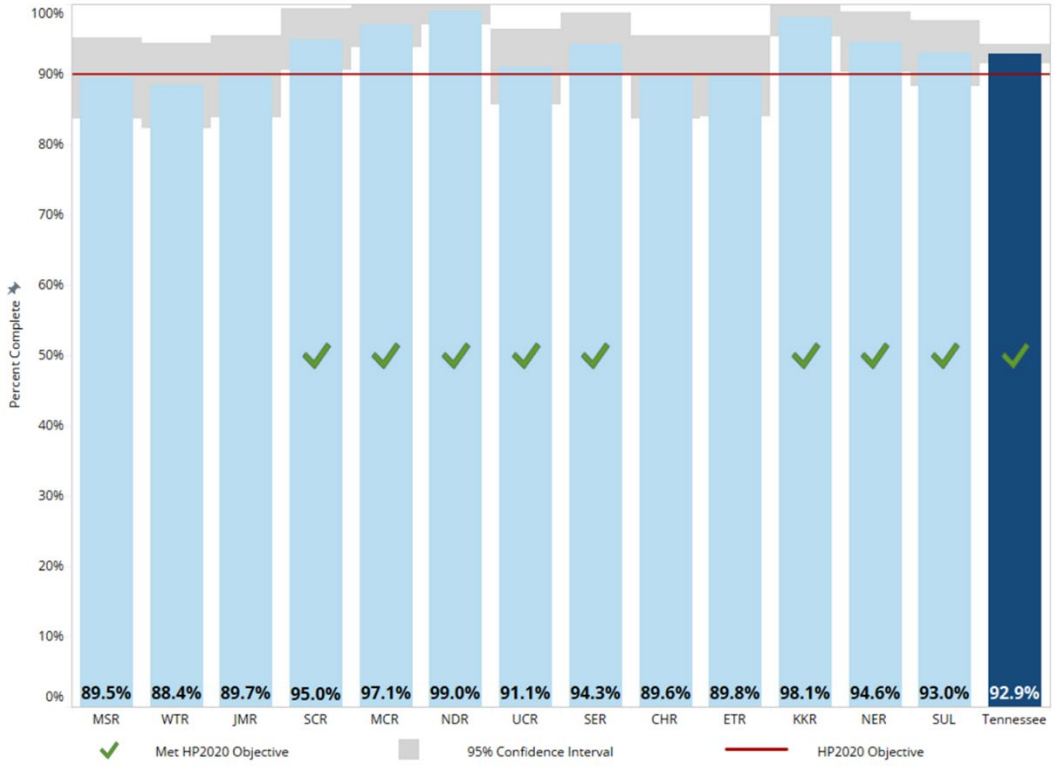
Appendix I

Regional Antigen Specific Results

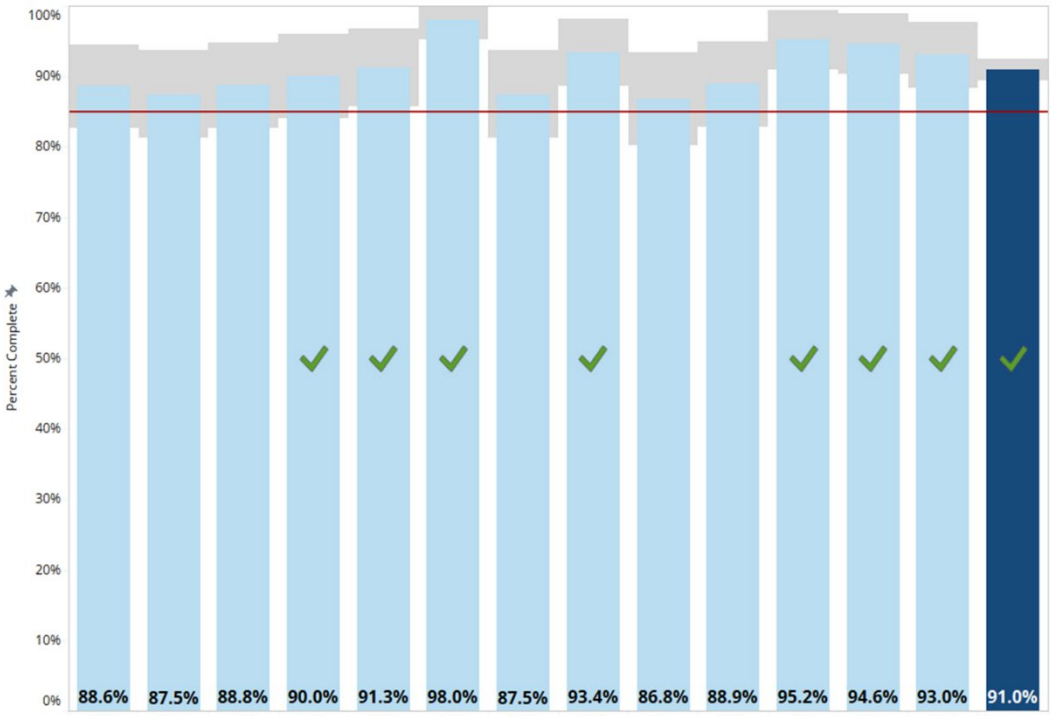
Percentage of Children with Complete Diphtheria, Tetanus, Pertussis (DTaP) Series by Health Department Region, Tennessee, 2022, n=1399



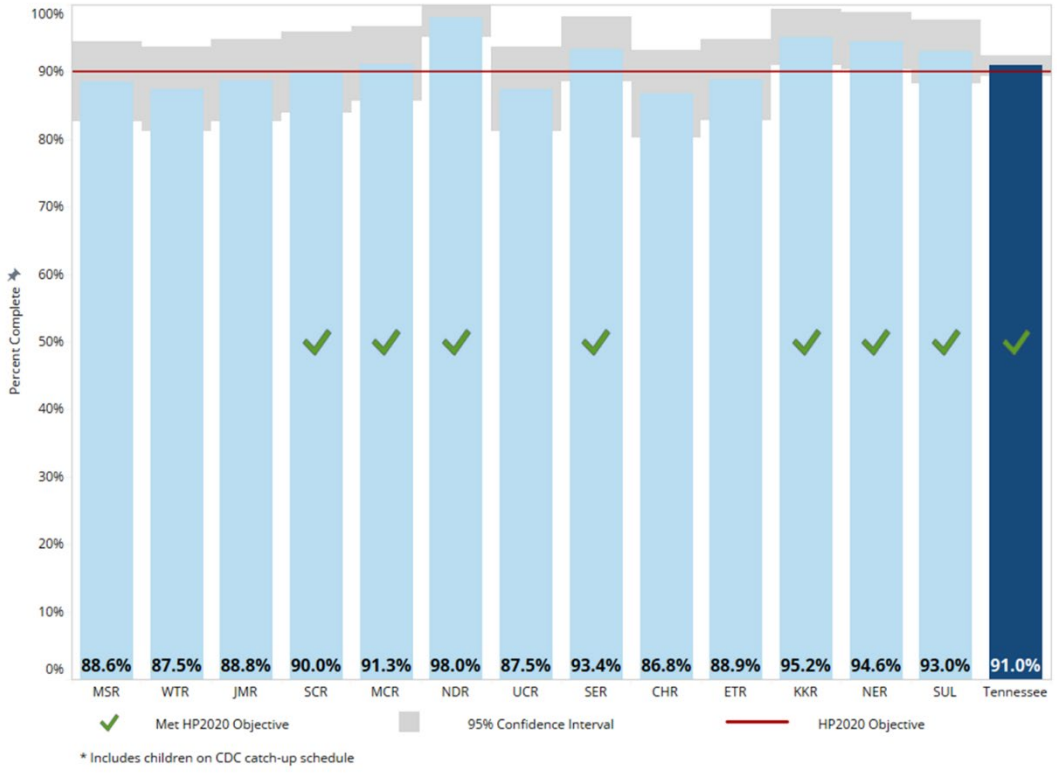
Percentage of Children with Complete Polio (IPV) Series by Health Department Region, Tennessee, 2022, n=1399



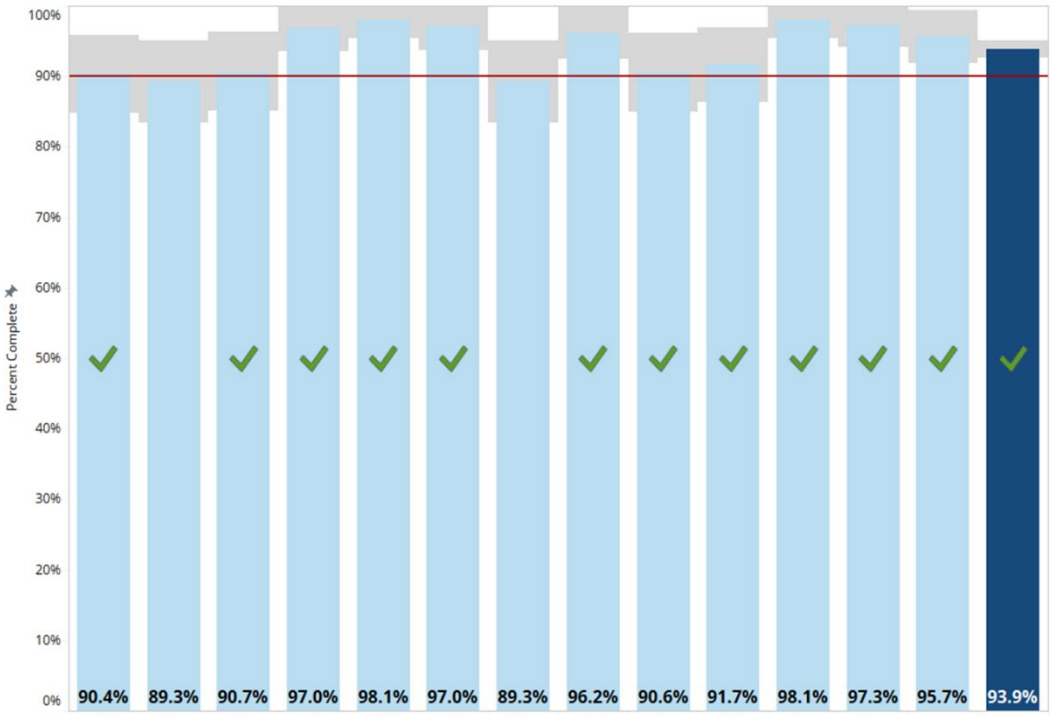
Percentage of Children with Complete Measles, Mumps, Rubella (MMR) Series by Health Department Region, Tennessee, 2022, n=1399



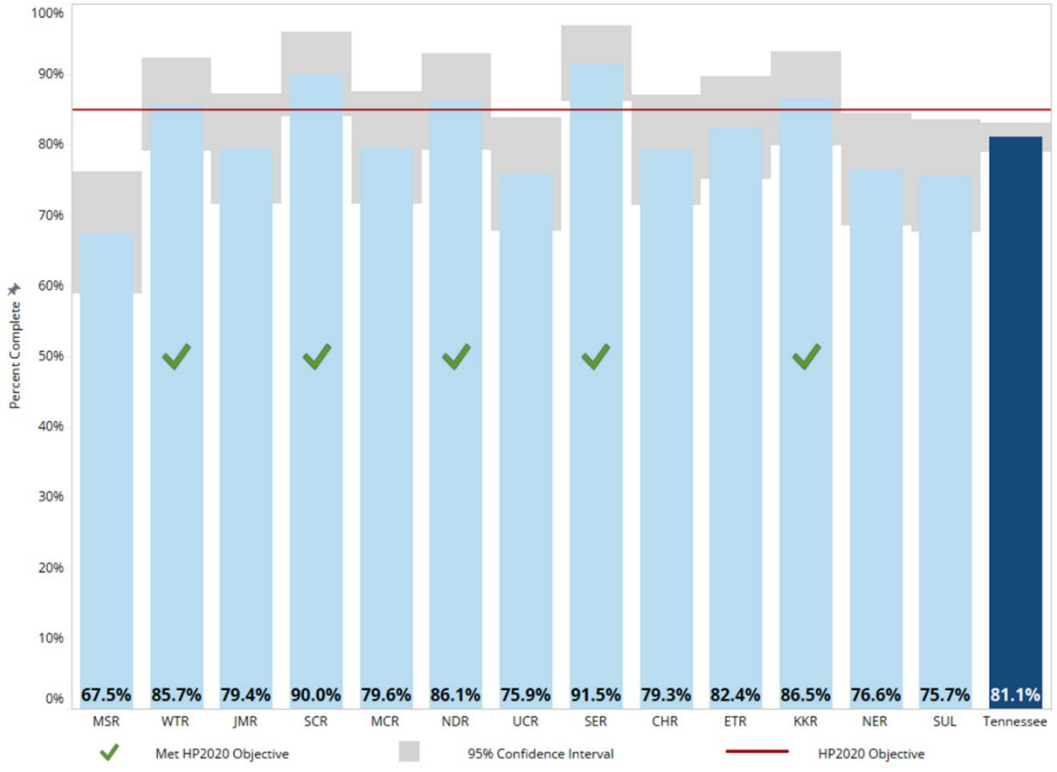
Percentage of Children with Complete Haemophilus influenzae type B (HIB)* Series by Health Department Region, Tennessee, 2022, n=1399



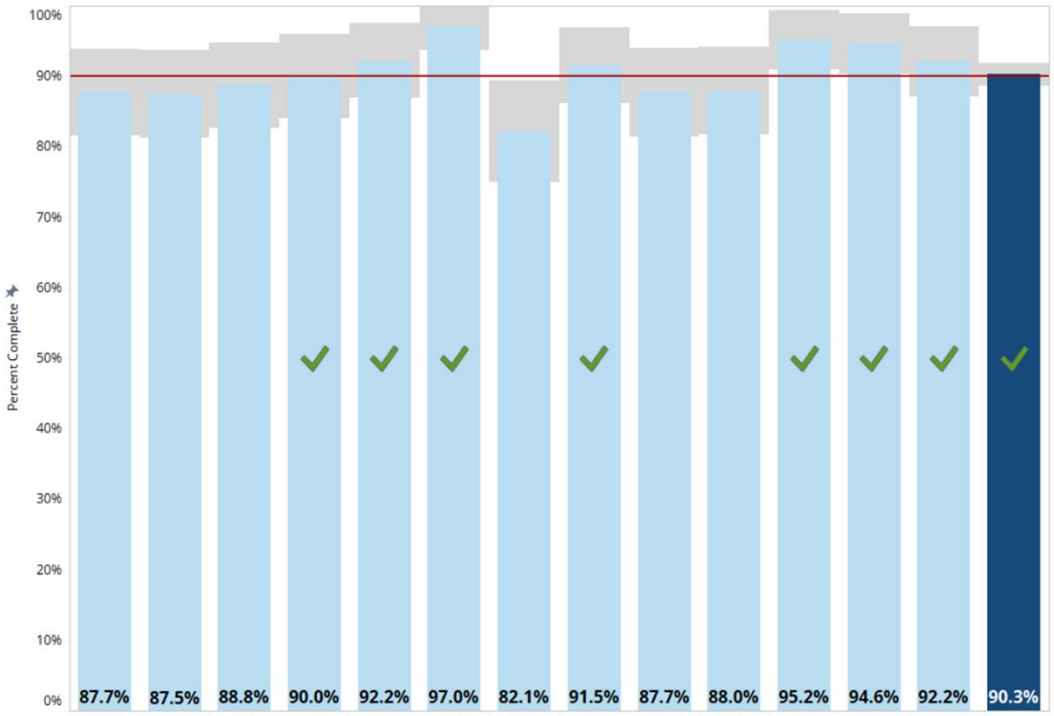
Percentage of Children with Complete Hepatitis B (HBV) Series by Health Department Region, Tennessee, 2022, n=1399



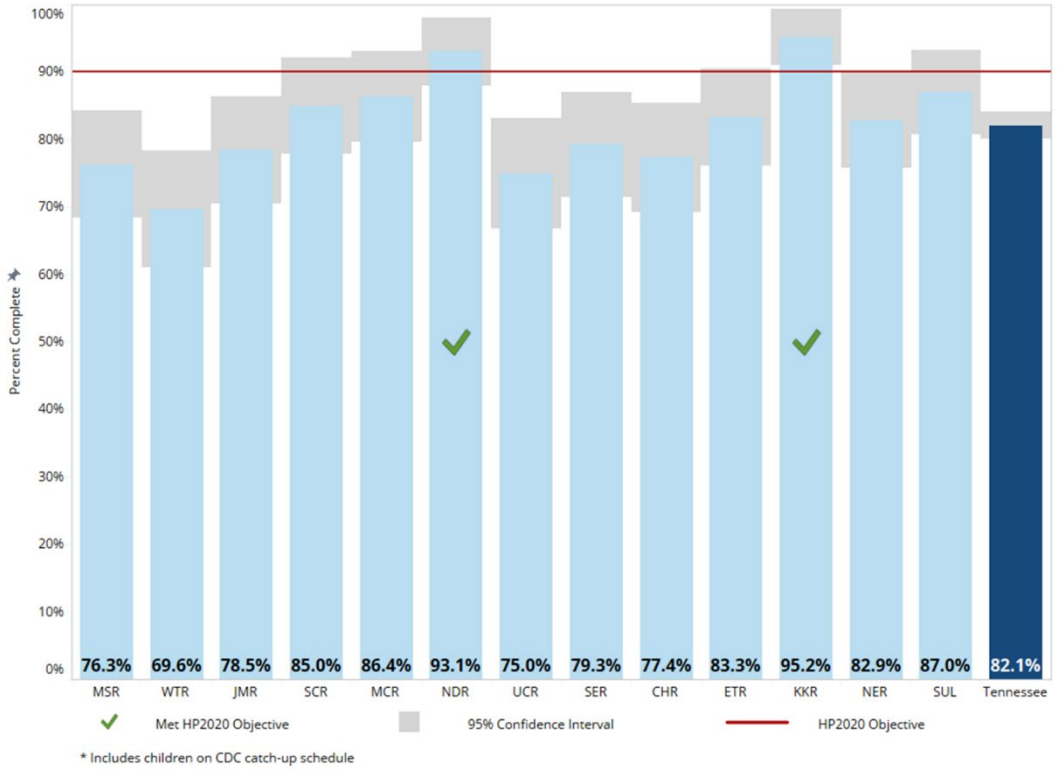
Percentage of Children with Complete Birth Dose Hepatitis B (bHBV) Series by Health Department Region, Tennessee, 2022, n=1399



Percentage of Children with Complete Varicella (VAR) Series by Health Department Region, Tennessee, 2022, n=1399

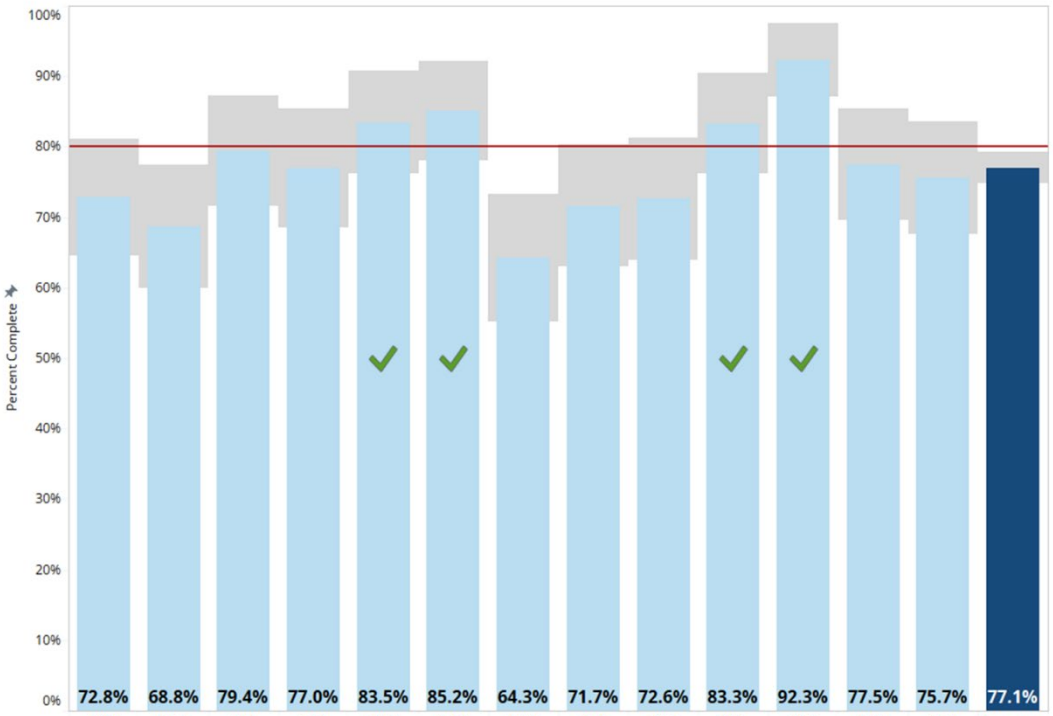


Percentage of Children with Complete Pneumococcus (PCV)* Series by Health Department Region, Tennessee, 2022, n=1399

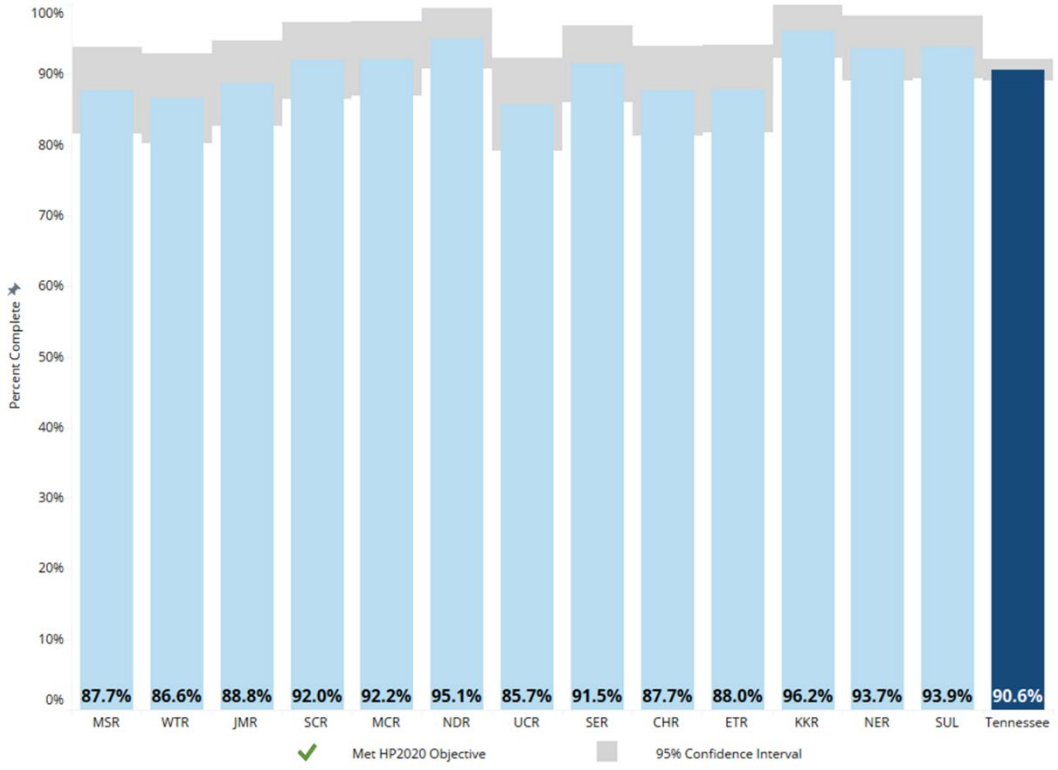


* Includes children on CDC catch-up schedule

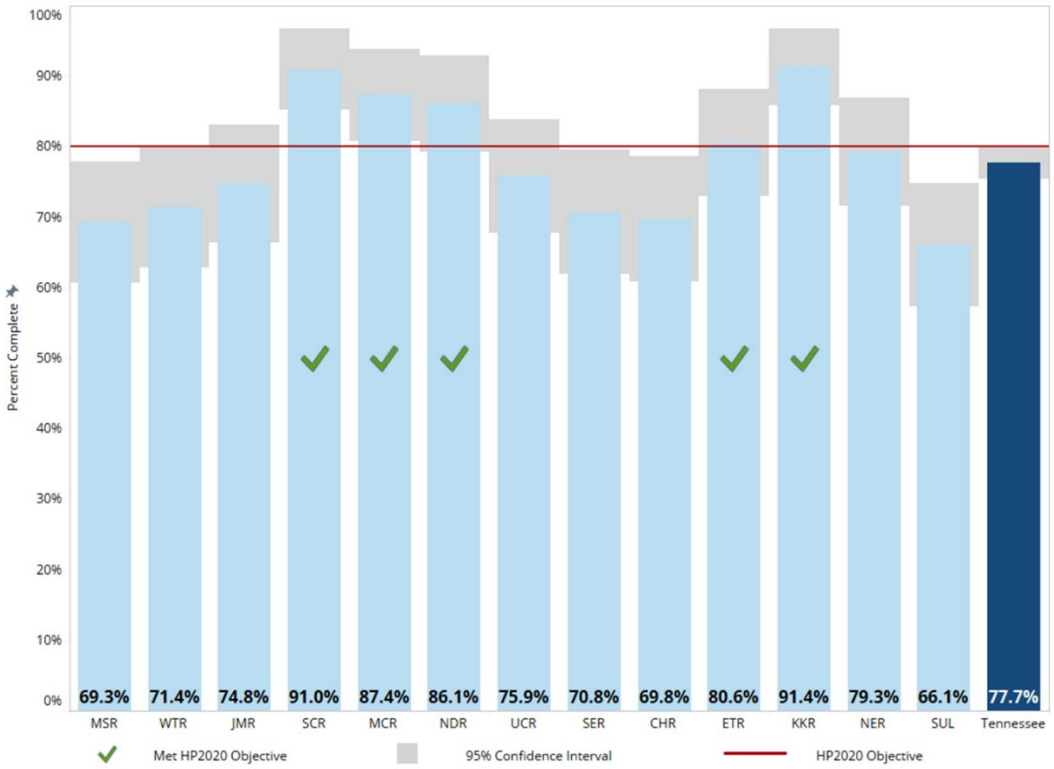
Percentage of Children with Complete 4:3:1:FS:3:1:FS Series by Health Department Region, Tennessee, 2022, n=1399



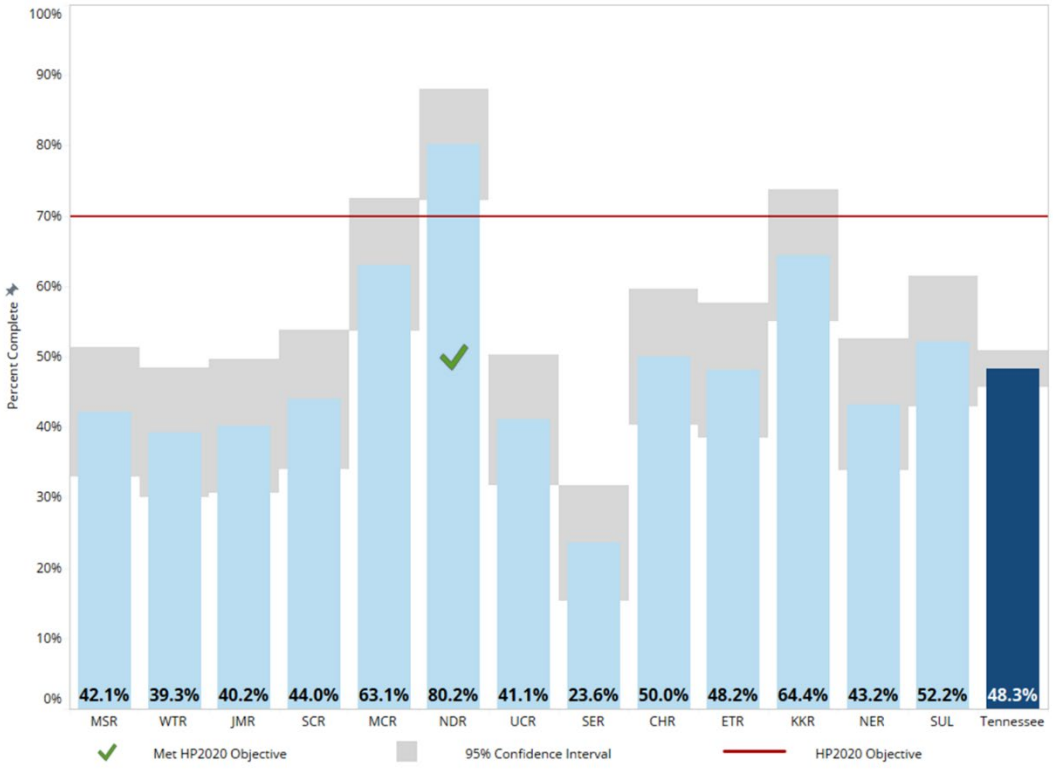
Percentage of Children with Complete Hepatitis (HAV) Series by Health Department Region, Tennessee, 2022, n=1399



Percentage of Children with Complete Rotavirus (RTV) Series by Health Department Region, Tennessee, 2022, n=1399



Percentage of Children with Complete Influenza (Flu) Series by Health Department Region, Tennessee, 2022, n=1399



Appendix II

Data Tables for Selected Analyses

2022 Series (4:3:1:FS:3:1:FS) by Region

Region	Complete	%
Memphis-Shelby County	83/114	72.8
West Tennessee Region	77/112	68.8
Jackson-Madison County	85/107	79.4
South Central Region	77/100	77.0
Mid-Cumberland Region	86/103	83.5
Nashville-Davidson County	86/101	85.2
Upper Cumberland Region	72/112	64.3
Southeast Region	76/106	71.7
Chattanooga-Hamilton County	77/106	72.6
East Tennessee Region	90/108	83.3
Knoxville-Knox County	96/104	92.3
Northeast Region	86/111	77.5
Sullivan County	87/115	75.7
Tennessee	1078/1399	77.1

Indicates value is above HP objective

2022 Series Complete (4:3:1:FS:3:1:FS) by Provider Type

Region	Health Department		Private Provider		Health Department & Private Provider	
	Complete	%	Complete	%	Complete	%
Memphis-Shelby County	-	-	82/111	73.9	1/2	50.0
West Tennessee Region	4/4	100.0	68/95	71.6	5/8	62.5
Jackson-Madison County	0/1	0.0	72/91	79.1	13/13	100.0
South Central Region	1/2	50.0	69/90	76.7	7/7	100.0
Mid-Cumberland Region	-	-	86/103	83.5	-	-
Nashville-Davidson County	0/1	0.0	81/94	86.2	1/1	100.0
Upper Cumberland Region	2/7	28.6	69/98	70.4	1/1	100.0
Southeast Region	-	-	67/92	72.8	6/8	75.0
Chattanooga-Hamilton County	0/1	0.0	76/100	76.0	1/1	100.0
East Tennessee Region	1/1	100.0	85/94	90.4	4/6	66.7
Knoxville-Knox County	-	-	93/100	93.0	3/3	100.0
Northeast Region	1/1	100.0	83/105	79.0	2/4	50.0
Sullivan County	-	-	83/109	76.1	4/5	80.0
Tennessee	9/18	50.0	1013/1288	79.0	48/59	81.4

Indicates value is above HP2020 objective

2022 Series Complete (4:3:1:FS:3:1:FS) by Race

Region	White Complete	%	Black Complete	%	Other Complete	%
Memphis-Shelby County	32/47	68.1	47/62	75.8	4/5	80.0
West Tennessee Region	59/86	68.6	17/24	70.8	1/2	50.0
Jackson-Madison County	63/75	84.0	21/31	67.7	1/1	100.0
South Central Region	70/90	77.8	6/9	66.7	1/1	100.0
Mid-Cumberland Region	69/84	82.1	12/14	85.7	5/5	100.0
Nashville-Davidson County	6880	85.0	16/18	88.9	2/3	50.0
Upper Cumberland Region	70/108	64.8	0/2	0.0	2/2	100.0
Southeast Region	70/97	72.2	4/6	66.7	2/3	66.7
Chattanooga-Hamilton County	67/87	77.0	9/16	56.3	1/3	33.3
East Tennessee Region	84/101	83.2	2/2	100.0	4/5	80.0
Knoxville-Knox County	86/94	91.5	7/7	100.0	3/3	100.0
Northeast Region	82/107	76.6	3/3	100.0	1/1	100.0
Sullivan County	84/111	75.7	1/2	50.0	1/2	50.0
Tennessee	904/1167	77.5	146/196	74.5	28/36	77.8

Indicates value is above HP objective.

2022 Series Complete (4:3:1:FS:3:1:FS) by Number of Older Siblings

Region	0 Siblings Complete	%	1 Sibling Complete	%	2+ Siblings Complete	%
Memphis-Shelby County	39/48	81.3	31/43	72.1	13/23	56.5
West Tennessee Region	30/39	76.9	28/37	75.7	19/36	52.8
Jackson-Madison County	37/41	90.2	27/31	87.1	21/35	60.0
South Central Region	35/40	87.5	30/41	73.2	12/19	63.2
Mid-Cumberland Region	38/45	84.4	32/38	84.2	16/20	80.0
Nashville-Davidson County	45/49	91.8	26/29	89.7	15/23	65.2
Upper Cumberland Region	26/37	70.3	22/35	62.9	24/40	60.0
Southeast Region	30/35	85.7	22/28	78.6	24/43	55.8
Chattanooga-Hamilton County	34/43	79.1	22/31	71.0	21/32	65.6
East Tennessee Region	42/49	85.7	33/35	94.3	15/24	62.5
Knoxville-Knox County	47/51	92.2	34/35	97.1	15/18	83.3
Northeast Region	41/46	89.1	27/39	69.2	18/26	69.2
Sullivan County	36/43	83.7	32/46	69.6	19/26	73.1
Tennessee	480/566	84.8	366/468	78.2	232/365	63.6

Indicates value is above HP objective

2022 Series Complete (4:3:1:FS:3:1:FS) by TennCare Enrollment Only

Region	Enrolled		Not Enrolled	
	Complete	%	Complete	%
Memphis-Shelby County	5/8	62.5	78/106	73.6
West TN	-	-	77/112	68.8
Madison County	7/11	63.6	78/96	81.3
South Central	12/17	70.6	65/83	78.3
Mid-Cumberland	-	-	86/103	83.5
Davidson County	1/2	50.0	85/99	85.9
Upper Cumberland	1/1	100.0	71/111	64.0
Southeast TN	0/2	0.0	76/104	73.1
Chattanooga-Hamilton County	17/25	68.0	60/81	74.1
East TN	4/5	80.0	86/103	83.5
Knox County	41/44	93.2	55/60	91.7
Northeast TN	6/8	75.0	80/103	77.7
Sullivan County	3/3	100.0	84/112	75.0
Total	97/126	77.0	981/1273	77.1

Indicates value is above HP objective

2022 Series Complete (4:3:1:FS:3:1:FS) by WIC Enrollment Only

Region	Enrolled		Not Enrolled	
	Complete	%	Complete	%
Memphis-Shelby County	6/11	54.5	77/103	74.8
West TN	15/22	68.2	62/90	68.9
Madison County	2/2	100.0	83/105	79.0
South Central	8/10	80.0	69/90	76.7
Mid-Cumberland	25/31	80.6	61/72	84.7
Davidson County	2/3	66.7	84/98	85.7
Upper Cumberland	26/43	60.5	46/69	66.7
Southeast TN	36/50	72.0	40/56	71.4
Chattanooga-Hamilton County	3/5	60.0	74/101	73.3
East TN	12/16	75.0	78/92	84.8
Knox County	-	-	96/104	92.3
Northeast TN	8/9	88.9	78/102	76.5
Sullivan County	13/22	59.1	74/93	79.6
Total	156/224	69.6	922/1175	78.5

Indicates value is above HP objective

Appendix III

Regional One Page Summaries

TN Department of Health

Memphis-Shelby County Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of MSR and Tennessee UTD Rate by Vaccine, 2022

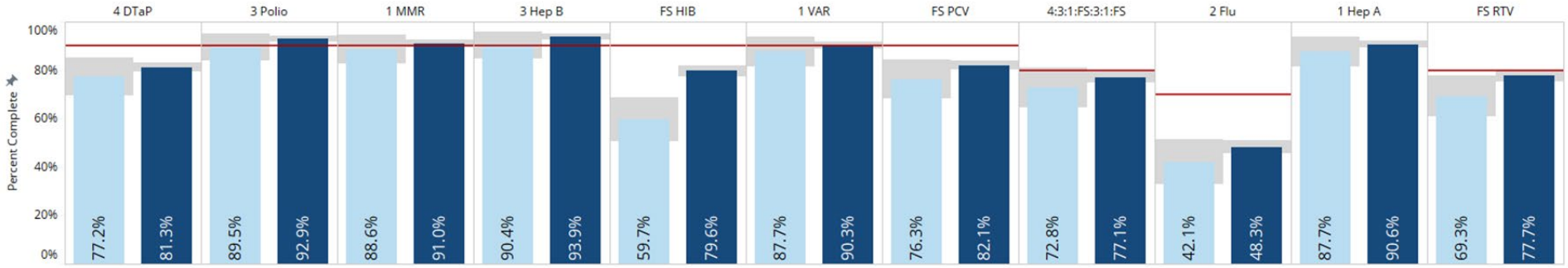


Figure B. MSR Attainment of HP2020 Objectives, by Vaccine, 2022

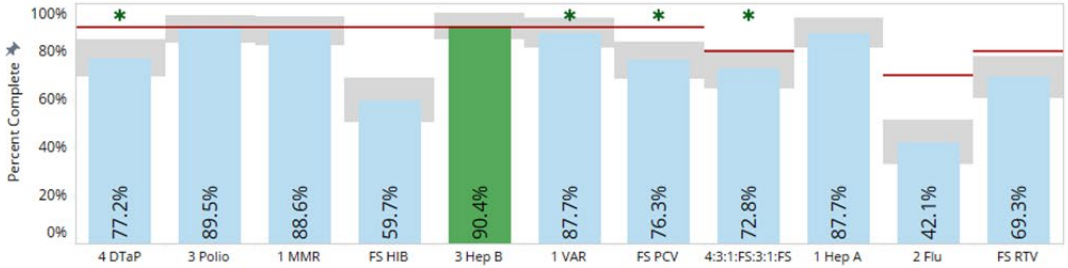
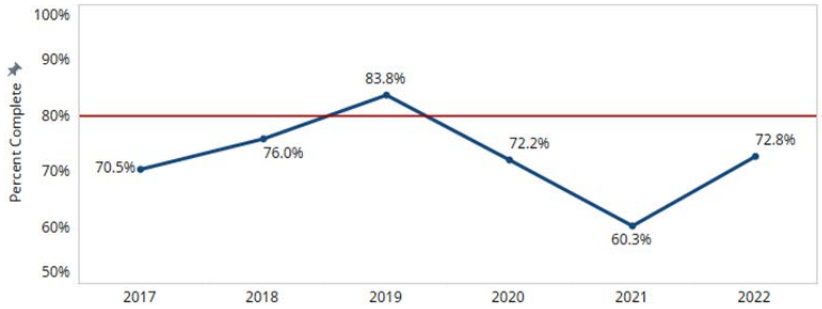


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, MSR, 2017-2022



Legend

Figure A
- Memphis-Shelby County Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Lower than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

West Tennessee Region

24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of WTR and Tennessee UTD Rate by Vaccine, 2022

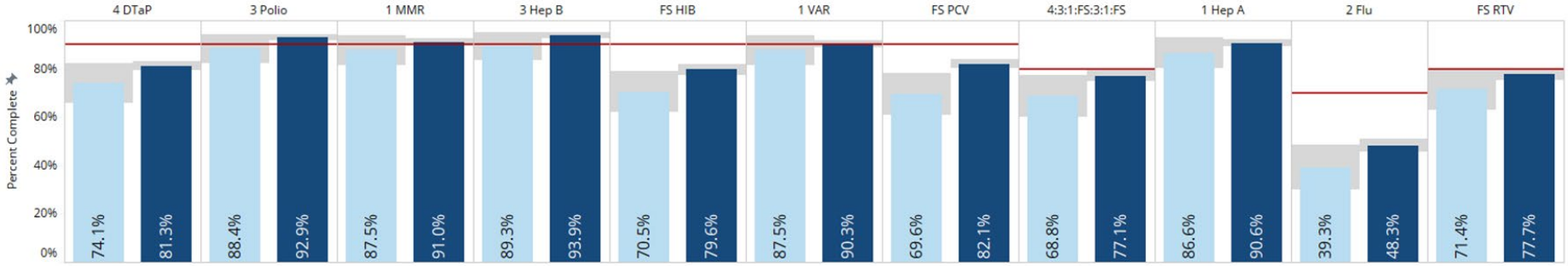


Figure B. WTR Attainment of HP2020 Objectives, by Vaccine, 2022

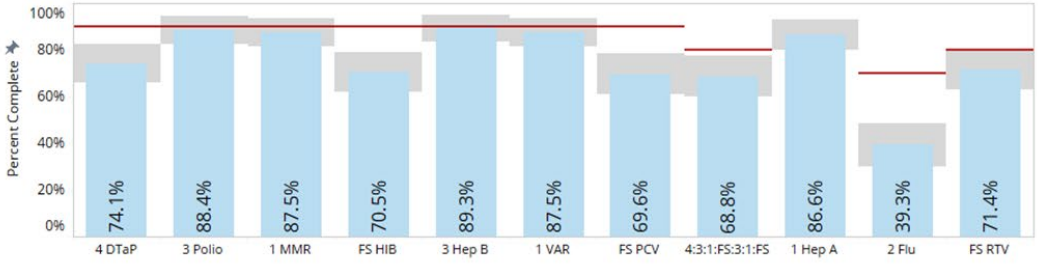
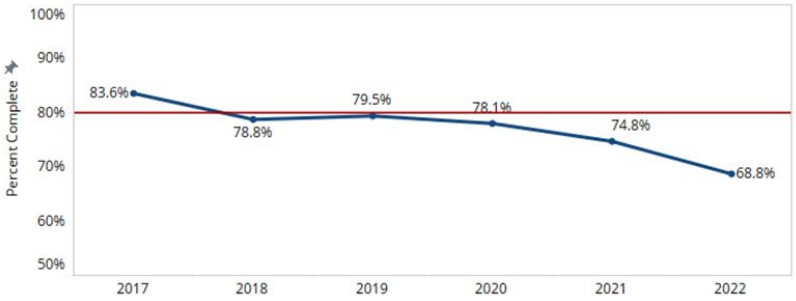


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, WTR, 2017-2022



Legend

Figure A

- West Tennessee Region
- Tennessee
- HP2020 Objective

Figure B

- Met HP2020 Objective
- 95% Confidence Interval
- HP2020 Objective

Figure C

- HP2020 Objective

TN Department of Health

Jackson-Madison County Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of JMR and Tennessee UTD Rate by Vaccine, 2022

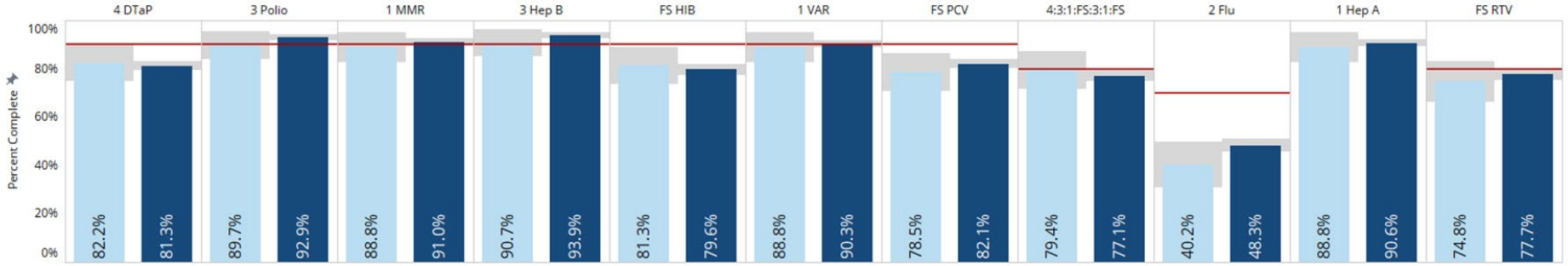


Figure B. JMR Attainment of HP2020 Objectives, by Vaccine, 2022

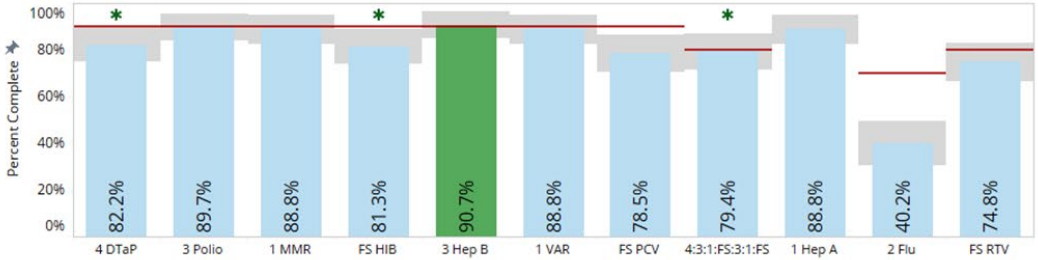
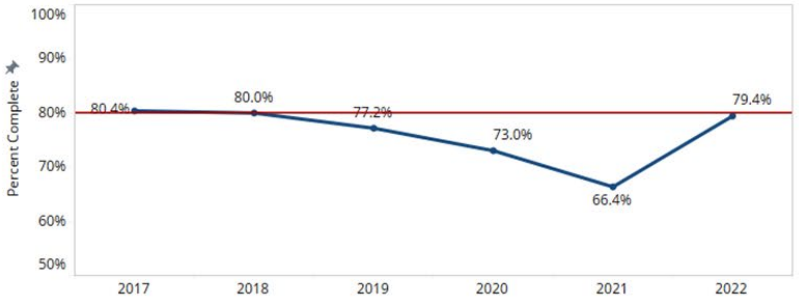


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, JMR, 2017-2022



Legend

Figure A
- Jackson-Madison County Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Higher than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

South Central Region

24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of SCR and Tennessee UTD Rate by Vaccine, 2022

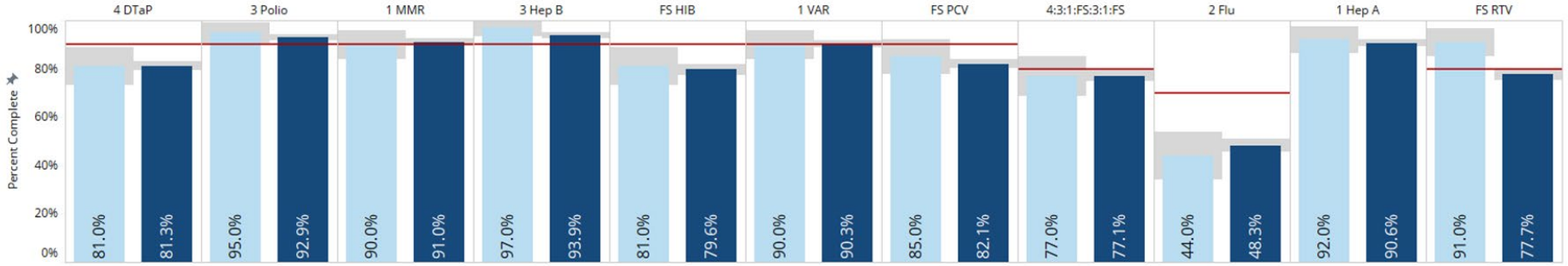


Figure B. SCR Attainment of HP2020 Objectives, by Vaccine, 2022

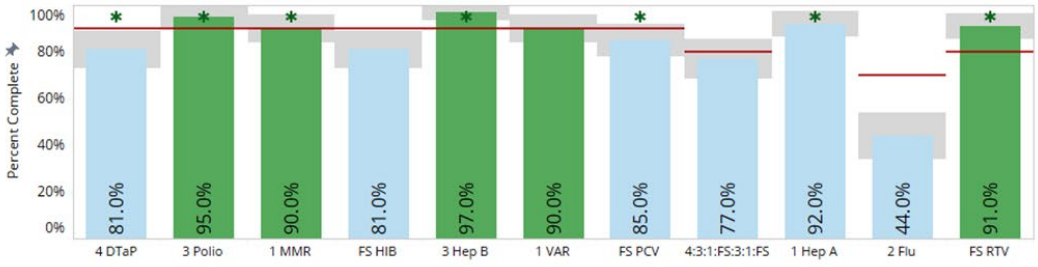
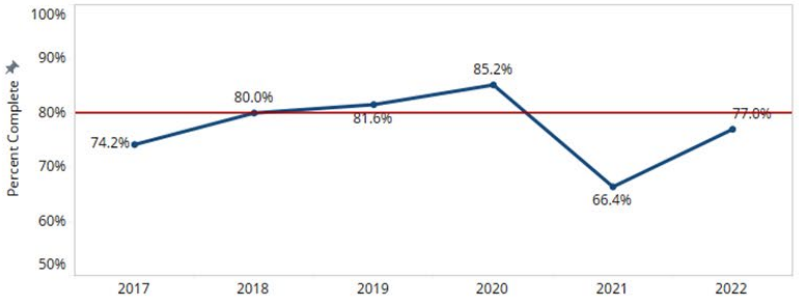


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, SCR, 2017-2022



Legend

Figure A

- South Central Region
- Tennessee
- HP2020 Objective

Figure B

- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Higher than Previous Year
- HP2020 Objective

Figure C

- HP2020 Objective

TN Department of Health

Mid-Cumberland Region

24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of MCR and Tennessee UTD Rate by Vaccine, 2022

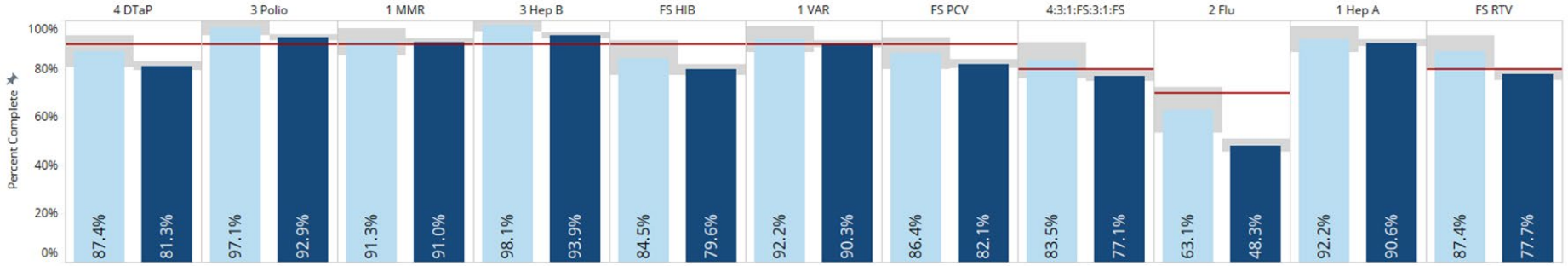


Figure B. MCR Attainment of HP2020 Objectives, by Vaccine, 2022

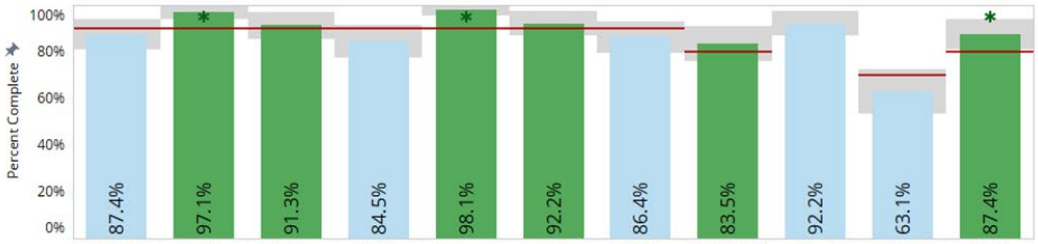
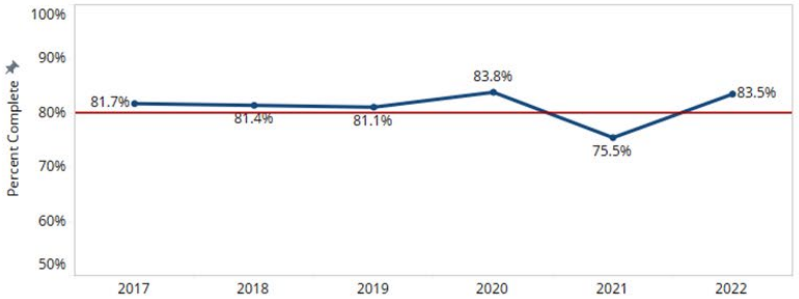


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, MCR, 2017-2022



Legend

Figure A

- Mid-Cumberland Region
- Tennessee
- HP2020 Objective

Figure B

- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Higher than Previous Year
- HP2020 Objective

Figure C

- HP2020 Objective

TN Department of Health

Nashville-Davidson County Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of NDR and Tennessee UTD Rate by Vaccine, 2022

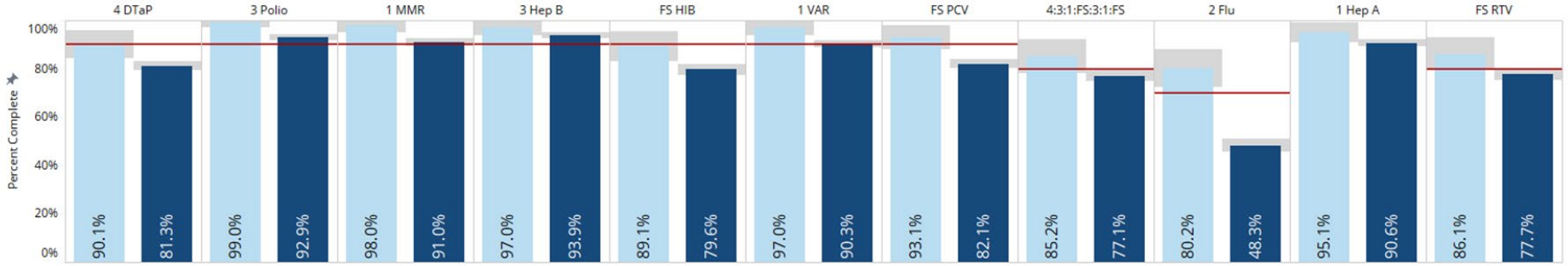


Figure B. NDR Attainment of HP2020 Objectives, by Vaccine, 2022

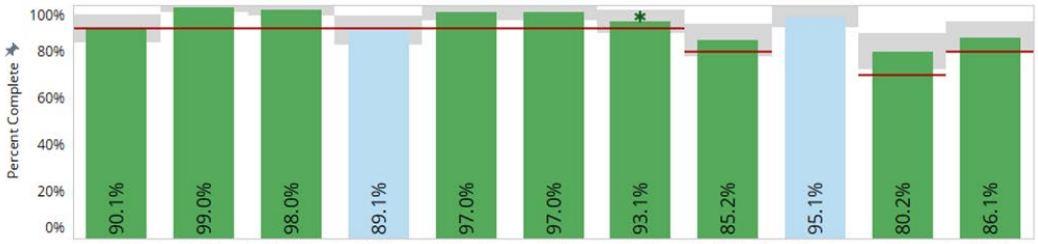
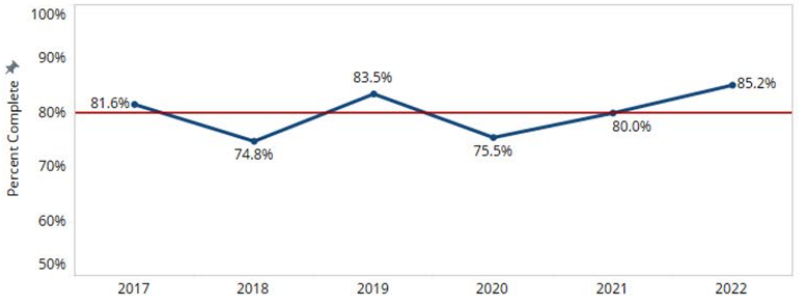


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, NDR, 2017-2022



Legend

Figure A
- Nashville-Davidson County Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Higher than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

Upper-Cumberland Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of UCR and Tennessee UTD Rate by Vaccine, 2022

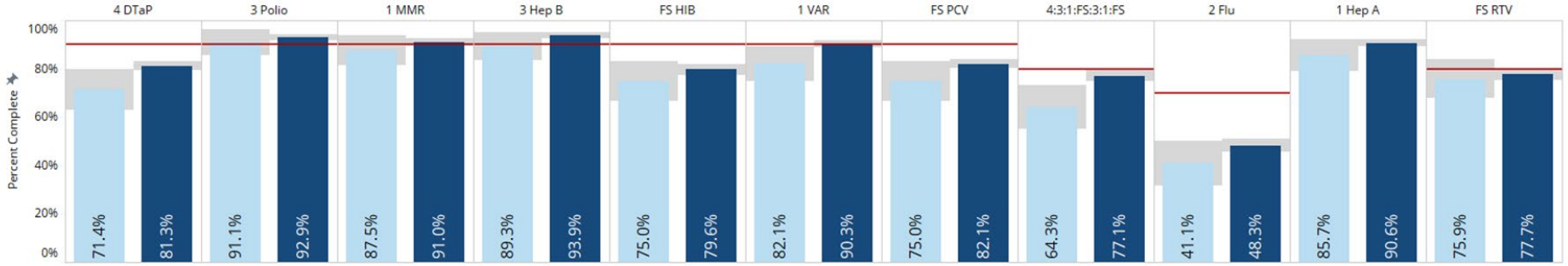


Figure B. UCR Attainment of HP2020 Objectives, by Vaccine, 2022

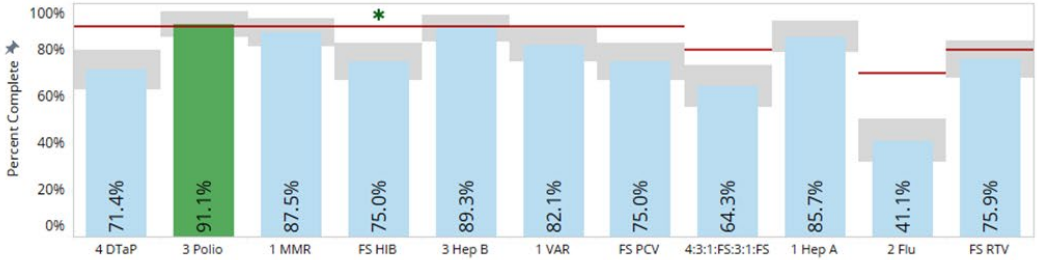
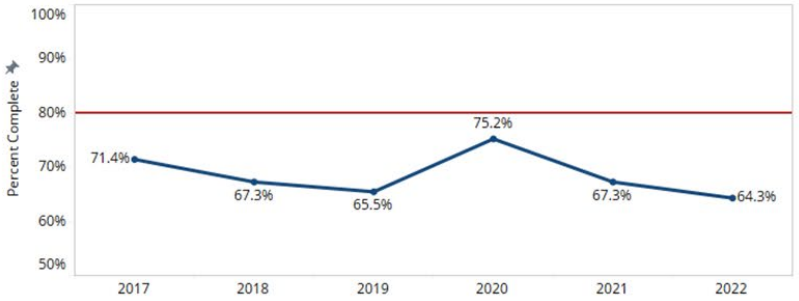


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, UCR, 2017-2022



Legend

Figure A
- Upper-Cumberland Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Higher than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

Southeast Region

24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of SER and Tennessee UTD Rate by Vaccine, 2022

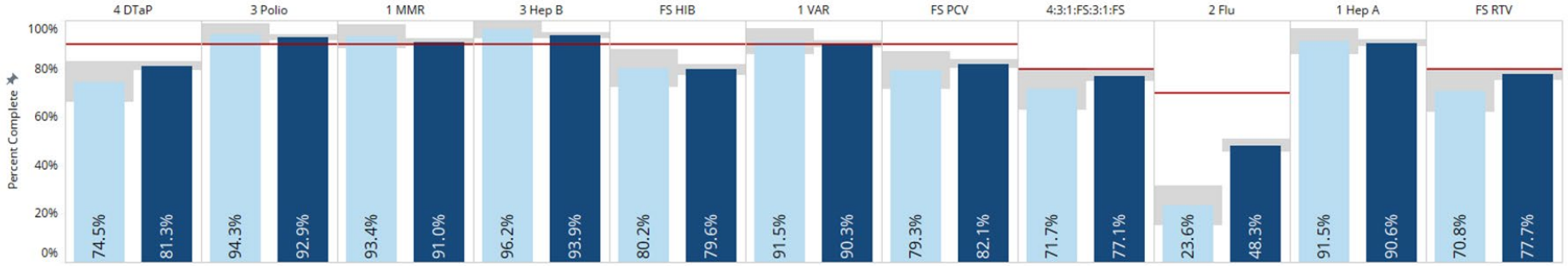


Figure B. SER Attainment of HP2020 Objectives, by Vaccine, 2022

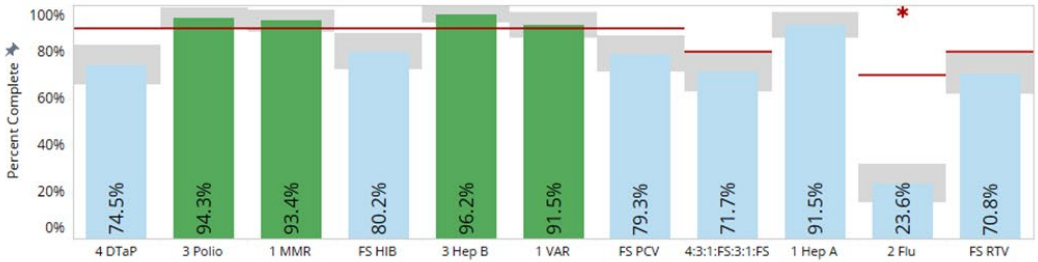
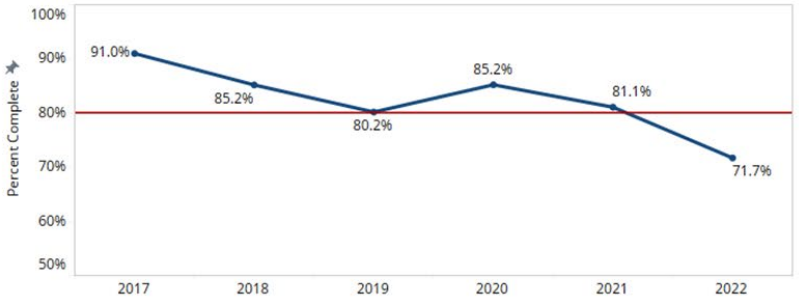


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, SER, 2017-2022



Legend

Figure A

- Southeast Region
- Tennessee
- HP2020 Objective

Figure B

- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Lower than Previous Year
- HP2020 Objective

Figure C

- HP2020 Objective

TN Department of Health

Chattanooga-Hamilton County Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of CHR and Tennessee UTD Rate by Vaccine, 2022

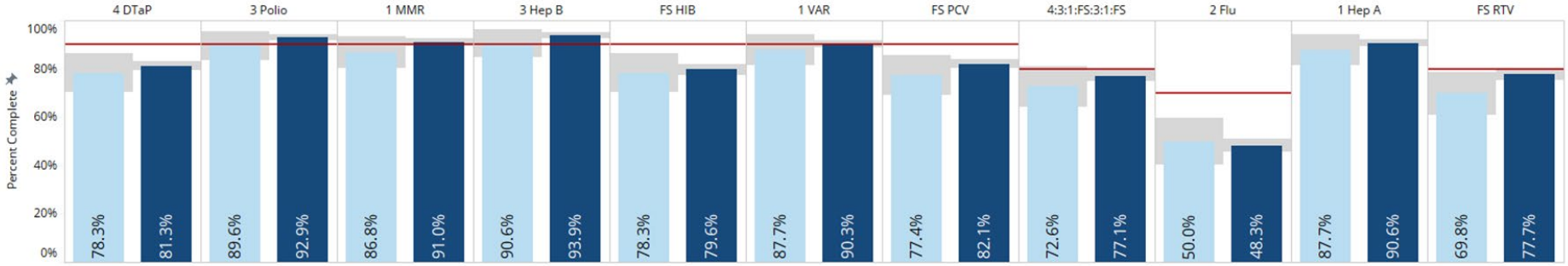


Figure B. CHR Attainment of HP2020 Objectives, by Vaccine, 2022

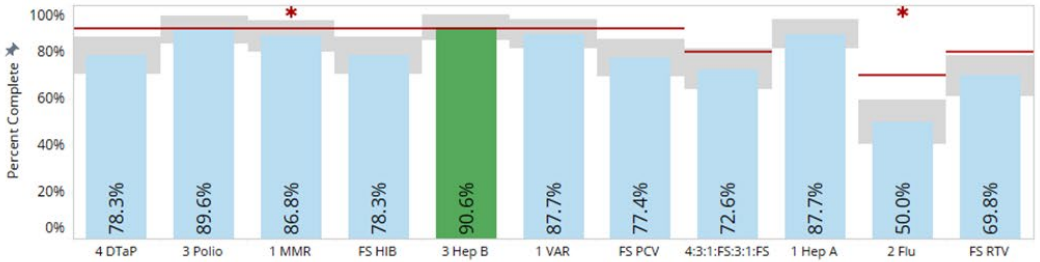
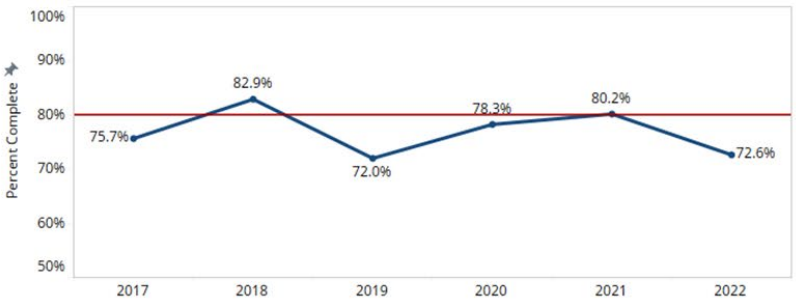


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, CHR, 2017-2022



Legend

Figure A
- Chattanooga-Hamilton County Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Lower than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

East Tennessee Region

24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of ETR and Tennessee UTD Rate by Vaccine, 2022

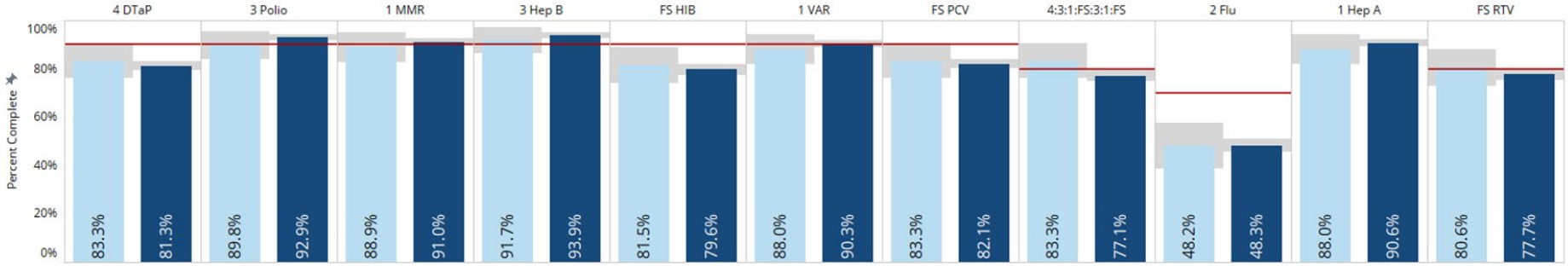


Figure B. ETR Attainment of HP2020 Objectives, by Vaccine, 2022

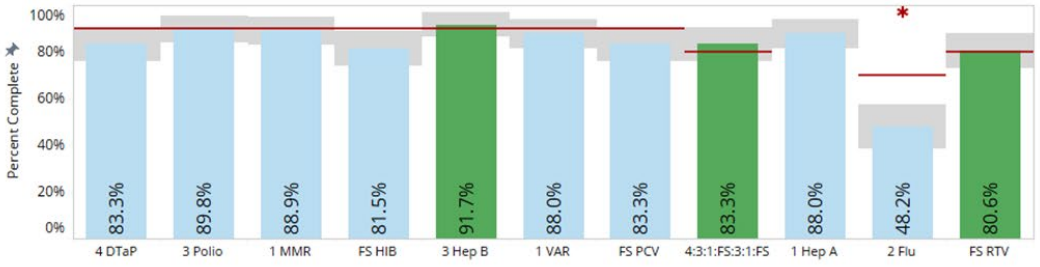
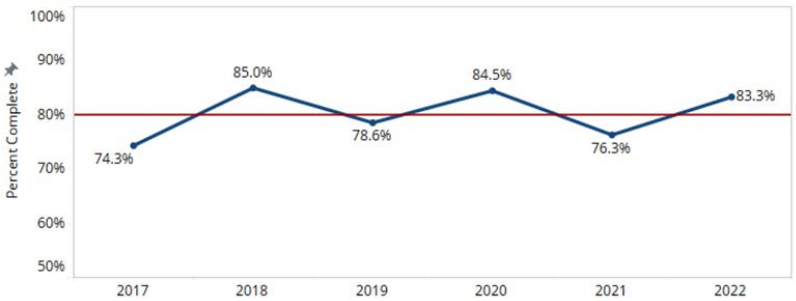


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, ETR, 2017-2022



Legend

Figure A

- East Tennessee Region
- Tennessee
- HP2020 Objective

Figure B

- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Lower than Previous Year
- HP2020 Objective

Figure C

- HP2020 Objective

TN Department of Health

Knoxville-Knox County Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of KKR and Tennessee UTD Rate by Vaccine, 2022

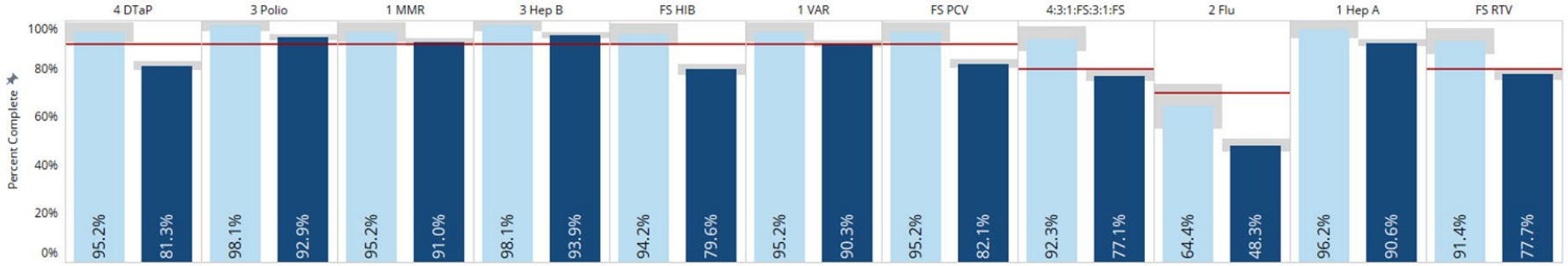


Figure B. KKR Attainment of HP2020 Objectives, by Vaccine, 2022

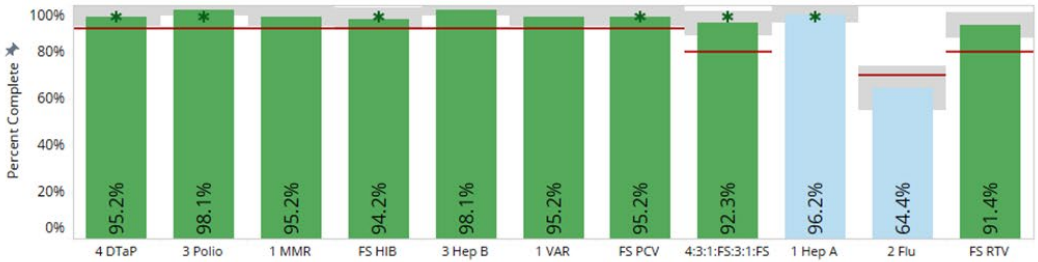
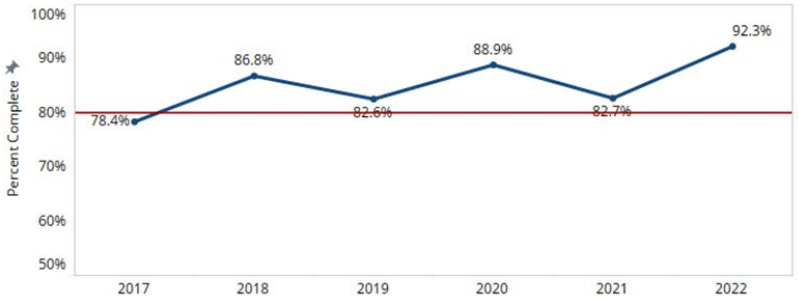


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, KKR, 2017-2022



Legend

Figure A
- Knoxville-Knox County Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Higher than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

Northeast Region
24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of NER and Tennessee UTD Rate by Vaccine, 2022

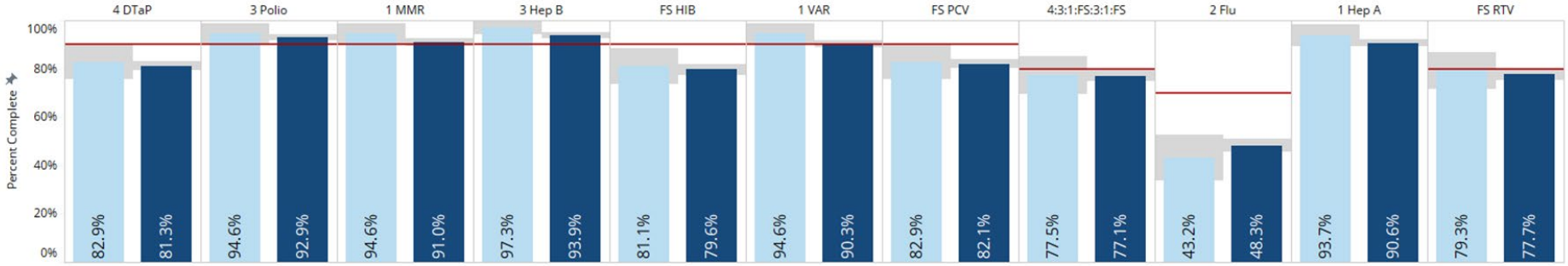


Figure B. NER Attainment of HP2020 Objectives, by Vaccine, 2022

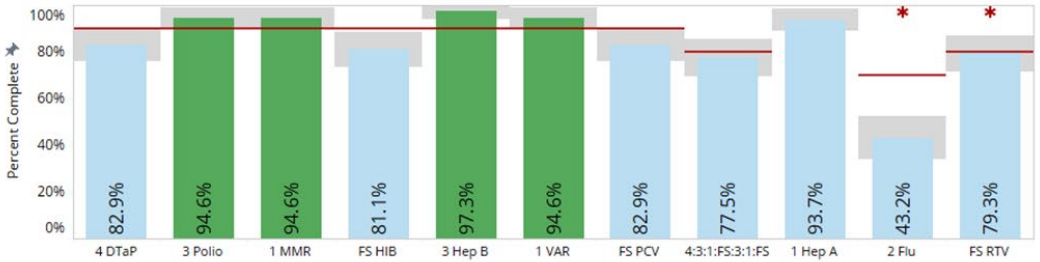
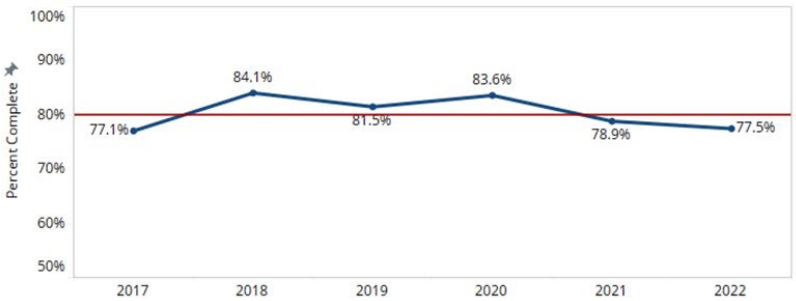


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, NER, 2017-2022



Legend

Figure A
- Northeast Region
- Tennessee
- HP2020 Objective

Figure B
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Lower than Previous Year
- HP2020 Objective

Figure C
- HP2020 Objective

TN Department of Health

Sullivan County Region

24-Month-Old Immunization Status Survey, 2022

Figure A. Comparison of SUL and Tennessee UTD Rate by Vaccine, 2022

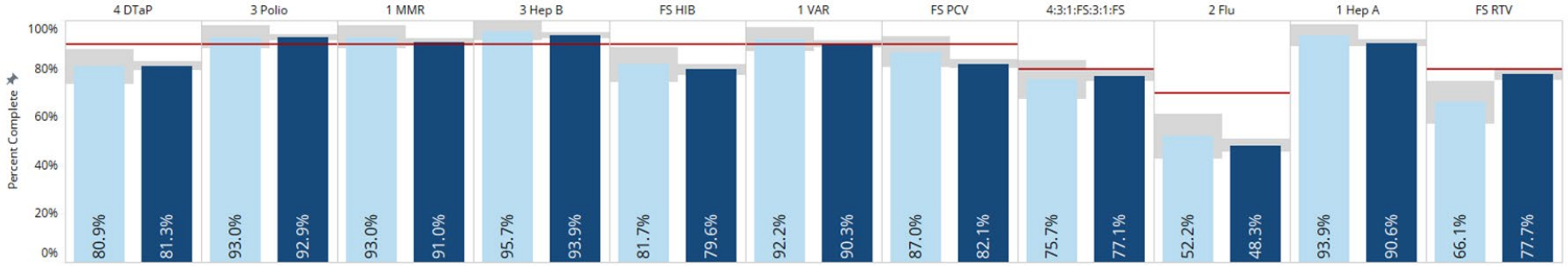


Figure B. SUL Attainment of HP2020 Objectives, by Vaccine, 2022

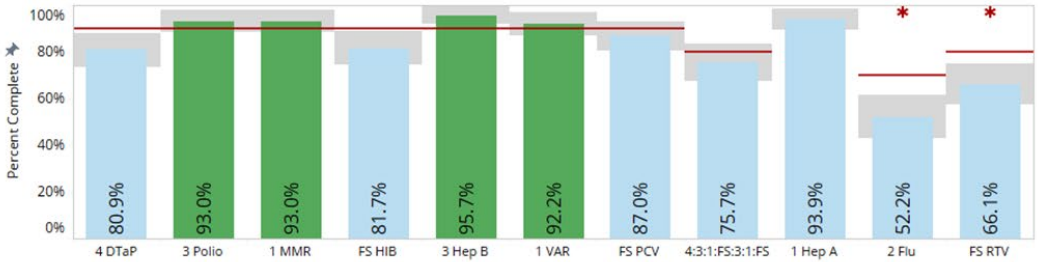
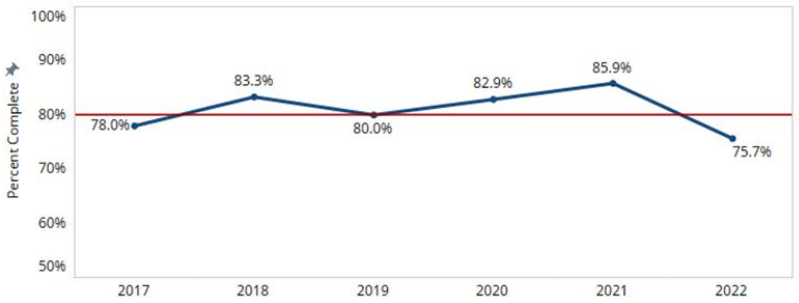


Figure C. 4:3:1:FS:3:1:FS Immunization Rate Trend, SUL, 2017-2022



Legend

Figure A

- Sullivan County Region
- Tennessee
- HP2020 Objective

Figure B

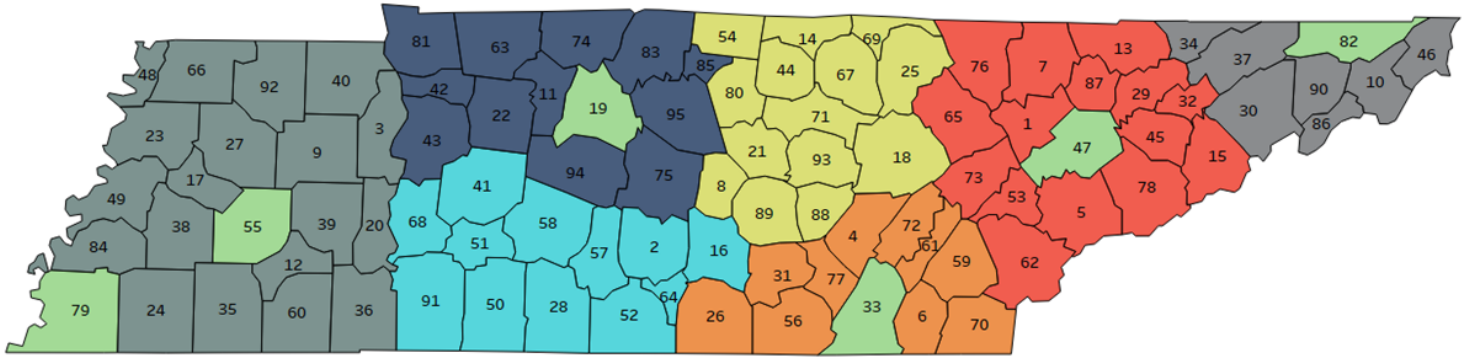
- Met HP2020 Objective
- 95% Confidence Interval
- Statistically Significantly Lower than Previous Year
- HP2020 Objective

Figure C

- HP2020 Objective

Appendix IV

TENNESSEE DEPARTMENT OF HEALTH REGIONAL/METRO HEALTH OFFICES



West	
County	#
Benton	3
Carroll	9
Chester	12
Crockett	17
Decatur	20
Dyer	23
Fayette	24
Gibson	27
Hardeman	35
Hardin	36
Haywood	38
Henderson	39
Henry	40
Lake	48
Lauderdale	49
McNairy	60
Obion	66
Tipton	84
Weakley	92

Mid Cumberland	
County	#
Cheatham	11
Dickson	22
Houston	42
Humphreys	43
Montgomery	63
Robertson	74
Rutherford	75
Stewart	81
Sumner	83
Trousdale	85
Williamson	94
Wilson	95

South Central	
County	#
Bedford	2
Coffee	16
Giles	28
Hickman	41
Lawrence	50
Lewis	51
Lincoln	52
Marshall	57
Maury	58
Moore	64
Perry	68
Wayne	91

Southeast	
County	#
Bledsoe	4
Bradley	6
Franklin	26
Grundy	31
Marion	56
McMinn	59
Meigs	61
Polk	70
Rhea	72
Sequatchie	77

Upper Cumberland	
County	#
Cannon	8
Clay	14
Cumberland	18
DeKalb	21
Fentress	25
Jackson	44
Macon	54
Overton	67
Pickett	69
Putnam	71
Smith	80
Van Buren	88
Warren	89
White	93

East	
County	#
Anderson	1
Blount	5
Campbell	7
Claiborne	13
Cocke	15
Grainger	29
Hamblen	32
Jefferson	45
Loudon	53
Monroe	62
Morgan	65
Roane	73
Scott	76
Sevier	78
Union	87

Northeast	
County	#
Carter	10
Greene	30
Hancock	34
Hawkins	37
Johnson	46
Unicoi	86
Washington	90

Metros	
County	#
Davidson	19
Hamilton	33
Knox	47
Madison	55
Sullivan	82

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February 2023