

# **Results of the 2013 Immunization Status Survey of 24-Month-Old Children in Tennessee**

**Prepared by the  
Tennessee Immunization Program  
Tennessee Department of Health  
<http://health.state.tn.us/CEDS/immunization.htm>  
Phone: 615-741-7247  
December 2013**

## **Acknowledgements**

Birth data were provided by the Tennessee Department of Health, Division of Policy, Planning and Assessment, Office of Health 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 Immunization Program.

# Table of Contents

	Page
<b>Executive Summary</b>	<b>... 4</b>
<b>Definitions of Abbreviations in Charts</b>	<b>... 6</b>
<b>General Information and Results</b>	<b>... 7</b>
Figure 1. Statewide percentage of children with age-appropriate immunization levels by vaccine	... 10
Figure 2. Percentage of children with on-time 4:3:1:3:3:1:4 immunization by region	... 11
Figure 3. Statewide percentage of age-appropriate vaccinations by vaccine, 2012 and 2013	... 12
Figure 4. 4:3:1:3:3:1:4 and 4:3:1:3:3:1 Immunization Level Trends: Tennessee 2000 to 2013	... 12
Figure 5a. Percentage of children with birth dose of hepatitis B vaccine by third day of life by region	... 13
Figure 5b. Percentage of children with birth dose of hepatitis B vaccine, 2012 and 2013	... 14
Figure 6. Statewide percentage of children with age-appropriate immunization levels by vaccine and race	... 15
Table 1. 4:3:1:3:3:1:4 Completion Levels of 24-Month-Old Children: Selected Characteristics	... 16
Figure 7. Source of Immunizations from 2000 to 2013	... 17
Table 2. Prevalence of risk factors for delayed immunizations by provider type	... 17
Summary of Key Findings and Next Steps	... 18
<b>Appendix 1</b>	
Details of Regional Samples (oversampled, vaccine refusal, child not located)	... 20
<b>Appendix 2: Vaccine Series and Individual Vaccine Charts</b>	<b>... 21</b>
On-time 4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series	... 22
DTaP (4-dose and 3-dose coverage)	... 23
<i>Haemophilus influenzae</i> type b & Hepatitis A (1-dose coverage)	... 24
Hepatitis A (2-dose coverage) & Hepatitis B	... 25
Influenza (2-dose and 3-dose coverage)	... 26
MMR & Pneumococcus (4-dose coverage)	... 27
Pneumococcus (PCV) (4-dose vs. 3-dose coverage) & Polio	... 28
Rotavirus & Varicella	... 29
<b>Appendix 3: Individual Health Department Region Charts (West→East)</b>	<b>... 30</b>
Shelby County	... 31
West Tennessee Region	... 31
Jackson-Madison County	... 32
South Central Region	... 32
Mid-Cumberland Region	... 33
Nashville-Davidson County	... 33
Upper Cumberland Region	... 34
Southeast Region	... 34
Hamilton County	... 35
East Tennessee Region	... 35
Knoxville-Knox County	... 36
Northeast Region	... 36
Sullivan County	... 37
<b>Appendix 4: Additional Statewide Charts for Specific Groups</b>	<b>... 38</b>
Immunization levels by vaccine and TennCare enrollment status	... 39
Immunization levels by vaccine and WIC enrollment status	... 39
Trends in on-time immunization coverage disparities (black vs. white) for 2010-2013	... 40
<b>Appendix 5: Data Tables for Selected Analyses</b>	<b>... 41</b>
Series Complete (4:3:1:3:3:1:4)	... 42
Series Complete (4:3:1:3:3:1:4) by Provider Type	... 42
Series Complete (4:3:1:3:3:1:4) by Race	... 43
Series Complete (4:3:1:3:3:1:4) by Number of Older Siblings	... 43
Series Complete (4:3:1:3:3:1:4) by TennCare Enrollment	... 44
<b>Appendix 6: Regional Health Department Map</b>	<b>... 45</b>

## Executive Summary

An annual survey of the on-time immunization status of 24 month old children is conducted by the Tennessee Department of Health (TDH) Immunization Program (TIP) to track progress toward achieving the national Healthy People (HP) 2020 objectives for immunization coverage with routinely recommended early childhood vaccines. Healthy People (HP) 2020 is a national framework established by the Department of Health and Human Services (HHS) for meeting health goals by the year 2020. This survey assesses the status of children as of their second birthday. For best results, vaccines need to be administered on time, as recommended by pediatricians and the Centers for Disease Control and Prevention (CDC).

### Value of vaccination:

A recent article in the New England Journal of Medicine estimates that vaccination has prevented 24 million cases of disease in the United States in the past decade.<sup>1</sup> Economic analysis by the CDC calculates that vaccination of U.S.-born children born in the U.S. each year with the current childhood immunization schedule yields a net savings of nearly \$14 billion in direct costs and \$69 billion in total costs to society.<sup>2</sup> Tennessee represents roughly 2 percent of the U.S. population, suggesting vaccines have *prevented* about 480,000 cases of disease in Tennessee in the past 10 years, with an *annual savings* of \$280 million in direct medical costs and \$1.38 billion in total costs to society. The federal Vaccines for Children Program (VFC) makes available federally-purchased vaccines to eligible children at no cost to the family or the State. Just below 50% of Tennessee children younger than 19 years of age are eligible.

### Methods:

A random sample of 1,591 children was selected from birth certificates of children born in 2011 in each of six metropolitan counties and in the 7 rural multi-county TDH regions. Children were excluded if they had moved out of state, if their birth record were sealed, or if the parents refused to participate: 1,486 children participated. Immunization rates are provided statewide, for the 6 major metropolitan counties and for rural multi-county regions. County rates within rural regions are not calculated because of the small number of children sampled. Local or state public health staff located each child and confirmed immunization histories with parents and healthcare providers.

### Results:

Tennessee's (TN) measurement against national Health People (HP) 2020 objectives for this age group:

Diseases	Healthy People 2020 Objective (19-35 months)	TN 2013 (24 months)
Diphtheria, Tetanus, Pertussis	90%	82.3%
Poliomyelitis	<b>90%</b>	<b>94.3%</b>
Measles, Mumps, Rubella	<b>90%</b>	<b>91.0%</b>
Hepatitis B	<b>90%</b>	<b>93.7%</b>
	85%	80.0%
<i>Haemophilus influenzae</i> , type B	<b>90%</b>	<b>94.1%</b>
Varicella (Chickenpox)	<b>90%</b>	<b>90.7%</b>
Pneumococcus	90%	82.8%
All of above	80%	75.4%
Hepatitis A	60% complete	1 dose: 89.3%

Influenza	70%	46.5%
Rotavirus	<b>80%</b>	<b>83.4%</b>

### Other Key Findings:

- The use of a routine birth dose of hepatitis B vaccine improved significantly for the second year, to 80%, up from 73.5% in 2011. At this pace, the HP 2020 target is achievable in 2014.
- Twenty-eight (28) of 1,489 children surveyed (1.9%) had not been vaccinated for religious or other personal reasons. No children were unvaccinated for medical reasons.
- A significant racial disparity persists in the use of influenza vaccine. Overall influenza vaccination rates are low, but the racial gap between white and black children is large (49.3% vs. 33.6%).
- Children enrolled in TennCare or Women, Infants and Children programs (WIC) were immunized at the same or higher rates as other children for the vaccines in the routine 4:3:1:3:3:1:4 series. These children had lower rates of vaccination against influenza.

### Key action steps:

- In 2014, TDH and partners will begin implementing a new, federally-funded immunization registry which will support immunization providers in ways that are unavailable in the legacy system it replaces. The new system will meet all national standards, including features to tell a caregiver exactly what vaccines a child needs at a medical visit and tools that help the clinic produce patient reminders. Such tools are proven in other states to improve immunization rates.
- TDH is working with partners to help immunization providers establish electronic reporting of immunizations from electronic health record systems into the state immunization registry, in order to preserve patient records from loss and improve the quality of patient care by preventing unnecessary vaccinations and missed opportunities to vaccinate children in need.
- Local health department staff will continue to receive monthly reports to assist them in following up on their young patients who are behind on vaccines.
- TIP staff will continue to work with a network of other public health and private health care providers to educate Tennesseans about the importance of timely vaccination and the particular need to improve influenza vaccination among all children.

<sup>1</sup> van Panhuis, et al. Contagious Diseases in the United States from 1888 to Present. New England Journal of Medicine. 369(22);2152-2158.

<sup>2</sup>CDC. Ten Great Public Health Achievements – United States 2001—2011. Morbidity and Mortality Weekly Report. 60(19);619-623.

## **Definitions of Abbreviations in Charts**

### **1. Vaccines**

- a. DTaP: diphtheria, tetanus, acellular pertussis**
- b. IPV: inactivated polio vaccine**
- c. HAV: hepatitis A vaccine**
- d. HBV: hepatitis B vaccine**
- e. HIB: *Haemophilus influenzae*, type B vaccine**
- f. MMR: measles, mumps, rubella**
- g. VAR: varicella (chickenpox) vaccine**
- h. PCV: pneumococcal conjugate vaccine**
- i. FLU: influenza vaccine**
- j. HAV: hepatitis A vaccine**
- k. RTV: rotavirus vaccine**

### **2. Public Health Regions**

- a. Rural, multi-county regions**
  - i. NER: Northeast Region**
  - ii. ETR: East Tennessee Region**
  - iii. SER: Southeast Region**
  - iv. UCR: Upper Cumberland Region**
  - v. SCR: South Central Region**
  - vi. MCR: Mid-Cumberland Region**
  - vii. WTR: West Tennessee Region**
- b. Metropolitan, single county regions**
  - i. SUL: Sullivan County**
  - ii. KKR: Knoxville-Knox County**
  - iii. HAM: Hamilton County (Chattanooga area)**
  - iv. NDR: Nashville-Davidson County**
  - v. JMR: Jackson-Madison County**
  - vi. SBY: Shelby County (Memphis area)**

# Results of the 2013 Immunization Status Survey

## Of 24-Month-Old Children in Tennessee

### **General:**

An annual survey of the immunization status of 24 month old children is conducted by the Tennessee Department of Health (TDH) Immunization Program (TIP) to track progress toward achieving at least 90% on-time immunization with each routinely recommended vaccine for that population. The survey is composed of random, statistically-valid samples drawn from birth certificates of infants born in each of the 13 health department regions. Regional samples are aggregated to give statewide statistics on immunization coverage levels in Tennessee.

### ***Introduction:***

This survey assesses the immunization status of Tennessee's young children for each of 10 vaccines, protecting against the following 14 diseases: diphtheria, tetanus, pertussis, (combined as DTaP); poliomyelitis (IPV); measles, mumps, rubella (combined as MMR); *Haemophilus influenzae* type B (HIB); hepatitis B (HBV); varicella (VAR); certain strains of pneumococcus (PCV); hepatitis A (HAV); rotavirus (RTV) and influenza (FLU).

This survey uses the same vaccine series definitions for its population as the Centers for Disease Control and Prevention (CDC) National Immunization Survey (NIS), which assesses 19-35 month old children. Beginning in 2010, the CDC added complete PCV vaccination (4 doses) to the aggregate immunization coverage rate it reports from the NIS. Thus, complete immunization in the 2013 survey is defined as having received four doses of DTaP, three doses of IPV, one dose of MMR, three doses of HIB, three doses of HBV, one dose of VAR and four doses of PCV (abbreviated hereafter as the **4:3:1:3:3:1:4** series). Tennessee surveys conducted from 2002-2009 reported coverage rates for the **4:3:1:3:3:1** series, excluding PCV.

Recommended vaccines not included in the 4:3:1:3:3:1:4 series are reported individually. Of note:

- Influenza vaccine (FLU) is considered complete with 2 or more doses.
- Hepatitis A vaccine (HAV) is complete with 2 doses; however, the recommended dose spacing of 6-18 months means that children who have 1 dose by the second birthday are not behind schedule. For this reason, this survey reports children as up to date with 1 dose of HAV.
- Rotavirus vaccine (RTV) is considered complete with at least 2 doses because this survey does not capture the brand of vaccine given (one rotavirus vaccine requires 2 doses and the other requires 3 doses).

### ***Healthy People 2020 objectives***

Healthy People (HP) 2020 objectives are established by the federal Department of Health and Human Services (HHS) to provide national targets for population health: these objectives include vaccine coverage levels among children 19-35 months of age and are tracked nationally through the NIS. TDH aims to reach or exceed each of these. The following objectives for the percentage of children immunized by 19-35 months of age have been established by HP 2020: 80% complete the 4:3:1:3:3:1:4 series; 90% complete each individual vaccine included in the 4:3:1:3:3:1:4 series; 60% complete hepatitis A vaccination; 80% complete rotavirus vaccination with 2 or more doses; and 70% appropriately immunized against influenza. In addition to these objectives, HP 2020 objectives also include having 85% of all children receive their first dose of hepatitis B vaccine within 3 days of life.

### ***The 2013 sample population:***

The 2013 statewide sample consisted of 1,591 children born in the first quarter of 2011 (January, February and March). Oversampling for black children was done in each region where the random sample contained fewer black children than the actual proportion of black children born in the first quarter of 2011 in that region. The oversampled records (n=11 of the 1,591) were included only in the state-level analysis of black-white racial disparities; one of these was excluded because the child had moved out of state, leaving 10 oversampled records in the final racial analysis. Of the 1,591 children in the final sample, 95 were excluded from the analysis for one of the following reasons: parents refused to participate (n=23), the child had moved out of state (n = 71) or the child had been adopted, put in foster care or was in state custody (n=1). After exclusions, 1,489 children remained in the primary sample

(1,479 + 10 oversampled records = 1,489 total records). See Appendix 1 for a table showing details by region of numbers of children who refused vaccines, children who could not be located and the number of oversampled records in each region used for racial disparity assessment at the state level.

***Unable to locate:***

Of the 1,489 total children, 22 children could not be located and could not be confirmed as having left the state. By protocol, these children are included in the analysis with any immunization records in the state immunization registry: all 22 had incomplete immunization information in the registry. See Appendix 1 for the regions of residence of these children.

***Vaccine refusal:***

Of the 1,489 children, 22 children with no immunizations (1.7%) had parents who confirmed that they refused vaccine for religious (n=11) or philosophical (n=11) reasons; none reported medical reasons for not vaccinating their child. Six additional children of parents who refused to vaccinate received only one or two doses of vaccine: four cited philosophical objections and two religious reasons. These children impacted regional coverage rates to different degrees: 4 regions had 0-1 children refuse vaccination, while one region had 7 children refuse vaccination. The rural South Central Region is home to some religious communities that traditionally avoid vaccination. See Appendix 1 for details of the number of unvaccinated children in each regional sample.

***Statistical notes:***

The survey is designed to allow valid statistical comparisons of the populations in each of the 13 health department regions; however, the sample size in a given region is too small to yield interpretable results at the county level within multi-county rural health department regions or to permit comparisons among subpopulations within a region.

Ninety-five percent confidence intervals (CI) were calculated and are displayed as whisker plots on graphs in this report to permit readers to visualize the statistical significance (or absence of significance) of differences in point estimates. Confidence intervals that do not overlap indicate that the point-estimate differences being compared have at least a 95% chance of representing true differences in the populations being compared. If CIs overlap, then differences are not considered statistically significant differences. CIs were not calculated for surveys before 2007.

***Minimum intervals:***

On-time immunization classification in this survey may overestimate appropriate immunization because analysis does not take into account whether dose intervals or ages meet CDC recommendations. Historically, minimum intervals were not considered in previous surveys: to add these criteria would limit the ability to compare current and past survey results.

**Additional information on specific vaccines:**

***Hepatitis B vaccine (HBV) birth dose***

This report includes information about the proportion of children receiving a birth dose of hepatitis B vaccine (given within 3 days of life). Widespread adoption of a routine birth dose in hospitals is a key strategy in national efforts to eliminate transmission of hepatitis B virus in the United States. These rates reflect the policies and practices of the delivery hospitals in each region. Charts showing results are provided in Figures 5a and 5b.

***Influenza vaccine (FLU)***

Children born in the first quarter of 2010 who received every influenza vaccine on time could have received 3 doses of seasonal influenza vaccine; however, the numbers of children who received 3 doses are very small and a national standard for measurement of completeness is not yet routinely used. This survey reports the percentage of children who received at least 2 doses of seasonal influenza vaccine by their second birthday. Influenza-specific charts are provided in Appendix 2.



***Haemophilus influenzae type B vaccine (HIB)***

Two different HIB schedules exist, depending upon the HIB formulation used. The Merck product requires a 2-dose primary series with a booster dose after the first birthday (total of 3 doses); the Sanofi Pasteur product requires a 3-dose primary series, with a booster dose after the first birthday (total of 4 doses). Because brand names are not captured in this survey, children with at least 3 doses have been classified as complete, with the acknowledgement that this may misclassify as complete some children who received only three doses of the 4-dose product. HIB-specific charts are provided in Appendix 2.

***Rotavirus vaccine (RTV)***

The 2010 survey was the first to report coverage with the oral rotavirus vaccine (RTV), first licensed and recommended in 2006. Like HIB, 2 different brands are available with different dose schedules. Rotateq<sup>®</sup> (Merck), requires 3 doses, typically given at 2, 4, and 6 months; Rotarix<sup>®</sup> (GSK, licensed early 2009) requires 2 doses, typically given at 2 and 4 months. RTV is unique among vaccines because the series must be initiated no later than 15 weeks of life and no doses should be given after a child turns 8 months old. Because brand names of doses administered are not collected, children who received at least 2 doses of RTV are classified as complete. Rotavirus-specific charts are provided in Appendix 2.

## Statewide Results and Trend Analysis:

### *Vaccine specific on-time immunization coverage*

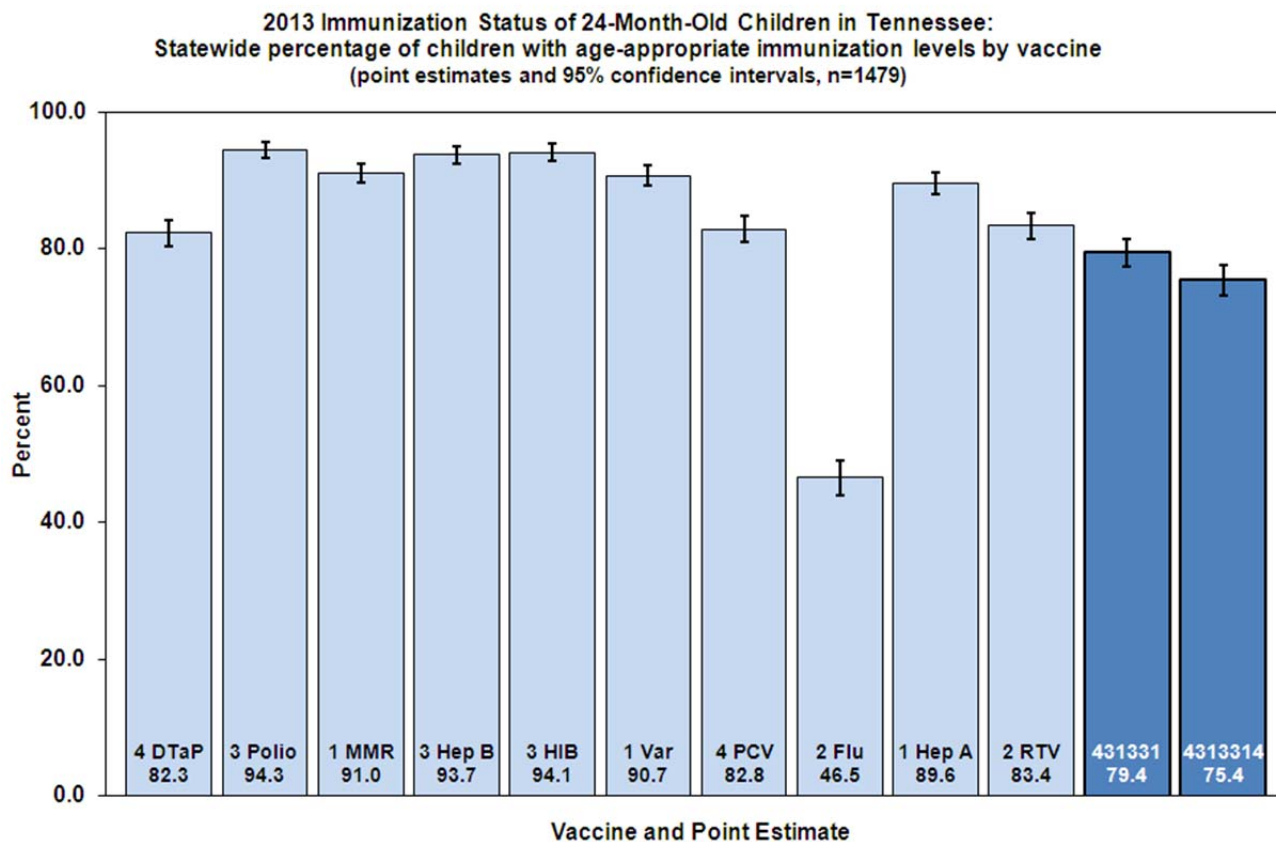
The proportion of children in the survey fully immunized on-time for each vaccine is in Figure 1 below. The HP 2020 objective of 90% on time coverage was exceeded for 5 out of 7 vaccines in the 4:3:1:3:3:1:4 series. Two vaccines requiring 4 doses, DTaP and PCV, failed to reach 90%; however, this target is within reach, because the percentages of children who had received 3 or more doses were 95.1% for DTaP and 94.4% for PCV (Appendix 2).

For the third year, the HP 2020 objective of 80% coverage with 2 or more doses of rotavirus vaccine was exceeded: 83.4% of children had at least 2 doses of RTV. For hepatitis A vaccine, 56.0% of children had completed the 2 dose series by the second birthday (HP 2020 objective is 60% completion by 35 months of age) and 89.6% were up to date, having had the first dose, with a second dose due 6 to 18 months later. Two-dose influenza vaccination coverage increased very slightly, by 2 percentage points, from 2012 and remains the lowest of all routinely recommended vaccines. See Figure 3 for comparisons to 2012.

The coverage rate for the 4:3:1:3:3:1:4 vaccine series was essentially unchanged, at 75.4% (compared to 75.3% in 2012), short of the 80% coverage HP 2020 objective. The series completion rates fall short as a result of the lower rates of completion of the 4<sup>th</sup> doses of 4-dose vaccines: DTaP and PCV. See Figure 4 for trends in these series completion rates over time.

Appendix 2 of this report contains charts of on-time immunization coverage rates for each vaccine in each public health region.

**Figure 1**



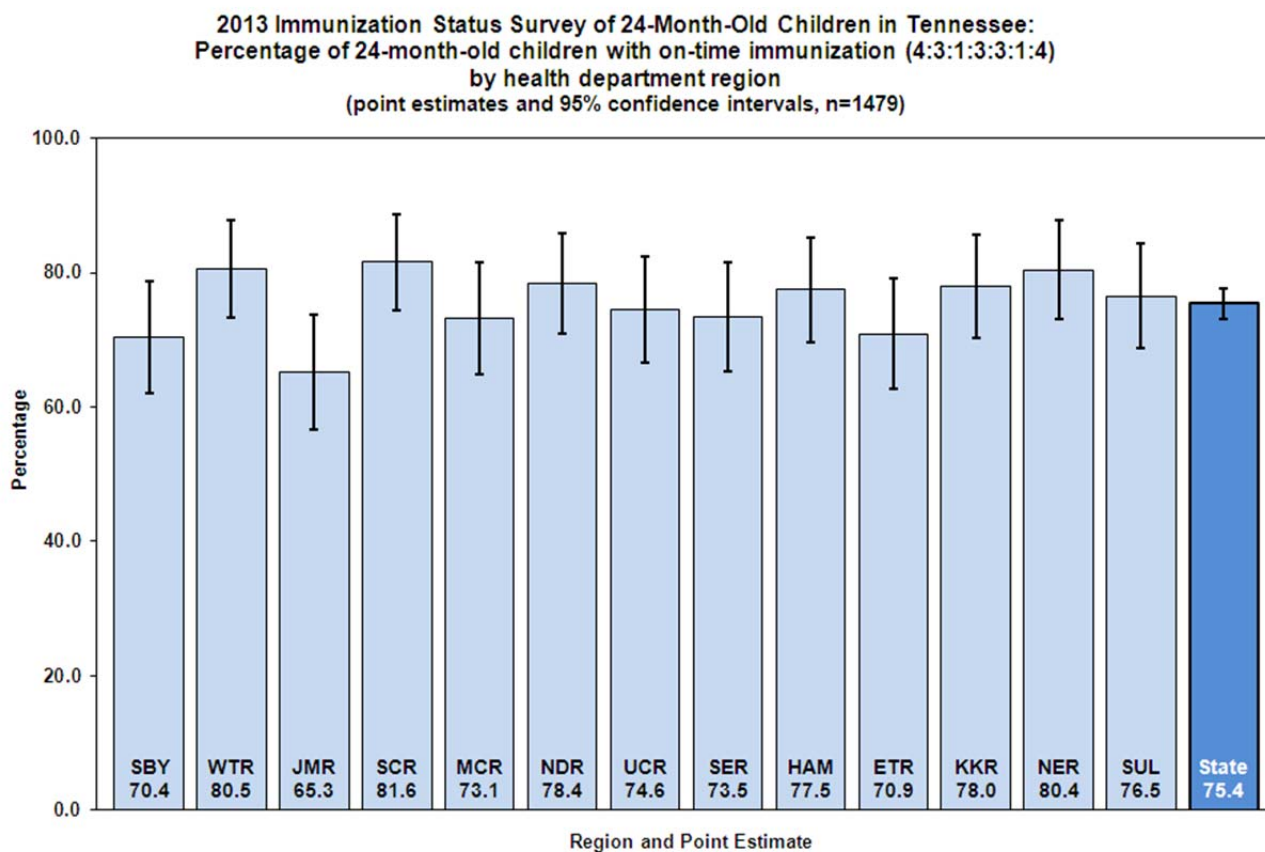
### ***Complete immunization levels statewide and by public health region***

The percentage of children immunized on time with all vaccines in 4:3:1:3:3:1:4 series, statewide and in each public health region, is shown in Figure 2. Statewide complete coverage reached 75.4% (95% CI: 73.2-77.6). The point estimates in three regions (West Tennessee [WTR], South Central [SCR], and Northeast [NER]) exceeded the HP 2020 objective of 80% coverage. No regional coverage estimate was statistically significantly higher or lower than the state as a whole.

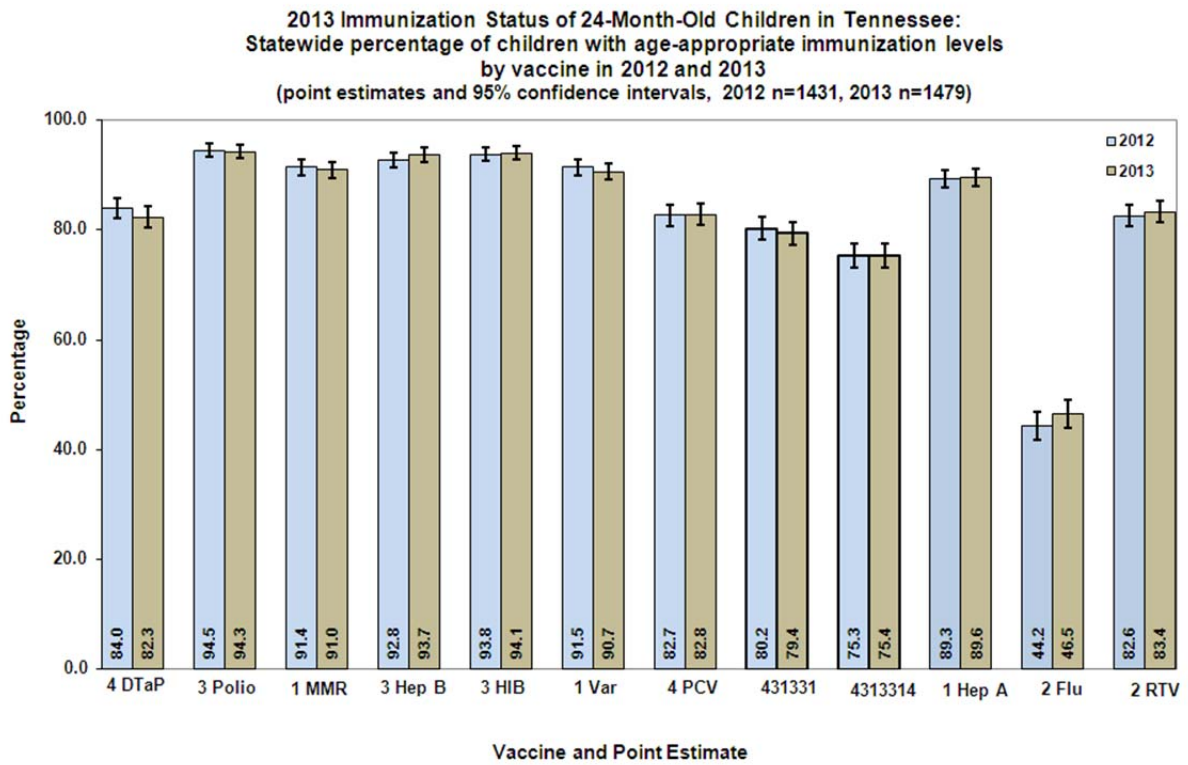
Figure 3 compares the statewide coverage rates measured in 2012 and 2013: no significant changes are noted.

Appendix 3 of this report contains charts for each public health region displaying the percentage of children in each region who were immunized on-time for each of the vaccines and for the 4:3:1:3:3:1:4 complete series.

**Figure 2**



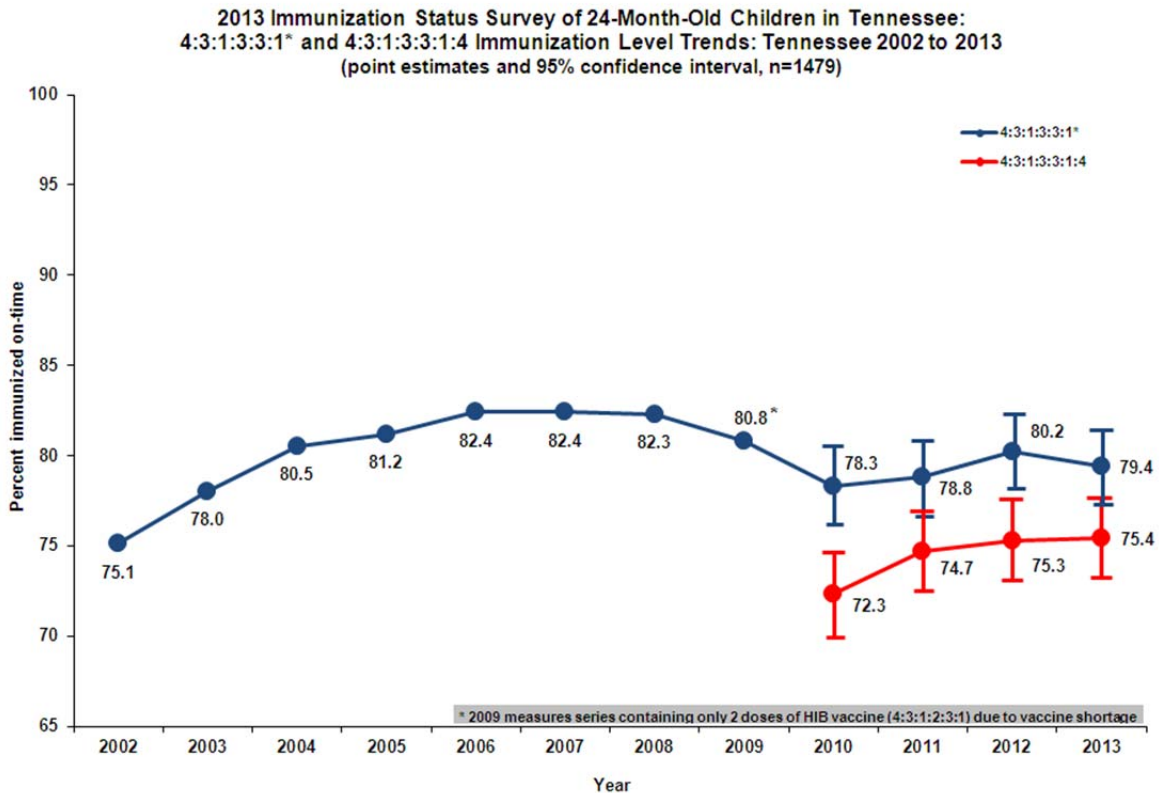
**Figure 3**



***Series completion trends over time***

Figure 4 below shows the trend over time of the 4:3:1:3:3:1 series completion rate from 2002 to 2013, as well as the 4:3:1:3:3:1:4 completion rate from 2010 to 2013.

**Figure 4**

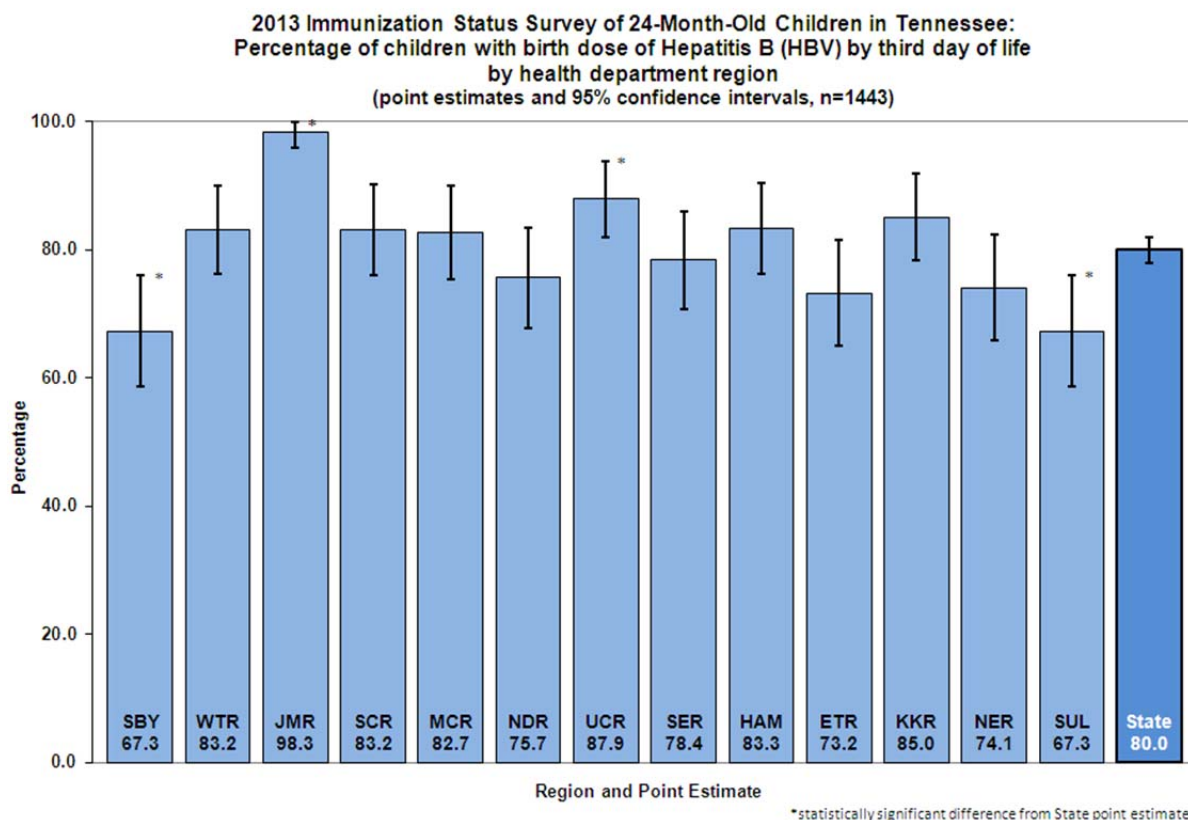


## Hepatitis B vaccine birth dose

Figure 5 shows the percentage of children assessed in each region who received a birth dose of HBV, defined as a dose given by day 3 of life. Without intervention, an infant born to a woman infected with hepatitis B has up to a 70% chance of being infected. Of those, about 90% will develop chronic infection, leading to liver damage, cirrhosis or liver cancer later in life. The infant's risk of infection can be reduced by about 95% by administering HBV and immunoglobulin within 12 hours of life to infants born to mothers known to be infected. Infants born to mothers of unknown status should receive HBV within 12 hours. To ensure no at-risk child is missed, the CDC recommends that all newborns be vaccinated before discharge. This birth dose can help protect the neonate if the mother's infection is not detected or if the newborn is exposed to the virus in some other way.

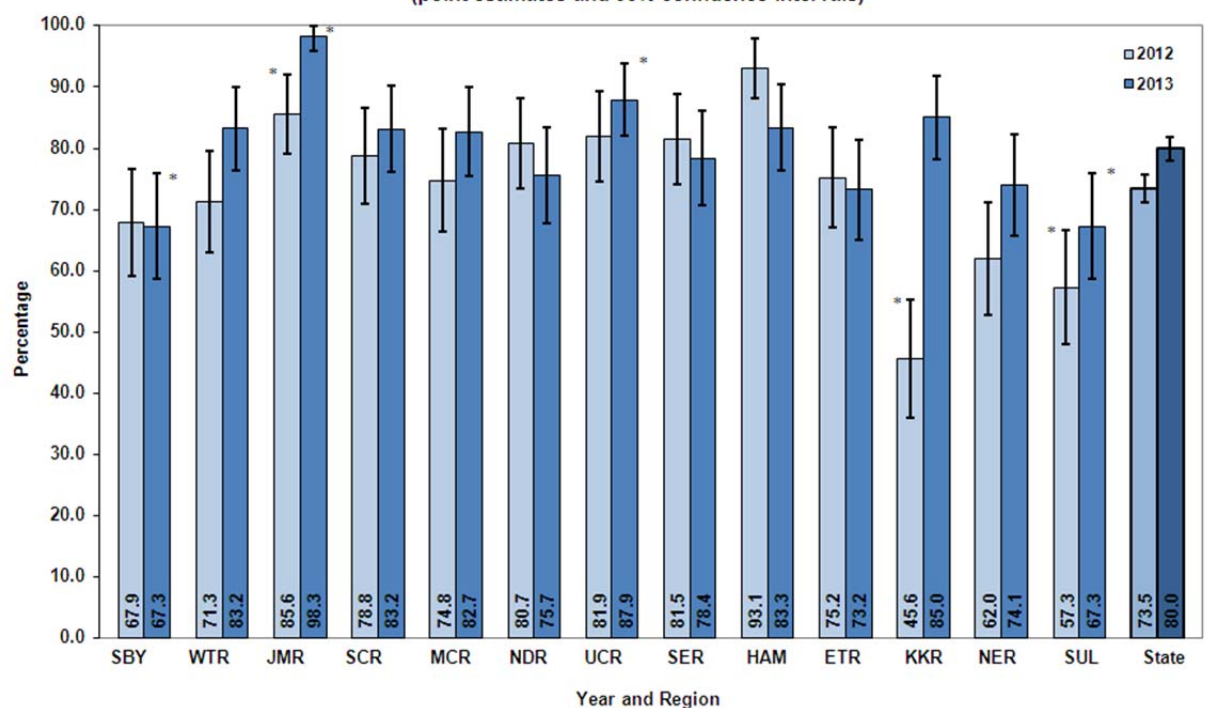
The HP 2020 objective is for 85% of infants to receive a birth dose of HBV. The comparison of 2012 and 2013 coverage rates reveal continued significant improvements each year. The most recent published birth dose rate for the United States is 71.6% (95% CI: +/- 1.4), from the 2012 NIS, at [http://www.cdc.gov/vaccines/stats-surv/nis/data/tables\\_2012.htm](http://www.cdc.gov/vaccines/stats-surv/nis/data/tables_2012.htm). The 2013 Tennessee survey measured a rate of 80.0% (95% CI: +/- 2.1). Eight of 13 public health regions reported increases in coverage; two point estimates were significantly higher than the state measurement for 2013. However, two regional point estimates were significantly lower than the 2013 overall measurement. Because birth doses are administered at the delivery hospital, differences in hospital policies and protocols for administering the birth dose account for regional variations in birth dose coverage. Substantial changes in coverage within a specific region or county within one year likely reflect changes in delivery hospital protocols that now follow federal recommendations. Examples include Madison (JMR) and Knox (KKR) counties in Figure 5b.

**Figure 5a**



**Figure 5b**

**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with birth dose of Hepatitis B (HBV) by third day of life**  
**by health department region in 2012 and 2013**  
**(point estimates and 95% confidence intervals)**



\*statistically significant difference from State point estimate

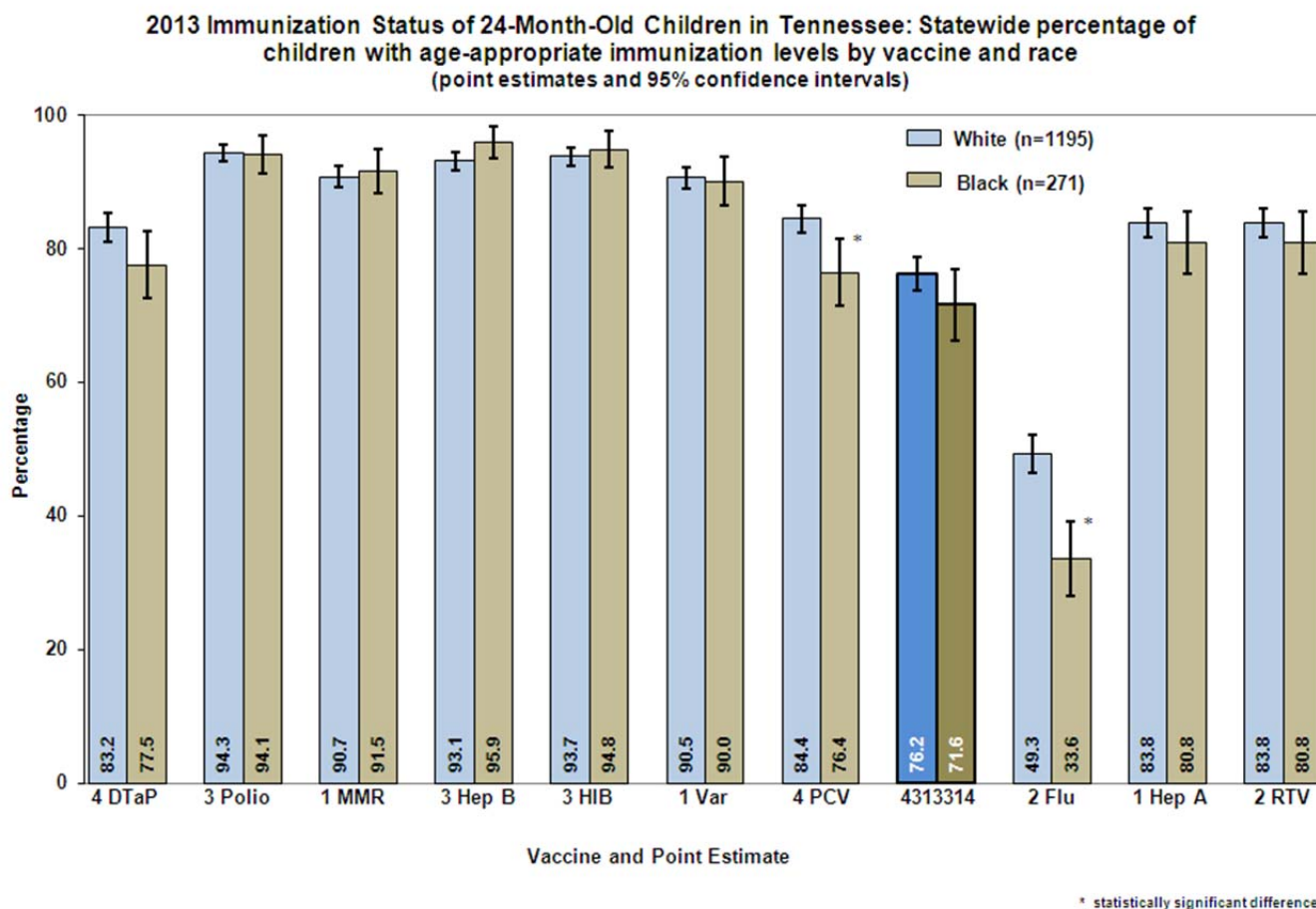
## Racial disparities

The differences measured between black and white children in on-time completion of the routine vaccine series have been small or statistically insignificant in recent years. This year the comparison was made between black (n = 271) and white (n=1,195) children. Because of small numbers, children of other races (n=23) are excluded from this analysis.

There were no statistically significant differences in vaccine series coverage between black and white children. However, black children had significantly lower coverage for influenza vaccine and the 4-dose pneumococcal vaccine (PCV). A comparison of the trends in on-time 4:3:1:3:3:1:4 series completion by race from 2010-2013 can be found in Appendix 4. Figure 6 shows the rates of on-time immunization of black and white children for each vaccine assessed.

In 2013, the racial disparity in influenza vaccine coverage persists, measured at 15.7 percentage points in 2013. The large racial disparity in influenza coverage rates has been consistently documented since influenza vaccine was first assessed in this survey in 2008.

**Figure 6**



## ***Immunization among selected sub-populations***

Certain risk factors consistently are associated with failure to complete the recommended series of immunizations on time, such as starting routine immunizations late (>120 days of age), or having two or more siblings. In the past, racial disparities made black race an important risk factor, though race has become less predictive of late immunization, other than for influenza vaccination. Having more than one sibling or starting routine immunizations late remain characteristics most likely to result in not being completely immunized on time.

The survey examines other groups of interest, as well. The survey captures the immunization provider type (public, private or both), TennCare (Medicaid) participation, and enrollment in the Women, Infants and Children (WIC) nutrition program for each child in the survey. Because only a small number of children (103 of 1,448 with a known source of vaccination) received all their immunizations in health departments, the point estimate for public provider coverage has wide confidence intervals and should be interpreted with caution. Infants in WIC have immunization records reviewed at WIC visits. Since 2008, targeted education and telephone follow-up have been used as the primary tools used to encourage catch-up immunization of WIC infants.

Children who begin routine immunizations after 4 months (120 days) of age are at very high risk of failing to catch up and be fully immunized on time. The survey reports children who receive their first routine vaccination other than rotavirus or birth dose HBV after 120 days of age: 32 children (2.2%) met these criteria. Table 1 below summarizes the 2013 on-time completion rates for 4:3:1:3:3:1:4 in these groups.

**Table 1**

<b>4:3:1:3:3:1:4 Completion Levels in the 2013 Survey of 24-Month-Old Children: Selected Characteristics</b>			
<b>Provider Type</b>	Public n=76/103	Private N=909/1165	Both n=130/180
	<b>73.8% ± 8.49</b>	<b>78.0% ± 2.38</b>	<b>72.2% ± 6.54</b>
<b>TennCare Enrollment</b>	Enrolled n=607/777	Not Enrolled n=508/702	
	<b>78.1% ± 2.91</b>	<b>72.4% ± 3.31</b>	
<b>WIC Enrollment</b>	Enrolled n=704/918	Not Enrolled n=411/561	
	<b>76.7% ± 2.74</b>	<b>73.3% ± 3.66</b>	
<b>Other Siblings</b>	None n=498/599	One n=346/472	Two or more n=268/405
	<b>83.1% ± 3.00</b>	<b>73.3% ± 3.99</b>	<b>66.2% ± 4.61</b>
<b>Age at First Immunization*</b>	≤120 days n=1099/1426	120 days n=16/32	
	<b>77.9% ± 2.16</b>	<b>50.0% ± 17.32</b>	

\*the first dose of a vaccine other than oral rotavirus vaccine or the birth dose of hepatitis B vaccine

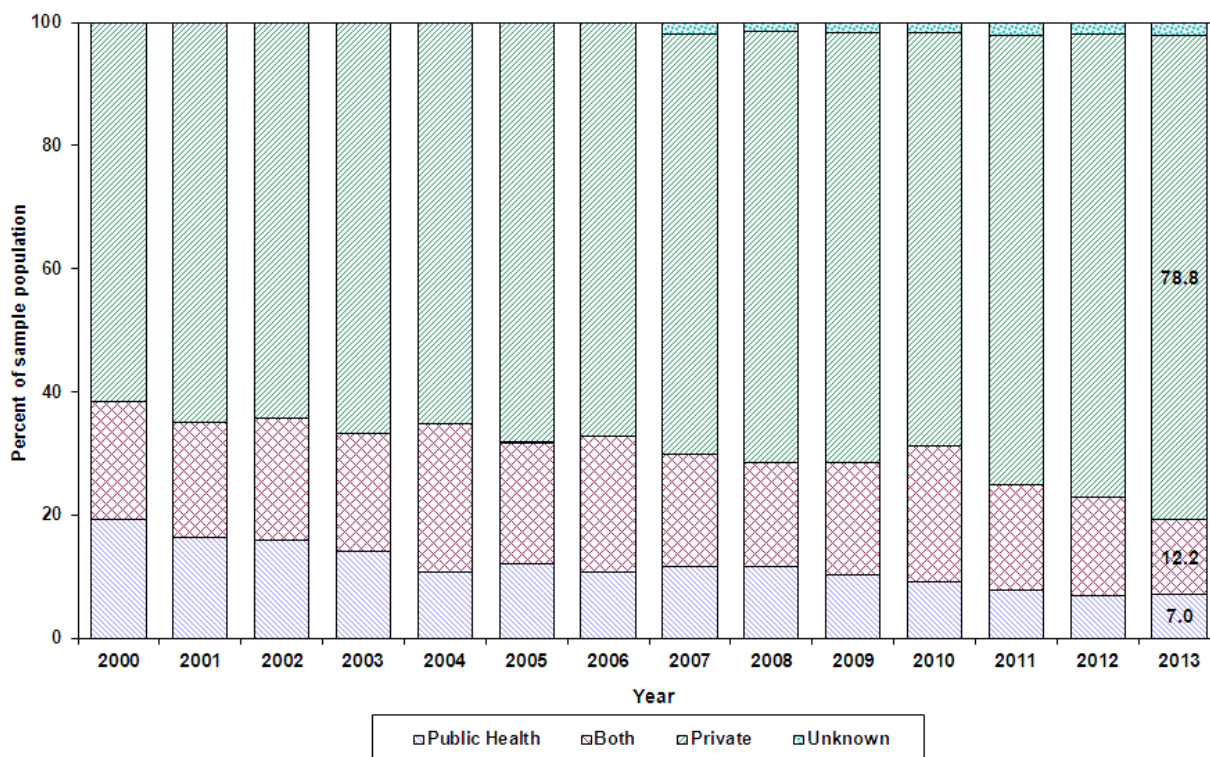
## ***Immunization provider types and patient populations***

The proportion of children immunized in public health departments began to decline in the late 1990s after TennCare and the Vaccines for Children (VFC) Program enabled medically underserved children to receive immunizations in a private medical home. Of children in the 2013 survey, 78.8% were immunized exclusively in private clinic settings, 12.2% received immunizations in a combination of private and public health clinics, 7.0% received their immunizations exclusively at a public health department. Data were unavailable for 2.1% of children. Figure 7 below shows the trends in these proportions over time.



**Figure 7**

**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Source of Immunizations from 2000 to 2013 (n=1479)**



Although only a small number of children surveyed were immunized exclusively in public health clinics, those immunized in health departments have a higher prevalence of risk factors for failure to complete immunization. Table 2 shows the prevalence of risk factors for incomplete immunization among populations immunized in a public health department, private clinic or a combination of settings.

**Table 2**

Prevalence of risk factors for delayed immunizations in the survey population by provider type			
Risk Factor	Health Department	Both Private and Public	Private Only
Black ( <i>risk for influenza</i> )	26.2% (27/103)	25.6% (46/180)	15.9% (185/1165)
2 or more siblings	35.0% (36/103)	36.7% (66/180)	26.1% (303/1162)
Age at first dose >120 days*	7.7% (8/103)	2.2% (4/180)	1.7% (20/1159)
Any of above risk factors	58.3% (60/103)	46.7% (84/180)	37.7% (439/1165)

\*the first dose of a vaccine other than oral rotavirus vaccine or the birth dose of hepatitis B vaccine

### Summary of Key Findings:

1. Table of Tennessee (TN) coverage rates relative to Health People (HP) 2020 objectives for this age group:

Measurement	HP 2020 Objective (19-35 months)	TN 2013 (24 months)
Complete 4:3:1:3:3:1:4 series	80%	75.4%
Each vaccine in 4:3:1:3:3:1:4 (DTaP, IPV, MMR, Hib, HBV, VZV, PCV)	90% rate for each of the 7 vaccines	<b>Exceeded 90% for 5 of 7, except:</b> 4 doses of DTaP (82.3%) and 4 doses of PCV (82.8%)
3 doses DTaP and PCV	<i>None: this is a process measure</i>	3 DTaP (95.1%) and 3 PCV (94.4%) <i>[could reach goals by closing gap in 3 dose and 4 dose coverage]</i>
Hepatitis A vaccine	60% 2 doses by 35 months	57.7% 2 doses; 89.3% 1 dose ( <i>not directly comparable</i> )
Influenza vaccine	70% appropriately immunized	46.5%
Rotavirus vaccine	80% with 2 doses	<b>83.4%</b>
Hepatitis B birth dose	85%	80.0%

2. The HBV birth dose rate again improved significantly from the previous year (from 73.5% in 2012 to 80.0% in 2013). TN is progressing rapidly to reach the HP 2020 target. This reflects delivery hospital policies and wider acceptance of this recommended dose schedule among caregivers of neonates by early 2010, when the children in this survey population were born.
3. Influenza vaccine 2-dose coverage remains low and minimally changed from 2012 at 46.5%. This represents a major area for improvement.
4. The significant racial disparity in influenza vaccine coverage between black and white children continues (33.6% vs. 49.3%); there is not a disparity in the 4:3:1:3:3:1:4 series of routine vaccines given. This continues to suggest barriers specific to influenza vaccine, rather than a more broad issue of vaccine access or acceptance.
5. Completion of the DTaP and pneumococcal four-dose series continues to be the primary barriers in achieving the Health People 2020 goal of 80% coverage for the 4:3:1:3:3:1:4 series for all children. Nearly 95% of children surveyed received three doses of both vaccines, whereas less than 83% received four doses.
6. For 6 of the 10 individual vaccines measured in this survey (polio, MMR, varicella, HBV, HIB, and HAV), WIC and TennCare enrollees had significantly higher coverage than children never enrolled in these programs. Point estimates of 4:3:1:3:3:1:4 series coverage for children enrolled in TennCare and/or WIC had immunization rates were higher than others, but the difference was not statistically significant. Unlike the other vaccines, WIC and TennCare-enrolled children had significantly lower coverage with influenza vaccine. (Appendix 4).
7. The rotavirus vaccine coverage for the state and most public health regions surpassed the national HP 2020 goal of 80% coverage.

### Next Steps:

The following steps in 2014 should continue to improve on-time immunization of Tennessee children:

1. TDH will be introducing a new state immunization registry with enhanced features to support immunization providers in immunizing children on time. A forecasting tool will display the vaccines due or overdue for a child when the child's record is opened by the healthcare provider. A reminder/recall tool will enable the healthcare provider to generate for patients in his or her practice reminders of vaccination appointments and recall children behind on vaccines. Neither tool is available in the current registry; both have been shown to improve immunization completion rates. These tools should be especially valuable in improving the lagging on-time rates of completion of DTaP and PCV after the first birthday.

2. Fewer than 20 percent of children in this age group had received any immunization in a local health department; however, these children tend to be ones with more risk factors for failing to be fully immunized on time. The Immunization Program provides county health departments with lists of children aged 20-24 months who have received immunizations in a health department clinic and whose records show they are incompletely immunized with DTaP vaccine. Staff at regional or local health departments may use these to facilitate active follow up of these children in order to complete all overdue immunizations.
3. In addition to forecasting and reminder/recall systems in the forthcoming immunization registry, TIP also will continue to emphasize to private providers the importance of having a system to recall patients who have missed doses of vaccine, especially focusing on DTaP and PCV, which require the most doses, as sentinel vaccines for tracking the completeness of immunization in toddlers.
4. TIP will continue to encourage providers to give the third DTaP at 6 months of age so the fourth DTaP may be administered as soon as the 12-month visit. The risk of incomplete immunization goes up after the first birthday among children at risk for falling behind schedule because these children visit medical clinics less often after the first birthday.
5. Since 2010, state immunization requirements for child care facilities include complete pneumococcal vaccination, which should ensure complete PCV coverage among children in child care.
6. TIP will continue to collaborate with healthcare providers who wish to enter immunization records into the state immunization registry. Electronic data exchange has increased dramatically as a result of Federal financial incentives, known as “Meaningful Use” grants from the Centers for Medicaid and Medicare Services (CMS), given to qualified healthcare providers. These grants require providers to move toward sharing immunization information with the state immunization registry.
7. TIP shares survey findings with WIC and TennCare leadership and supports immunization promotion in these programs.
8. Patients enrolled in WIC will continue to receive immunization education, reminder and follow-up phone calls. These remain important to assure that WIC infant immunization rates remain equivalent or exceed those of children who do not qualify for WIC.
9. TIP will conduct its annual Immunization Spring Review in April 2014 in 4 cities across the state. The Review is an educational conference free to all healthcare providers and staff who volunteer to participate in the Vaccines for Children (VFC) Program. It also continues other educational outreach, including educational site visits to VFC vaccine providers.
10. TIP staff located in each public health region will conduct site visits in at least 50% of healthcare provider offices that participate in the federal VFC Program to evaluate compliance with VFC Program requirements and to provide vaccine education.

## Appendix 1

### 2013 Immunization Status Survey of 24-Month-Old Children in Tennessee

Details of Regional Samples: Oversampled Records, Vaccine Refusal and Children with Incomplete Records Who were Not Located

Region	Records analyzed <sup>1</sup> (oversampled) <sup>2</sup>	Total vaccine refusals	Reason given for refusing vaccine <sup>3</sup>			Total % Refusal	Children who could not be located <sup>4</sup>	Total % not located
			Religious	Philosophical	Medical			
Northeast TN	112 (1)	4	3	1	-	3.6%	0	-
East TN	117 (1)	0	-	-	-	-	8	6.8%
Southeast TN	113 (0)	2	0	2	-	1.8%	0	-
Upper Cumberland	118 (0)	3	2	1	-	2.5%	0	-
Mid-Cumberland	108 (0)	1	0	1	-	0.9%	2	1.9%
South Central	114 (2)	7	6	1	-	6.1%	0	-
West TN	113 (1)	1	0	1	-	0.9%	0	-
Shelby County	115 (0)	1	0	1	-	0.9%	2	1.7%
Davidson County	116 (0)	0	-	-	-	-	0	-
Knox County	109 (1)	2	1	1	-	1.8%	1	0.9%
Hamilton County	111 (4)	3	1	2	-	2.7%	0	-
Madison County	118 (0)	2	0	2	-	1.7%	9	7.6%
Sullivan County	115 (0)	2	0	2	-	-	0	-
<b>TOTAL</b>	<b>1489 (10)</b>	<b>28 of 1489</b>	<b>13</b>	<b>15</b>	<b>0</b>	<b>1.9%</b>	<b>22 of 1489</b>	<b>1.5%</b>

<sup>1</sup>Total records included in analysis, excluding children in the original sample who had moved out of state, refused to participate or were adopted, in foster care or in state custody

<sup>2</sup>Number in parentheses is the number of oversampled records of black children. Oversampling was done in regions where the proportion of black children in the original sample was smaller than the proportion of black children born in the region during the period when the sample was drawn. These additional records were included only in the statewide analysis of racial disparities in immunization rates. Among the 17 oversampled records analyzed, all were located and none had refused vaccine.

<sup>3</sup>Of the 28 whose parents had refused vaccinations, all had received  $\leq 2$  doses.

<sup>4</sup>Children assigned to each region that could not be located. These children were included in the analysis with any vaccinations recorded in the state immunization registry. Of these, 16 had 2 or fewer doses documented in the registry, 6 had more than 2 doses in the registry.

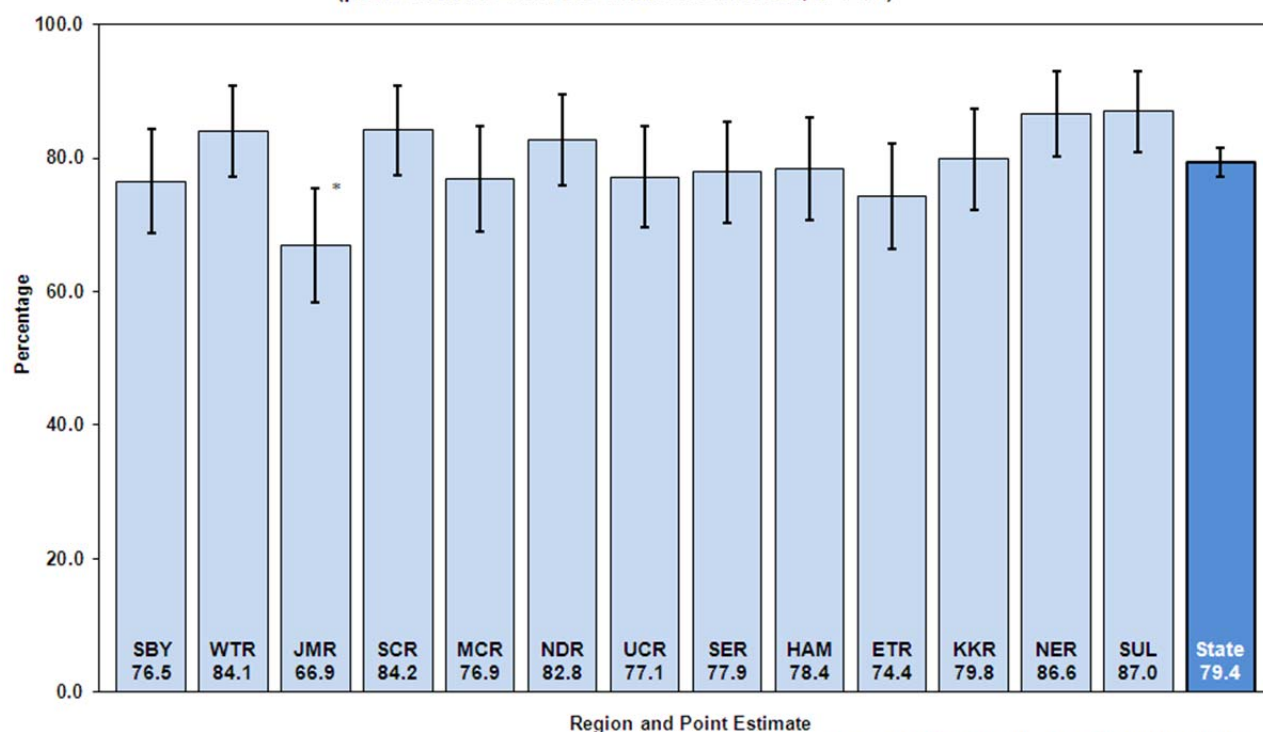
## **Appendix 2**

### **2013 Immunization Status Survey Of 24-Month-Old Children in Tennessee**

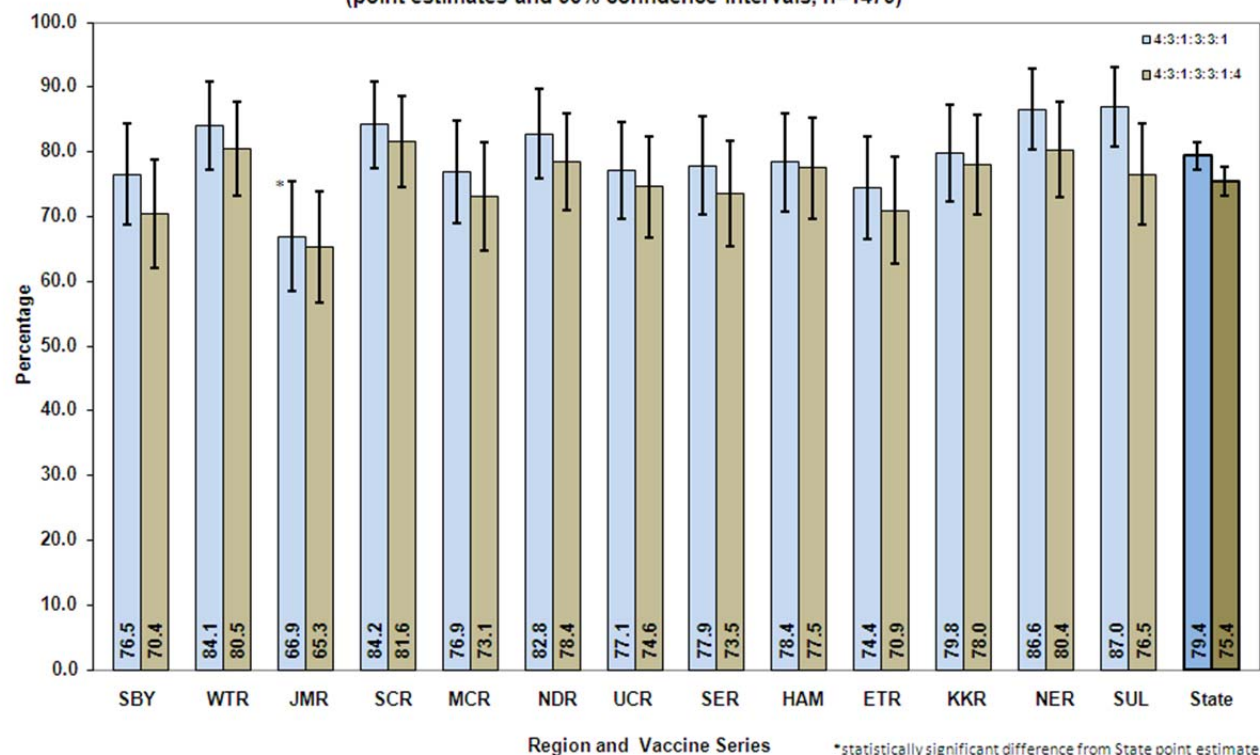
#### **Individual Vaccine Charts, with Coverage Rates Measured in Each Health Department Region and Statewide**

	Page
On-time 4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series	... 22
DTaP (4-dose and 3-dose coverage)	... 23
<i>Haemophilus influenzae</i> type b & Hepatitis A (1-dose coverage)	... 24
Hepatitis A (2-dose coverage) & Hepatitis B	... 25
Influenza (2-dose and 3-dose coverage)	... 26
MMR & Pneumococcus (4-dose coverage)	... 27
Pneumococcus (PCV) (4-dose vs. 3-dose coverage) & Polio	... 28
Rotavirus & Varicella	... 29

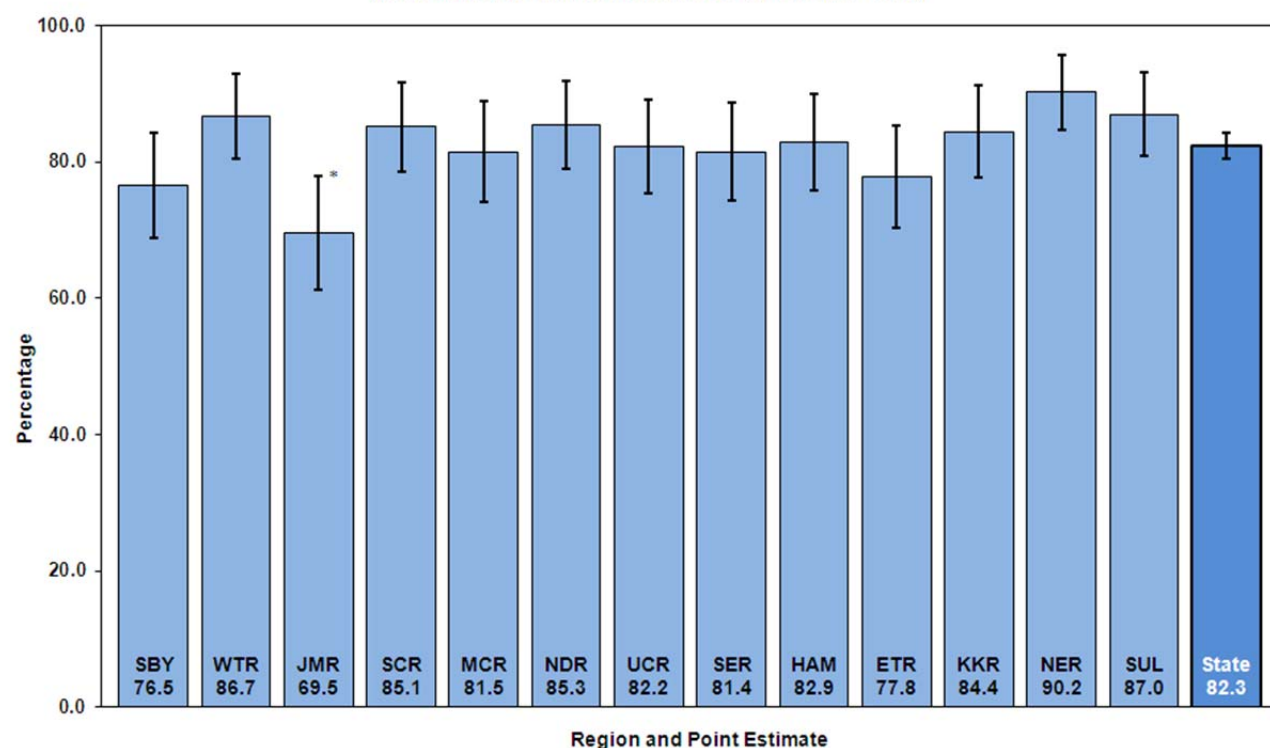
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of 24-month-old children with on-time immunization (4:3:1:3:3:1)  
by health department region  
(point estimates and 95% confidence intervals, n=1479)



2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage (%) of children complete for 4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series  
by health department region  
(point estimates and 95% confidence intervals, n=1479)

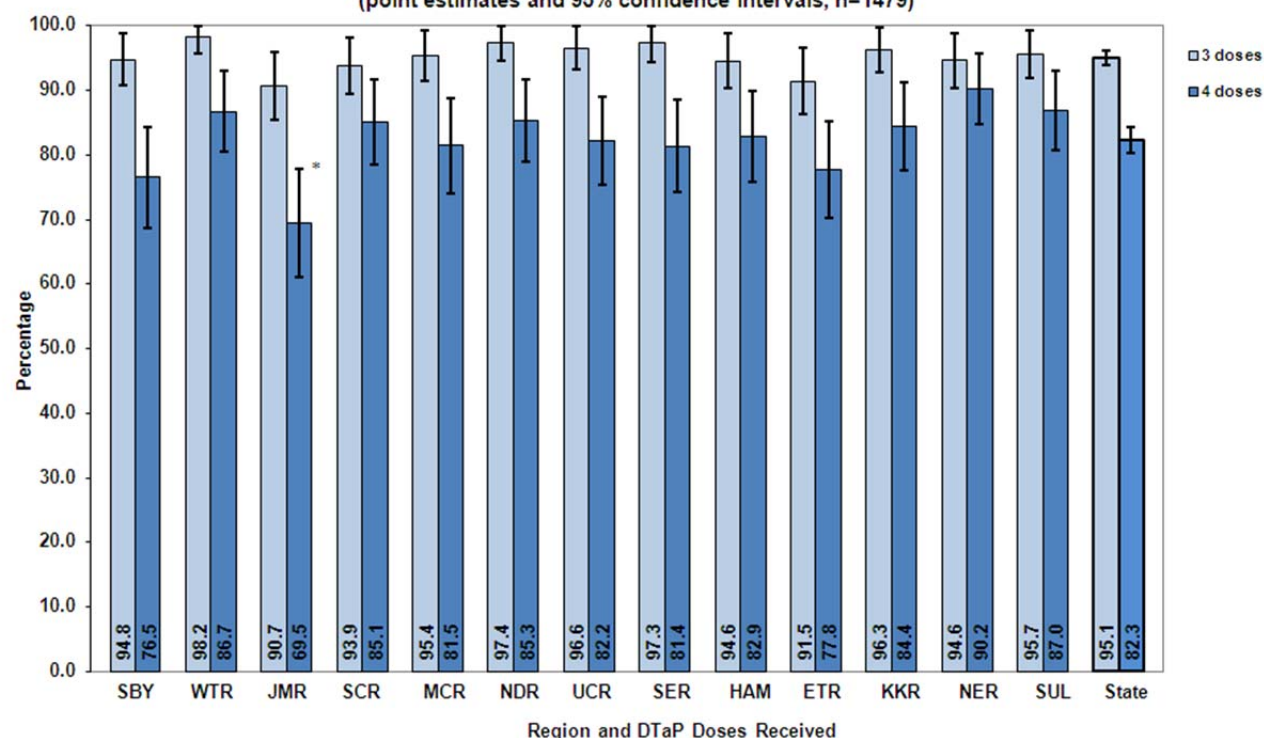


**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with complete DTaP series (4 doses) by health department region**  
 (point estimates and 95% confidence intervals, n=1479)



\*statistically significant difference from State point estimate

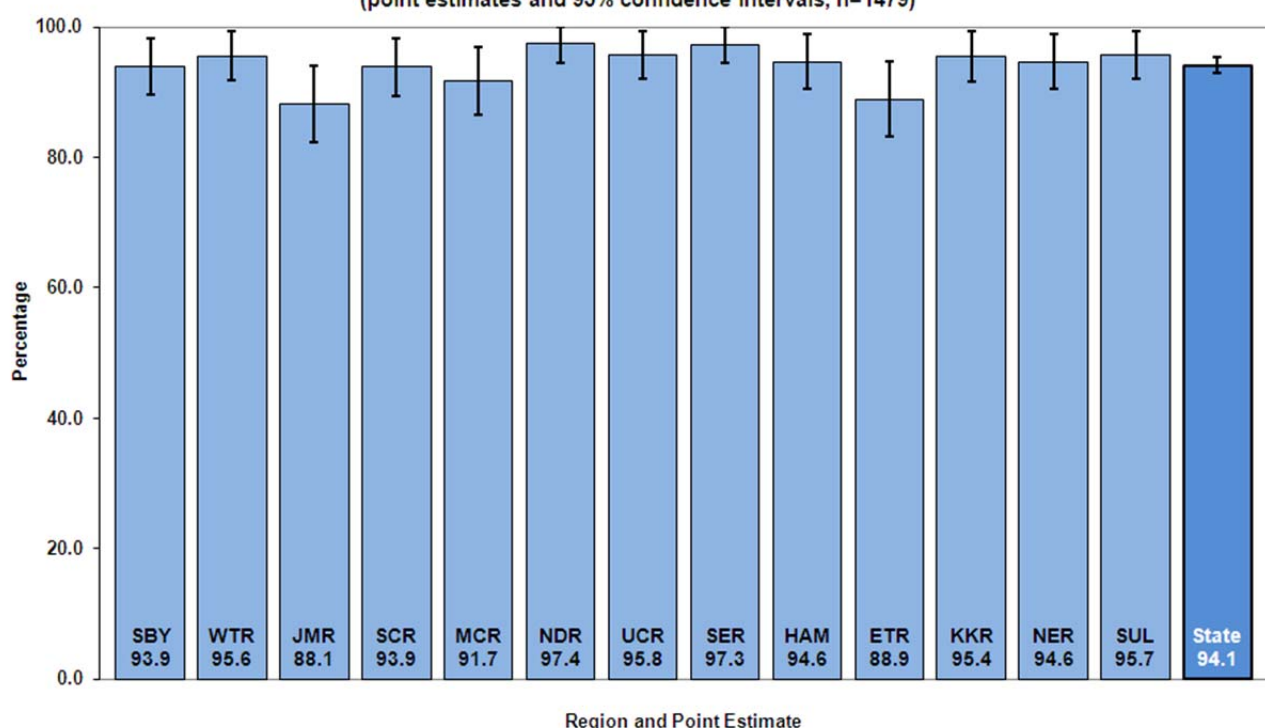
**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee: Percentage of children with 3 or 4 doses of diphtheria, tetanus and acellular pertussis (DTaP) by health department region**  
 (point estimates and 95% confidence intervals, n=1479)



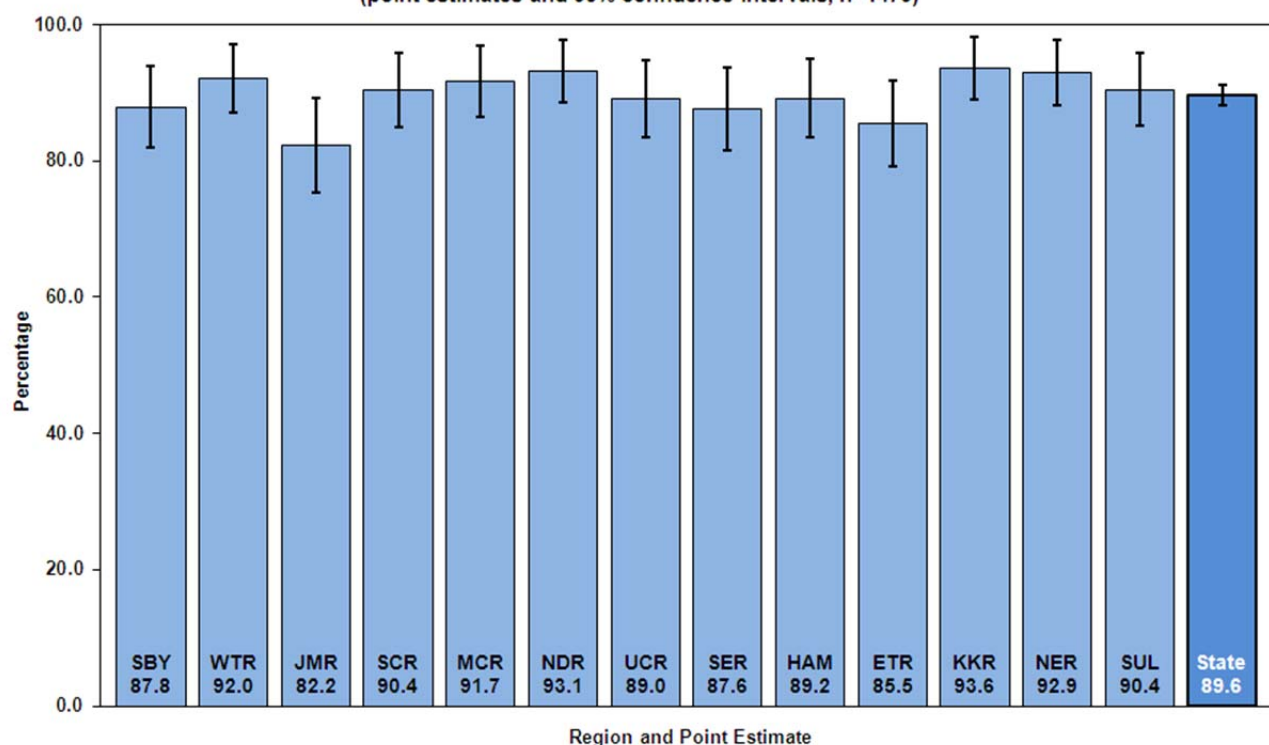
\*statistically significant difference from State point estimate



2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete *Haemophilus influenzae* type B (Hib) series ( $\geq 3$  doses)  
 by health department region  
 (point estimates and 95% confidence intervals, n=1479)

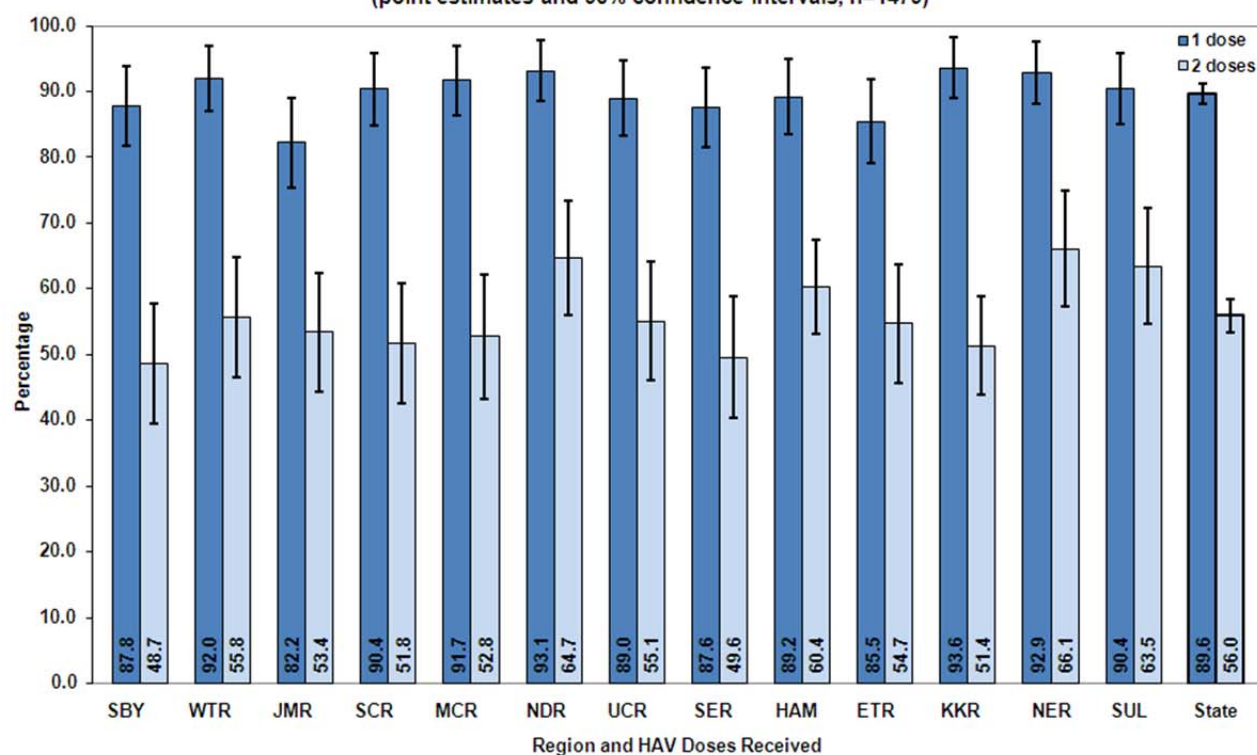


2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with at least one dose of Hepatitis A (HAV)  
 by health department region  
 (point estimates and 95% confidence intervals, n=1479)

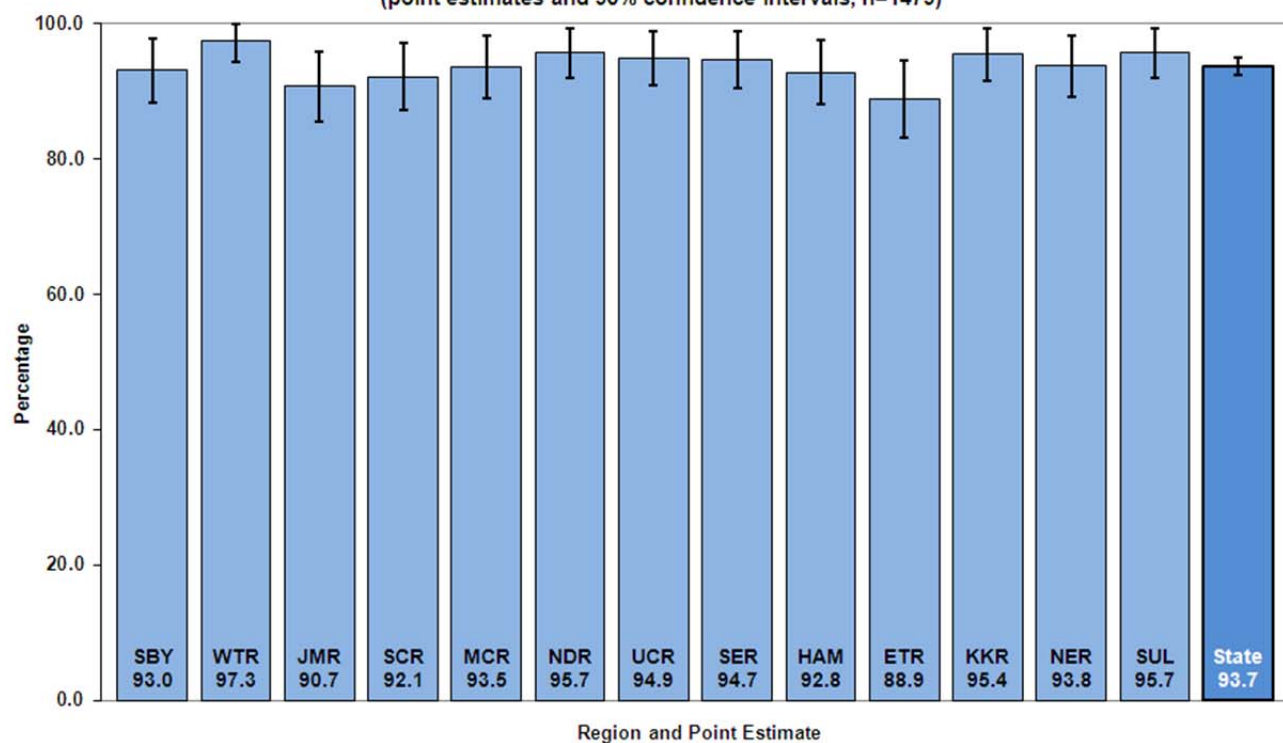




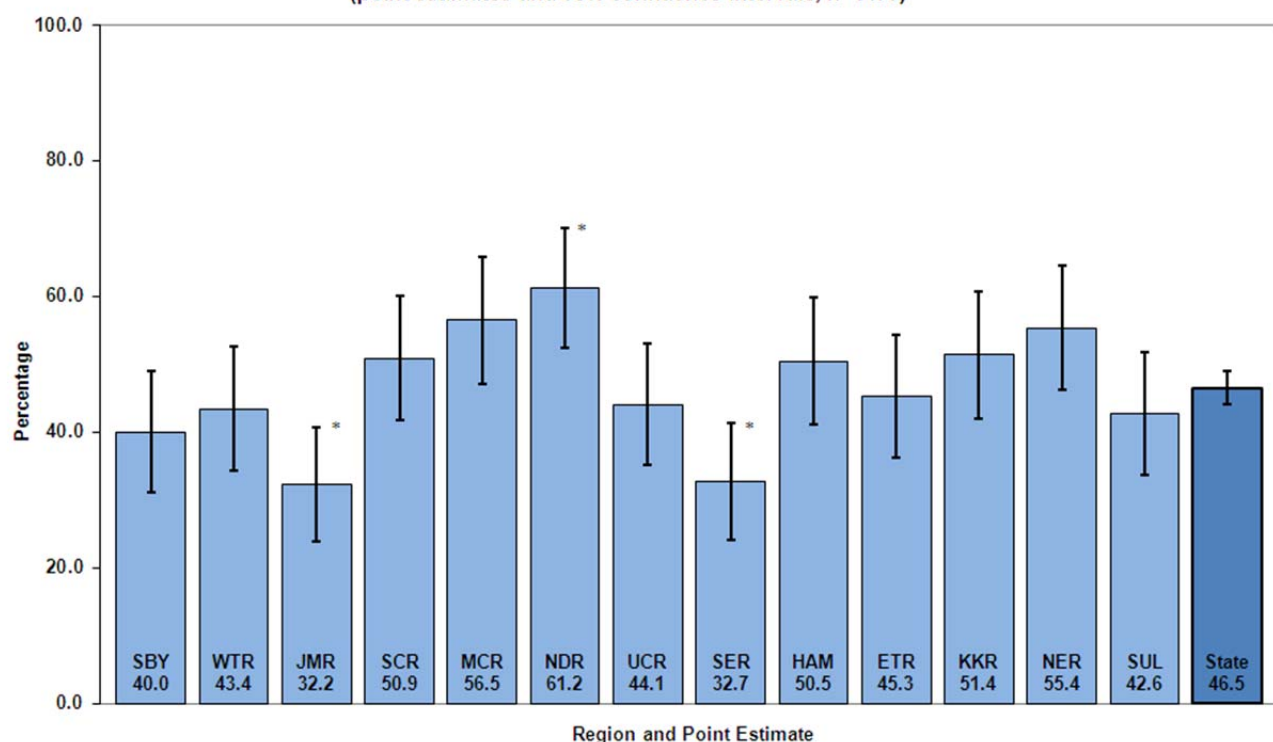
**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with 1 or 2 doses of Hepatitis A (HAV) by health department region**  
 (point estimates and 95% confidence intervals, n=1479)



**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with complete Hepatitis B (HBV) series ( $\geq 3$  doses)**  
**by health department region**  
 (point estimates and 95% confidence intervals, n=1479)

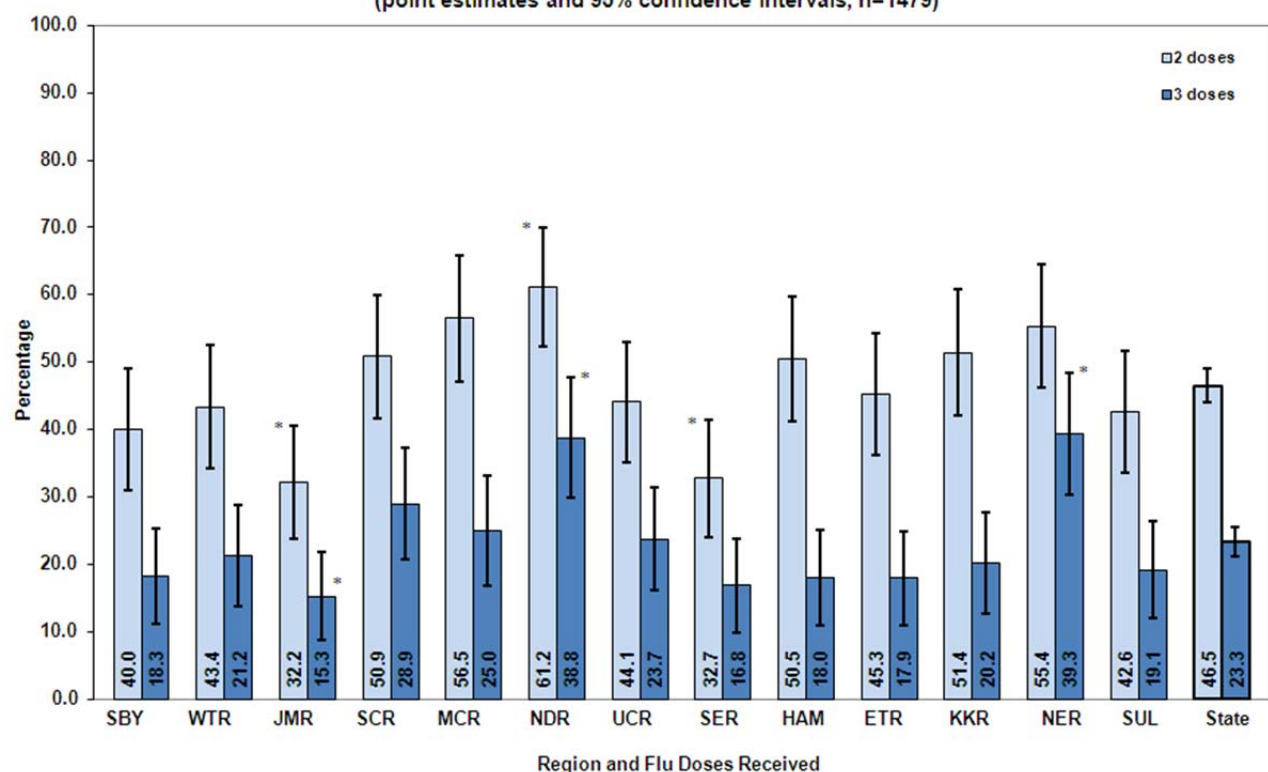


**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with 2 doses of Influenza vaccine by health department region**  
 (point estimates and 95% confidence intervals, n=1479)



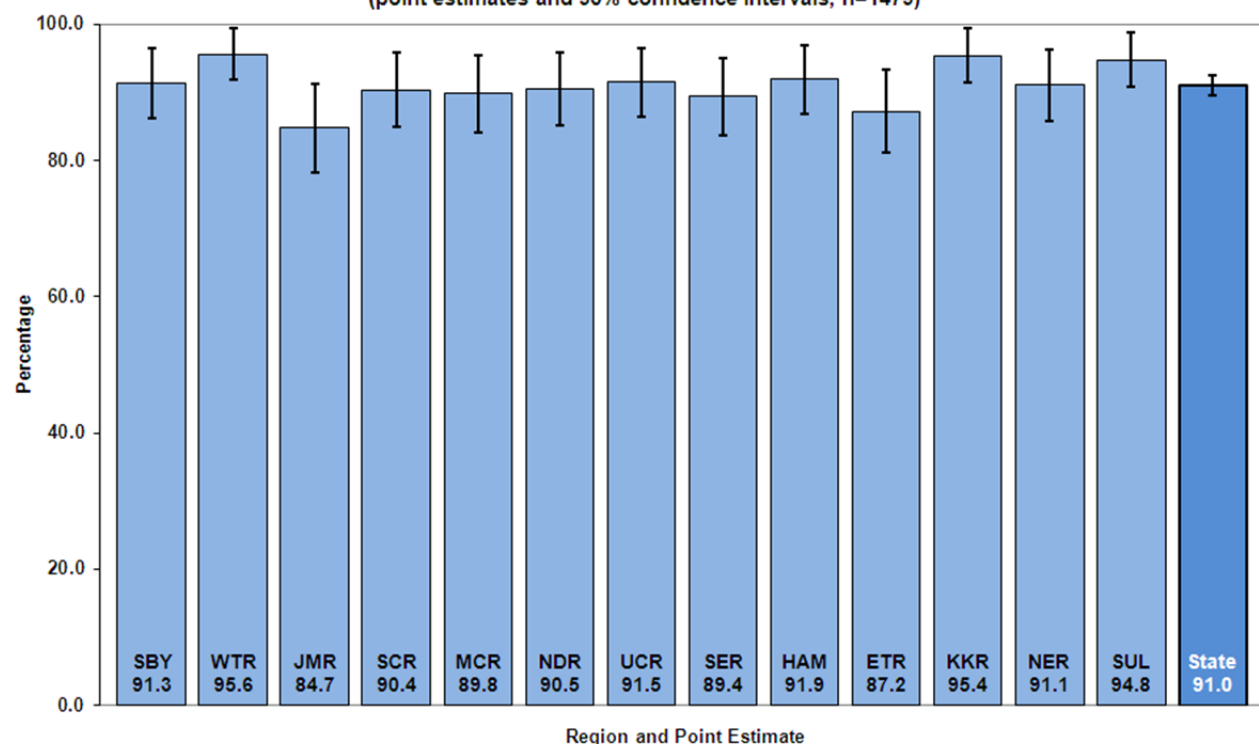
\*statistically significant difference from State point estimate

**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with 2 or 3 doses of Influenza vaccine by health department region**  
 (point estimates and 95% confidence intervals, n=1479)

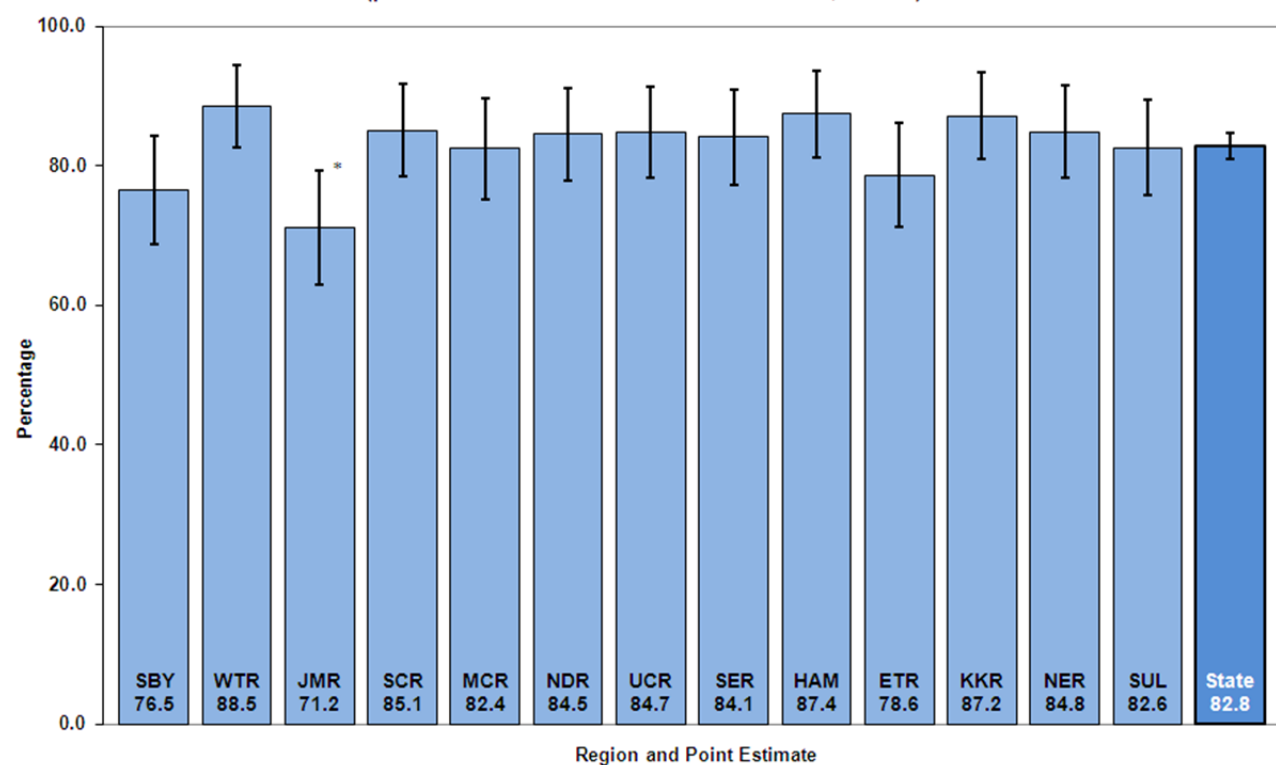


\*statistically significant difference from State point estimate

**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with complete measles, mumps, and rubella (MMR) series (1 dose)**  
**by health department region**  
 (point estimates and 95% confidence intervals, n=1479)

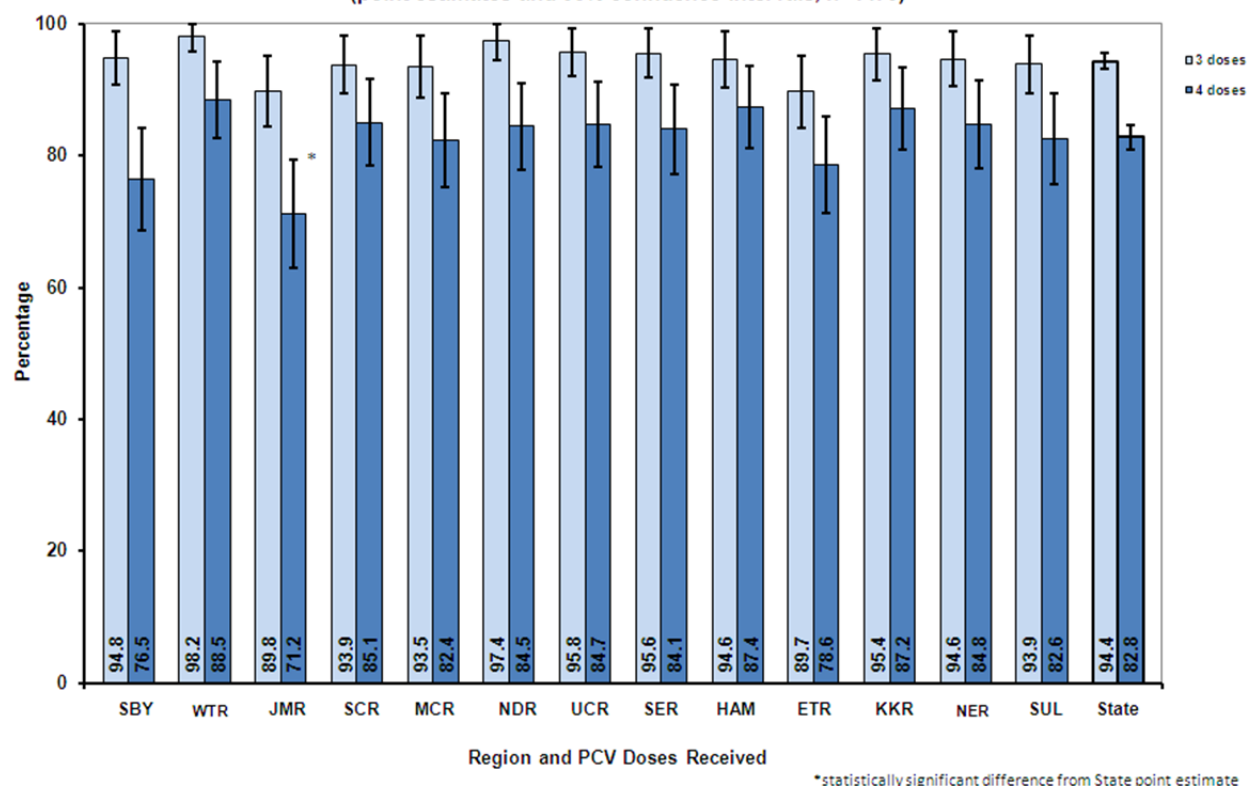


**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with complete PCV series (4 doses) by health department region**  
 (point estimates and 95% confidence intervals, n=1479)

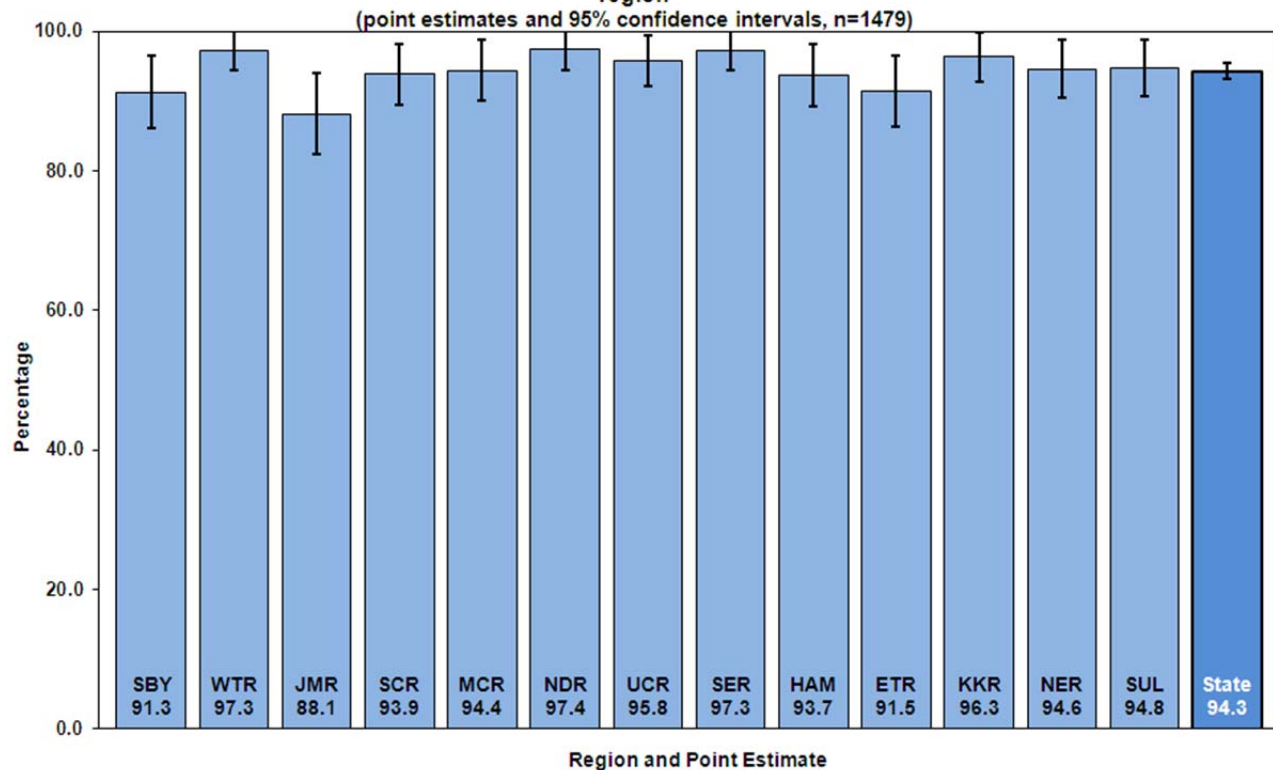


\*statistically significant difference from State point estimate

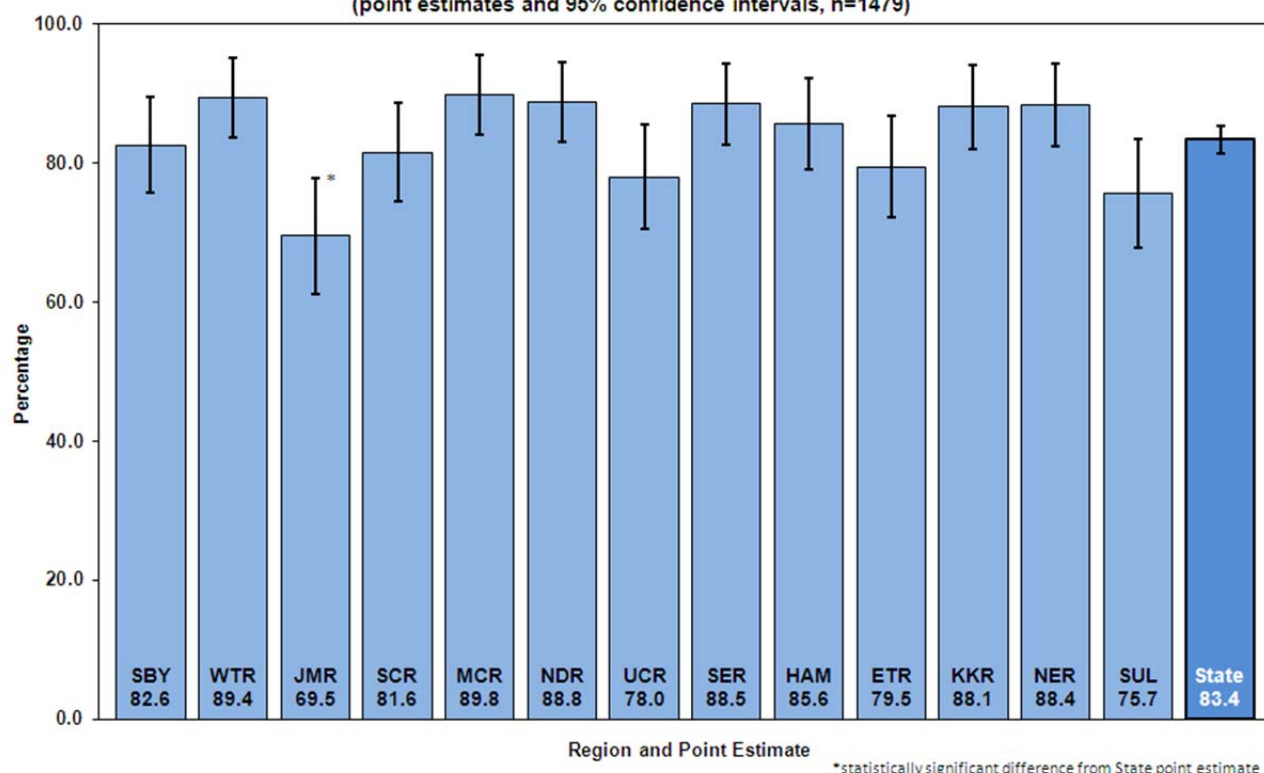
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with 3 or 4 doses of PCV by health department region  
(point estimates and 95% confidence intervals, n=1479)



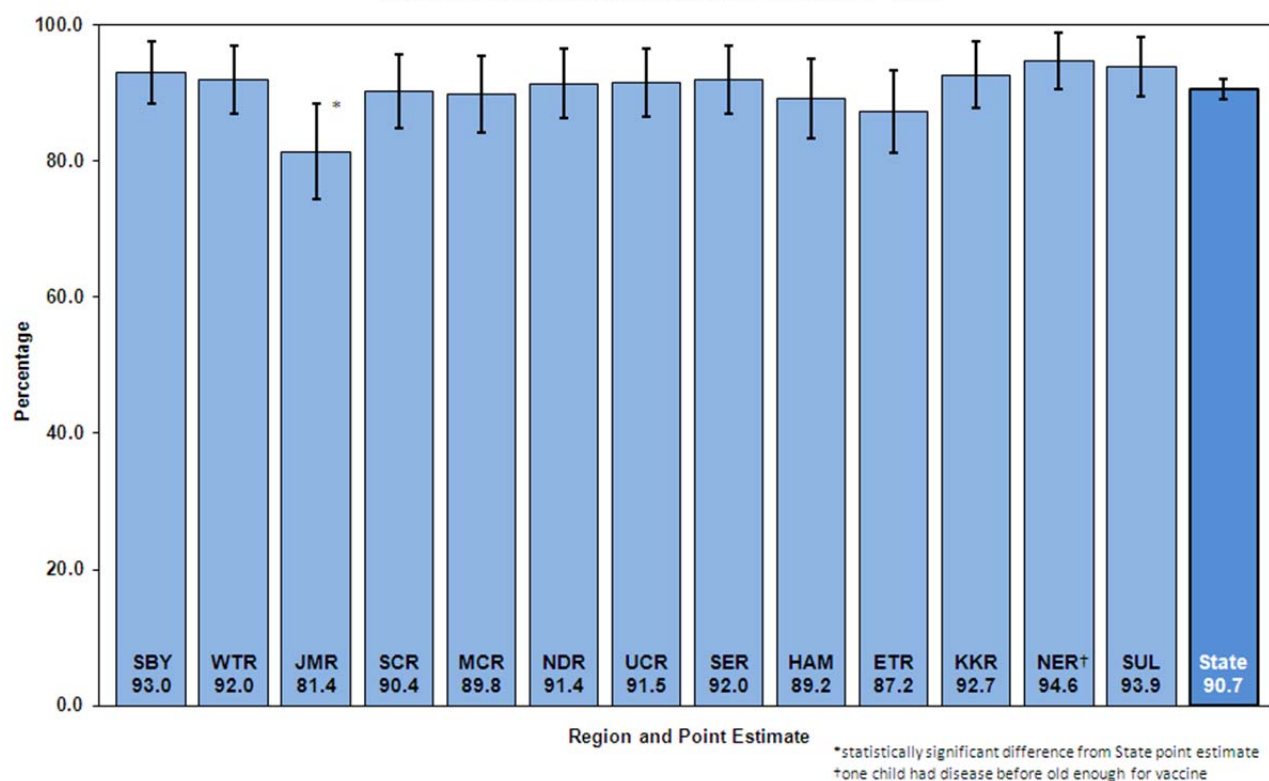
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with complete polio (IPV) series (3 doses) by health department region  
(point estimates and 95% confidence intervals, n=1479)



**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with complete Rotavirus (RTV) series (≥2 doses)**  
**by health department region**  
 (point estimates and 95% confidence intervals, n=1479)



**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children with complete Varicella vaccine (1 dose) by health department region**  
 (point estimates and 95% confidence intervals, n=1479)



# **Appendix 3**

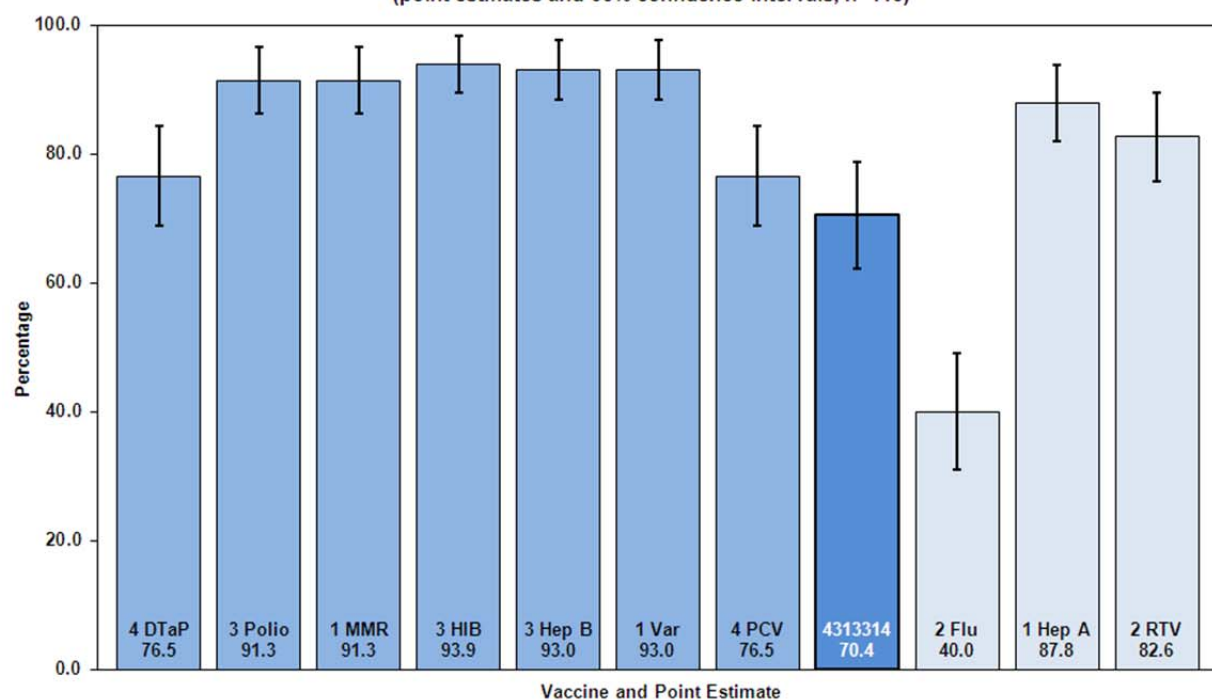
## **2013 Immunization Status Survey**

### **Of 24-Month-Old Children in Tennessee**

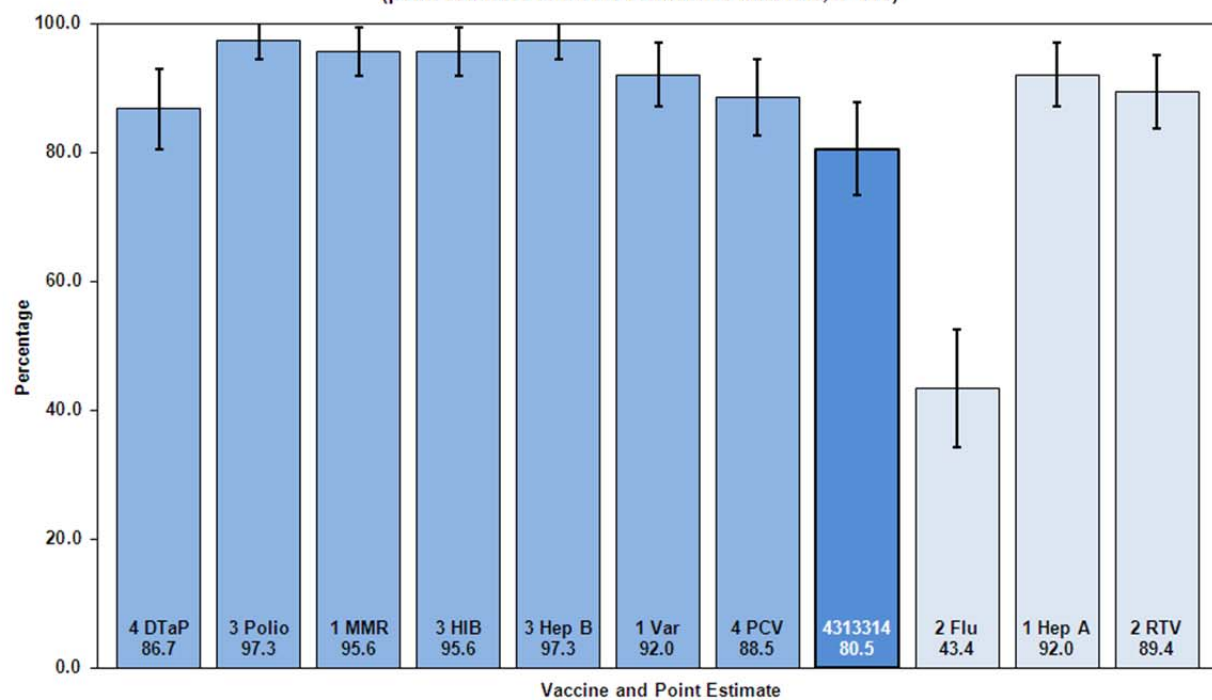
#### **Individual Health Department Region Charts with Coverage Rates for All Vaccines Assessed**

	Page
Shelby County	... 31
West Tennessee Region	... 31
Jackson-Madison County	... 32
South Central Region	... 32
Mid-Cumberland Region	... 33
Nashville-Davidson County	... 33
Upper Cumberland Region	... 34
Southeast Region	... 34
Hamilton County	... 35
East Tennessee Region	... 35
Knoxville-Knox County	... 36
Northeast Region	... 36
Sullivan County	... 37

2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Shelby County (SBY) by vaccine  
(point estimates and 95% confidence intervals, n=115)

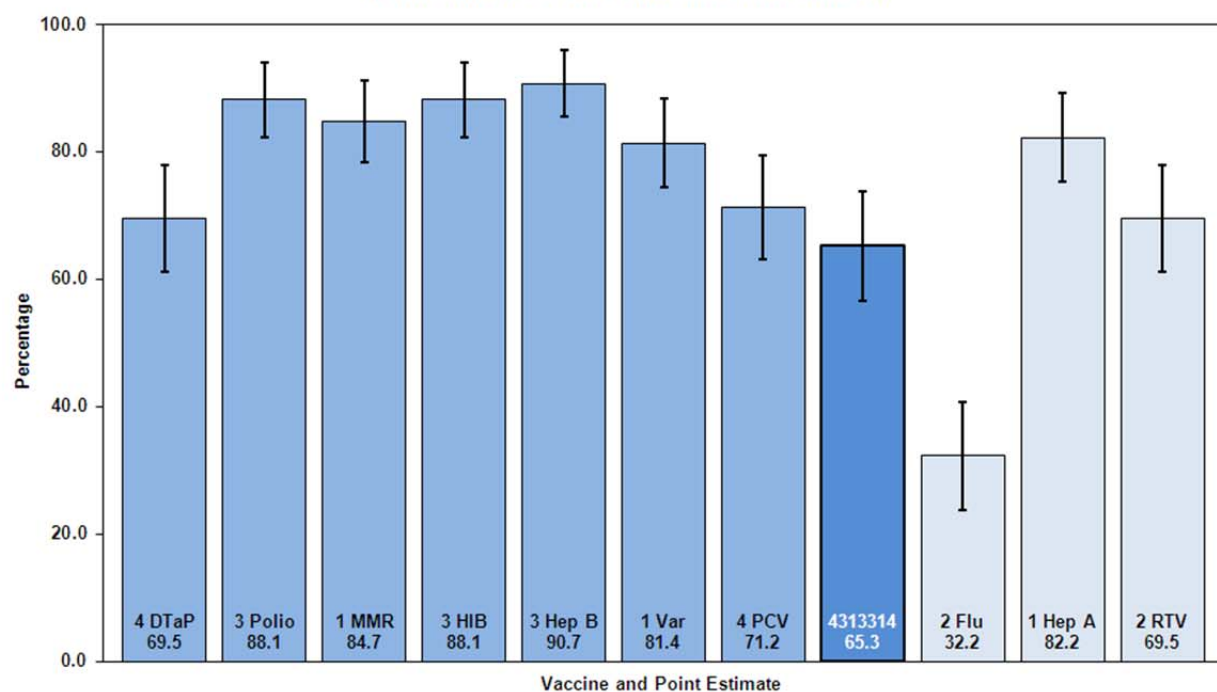


2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in West Tennessee Region (WTR) by vaccine  
(point estimates and 95% confidence intervals, n=113)

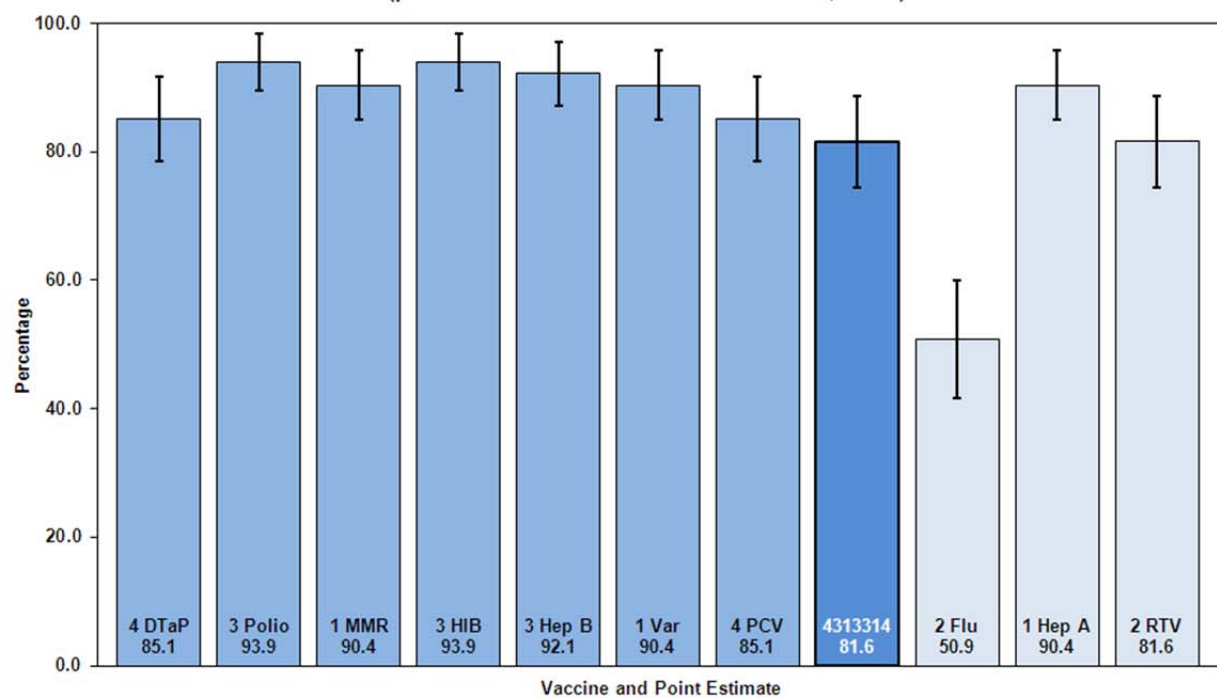




2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Jackson-Madison Region (JMR) by vaccine  
(point estimates and 95% confidence intervals, n=118)

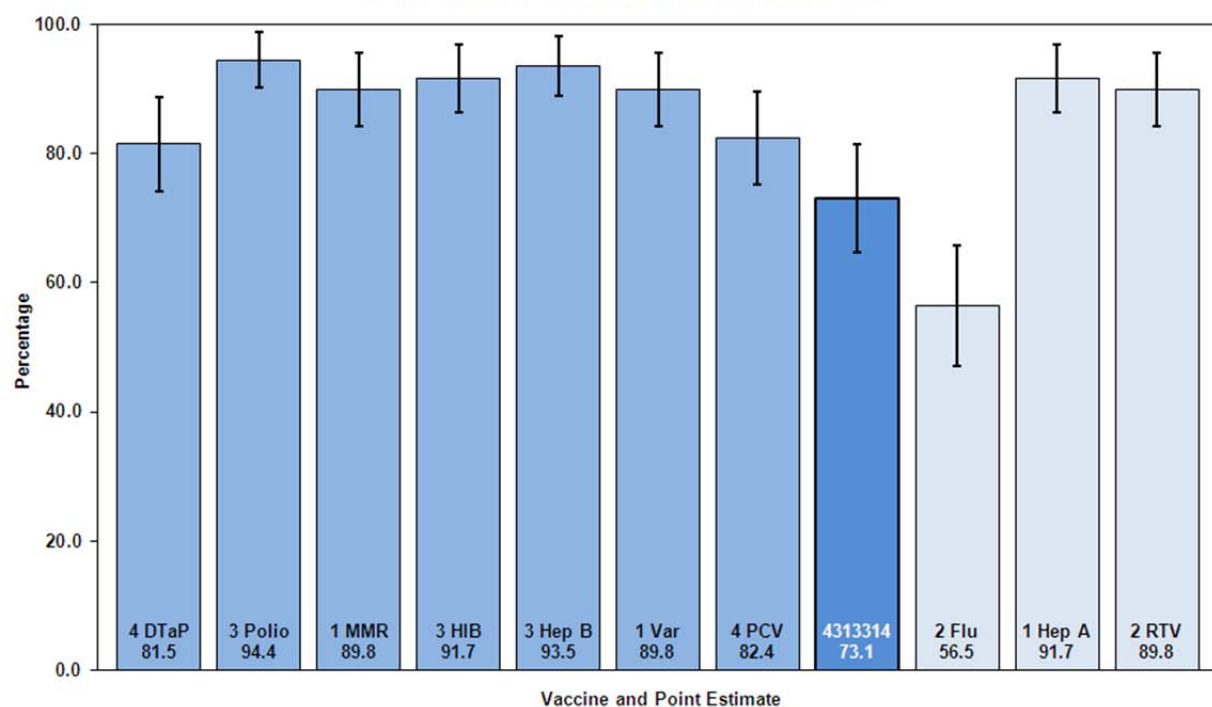


2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in South Central Region (SCR) by vaccine  
(point estimates and 95% confidence intervals, n=114)

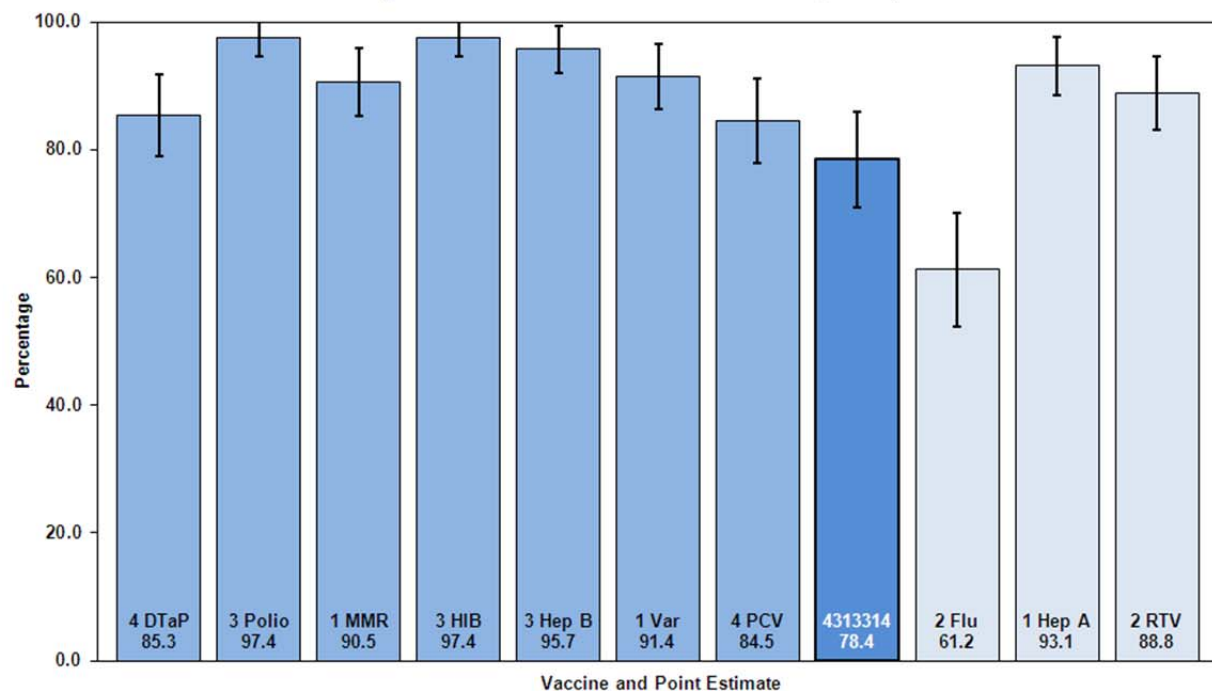




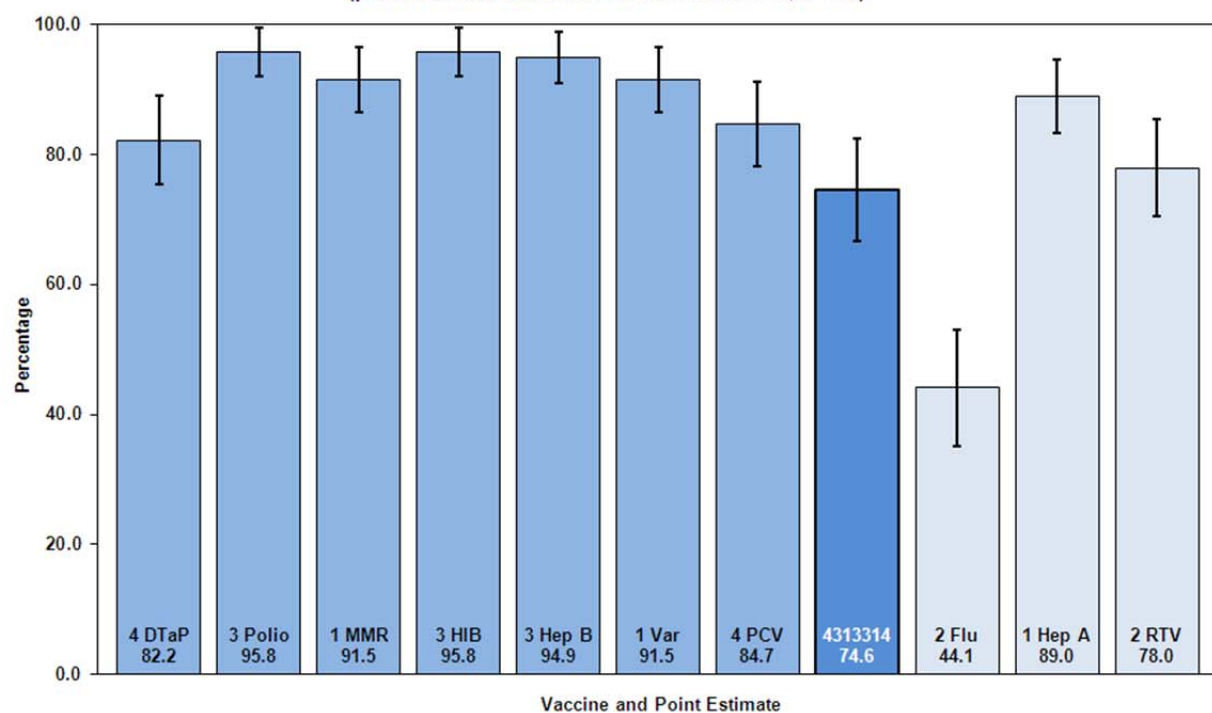
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Mid-Cumberland Region (MCR) by vaccine  
(point estimates and 95% confidence intervals, n=108)



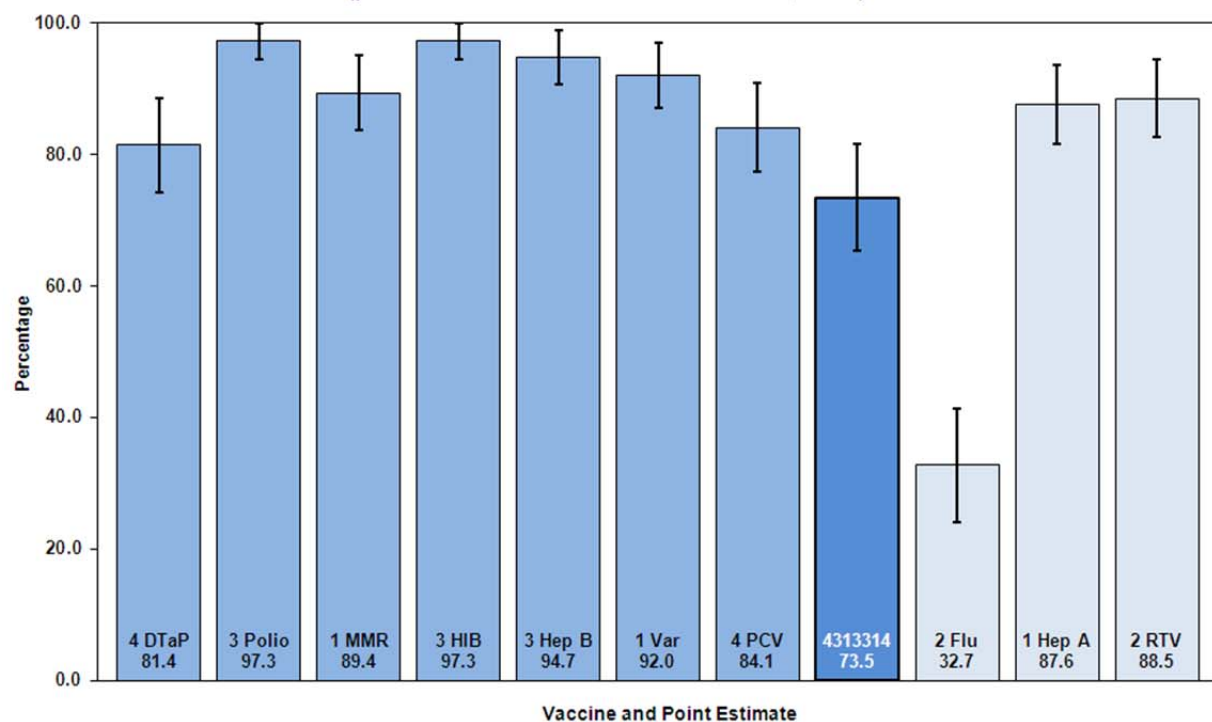
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Nashville-Davidson Region (NDR) by vaccine  
(point estimates and 95% confidence intervals, n=116)



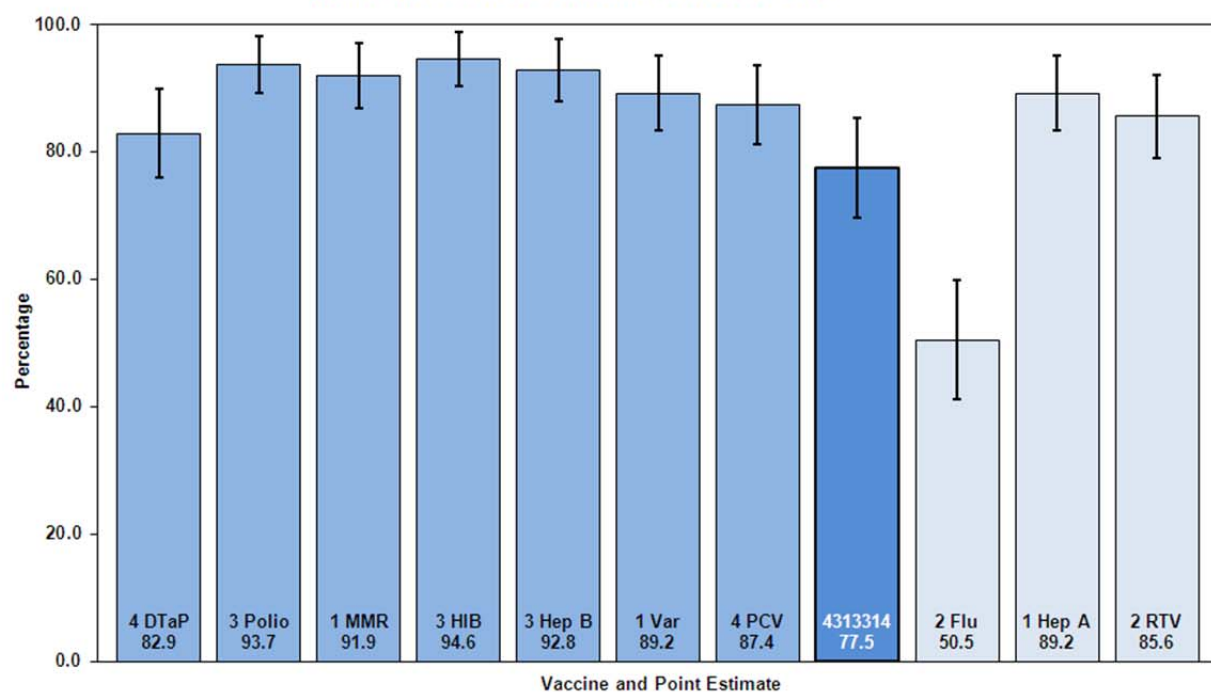
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Upper Cumberland Region (UCR) by vaccine  
(point estimates and 95% confidence intervals, n=118)



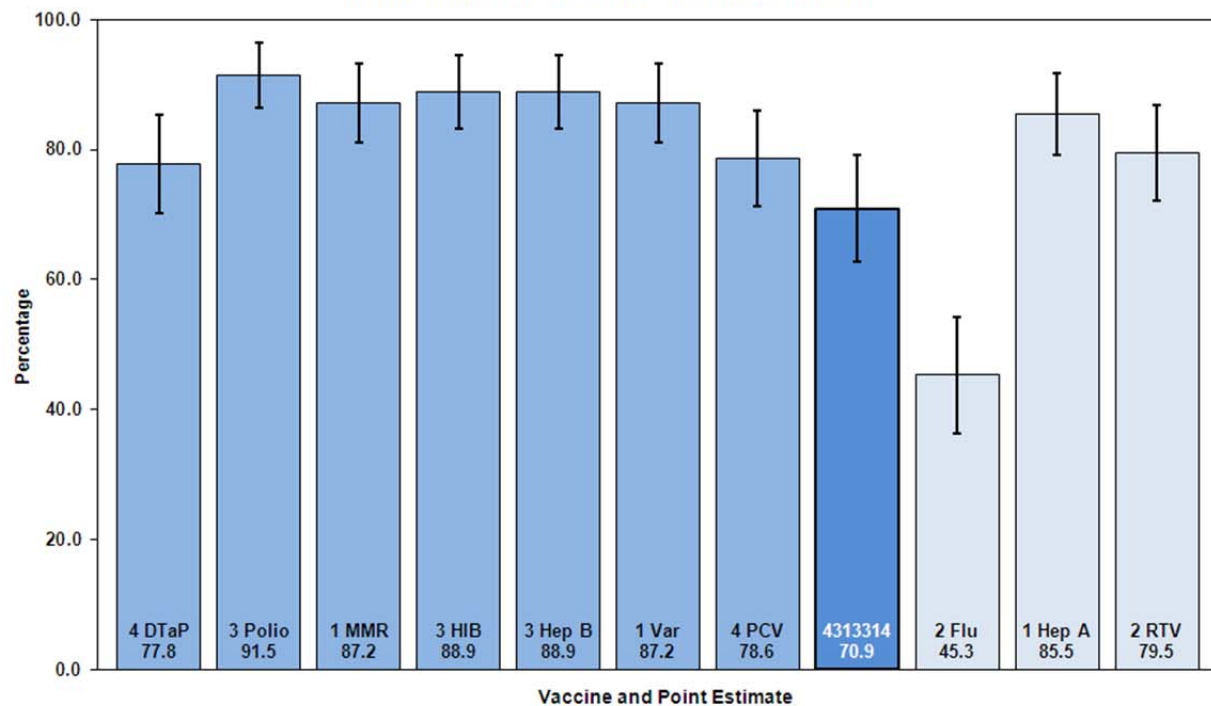
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Southeast Region (SER) by vaccine  
(point estimates and 95% confidence intervals, n=113)



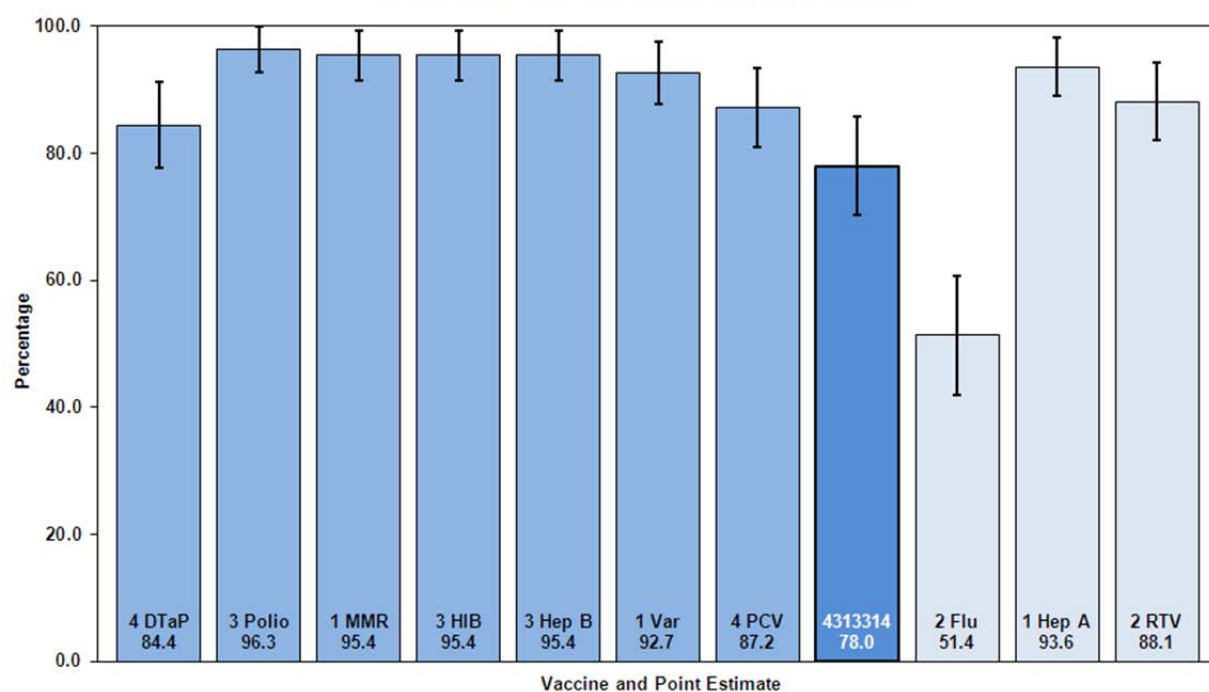
**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children complete in Hamilton County (HAM) by vaccine**  
 (point estimates and 95% confidence intervals, n=111)



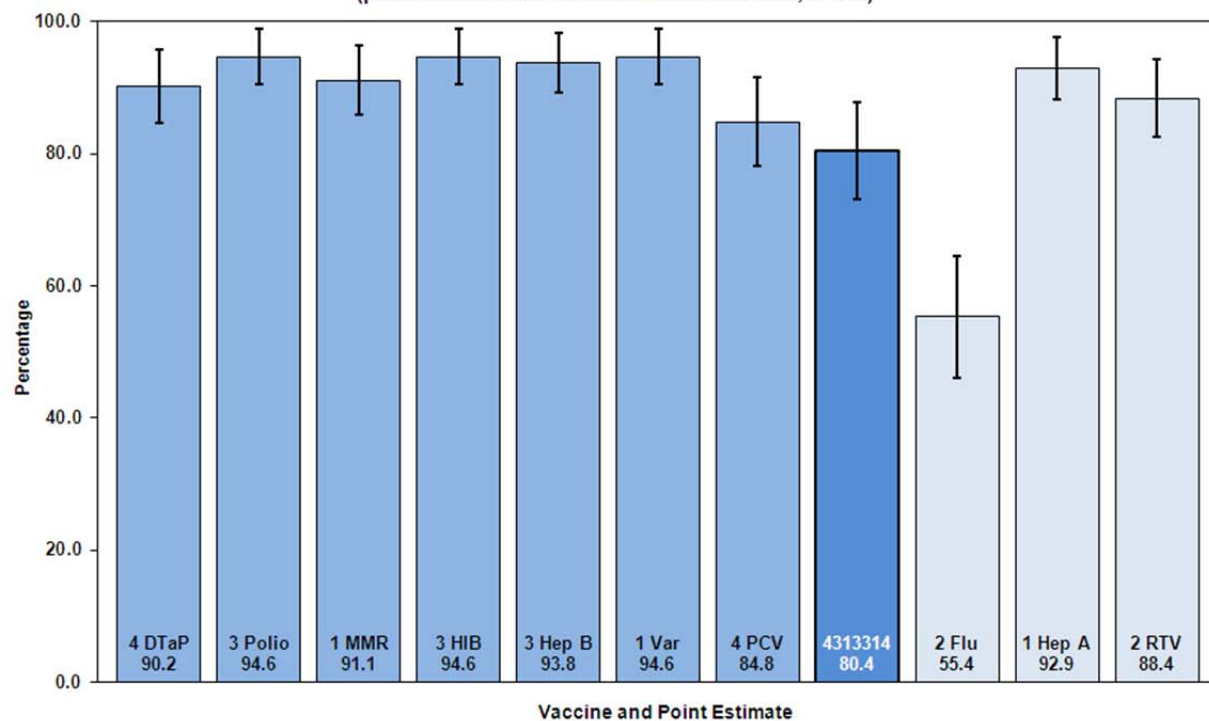
**2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Percentage of children complete in East Tennessee Region (ETR) by vaccine**  
 (point estimates and 95% confidence intervals, n=117)



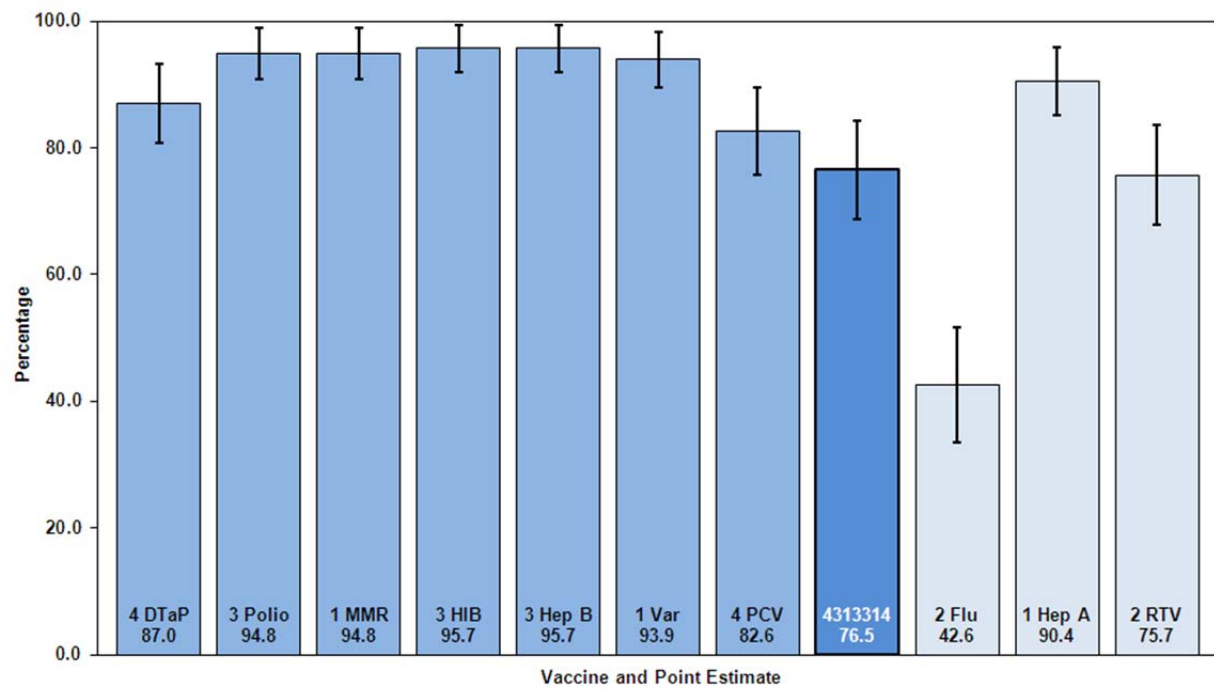
2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Knoxville-Knox Region (KKR) by vaccine  
(point estimates and 95% confidence intervals, n=109)



2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Northeast Region (NER) by vaccine  
(point estimates and 95% confidence intervals, n=112)



2013 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children complete in Sullivan County (SUL) by vaccine  
 (point estimates and 95% confidence intervals, n=115)



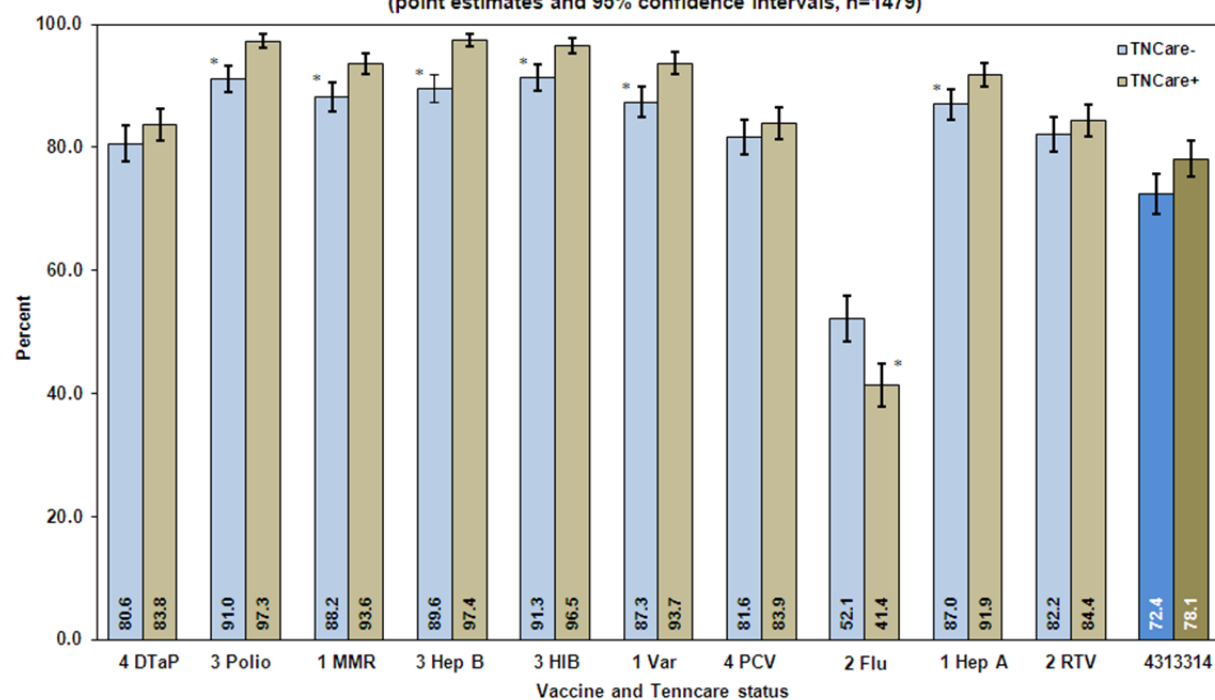
# **Appendix 4**

## **2013 Immunization Status Survey Of 24-Month-Old Children in Tennessee**

### **Additional Statewide Charts for Specific Groups**

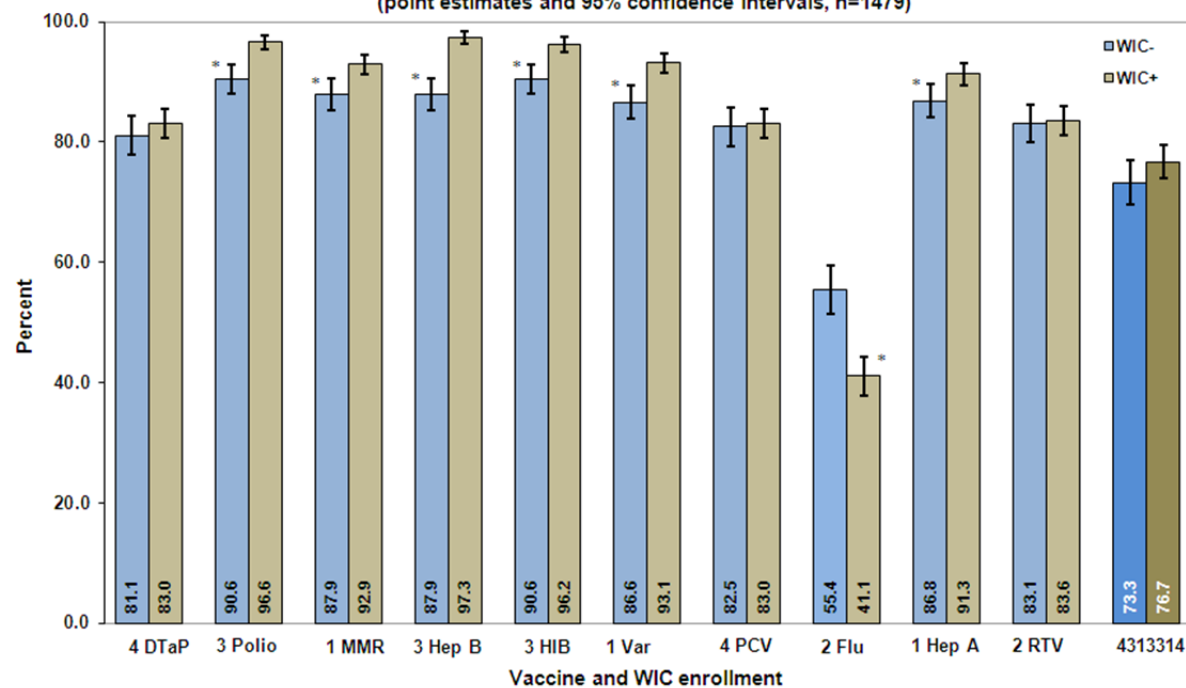
	Page
Immunization levels by vaccine and TennCare enrollment status	... 39
Immunization levels by vaccine and WIC enrollment status	... 39
Trends in on-time immunization coverage disparities (Black vs. White, 2010-2013)	... 40

**2013 Immunization Status of 24-Month-Old Children in Tennessee:**  
**Statewide percentage of children with age-appropriate immunization levels**  
**by vaccine and TennCare enrollment status**  
 (point estimates and 95% confidence intervals, n=1479)



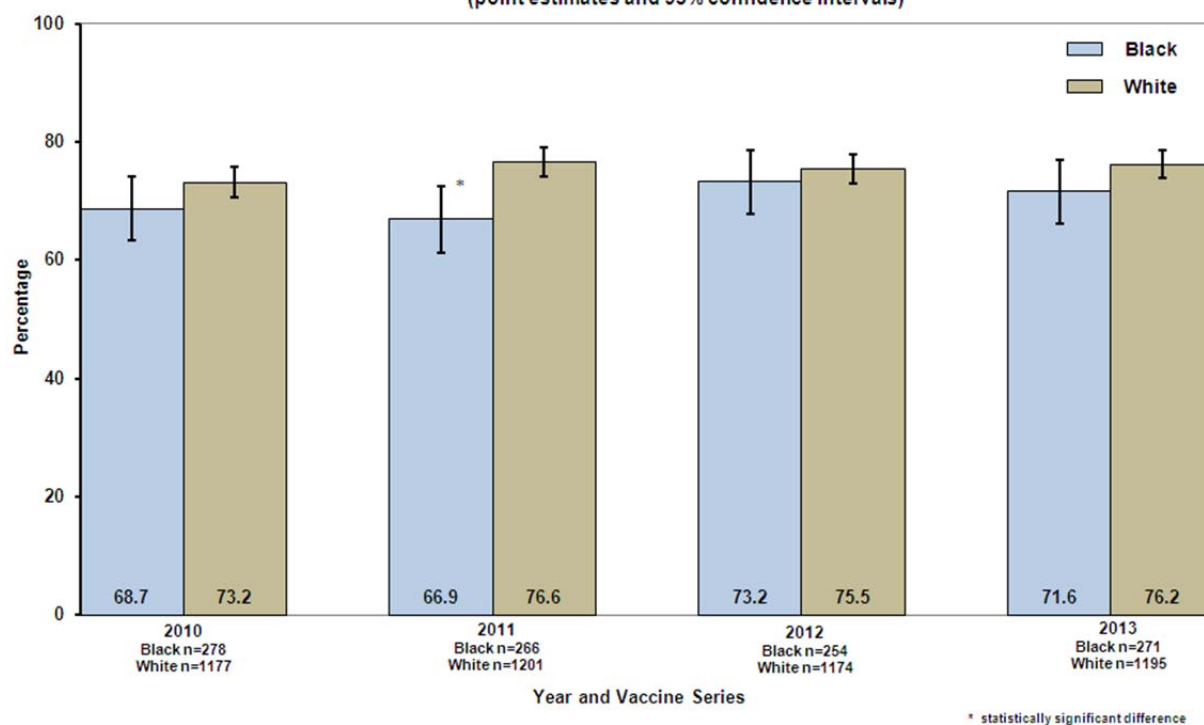
\*statistically significantly lower point estimate than the comparison group

**2013 Immunization Status of 24-Month-Old Children in Tennessee:**  
**Statewide percentage of children with age-appropriate immunization levels**  
**by vaccine and WIC enrollment status**  
 (point estimates and 95% confidence intervals, n=1479)



\*statistically significantly lower point estimate than the comparison group

2013 Immunization Status of 24-Month-Old Children in Tennessee:  
 Statewide percentage of children with age-appropriate 4:3:1:3:3:1:4 immunization levels  
 by race  
 (point estimates and 95% confidence intervals)





# **Appendix 5**

## **2013 Immunization Status Survey Of 24-Month-Old Children in Tennessee**

### **Data Tables for Selected Analyses**

	Page
Series Complete (4:3:1:3:3:1:4)	... 42
Series Complete (4:3:1:3:3:1:4) by Provider Type	... 42
Series Complete (4:3:1:3:3:1:4) by Race	... 43
Series Complete (4:3:1:3:3:1:4) by Number of Older Siblings	... 43
Series Complete (4:3:1:3:3:1:4) by TennCare Enrollment	... 44

### Series Complete (4:3:1:3:3:1:4)

Region	Yes		No		Total
	n=	%	n=	%	n=
Northeast TN	90	80.4%	22	19.6%	112
East TN	83	70.9%	34	29.1%	117
Southeast TN	83	73.5%	30	26.5%	113
Upper Cumberland	88	74.6%	30	25.4%	118
Mid-Cumberland	79	73.2%	29	26.8%	108
South Central	93	81.6%	21	18.4%	114
West TN	91	80.5%	22	19.5%	113
Shelby County	81	70.4%	34	29.6%	115
Davidson County	91	78.5%	25	21.5%	116
Knox County	85	78.0%	24	22.0%	109
Hamilton County	86	77.5%	25	22.5%	111
Madison County	77	65.3%	41	34.7%	118
Sullivan County	88	76.5%	27	23.5%	115
Total	1115	75.4%	364	24.6%	1479

### Series Complete (4:3:1:3:3:1:4) by Provider Type

Region	Public			Private			Both		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	3	3	100.0%	79	95	83.2%	8	12	75.0%
East TN	4	7	57.1%	63	83	75.9%	16	22	72.7%
Southeast TN	6	8	75.0%	68	89	76.4%	9	14	64.3%
Upper Cumberland	9	13	69.3%	70	93	75.3%	9	10	90.0%
Mid-Cumberland	1	1	100.0%	75	99	75.8%	3	5	60.0%
South Central	7	7	100.0%	72	84	85.7%	14	16	87.5%
West TN	20	24	83.3%	52	70	74.3%	19	19	100.0%
Shelby County	2	3	66.7%	66	88	75.0%	13	22	59.1%
Davidson County	0	1	0.0%	86	106	81.1%	5	9	55.6%
Knox County	3	3	100.0%	75	94	79.8%	7	10	70.0%
Hamilton County	0	0	0.0%	79	99	79.8%	7	9	77.8%
Madison County	16	25	64.0%	47	71	66.2%	14	20	70.0%
Sullivan County	5	8	62.5%	77	94	81.9%	6	12	50.0%
Total	76	103	73.8%	909	1165	78.0%	130	180	72.2%

### Series Complete (4:3:1:3:3:1:4) by Race

Region	White			Black			Other		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	87	108	80.6%	2	3	66.7%	1	2	50.0%
East TN	87	113	71.7%	2	3	66.7%	1	2	50.0%
Southeast TN	77	106	72.6%	4	5	80.0%	2	2	100.0%
Upper Cumberland	83	113	73.5%	3	3	100.0%	2	2	100.0%
Mid-Cumberland	71	96	74.0%	7	11	63.6%	1	1	100.0%
South Central	89	107	83.2%	6	8	75.0%	0	1	0.0%
West TN	74	91	81.3%	18	23	78.3%	0	0	0.0%
Shelby County	29	40	72.5%	51	74	68.9%	1	1	100.0%
Davidson County	59	77	76.6%	29	36	80.6%	3	3	100.0%
Knox County	74	93	79.6%	9	14	64.3%	3	3	100.0%
Hamilton County	68	87	78.2%	19	27	70.4%	1	1	100.0%
Madison County	36	59	61.0%	40	58	69.0%	1	1	100.0%
Sullivan County	83	105	79.1%	4	6	66.7%	1	4	25.0%
Total	911	1195	76.2%	194	271	71.6%	17	23	73.9%

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

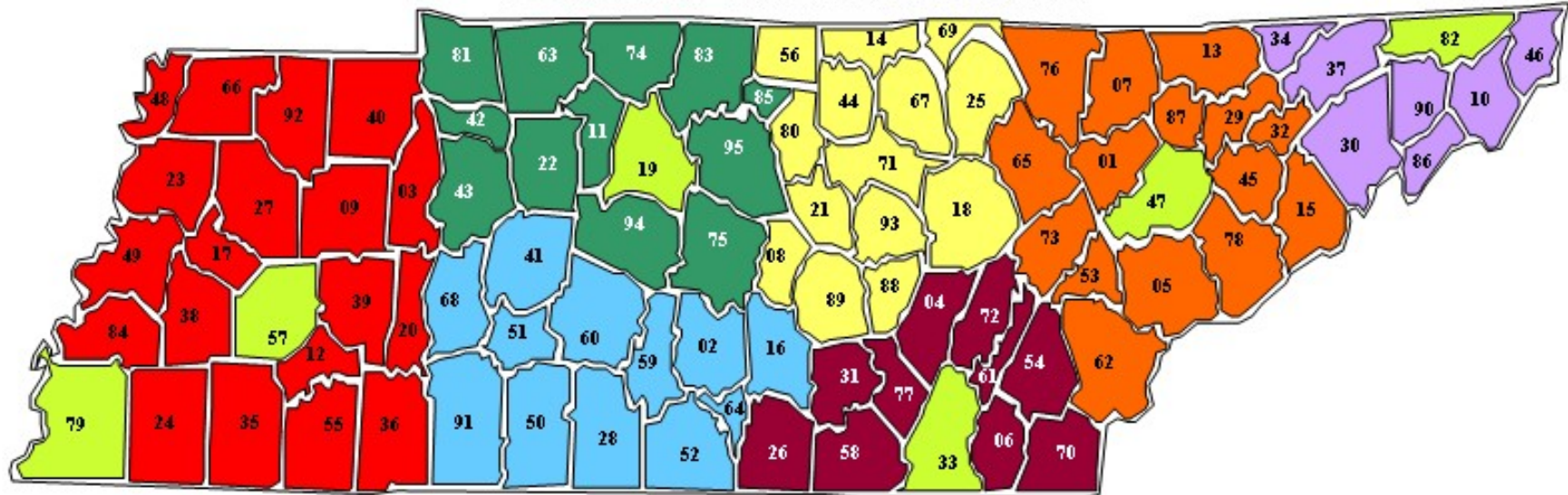
Region	0 Siblings			1 Siblings			2+Siblings		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	47	56	83.9%	34	42	81.0%	9	14	64.3%
East TN	31	40	77.5%	29	41	70.7%	23	36	63.9%
Southeast TN	37	47	78.7%	30	41	73.2%	16	25	64.0%
Upper Cumberland	40	49	81.6%	22	29	75.9%	26	40	65.0%
Mid-Cumberland	35	47	74.5%	22	32	68.8%	22	29	75.9%
South Central	39	42	92.9%	26	33	78.8%	27	38	71.1%
West TN	39	44	88.6%	25	34	75.5%	27	35	77.1%
Shelby County	38	45	84.4%	21	34	61.8%	22	36	61.1%
Davidson County	36	43	83.7%	28	35	80.0%	25	36	69.4%
Knox County	41	48	85.4%	31	40	77.5%	13	21	61.9%
Hamilton County	45	52	86.5%	24	33	72.7%	17	26	65.4%
Madison County	34	42	81.0%	24	39	61.5%	19	37	51.4%
Sullivan County	36	44	81.8%	30	39	76.9%	22	32	68.8%
Total	498	599	83.1%	346	472	73.3%	268	405	66.2%

### Series Complete (4:3:1:3:3:1:4) by TennCare Enrollment

Region	Enrolled			Not Enrolled		
	Yes	Total	%	Yes	Total	%
Northeast TN	54	64	84.3%	36	48	75.0%
East TN	67	86	77.9%	16	31	51.6%
Southeast TN	46	55	70.8%	37	48	77.1%
Upper Cumberland	56	74	75.7%	32	44	72.7%
Mid-Cumberland	26	58	68.4%	53	70	75.7%
South Central	55	65	84.6%	38	49	77.6%
West TN	70	80	87.5%	21	33	63.6%
Shelby County	47	65	72.3%	34	50	68.0%
Davidson County	41	53	77.4%	50	63	79.4%
Knox County	33	46	71.7%	52	63	82.5%
Hamilton County	41	51	80.4%	45	60	75.0%
Madison County	33	48	68.8%	44	70	62.9%
Sullivan County	38	42	90.5%	50	73	68.5%
Total	607	777	78.1%	508	702	72.4%

## Appendix 6

### TENNESSEE DEPARTMENT OF HEALTH REGIONAL/METRO HEALTH OFFICES



West		Mid Cumberland		South Central		Southeast		Upper Cumberland		East		North East	
#	County	#	County	#	County	#	County	#	County	#	County	#	County
03	Benton	11	Cheatham	02	Bedford	04	Bledsoe	08	Cannon	01	Anderson	10	Carter
09	Carroll	22	Dickson	16	Coffee	06	Bradley	14	Clay	05	Blount	30	Greene
12	Chester	42	Houston	28	Giles	26	Franklin	18	Cumberland	07	Campbell	34	Hancock
17	Crockett	43	Humphreys	41	Hickman	31	Grundy	21	DeKalb	13	Claiborne	37	Hawkins
20	Decatur	63	Montgomery	50	Lawrence	54	McMinn	25	Fentress	15	Coke	46	Johnson
23	Dyer	74	Robertson	51	Lewis	58	Marion	44	Jackson	29	Grainger	86	Unicoi
24	Fayette	75	Rutherford	52	Lincoln	61	Meigs	56	Macon	32	Hamblen	90	Washington
27	Gibson	81	Stewart	59	Marshall	70	Polk	67	Overton	45	Jefferson		
35	Hardeman	83	Sumner	60	Maury	72	Rhea	69	Pickett	53	Loudon		
36	Hardin	85	Trousdale	64	Moore	77	Sequatchie	71	Putnam	62	Monroe		METROS
38	Haywood	94	Williamson	68	Perry			80	Smith	65	Morgan	#	County
39	Henderson	95	Wilson	91	Wayne			88	Van Buren	73	Roane	19	Davidson
40	Henry							89	Warren	76	Scott	33	Hamilton
48	Lake							93	White	78	Sevier	47	Knox
49	Lauderdale									87	Union	57	Madison
55	McNairy											79	Shelby
66	Obion											82	Sullivan
84	Tipton												
92	Weakley												