

Results of the 2014 Immunization Status Survey of 24-Month-Old Children in Tennessee

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December 2014**

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.

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, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages and 4) procedures for importing data from external sources.

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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:

Timely routine vaccination of children saves money, health and lives. 2014 is the 20th anniversary of the federal Vaccines for Children (VFC) Program that has assured affordable access to all routine vaccines for children without private insurance coverage. The CDC reported that the routine vaccines already given to US children born between 1994 and 2013 will prevent an average of 4.1 illnesses per child, prevent the hospitalization of one in four and prevent the premature death of nearly one in 100 of these children over their lifetimes.¹ The CDC calculates that vaccination of U.S.-born children each year with the current immunization schedule yields a net savings of nearly \$14 billion in direct costs and \$69 billion in total costs to society.² With roughly 2 percent of the U.S. population, this suggests Tennessee has benefitted from the prevention of about 480,000 cases of disease in the past decade, with *annual savings* of \$280 million in direct medical costs and \$1.38 billion in total costs to society.

Methods:

A random sample of 1,601 children was selected from birth certificates of children born in 2012 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 was sealed (e.g. through adoption or placement in foster care), if the parents or guardians refused to participate, or if the child died: 1,450 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.

In 2014, the survey analysis was updated to provide a more accurate assessment of *Haemophilus influenzae* type B (HIB) vaccination and rotavirus vaccination (RTV). Past surveys classified the minimum number of doses necessary as complete although certain brands required more doses; the 2014 survey took into account the vaccine brand, if known, and classified a child as complete only if the appropriate number of doses had been administered. The 2014 results are more accurate and better match methods now used by the CDC. Using the old method, vaccination rates for HIB, RTV, and the total vaccine series *were higher than* 2013; the new method resulted in more accurate, but lower, coverage estimates. For this reason, the text will indicate the 2014 vaccine series as 4:3:1:3* :3:1:4, with the asterisk indicating that HIB vaccine was considered complete with 4 doses, instead of 3, if the 4-dose brand was used.

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 2014 (24 months)
Diphtheria, Tetanus, Pertussis	90%	85.0%
Poliomyelitis	90%	94.6%

Measles, Mumps, Rubella	90%	93.3%
Hepatitis B	90%	95.1%
Hepatitis B, birth dose	85%	76.8%
<i>Haemophilus influenzae</i> , type B	90%	85.7%
Varicella (Chickenpox)	90%	92.3%
Pneumococcus	90%	84.3%
All of above	80%	73.1%
Hepatitis A	60% complete	1 dose: 91.2%
Influenza	70%	51.8%
Rotavirus	80%	79.8%

Other Key Findings:

- Sixteen (1.1%) of 1,450 children surveyed had not received a single dose of vaccine. Fifteen of 16 had not been vaccinated for religious or other personal reasons; one cited a medical reason. Ten (0.7%) others had received at least one vaccination but cited a religious, personal or medical reason for rejecting further vaccines.
- A significant racial disparity persists in the use of influenza vaccine (54.4% for white children vs. 35.2% for black children). Overall influenza vaccination rates are higher than the previous year, but remain low relative to other vaccine coverage rates.
- Children enrolled in TennCare or Women, Infants and Children programs (WIC) were immunized at similar rates as other children for most of the vaccines in the routine 4:3:1:3^{*}:3:1:4 series:
 - Children enrolled in TennCare were significantly *less* likely to be fully protected against diphtheria, tetanus, pertussis (DTaP) and pneumococcal (PCV) disease than non-enrollees.
 - WIC-enrolled children were *more* likely to have received three doses of hepatitis B vaccine by their second birthday than those not enrolled in WIC.
 - WIC and TennCare participants had significantly lower rates of vaccination against influenza.

Key action steps:

- In November 2014, TDH implemented a new, federally-funded immunization information system, “TennIIS”, which is available to all public and private immunization providers. It includes new clinical support features not available previously (www.TennesseeIIS.gov). TennIIS meets all national functional standards, including vaccine forecasting, which automatically lists vaccines recommended for a child based on the child’s record, and a patient reminder feature. In other states, such tools have been proven to improve immunization rates.
- TDH is working with immunization providers in medical clinics and pharmacies to establish electronic reporting of immunizations from electronic health record systems into TennIIS. Comprehensive reporting to an IIS improves the quality of patient care by establishing a permanent and complete immunization record available to all the patient’s healthcare providers.
- Local health departments receive monthly reports of children who may be falling behind on key immunizations to assist them in actively following up on these young patients.
- 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.

¹ CDC. Benefits from Immunization During the Vaccines for Children Program Era — United States, 1994–2013. Morbidity and Mortality Weekly Report. 63(16);352-355.

² 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 2014 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:

Disease(s)	Possible complications of disease	Vaccination	# of doses*
Diphtheria, tetanus, pertussis	<i>Diphtheria</i> : upper airway obstruction, pneumonia, respiratory failure, death <i>Tetanus</i> : spasms of respiratory and skeletal muscles, death <i>Pertussis</i> : Outbreaks; severe, long-term cough, vomiting, breathlessness, death in infants	DTaP	4
Poliomyelitis	Paralysis, death	IPV	3
Measles, mumps, rubella	<i>Measles</i> : Outbreaks; ear infections, pneumonia, cardiac and neurologic problems, encephalitis, death <i>Mumps</i> : Outbreaks; sterility, meningitis, arthritis, hearing impairment <i>Rubella</i> : arthritis, encephalitis, birth defects	MMR	1
<i>Haemophilus influenzae</i> type B	Pneumonia, meningitis, neurologic problems, death	HIB	3 or 4 [†]
Hepatitis B	Fulminant hepatitis, jaundice, liver cancer, cirrhosis, premature death	HBV	3
Varicella (chickenpox)	Rash illness, severe disease in immunocompromised	VAR	1
Pneumococcus (certain strains)	Ear infections, pneumonia, meningitis, blood stream infections, death	PCV	4
Hepatitis A	Outbreaks: fever, nausea, jaundice, rare death	HAV	1
Influenza	Outbreaks: secondary pneumonia, exacerbation of chronic diseases, hospitalizations, deaths	FLU	2
Rotavirus	Outbreaks in daycare settings, dehydration, hospitalization	RTV	2 or 3 [†]

*number of doses considered complete in this survey

[†] Doses required depend on the number necessary for full series of the brand of vaccine administered

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. 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 2014 survey is defined as having received four doses of DTaP, three doses of IPV, one dose of MMR, three *or* four doses of HIB (4 doses required if any dose is the 4-dose brand, indicated by the 3^{*}), 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; all series estimates before 2014 counted HIB vaccination as complete with 3 doses because brand information was unavailable.

Recommended vaccines not included in the 4:3:1:3* :3:1:4 series are reported individually:

- Influenza vaccine (FLU) is given annually at age 6 months and older. Protection is conferred only after 2 doses, so analysis considers a child immunized 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 only 1 dose by the second birthday are on schedule. For this reason, this survey reports children as up to date with 1 dose of HAV.
- Rotavirus vaccine (RTV) is complete with 2 doses of Rotarix[®] or with 3 doses, if any dose was known to be Rotateq[®]. If no brand information was available, 2 doses of rotavirus vaccine were considered complete.

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. HP 2020 objectives also include having 85% of all children receive their first dose of hepatitis B vaccine within 3 days of life.

The 2014 sample population:

The 2014 statewide sample consisted of 1,601 children born in the first quarter of 2012 (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 2012 in that region. Twenty-eight (28) additional children of black race were randomly selected for inclusion in racial disparity analysis.

Of the 1,601 sampled births, 151 were excluded from the analysis for one of the following reasons: parents refused to participate (n=38), the child had moved out of state (n = 104), the child had been adopted, put in foster care or was in state custody (n=8), or the child died (n=1). Two of the 28 oversampled records included only in the state-level racial disparity analysis were excluded because the children had moved out of state.

After exclusions, 1,450 children remained in the primary sample (1,424 + 26 oversampled records =1,450 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.

Unable to locate:

Of the 1,450 total children, two with incomplete vaccination information 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: both had incomplete immunization information in the registry. See Appendix 1 for the regions of residence of these children.

The 2014 survey method included the use of Accurint, a subscription-based database compiling publicly available address information, to which the TDH obtained licensed access in late 2012. This increased the efficiency of locating children randomly selected for participation. Publicly available contact details for parents of each child were provided to local and regional health department staff at the beginning of the survey period.

Vaccine refusal:

Of the 1,450 children, 16 children with no immunizations (1.1%) had parents who confirmed that they refused vaccine for religious (n=6), philosophical (n=9), or medical (n=1) reasons. Ten additional children who had received at least one immunization had parents who reported refusing additional immunizations for philosophical (n=4), religious (n=2) or medical (n=4) reasons. These children impacted regional coverage rates to different degrees: 7 regions had 0-1 child whose parents refused vaccination, while 4 regions had 4-5 such children. 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:

It is possible that on-time immunization classification in this survey overestimates appropriate immunization because analysis does not take into account whether dose intervals meet CDC recommendations.

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 the first three 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 2012 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): 2014 change in method

Two different HIB schedules exist depending upon the vaccine used. The full series (FS) of the Merck product requires a total of 3 doses; the FS of the Sanofi Pasteur product requires a total of 4 doses. The 2014 analysis required 4-dose coverage for children with any documented dose of the 4-dose product; all others required only 3 doses to classify as complete. In the sample of 1424 children, 909 required 4 doses, 307 received the 3-dose product alone or in combination with unknown doses and 208 had no brand information and were counted complete with 3 doses. This analysis change reduced, though did not completely eliminate, the degree of inflation in on-time completion in past years. When 2013 analytic methods were applied to the 2014 sample, Hib vaccination remained consistent with 2013 (see figure 3); including product-specific dose requirements produces a lower but more accurate coverage estimate in line with CDC National Immunization Survey (NIS) results. HIB-specific charts are provided in Appendix 2.

Rotavirus vaccine (RTV): 2014 change in method

Like HIB, 2 products are available with different dose schedules. Rotateq[®] (Merck), requires 3 doses; Rotarix[®] (GSK) requires 2 doses. 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 8 months of age. The 2014 sample of 1424 children required 3 doses for the 788 children who received at least one dose of Rotateq[®], 2 doses for those 302 who received Rotarix[®] or Rotarix[®] and an unknown dose, and 2 doses for the 334 whose product information was unknown. Under previous methods, RTV coverage increased over 2013 (see figure 3); the new analysis produces a lower, more accurate FS coverage estimate. 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. The HP 2020 objective of 90% on time coverage was exceeded for 4 out of 7 vaccines in the 4:3:1:3*:3:1:4 series. The three vaccines that could require 4 doses for on-time completion (DTaP, PCV and HIB) failed to reach 90%. This target is within reach, because the percentages of children who had received 3 or more doses were 95.6% for DTaP and 94.7% for PCV (Appendix 2).

The change to brand-specific full series analysis for HIB and RTV lowered coverage when compared to the previous methods applied to the 2014 data (see Figure 3). However, the lowest coverage rates were found in the children with completely unknown brand information, despite the lower number of doses to be classified as complete. For HIB vaccine, the series was complete for 843 of 909 (92.7%) who required 4 doses to be classified as complete. Of the remaining children who were counted as complete with 3 doses, 281 of 307 (91.5%) of those confirmed as receiving one or more doses of the 3-dose product were complete, but just 97 of 208 (47%) with no brand information were complete. Overall, 85.7% of children surveyed were complete for HIB, below the 90% HP2020 target.

The same pattern seen in HIB was observed in the new RTV analysis. In 2014, 658 of the 788 (83.5%) children who required a 3 dose schedule were complete. Of the remaining children classified as complete with 2 doses: 283 of 302 (94%) with at least one confirmed dose of Rotarix[®] were complete, but just 195 of 334 (58%) with no brand information were complete. Overall, 79.8% of children were complete, just shy of the 80% HP2020 target.

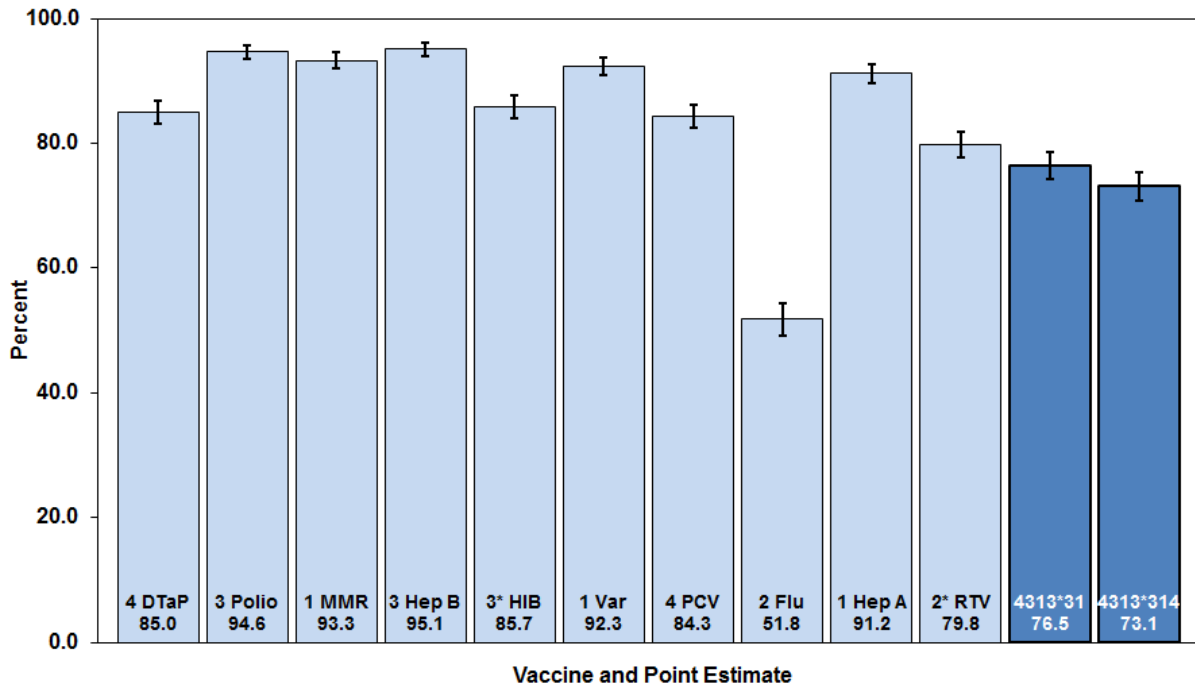
For hepatitis A vaccine, 57.1% of children had completed the 2-dose series by their 2nd birthday (HP 2020 objective is 60% completion by the 3rd birthday); 91.2% had received the first dose and were due for a dose 6 to 18 months later. Two-dose influenza vaccination coverage increased 5 percentage points from the 2013 estimate, a statistically significant increase, although influenza coverage rates remain distantly behind all other routine childhood vaccines.

The lower HIB estimate resulted in an overall 4:3:1:3*:3:1:4 vaccine series completion of 73.1% (95% CI, 70.8, 75.4). Using the previous method of HIB coverage assessment, the 2014 series would have *increased* to 77.9% from 75.4% in 2013, as a result of improvement in DTaP and PCV coverage. See Figure 3 for comparisons to 2013, with the application of 2013 analysis methods to 2014 data to allow direct comparison. See Figure 4 for trends in these series completion rates over time.

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

Figure 1

2014 Immunization Status of 24-Month-Old Children in Tennessee:
Statewide percentage of children with age-appropriate immunization levels by vaccine
 (point estimates and 95% confidence intervals, n=1424)



*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

Complete immunization levels statewide and by public health region

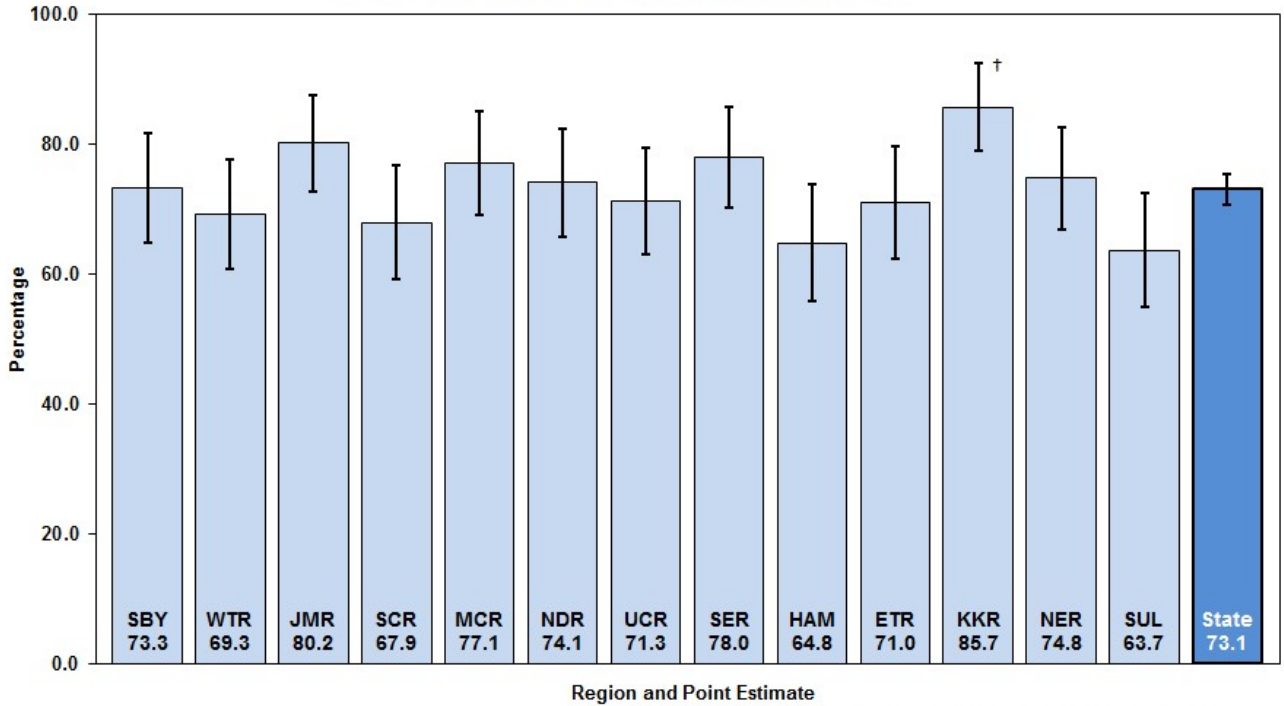
The statewide and regional percentages of children immunized on time with all vaccines in 4:3:1:3*:3:1:4 series are shown in Figure 2. Statewide complete coverage was 73.1% (95% CI, 70.8, 75.4). The point estimates in two regions (Jackson-Madison [JMR] and Knoxville-Knox [KKR]) exceeded the HP 2020 objective of 80% coverage. The estimate for KKR was statistically significantly higher than the state as a whole.

For the purposes of direct comparison, Figure 3 compares the 2013 and 2014 statewide coverage rates by individual vaccine using the 2013 analysis method for both years. Elsewhere in the survey the 2014 and 2013 results for the complete series, HIB, and RTV are not exactly comparable due to the change in analysis in 2014. A statistically significant increase in influenza vaccination coverage was measured, from 46.5% (95% CI: 44.0, 49.1) in 2013 to 51.8% (95% CI: 49.2, 54.4%) in 2014. Higher point estimates of coverage were achieved for DTaP and PCV in 2014.

Appendix 3 contains region-specific charts of coverage rates for each of the vaccines and the 4:3:1:3*:3:1:4 series.

Figure 2

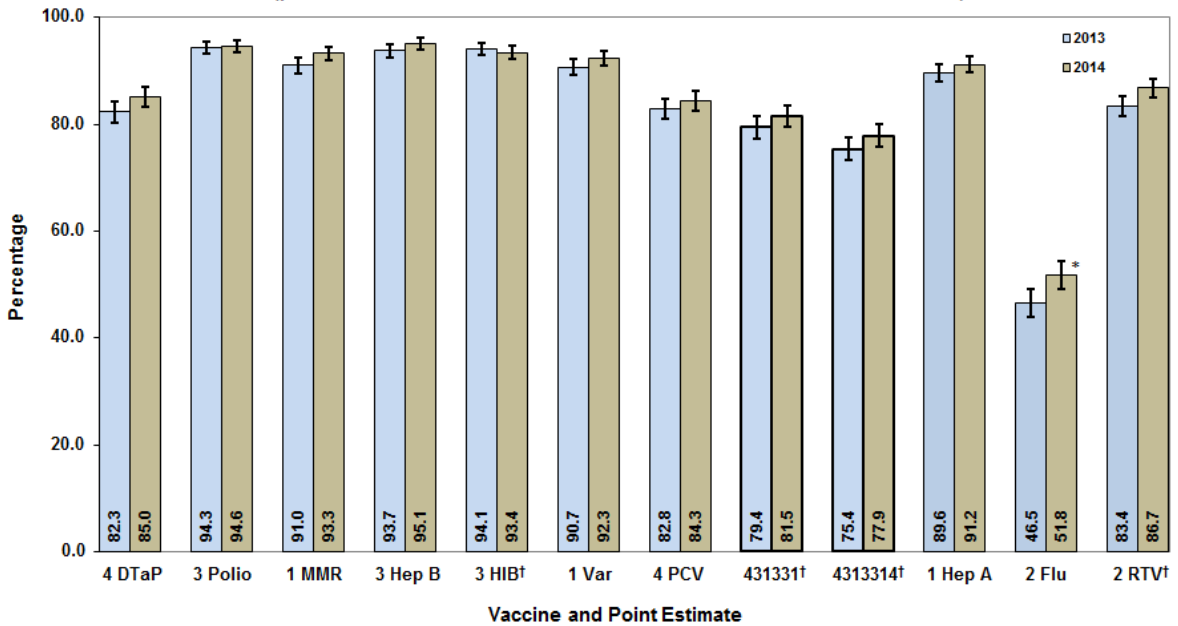
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of 24-month-old children with on-time immunization (4:3:1:3*:3:1:4)
by health department region
(point estimates and 95% confidence intervals, n=1424)**



†statistically significant difference from State point estimate
*Full Hib series requires 3 or 4 doses depending on product

Figure 3

**2014 Immunization Status of 24-Month-Old Children in Tennessee:
Statewide percentage of children with age-appropriate immunization levels
by vaccine in 2013 and 2014
(point estimates and 95% confidence intervals, 2013 n=1479, 2014 n=1424)**



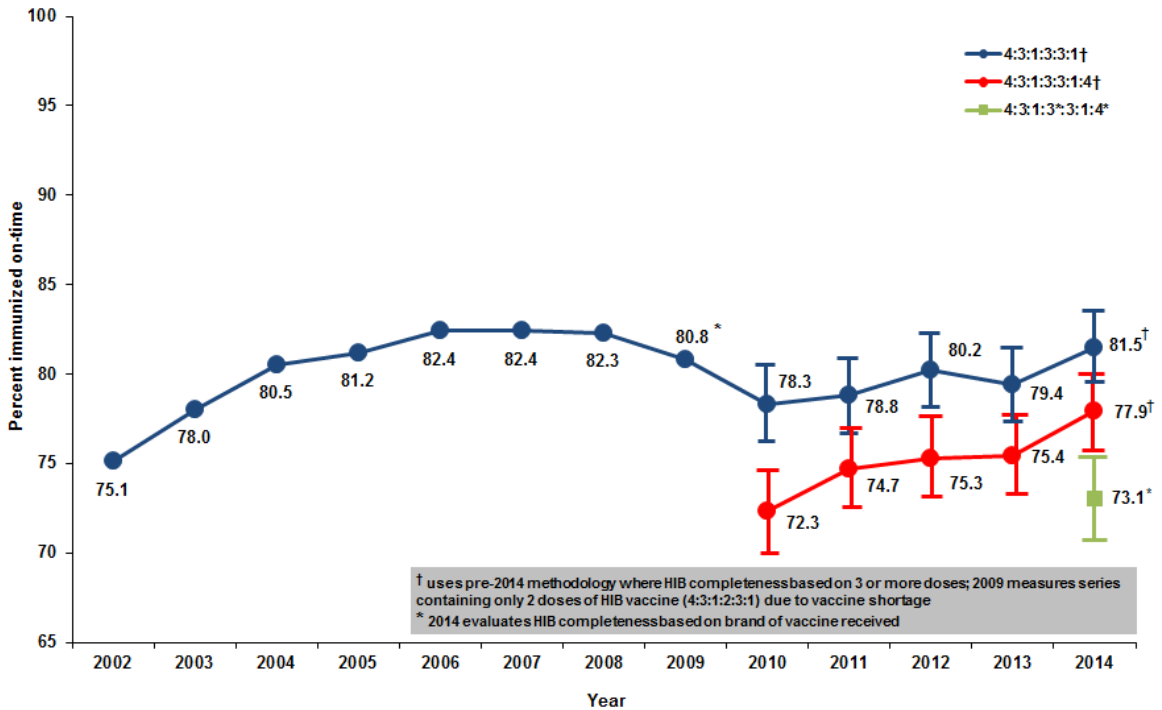
*statistically significant difference from prior year's point estimate
†For 2013 and 2014, Hib complete = 3+ doses, RTV complete = 2+ doses (method used in 2013 report)

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 and 4:3:1:3* :3:1 rate for 2014, as well as the 4:3:1:3:3:1:4 completion rate from 2010 to 2013 and 4:3:1:3* :3:1:4 in 2014.

Figure 4

**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
4:3:1:3:3:1 and 4:3:1:3:3:1:4 Immunization Level Trends: Tennessee 2002 to 2014
(point estimates and 95% confidence interval, n=1424)**



† uses pre-2014 methodology where Hib completeness based on 3 or more doses; 2009 measures series containing only 2 doses of Hib vaccine (4:3:1:2:3:1) due to vaccine shortage
* 2014 evaluates Hib completeness based on brand of vaccine received

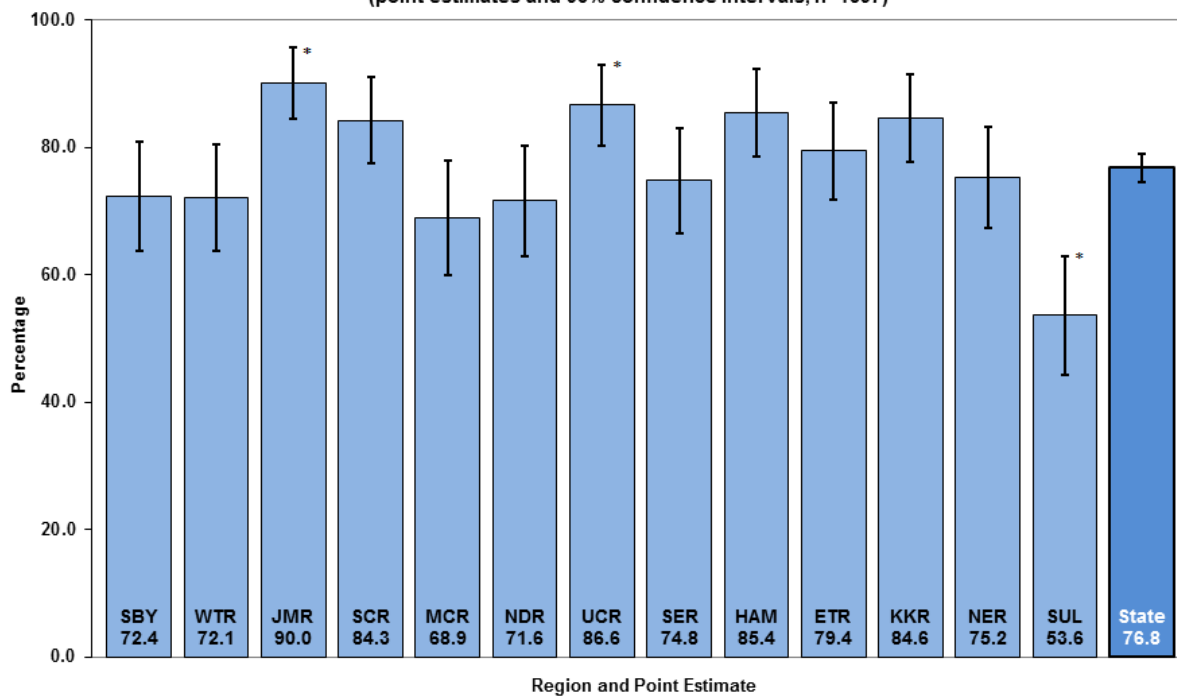
Hepatitis B vaccine birth dose

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. An infant born to a woman infected with hepatitis B has up to a 70% chance of being infected without proper medical intervention. An exposed infant’s risk of infection can be reduced by about 95% by administering HBV and immunoglobulin within 12 hours of life; infants born to mothers of unknown status should receive HBV within 12 hours. The CDC recommends that *all* newborns be vaccinated before discharge from the delivery hospital. 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 by the third day of life. The 2014 coverage rate for the state was 76.8% (95% CI: 74.6, 79.0), compared to 80.0% in 2013. This still exceeds the 2013 United States rate of 74.2% (95% CI: 72.8, 75.6) reported in the NIS at www.cdc.gov/vaccines/imz-managers/coverage/nis/child/data/tables-2013.html#overall. Results vary among regions, with five of 13 public health regions reporting increases since 2013 and four reporting decreases of 8 or more percentage points. The 2014 Sullivan County point estimate was significantly lower than the state. Because birth doses are administered at the delivery hospital, some differences may be explained either by changes in hospital policies enforcing the federal birth dose recommendations or by greater difficulty locating birth dose records for some institutions. Changes in hospital policy can lead to significant improvements in coverage from year to year (Figure 5b).

Figure 5a

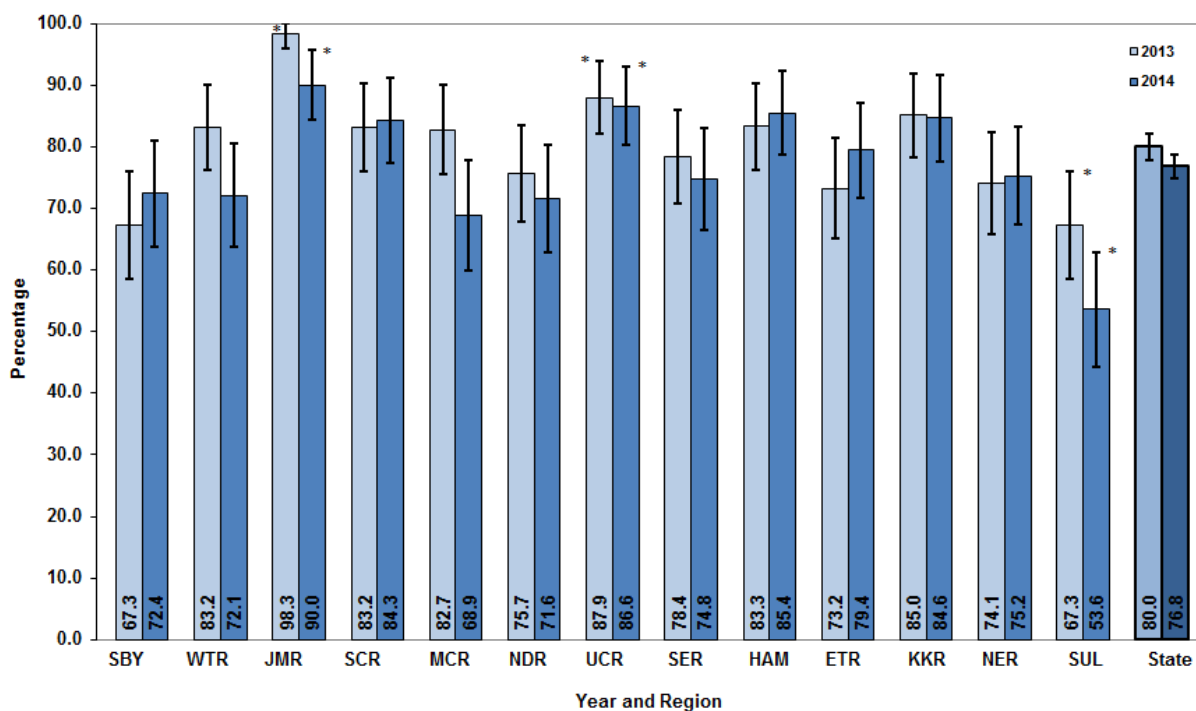
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with birth dose of Hepatitis B (HBV) by third day of life
by health department region
(point estimates and 95% confidence intervals, n=1397)**



*statistically significant difference from State point estimate

Figure 5b

**2014 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 2013 and 2014
(point estimates and 95% confidence intervals, 2013 n=14)**



*statistically significant difference from State point estimate

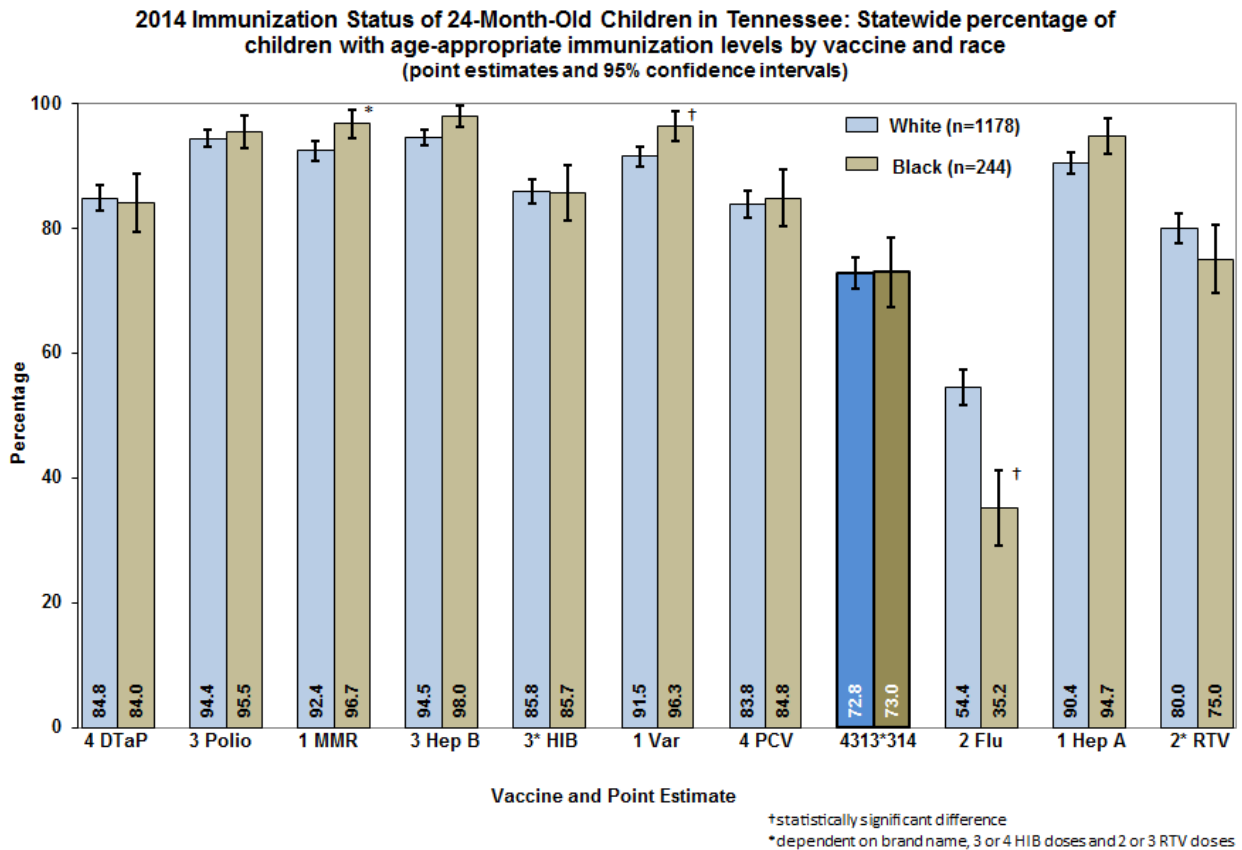
Racial disparities

The differences in on-time completion of the recommended vaccine series among black and white children have been small or statistically insignificant in recent years. This year’s survey included 244 black and 1,178 white children. Due to small numbers, children of other races (n=28) are excluded from this analysis.

There were two statistically significant differences in vaccine series coverage between black and white children: black children were more likely to be protected by MMR and VAR vaccines; this is not part of a trend and coverage among all children is high, so it may not have programmatic or clinical significance. However, black children had significantly lower coverage for influenza vaccine again this year. A comparison of the trends in on-time series completion by race from 2010-2014 can be found in Appendix 4. Figure 6 shows the rates of on-time immunization of black and white children for each vaccine assessed.

The large racial disparity in influenza vaccine coverage rates has been consistently documented since influenza vaccine was first assessed in this survey in 2008. Over time, both white and black children have had small increases in influenza coverage. However, a nearly 19 percentage point disparity between whites and blacks (54.4% vs. 35.2%) is measured in 2014.

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 for vaccines other than influenza. 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 (51 of 1,408 with a known source of vaccination) received all immunizations in health departments, the point estimate for public provider coverage has wide confidence intervals and is too small to be interpreted meaningfully. 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. The survey reports 23 children received their first routine vaccination other than rotavirus or birth dose HBV after 120 days of age. Table 1 below summarizes the 2014 on-time completion rates for 4:3:1:3*:3:1:4 in these groups.

Table 1

4:3:1:3* :3:1:4 Completion Levels in the 2014 Survey of 24-Month-Old Children: Selected Characteristics			
Provider Type	Public n=34/51	Private N=821/1081	Both n=186/276
	66.7% +12.94	76.0% + 2.55	67.4% + 5.53
TennCare Enrollment	Enrolled n=588/825	Not Enrolled n=453/599	
	71.3% + 3.09	79.3% + 3.44	
WIC Enrollment	Enrolled n=640/889	Not Enrolled n=401/535	
	72.0% + 2.95	75.0% + 3.67	
Other Siblings	None n=480/611	One n=328/451	Two or more n=229/354
	78.6% + 3.25	72.7% + 4.11	64.7% + 4.98
Age at First Immunization**	≤120 days n=1033/1384	120 days n=8/23	
	74.6% + 2.29	34.8% + 19.47	

4:3:1:3* :3:1:4 indicates that HIB completion required 4 (not 3) doses if any of the 4-dose product was administered.

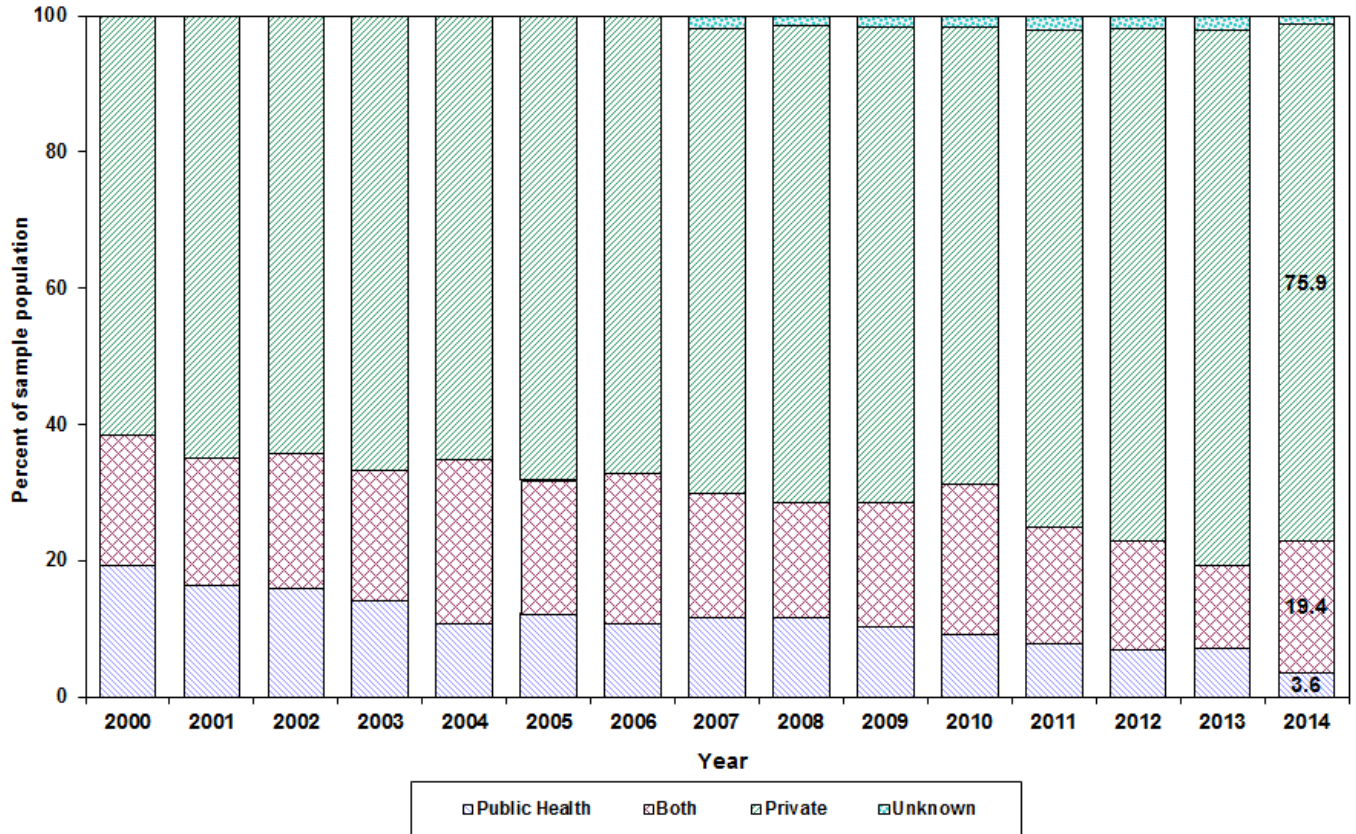
**the first dose of a vaccine other than oral rotavirus vaccine or the birth dose of hepatitis B vaccine

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 2014 survey, 75.9% were immunized exclusively in private clinic settings, 19.4% received immunizations in a combination of private and public health clinics, and 3.6% received their immunizations exclusively at a public health department. Data were unavailable for 1.1% of children. Figure 7 below shows the trends in these proportions over time.

Figure 7

**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Source of Immunizations from 2000 to 2014 (n=1424)**



Although only a small number of children surveyed were immunized exclusively in public health clinics, those immunized in health departments had 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>)	13.7% (7/51)	21.4% (59/276)	14.1% (152/1081)
2 or more siblings	47.1% (24/51)	28.0% (77/275)	23.0% (247/1074)
Age at first dose >120 days*	3.9% (2/51)	4.7% (13/276)	1.7% (8/1080)
Any of above risk factors	52.9% (27/51)	44.6 (123/276)	32.6% (352/1081)

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

Summary of Key Findings:

1. A more rigorous product-specific assessment of Hib and rotavirus vaccination provided a more accurate understanding of these two vaccines, but reduced estimated Tennessee (TN) coverage rates relative to Health People (HP) 2020 objectives:

Measurement	HP 2020 Objective (19-35 months)	TN 2014 (24 months)
Complete 4:3:1:3 [*] :3:1:4 series	80%	73.1%
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	Exceeded 90% for 4 of 7, except: 4 doses of DTaP (85.0%), Full series (3 or 4) of Hib (85.7%) and 4 doses of PCV (84.3%)
3 doses DTaP and PCV	<i>None: this is a process measure</i>	3 DTaP (95.6%) and 3 PCV (94.6%): <i>goals achievable by closing gap between 3rd and 4th doses</i>
Hepatitis A vaccine	60% 2 doses by 35 months	2 HAV (57.1%); 1 HAV (91.2%): <i>not comparable to HP2020</i>
Influenza vaccine	70% appropriately immunized	51.8%
Rotavirus vaccine	80% with 2 doses	79.8%
Hepatitis B birth dose	85%	76.8%

2. After two years of substantial increases in HBV birth dose rates, the estimate dropped slightly in 2014. Adherence to delivery hospital policies and stronger recommendations by caregivers of neonates will help achieve the goal; improvements in documentation of birth doses in the immunization information system (IIS) will improve assessment accuracy.
3. Completion of vaccines that require four doses continues to be the primary barrier in achieving the HP 2020 target of 80% coverage for the 4:3:1:3^{*}:3:1:4 series for all children. Although improved over 2013, program and clinic activities should focus on this precipitous drop from around 95% coverage with 3 of 4 necessary doses to about 85% coverage with all 4 doses, which represents complete on-time protection from disease.
4. Influenza vaccine 2-dose coverage remains low, but there was a significant increase from 2013 to 2014 (46.5% to 51.8%). Adequate influenza immunization represents a major area for improvement in this age group.
5. The persistent disparity in influenza vaccine coverage between black and white children remains significant (35.2% vs. 54.4%). There is not a disparity in the routine series of recommended vaccines given which suggests barriers specific to influenza vaccine, rather than broader issues of vaccine access or acceptance.
6. The coverage point estimates of 4:3:1:3^{*}:3:1:4 series and other recommended vaccines for children enrolled in TennCare and/or WIC were lower than others. Most of the differences were not statistically significant, except:
 - a. Children enrolled in TennCare were significantly less likely to be fully protected against diphtheria, tetanus, pertussis (DTaP) and pneumococcal (PCV) disease than non-enrollees.
 - b. WIC-enrolled children were more likely to have received three doses of hepatitis B vaccine by their second birthday than those not enrolled in WIC.
 - c. WIC and TennCare-enrolled children had significantly lower coverage with influenza vaccine (Appendix 4).
7. By changing to a product-specific full series assessment of completion, estimates of coverage rates for Hib vaccine decreased 8.4 percentage points from 2013 (had the method been unchanged, coverage would have been estimated at 93.4%). Results demonstrated the lowest completion was among children for whom brand names could not be ascertained; coverage was high among children for whom any brand name was known, even if more doses were required. This finding suggests that the inability to confirm the brand name of received doses is associated with incomplete immunizations, but the reasons for this correlation are not clear.

8. As was observed with HIB, the product-specific full series assessment resulted in an apparent decline in rotavirus coverage with very low completion rates among children whose dose brands were unknown. Using the previous method, coverage would have been reported as going up to 86.7%, rather than down.
9. The use of the Accurint database significantly reduced the number of children who could not be located, which helped survey staff ensure complete documentation of all doses.

Next Steps:

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

1. When discussing overall immunization rates, emphasis will focus on DTaP and PCV, which require the most doses, as sentinel vaccines for tracking the completeness of immunization in toddlers. If clinics were to track only the on-time 4th dose of DTaP and then administer all recommended vaccines at that visit, including the 4th PCV and the 4th HIB (if needed), immunization coverage rates could surpass HP2020 targets in a single year.
2. In November 2014, TDH introduced a new state immunization registry, “TennIIS” (www.TennesseeIIS.gov), with features shown to improve immunization completion rates in other states. To support immunization providers in immunizing children on time, TennIIS provides:
 - a. A forecasting tool that displays the vaccines due or overdue for a child when the child’s record is opened by the healthcare provider, and
 - b. A reminder/recall tool to enable providers to generate reminders of vaccination appointments and recall children behind on vaccines in his or her practice.

As more clinics record given immunizations in TennIIS, the proportion with unknown brand type will decline and automatic reminders in TennIIS will then help prompt full immunization.

In 2015, TennIIS staff will focus on training providers to use TennIIS and its new features effectively to enhance clinical practice and immunization quality.

3. In addition to training, other TennIIS staff will continue to establish active connections between electronic health record systems (EHRs) and TennIIS for electronic sharing of immunization data to improve patient care. This work is supported by Federal financial incentives to qualified healthcare providers, known as “Meaningful Use” grants, from the Centers for Medicaid and Medicare Services (CMS). These grants require recipients to upload immunization information from their EHR to TennIIS.
4. The role of local health department clinics (LHDs) as primary immunization sites for children continues to decline; however, children visiting LHDs for all immunizations are more at risk for failing to be fully immunized on time. TIP provides LHDs with lists of children aged 20-24 months who have received immunizations in a LHD and whose records show they are incompletely immunized with DTaP vaccine. These reports can facilitate active follow up of these children in order to complete all overdue immunizations.
5. TIP will continue to encourage providers to give the third DTaP at 6 months of age so the fourth DTaP may be administered at the 12-month visit. Starting a vaccine series on-time is the first step in timely series completion. The risk of incomplete immunization goes up after the first birthday among children at risk for falling behind because visits to medical clinics occur less frequently.
6. Since 2010, state immunization requirements for child care facilities include complete pneumococcal vaccination, which should improve complete PCV coverage among children in child care. Since introducing a requirement for the first dose of hepatitis A vaccine for daycare, coverage has exceeded 90%.
7. TIP shares survey findings with WIC and TennCare leadership; they support immunization promotion.
8. Patients enrolled in WIC will continue to receive immunization education and follow-up phone calls.
9. TIP will conduct its annual Immunization Spring Review in April 2015 in 4 cities across the state. This is an educational conference free to all healthcare providers who participate in the Vaccines for Children (VFC) Program. In addition to extensive educational work with VFC Program participants, the Director of TIP promotes immunization through presentations to a variety of professional health organizations annually.
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

2014 Immunization Status Survey of 24-Month-Old Children in Tennessee

Details of Regional Samples: Oversampled Records, Vaccine Refusal and Children with Incomplete Records not Located

Region	Records analyzed ¹ (oversampled) ²	Total vaccine refusals ³	Reason given for refusing vaccine ³			Total % Refusal	Children who could not be located ⁴	Total % not located
			Religious	Philosophical	Medical			
Northeast TN	117 (2)	2	1	1	-	1.7%	0	-
East TN	107 (0)	1	0	0	1	0.9%	0	-
Southeast TN	109 (0)	5	1	1	3	4.6%	0	-
Upper Cumberland	115 (0)	4	2	2	0	3.5%	0	-
Mid-Cumberland	112 (7)	1	0	1	0	0.9%	1	0.9%
South Central	109 (0)	1	0	1	0	0.9%	0	-
West TN	115 (1)	4	2	1	1	3.5%	0	-
Shelby County	107 (2)	0	0	0	0	-	1	0.9%
Davidson County	109 (1)	5	1	4	0	4.6%	0	-
Knox County	105 (0)	1	0	1	0	1.0%	0	-
Hamilton County	109 (1)	2	1	1	0	1.8%	0	-
Madison County	121 (10)	0	0	0	0	-	0	-
Sullivan County	115 (2)	0	0	0	0	-	0	-
TOTAL	1450 (26)	26 of 1450	8	13	5	1.9%	2 of 1450	0.1%

¹Total 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

²Number 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.

³ Of the 26 whose parents had refused vaccinations, 18 had received ≥ 2 doses (range: 0-23 doses).

⁴Children 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. Both of these children had >10 doses documented in the registry.

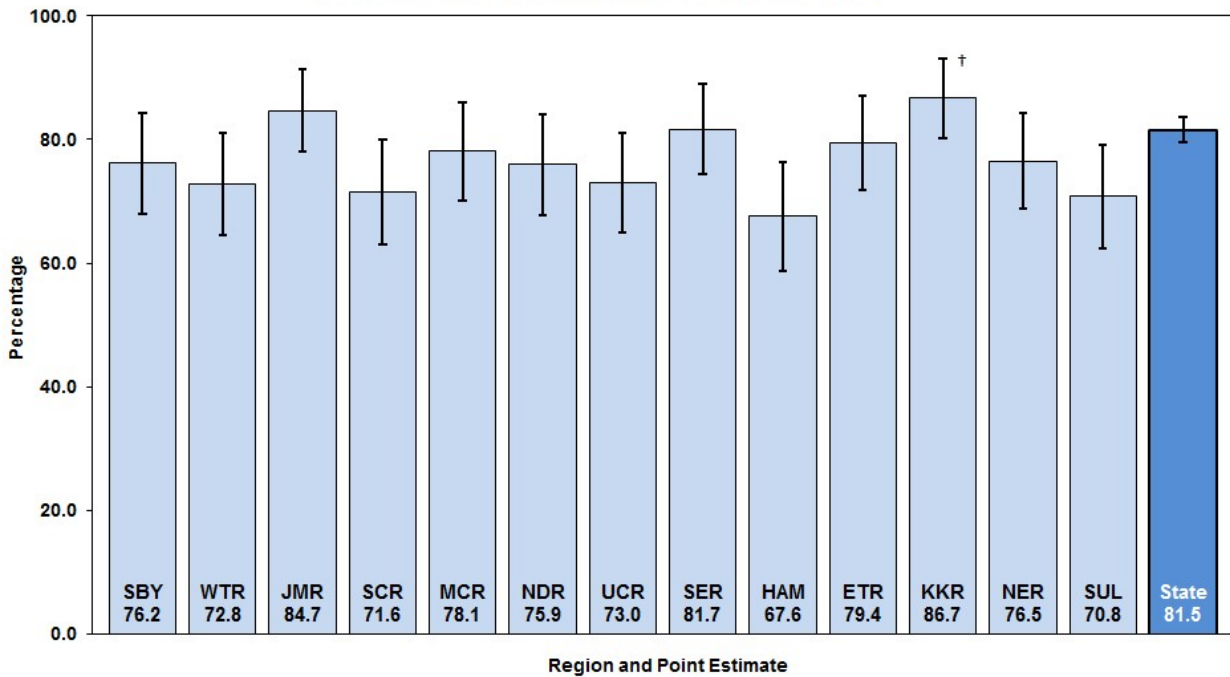
Appendix 2

2014 Immunization Status Survey of 24-Month-Old Children in Tennessee

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

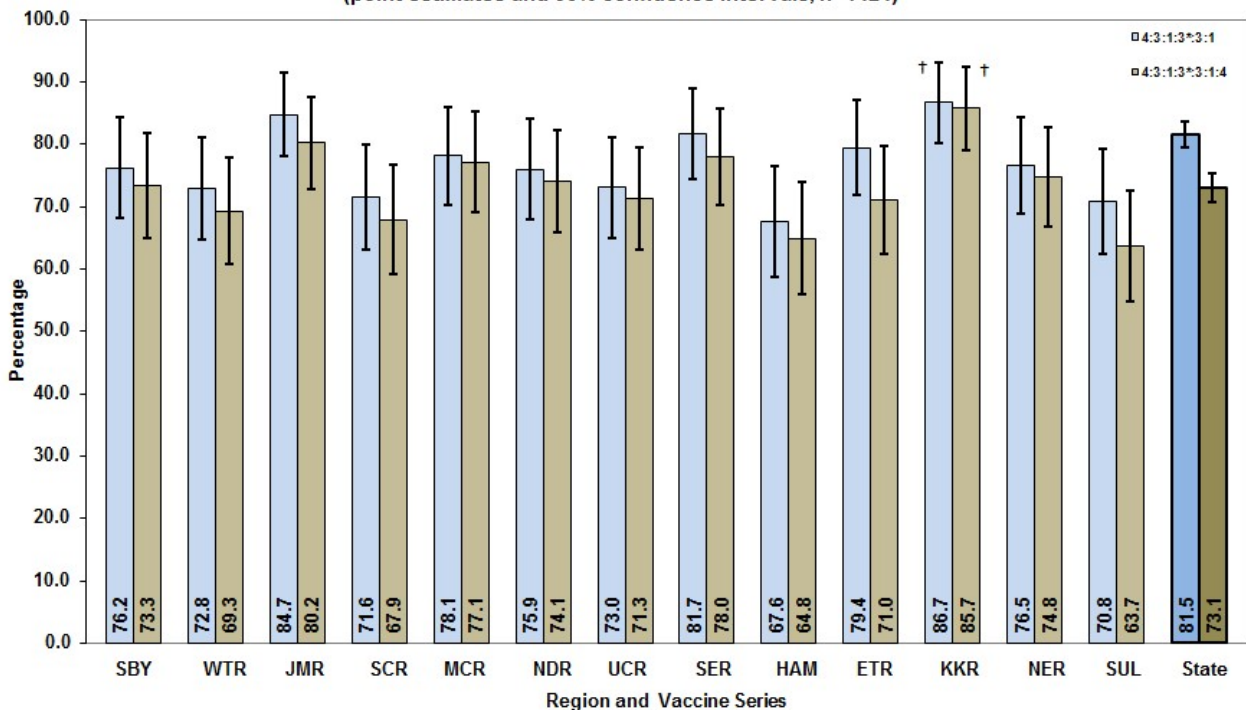
	Page
On-time 4:3:1:3 :3:1 and 4:3:1:3 :3:1:4 vaccine series	... 22
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<i>Haemophilus influenzae</i> type b & Hepatitis A (1-dose coverage)	... 24
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Influenza (2-dose and 3-dose coverage)	... 26
MMR & Pneumococcus (4-dose coverage)	... 27
Pneumococcus (PCV) (4-dose vs. 3-dose coverage) & Polio	... 28
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**2014 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=1424)**



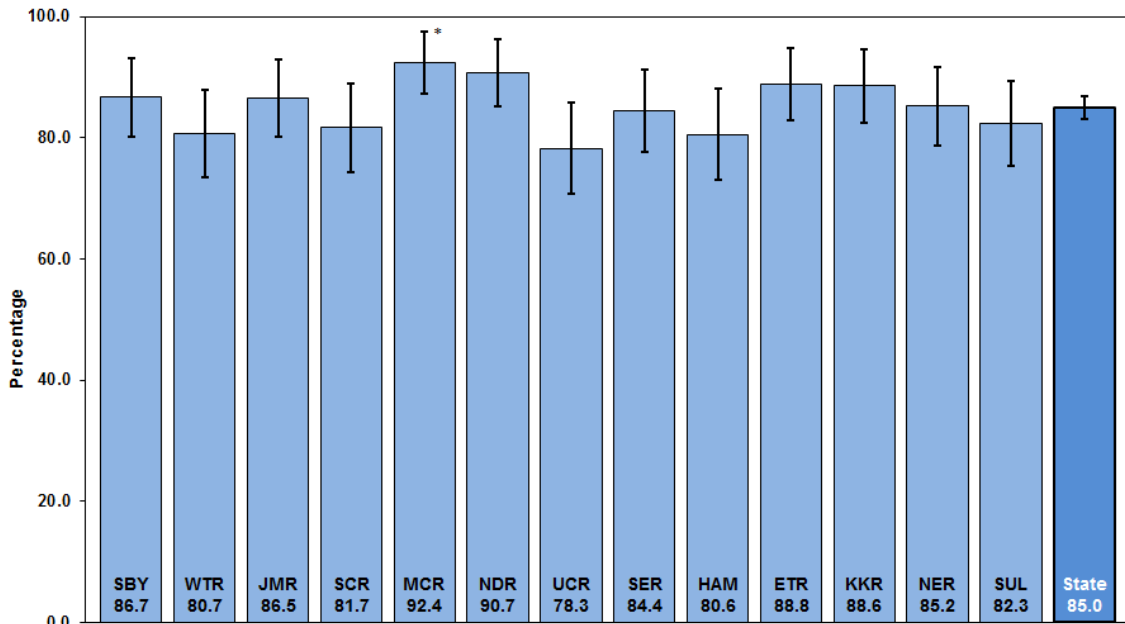
†statistically significant difference from State point estimate
*Full Hib series requires 3 or 4 doses depending on product

**2014 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=1424)**



†statistically significant difference from State point estimate
*Full Hib series requires 3 or 4 doses depending on product

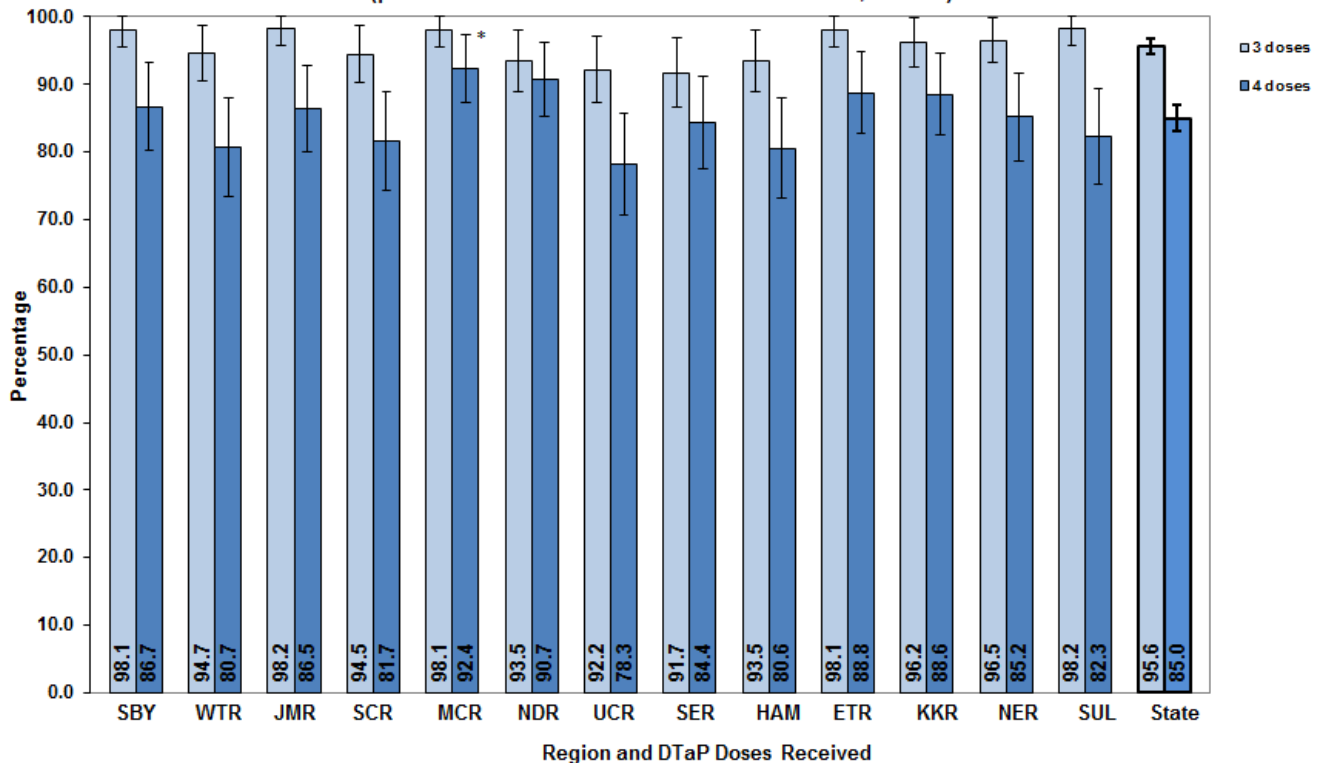
2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete DTaP series (4 doses) by health department region
 (point estimates and 95% confidence intervals, n=1424)



Region and Point Estimate

*statistically significant difference from State point estimate

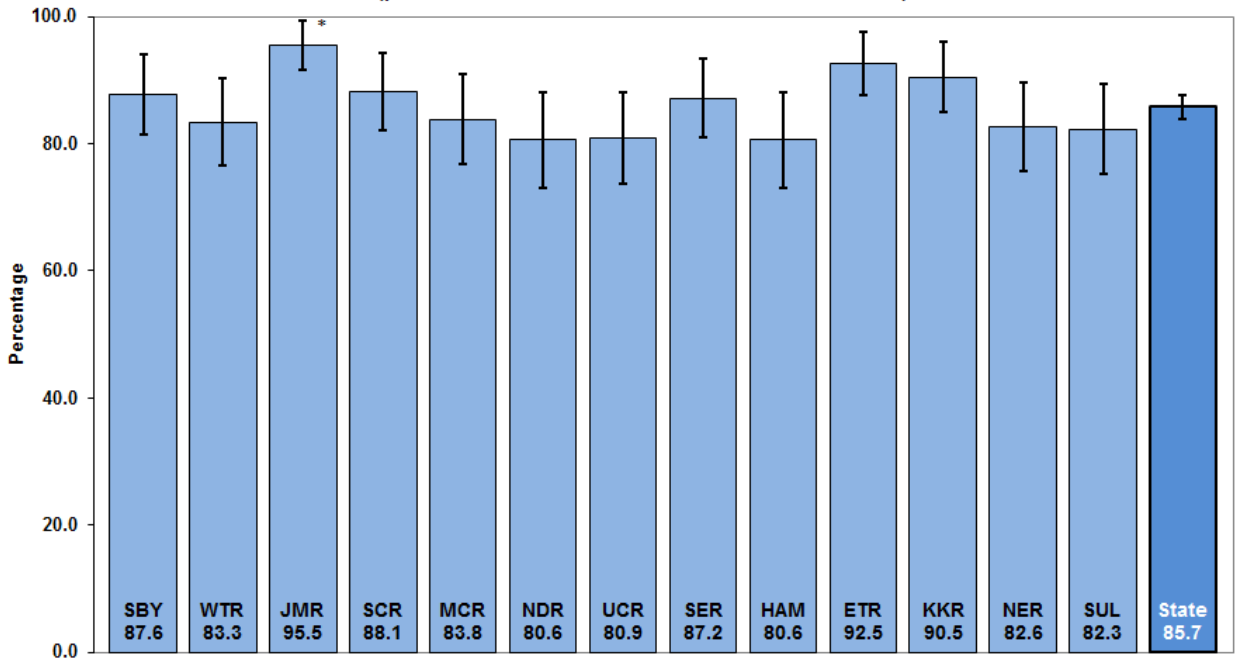
2014 Immunization Status Survey of 24-Month-Old Children in Tennessee: Percentage of children with 3 or 4 doses of diphtheria, tetanus and acellular pertussis (DTaP) by health department region (point estimates and 95% confidence intervals, n=1424)



Region and DTaP Doses Received

*statistically significant difference from State point estimate

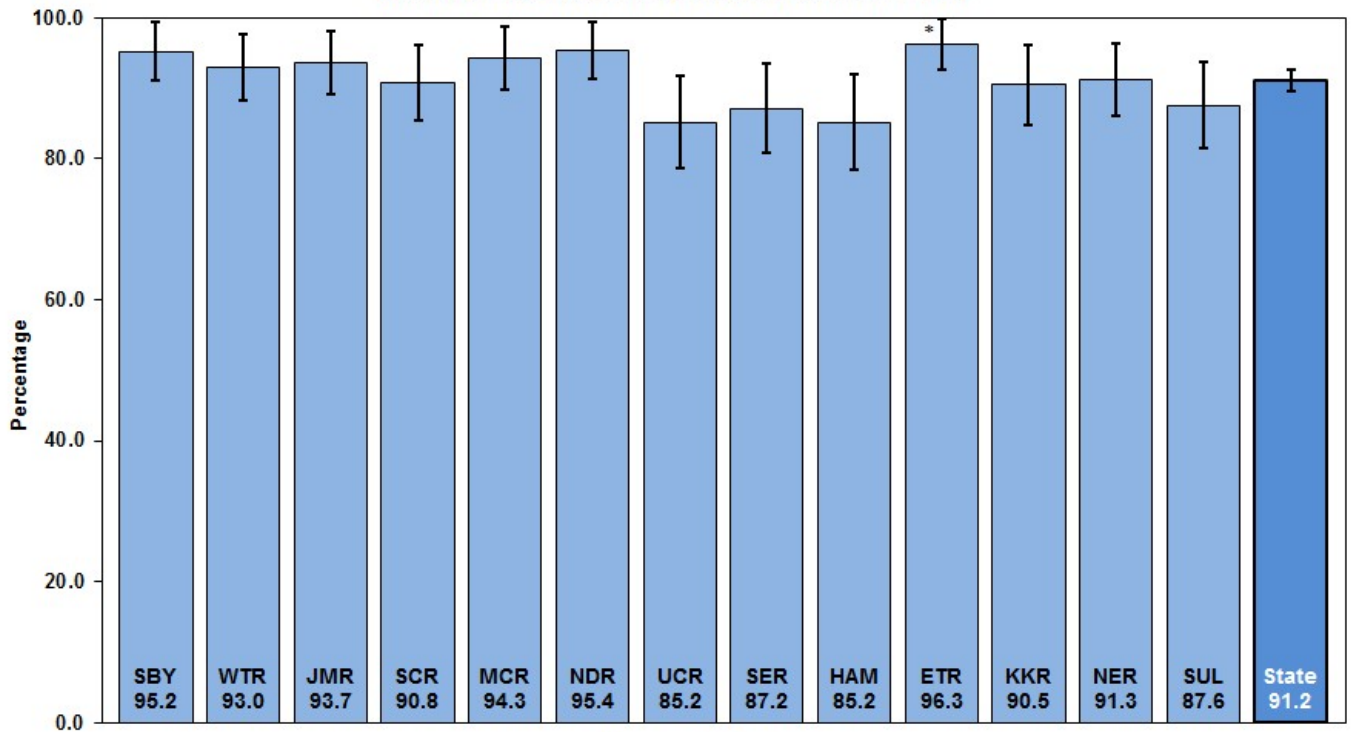
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete *Haemophilus influenzae* type B (Hib) series
 (either ≥ 3 or ≥ 4 doses depending on brand) by health department region
 (point estimates and 95% confidence interval, n=1424)**



Region and Point Estimate

*statistically significant difference from State point estimate

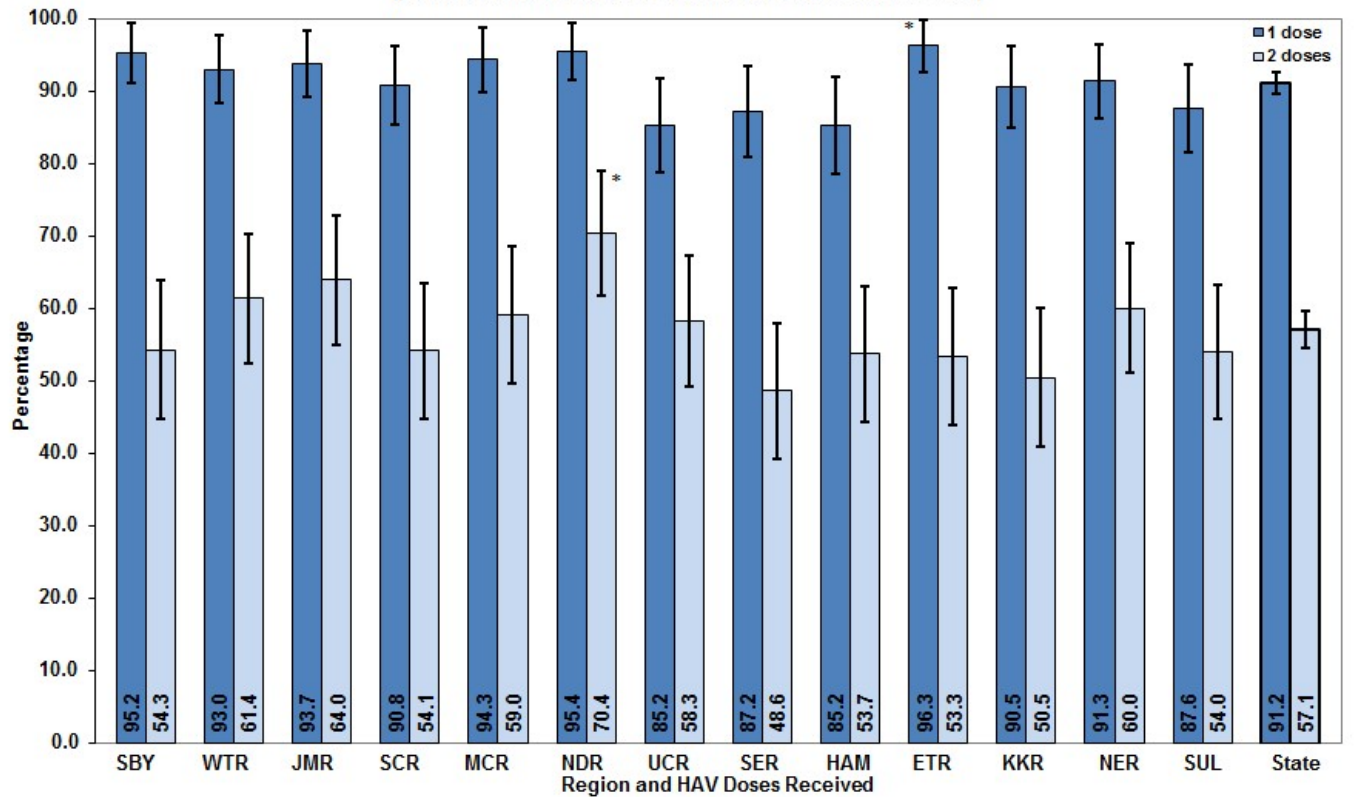
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with at least one dose of Hepatitis A (HAV)
 by health department region
 (point estimates and 95% confidence intervals, n=1424)**



Region and Point Estimate

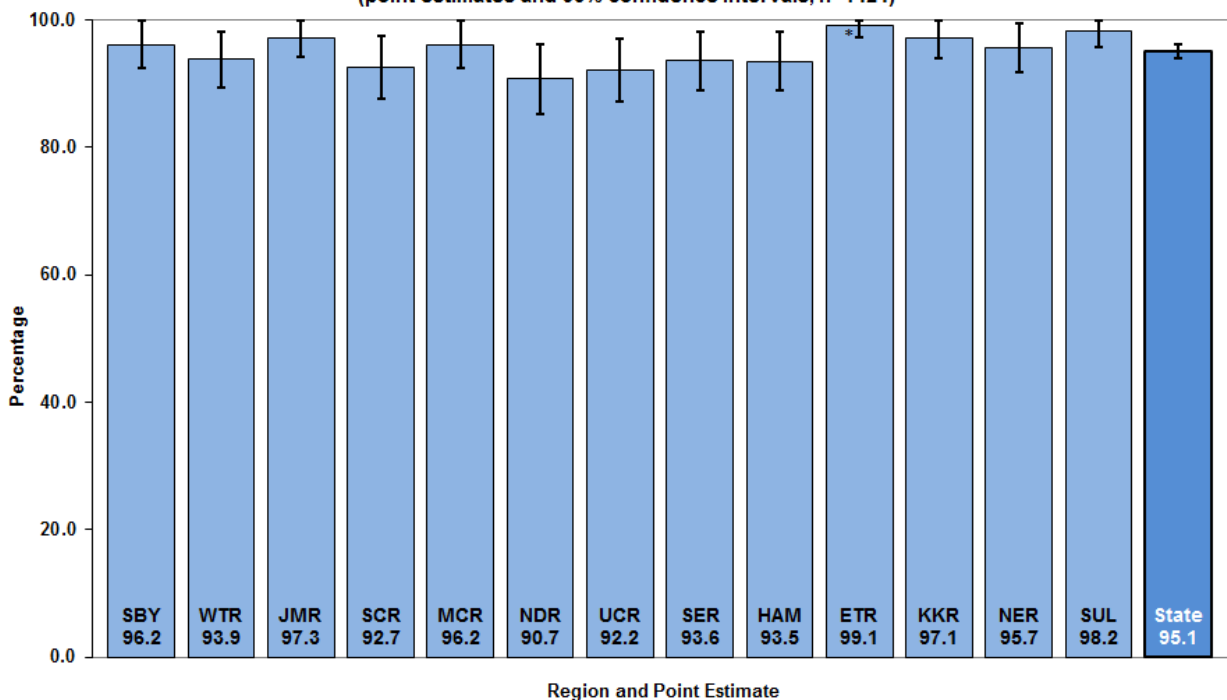
*statistically significant difference from State point estimate

**2014 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=1424)**



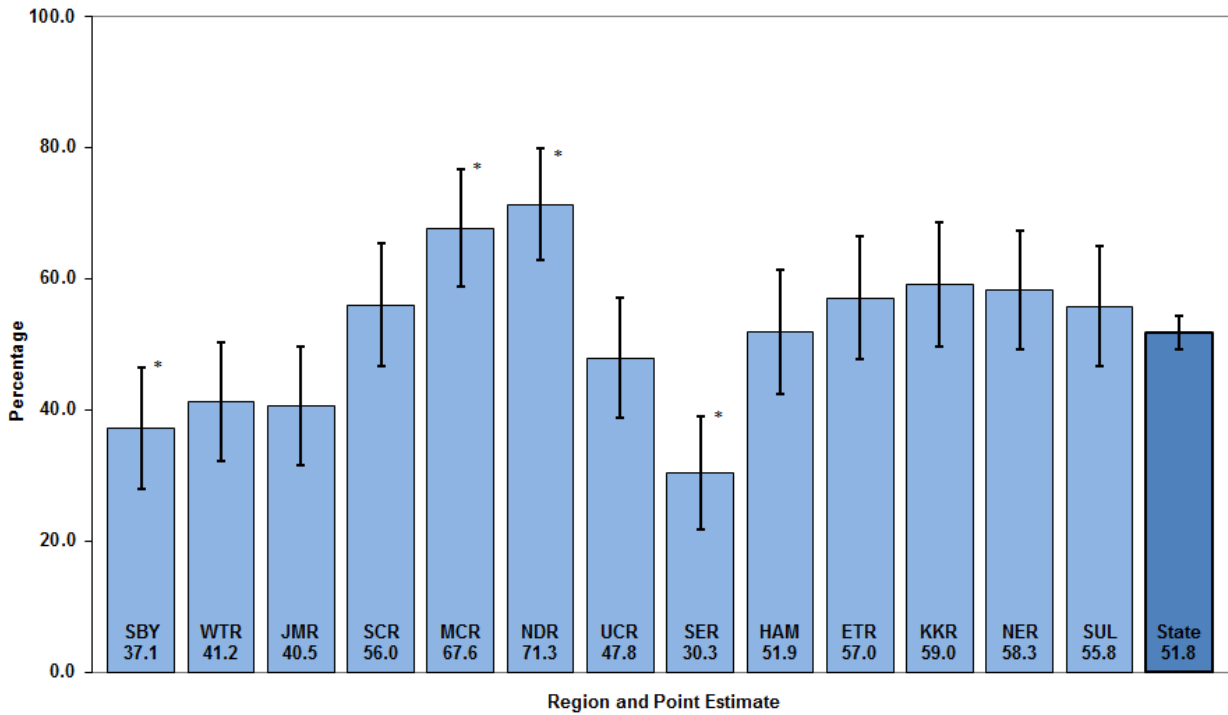
*statistically significant difference from State point estimate

**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with complete Hepatitis B (HBV) series (≥ 3 doses)
by health department region
(point estimates and 95% confidence intervals, n=1424)**



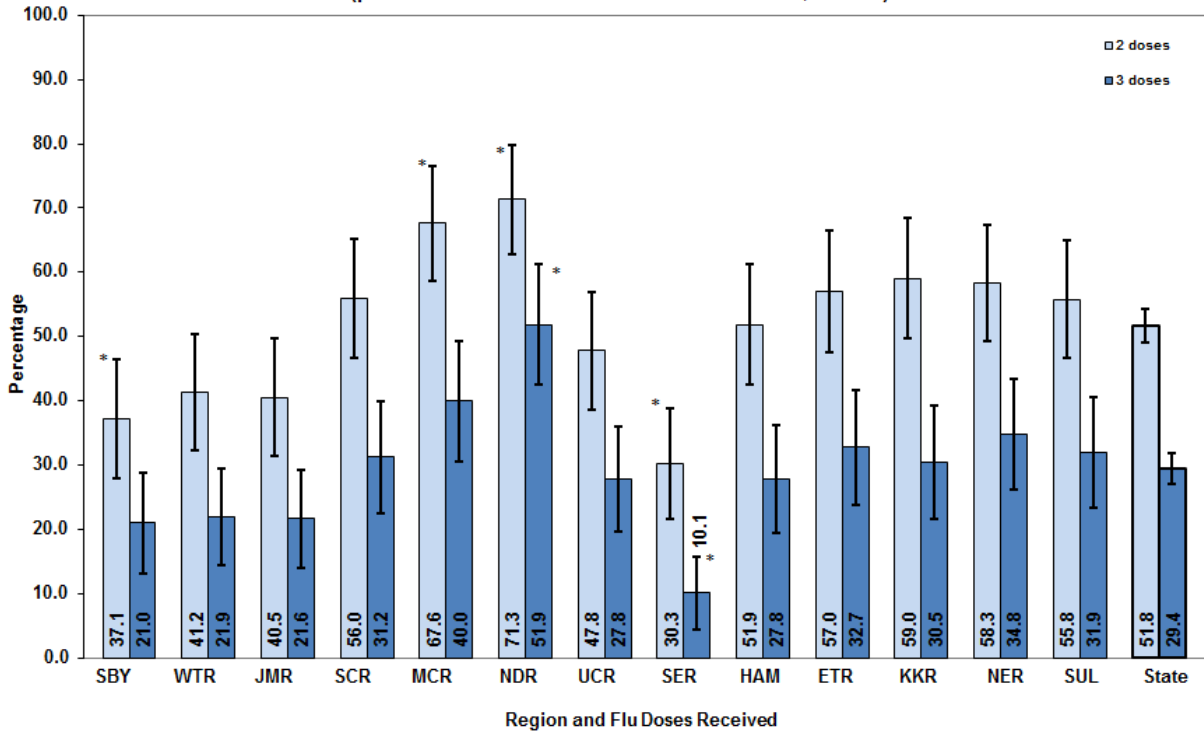
*statistically significant difference from State point estimate

2014 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=1424)



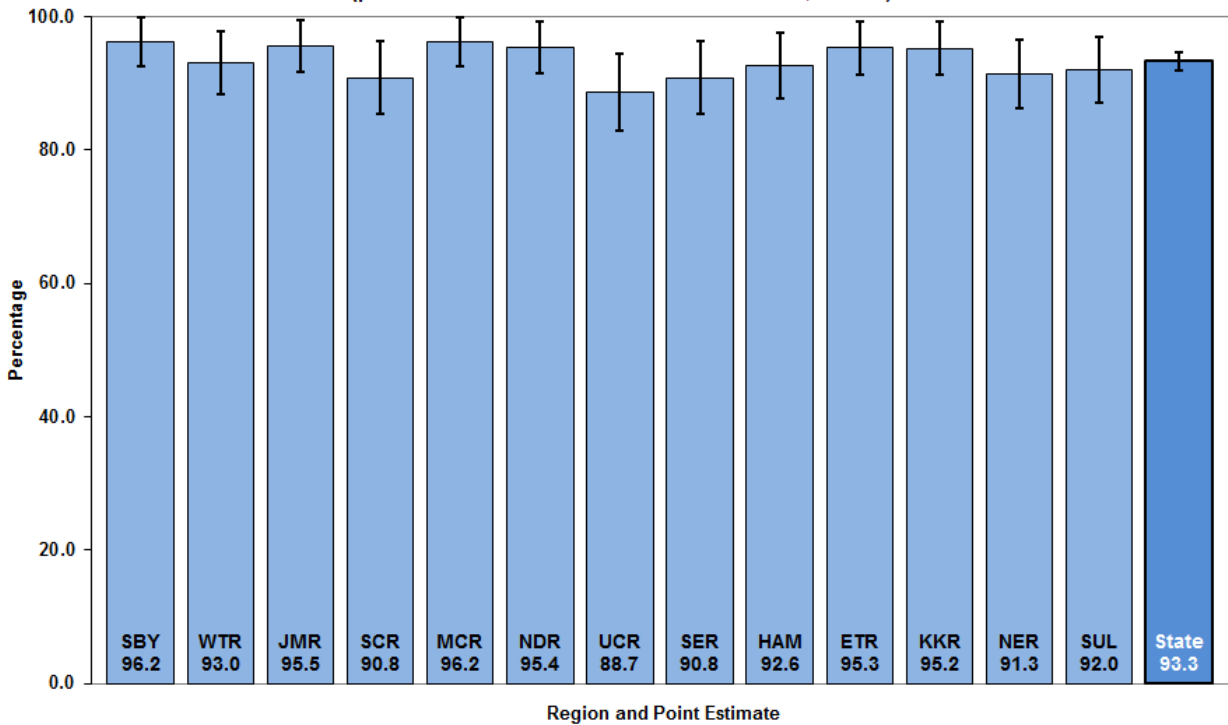
*statistically significant difference from State point estimate

2014 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=1424)

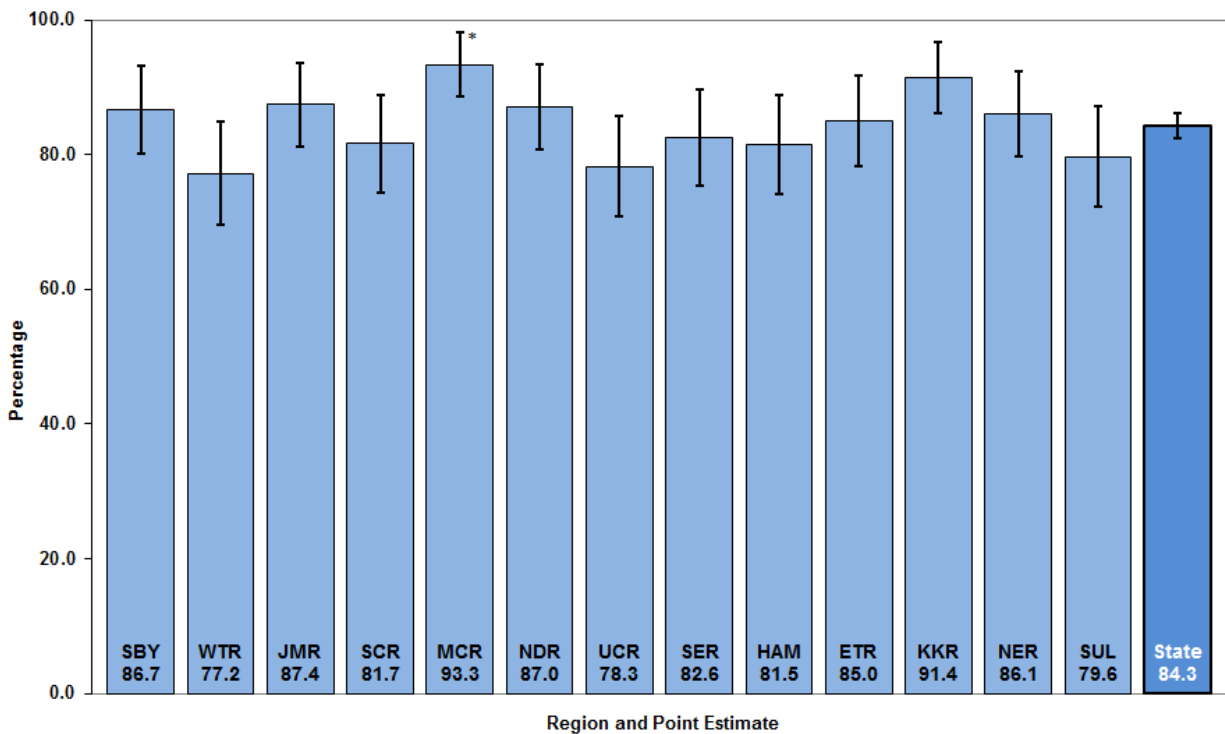


*statistically significant difference from State point estimate

2014 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=1424)

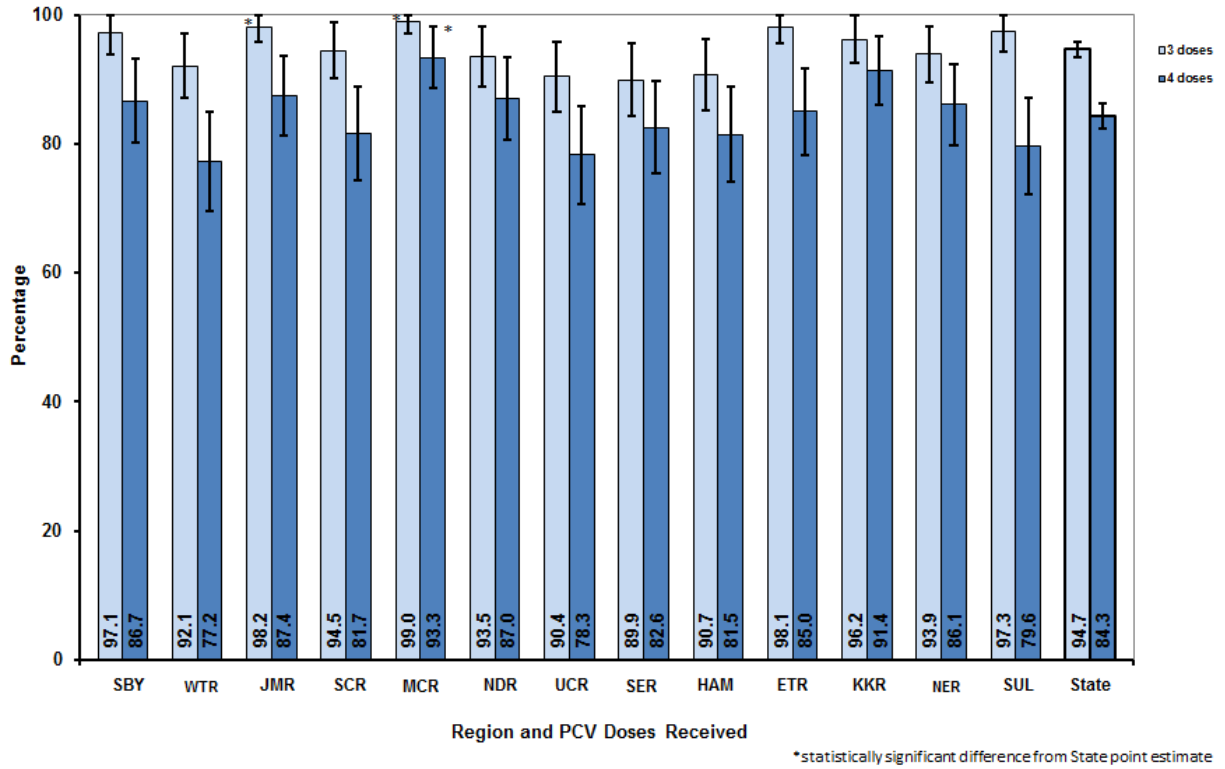


2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete PCV series (4 doses) by health department region
 (point estimates and 95% confidence intervals, n=1424)

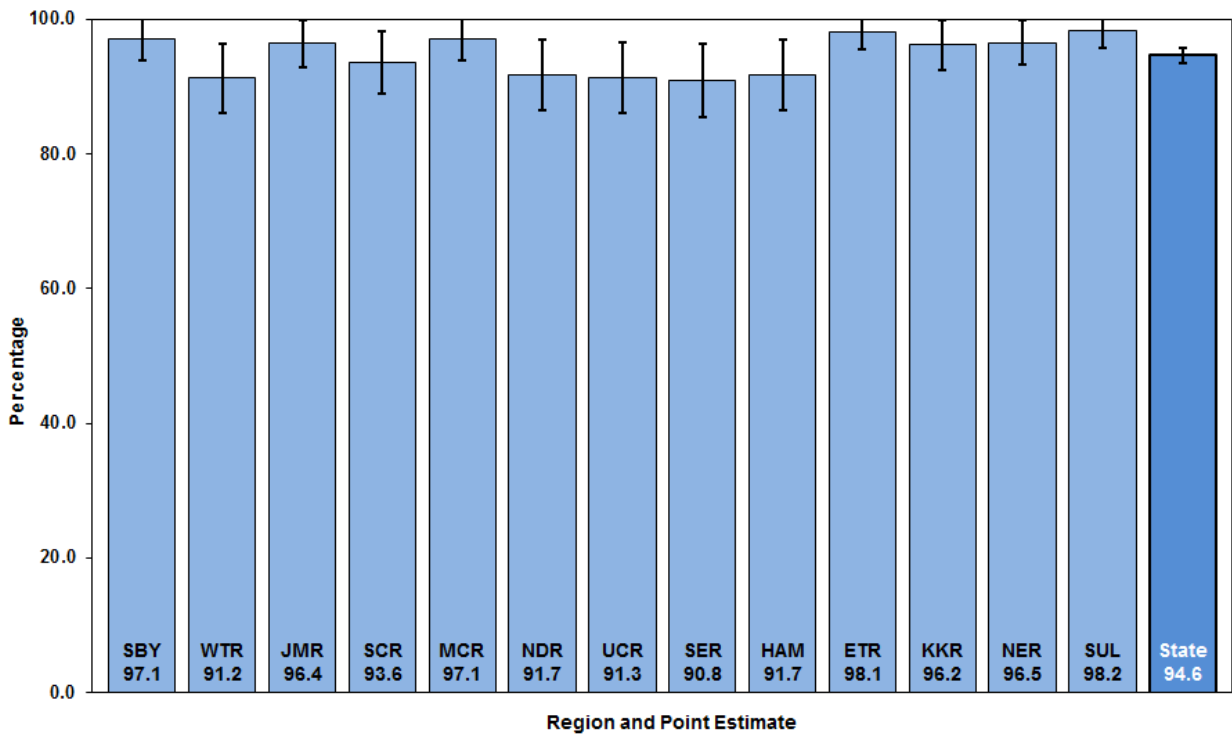


*statistically significant difference from State point estimate

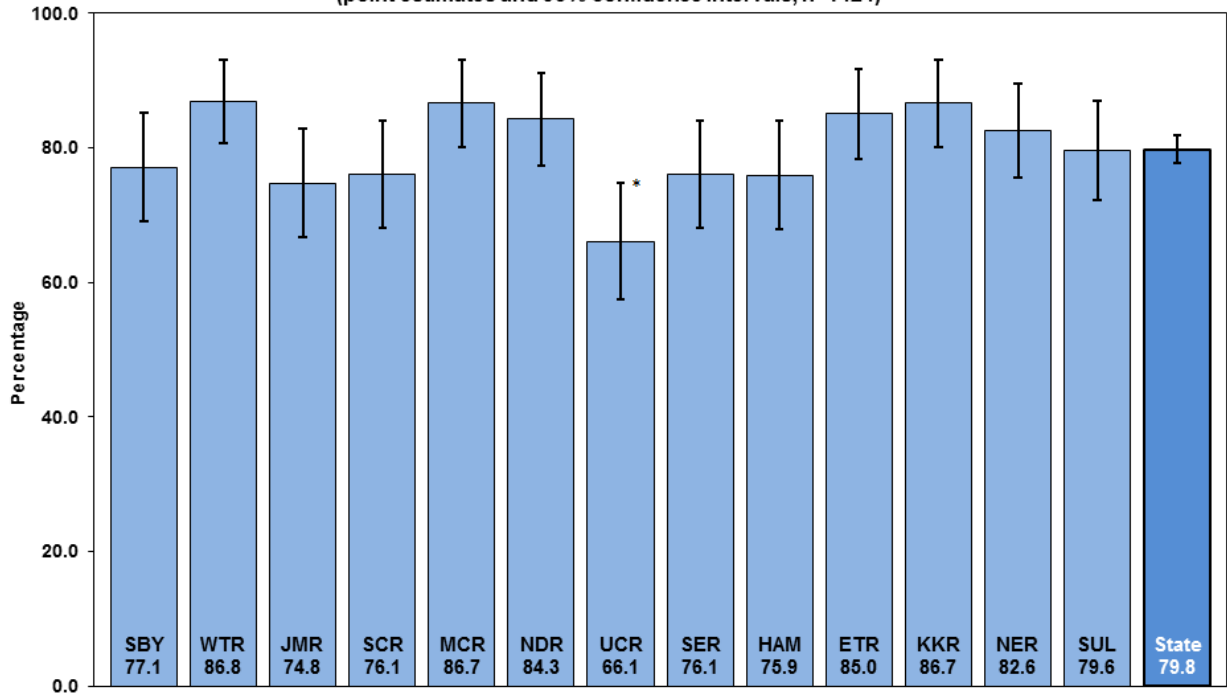
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with 3 or 4 doses of PCV by health department region
(point estimates and 95% confidence intervals, n=1424)**



**2014 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=1424)**



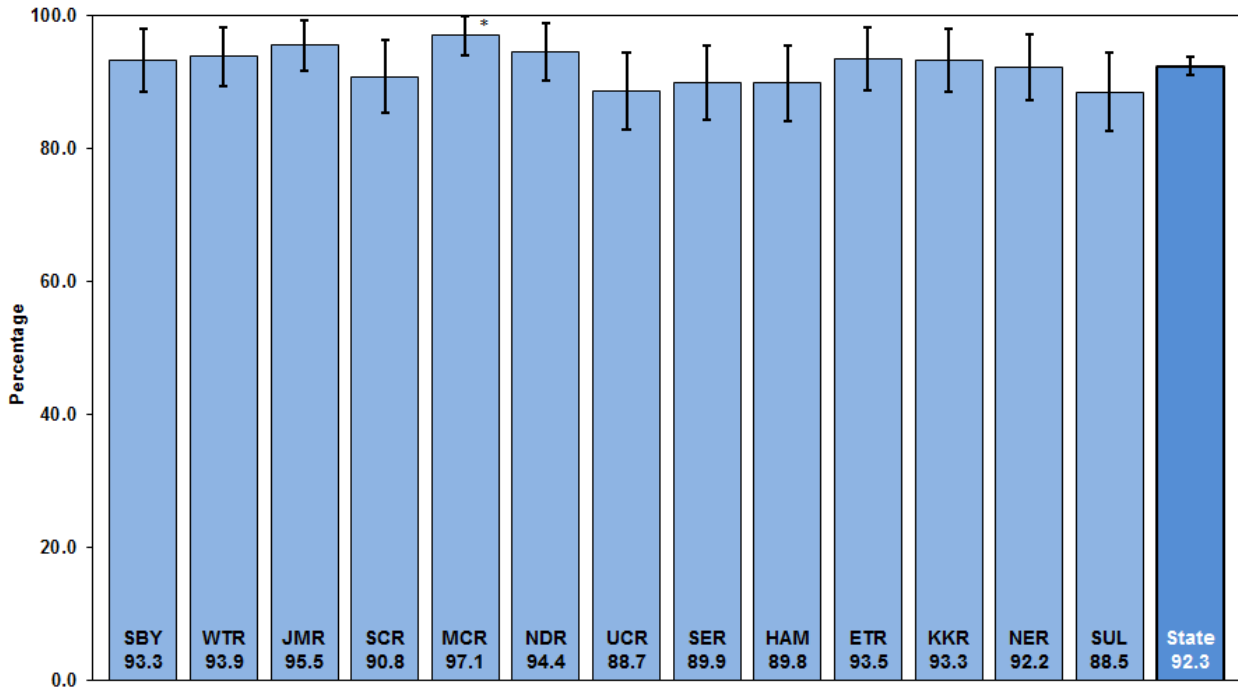
2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete Rotavirus (RTV) series
 (either ≥ 2 or ≥ 3 doses depending on brand) by health department region
 (point estimates and 95% confidence intervals, n=1424)



Region and Point Estimate

*statistically significant difference from State point estimate

2014 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=1424)



Region and Point Estimate

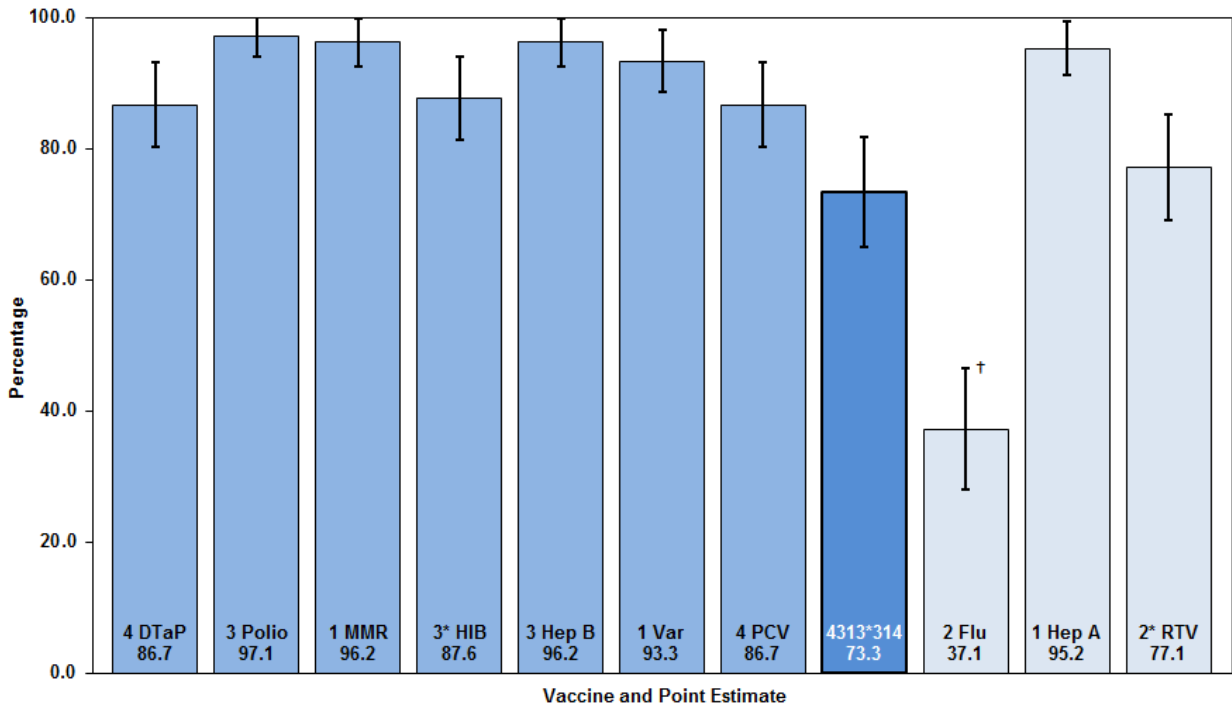
*statistically significant difference from State point estimate

Appendix 3
2014 Immunization Status Survey
of 24-Month-Old Children in Tennessee

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

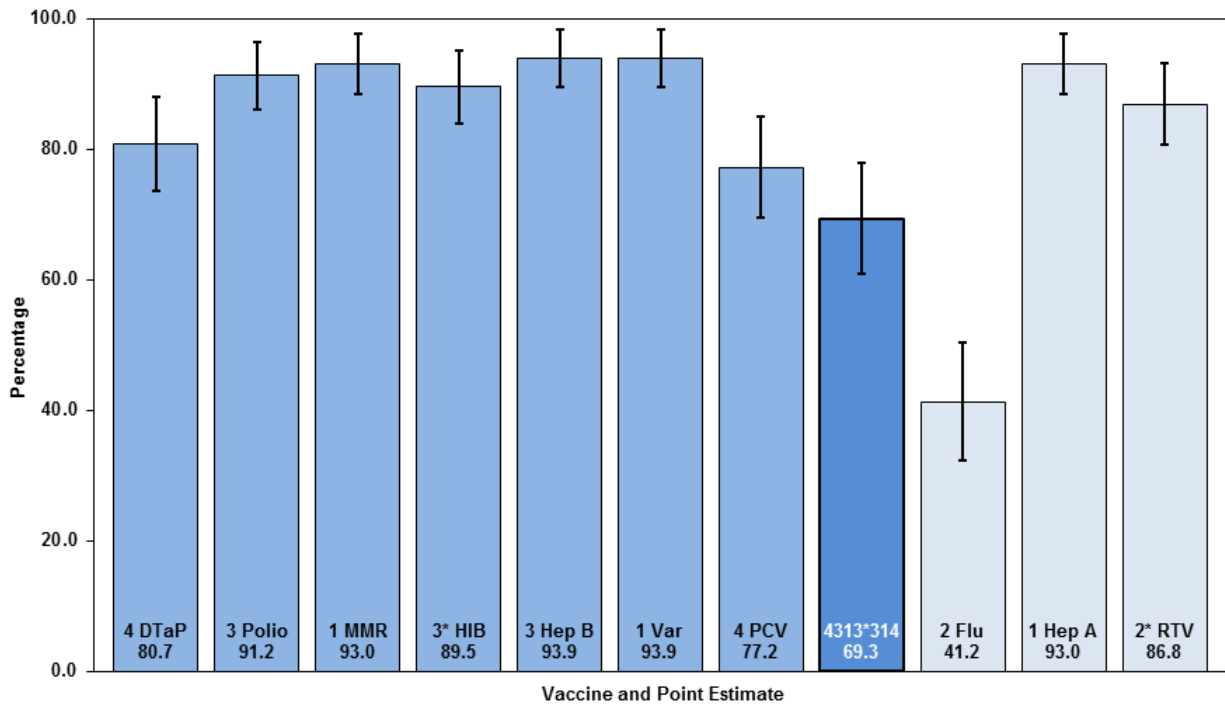
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**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Shelby County (SBY) by vaccine
(point estimates and 95% confidence intervals, n=105)**



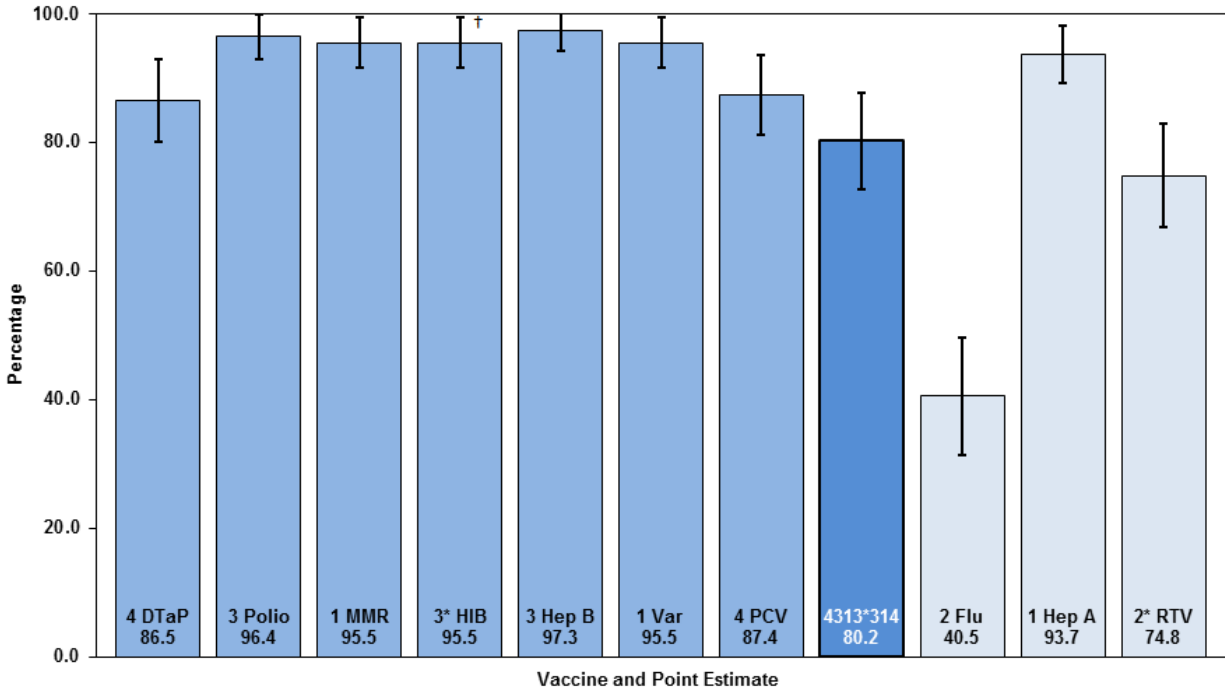
*statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=114)**



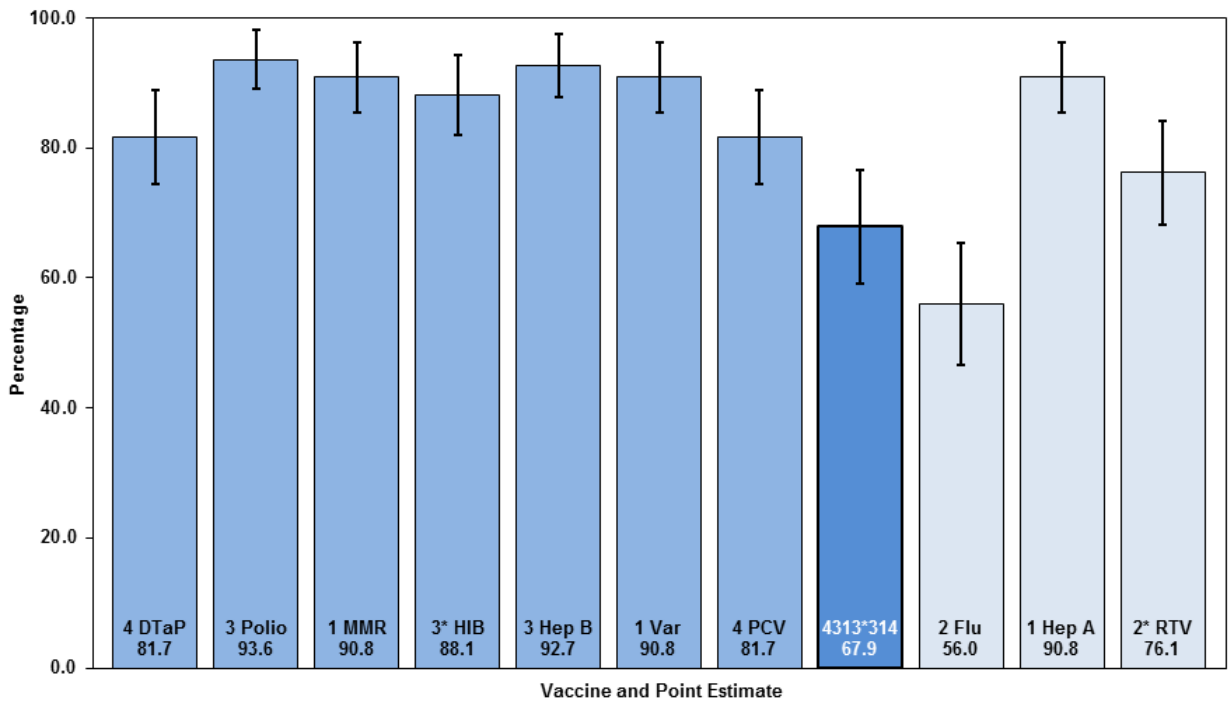
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=111)**



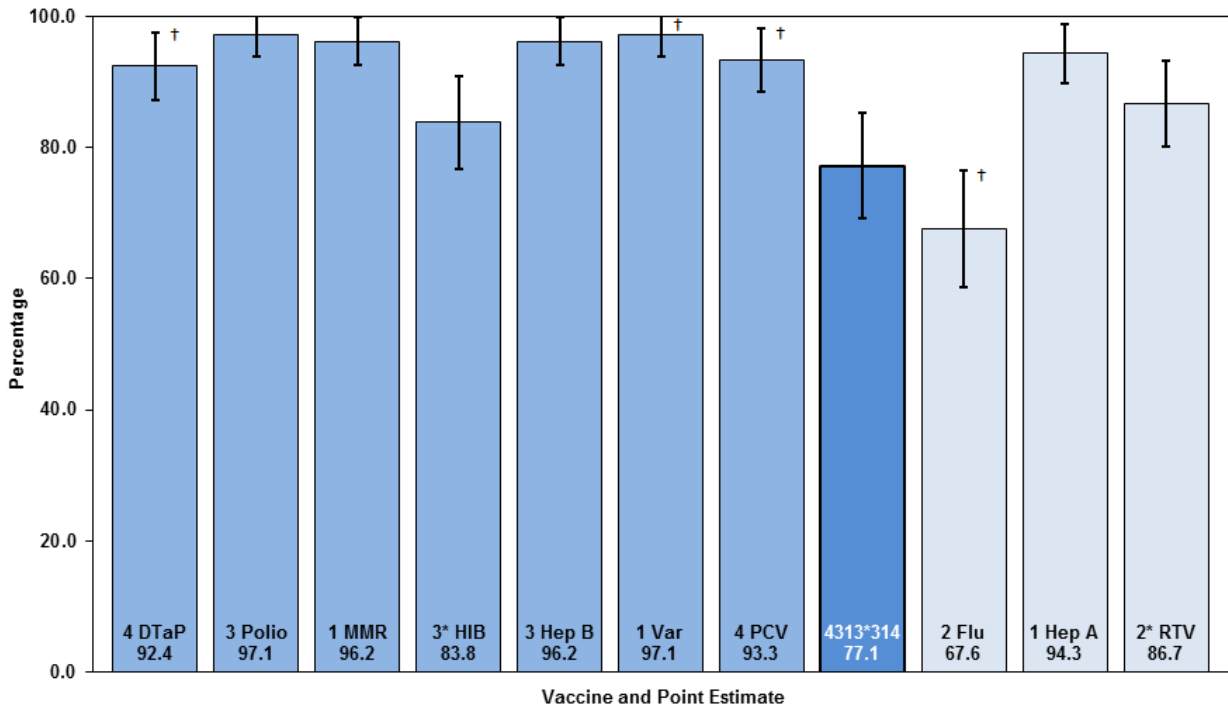
†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=109)**



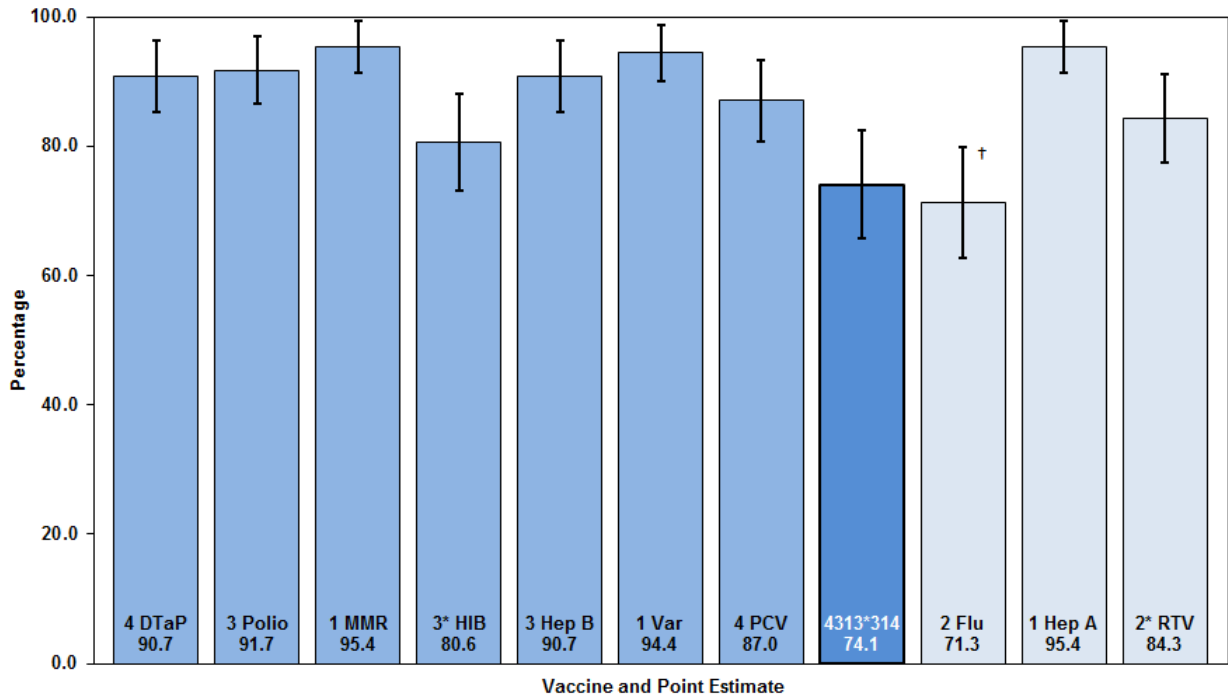
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=105)**



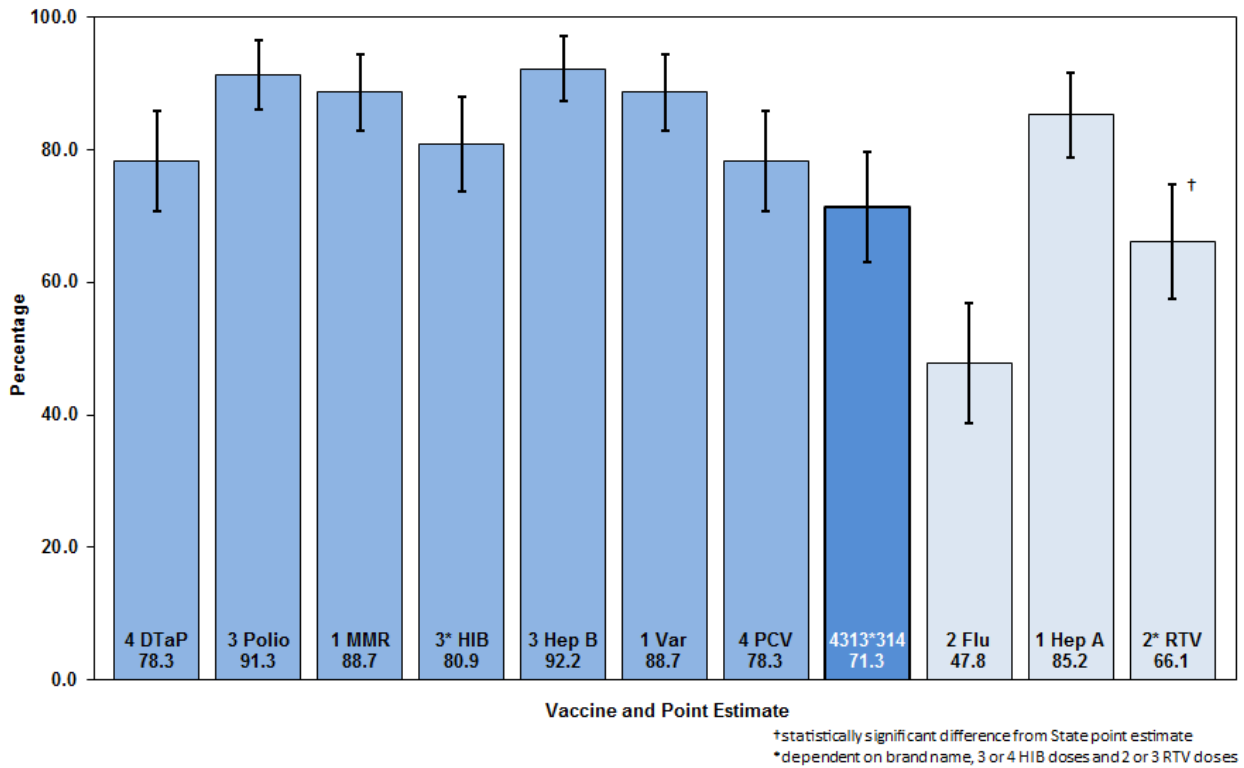
†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=108)**

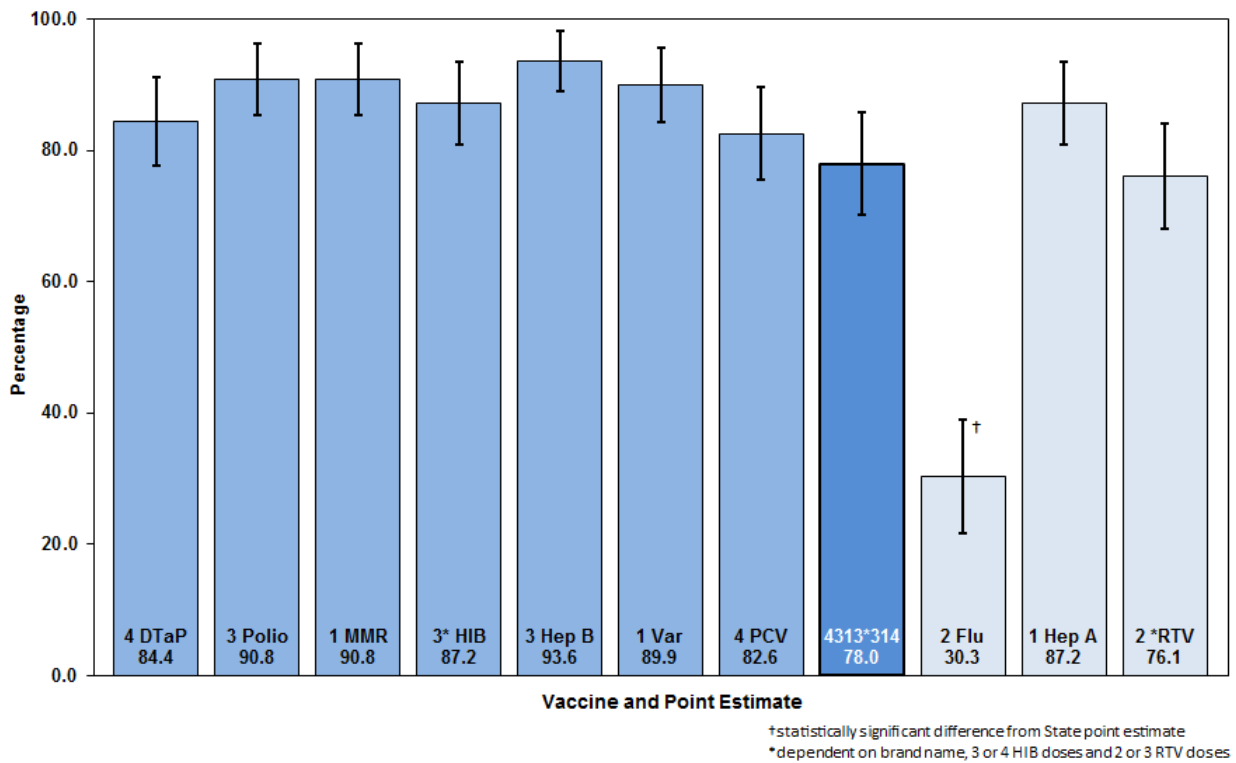


†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

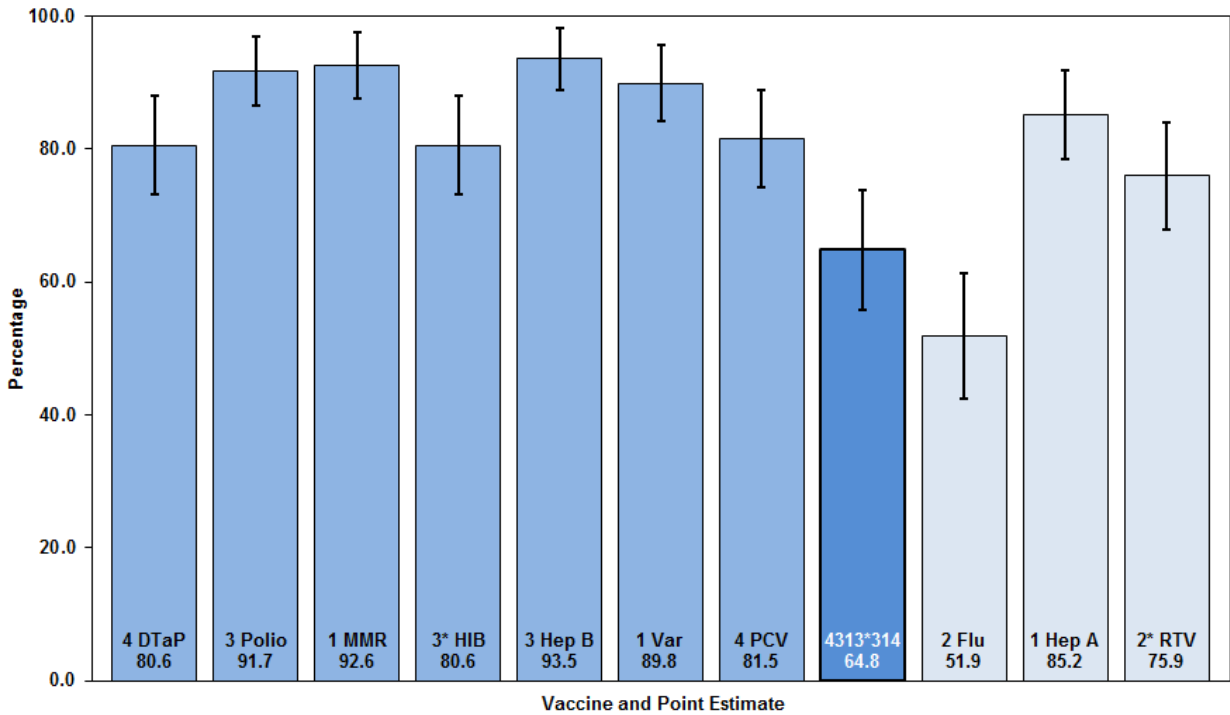
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Upper Cumberland Region (UCR) by vaccine
(point estimates and 95% confidence intervals, n=115)**



**2014 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=109)**

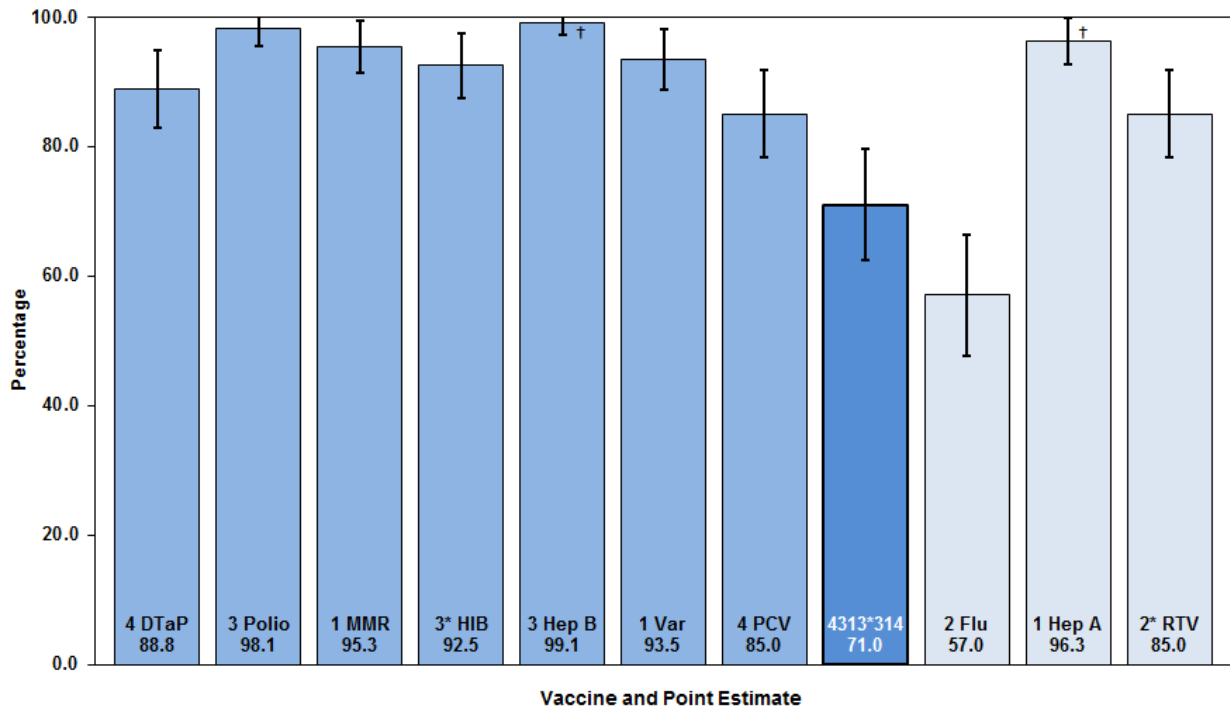


**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Hamilton County (HAM) by vaccine
(point estimates and 95% confidence intervals, n=108)**



*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

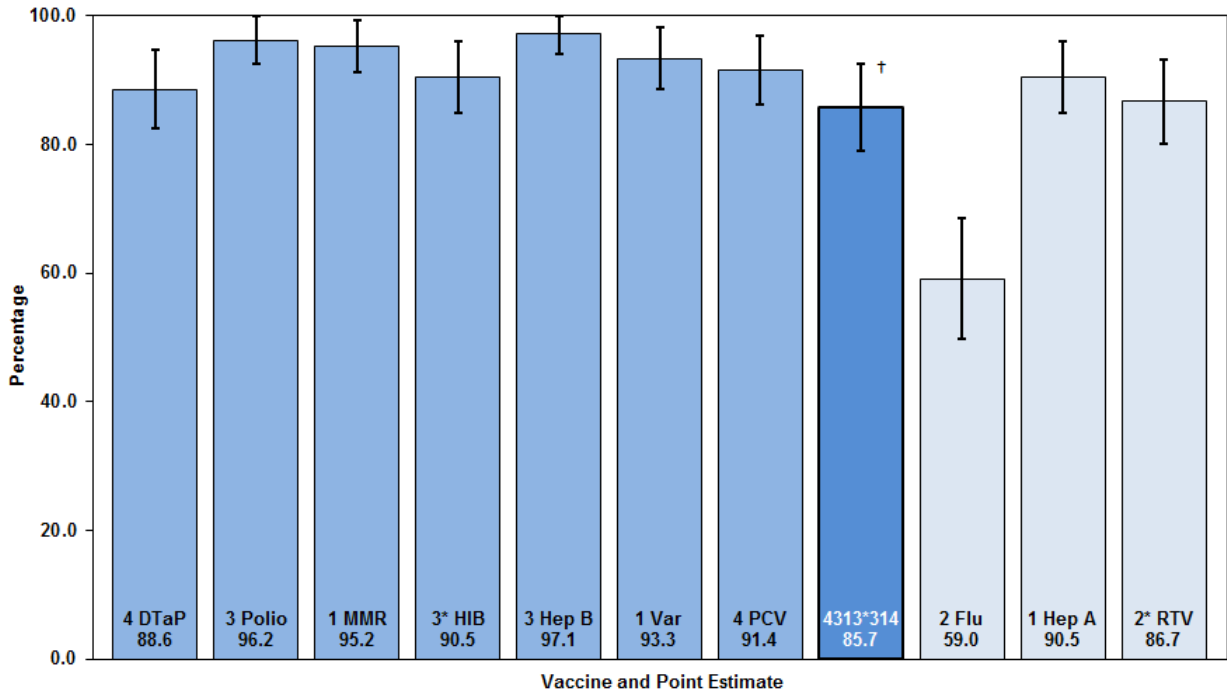
**2014 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in East Tennessee Region (ETR) by vaccine
(point estimates and 95% confidence intervals, n=107)**



†statistically significant difference from State point estimate

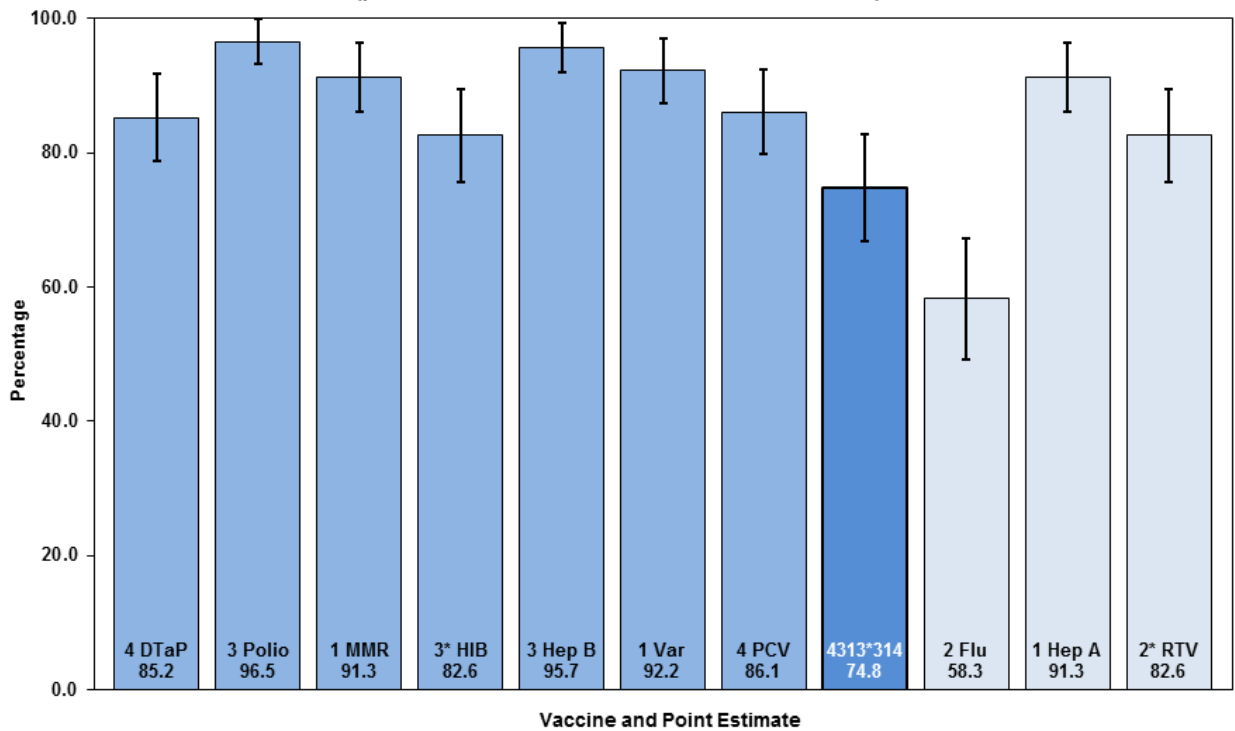
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=104)**



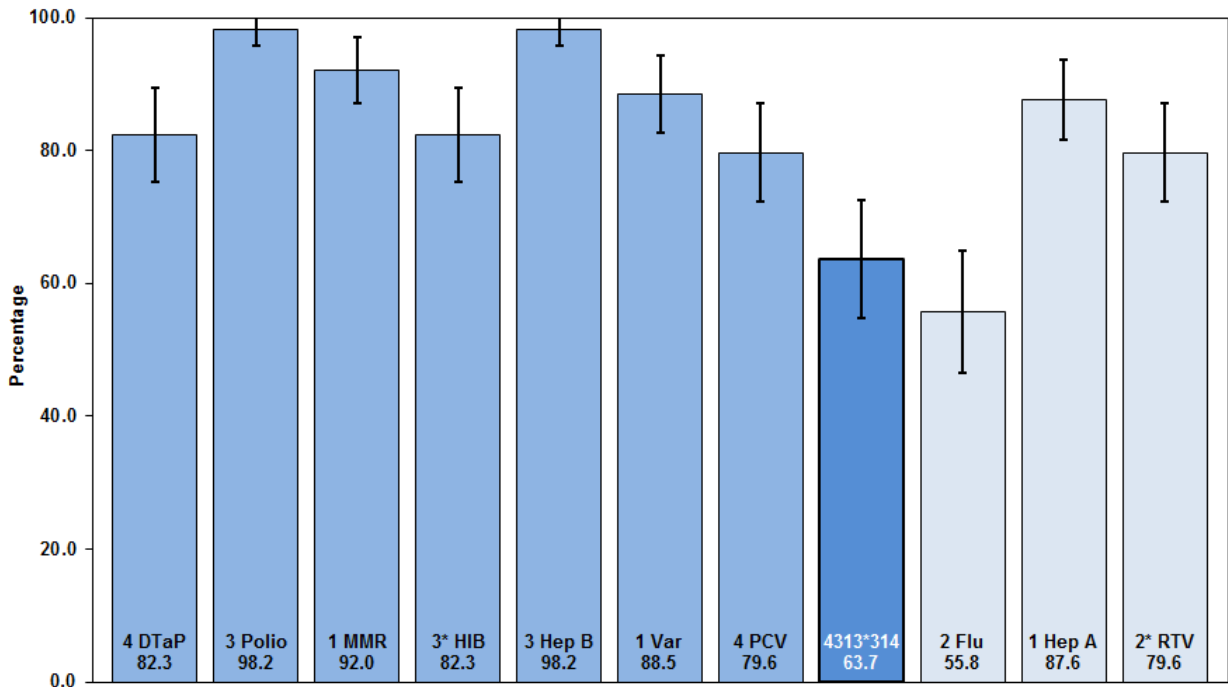
†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2014 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=115)**



*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

2014 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=113)



*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

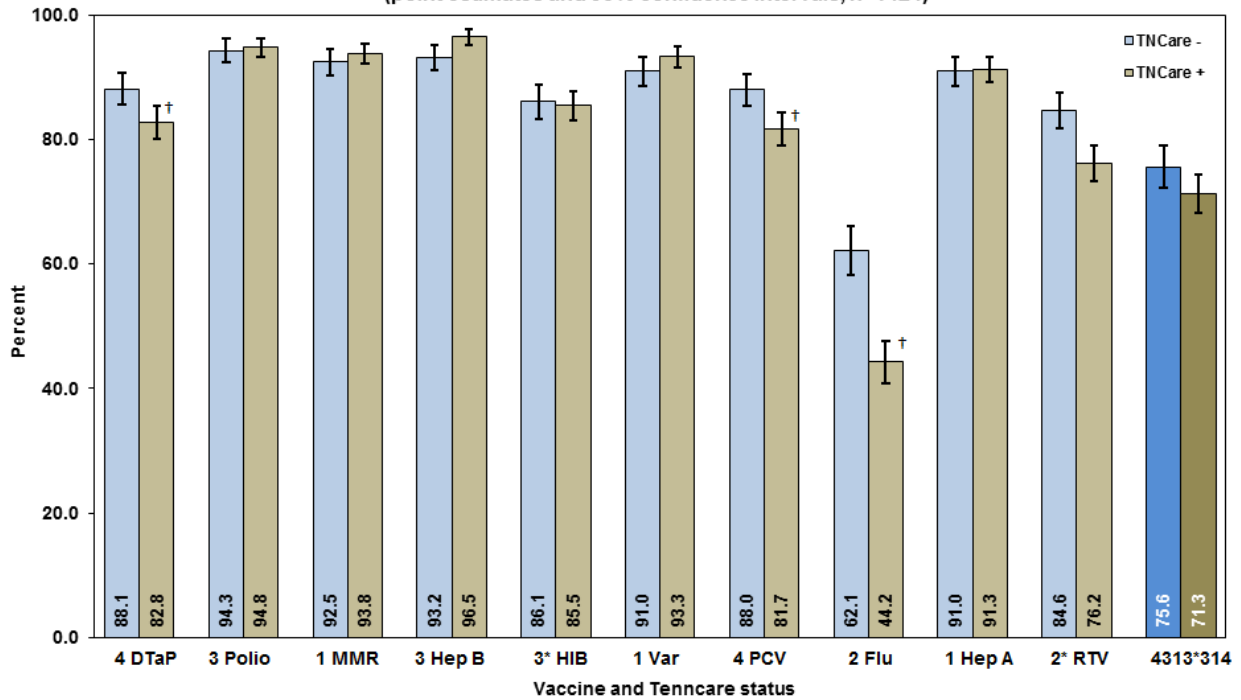
Appendix 4

2014 Immunization Status Survey of 24-Month-Old Children in Tennessee

Additional Statewide Charts for Specific Groups

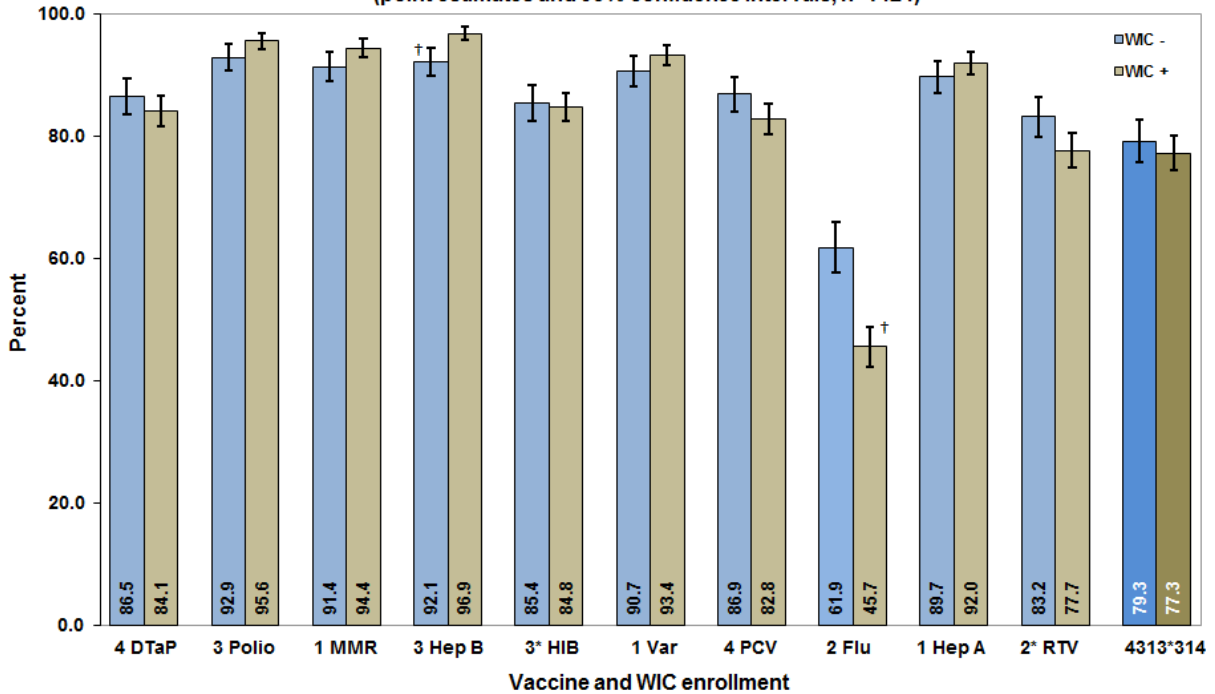
	Page
Immunization levels by vaccine and TennCare enrollment status	... 39
Immunization levels by vaccine and WIC enrollment status	... 39
Trends in on-time immunization coverage disparities (Black vs. White, 2010-2014)	... 40

2014 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=1424)



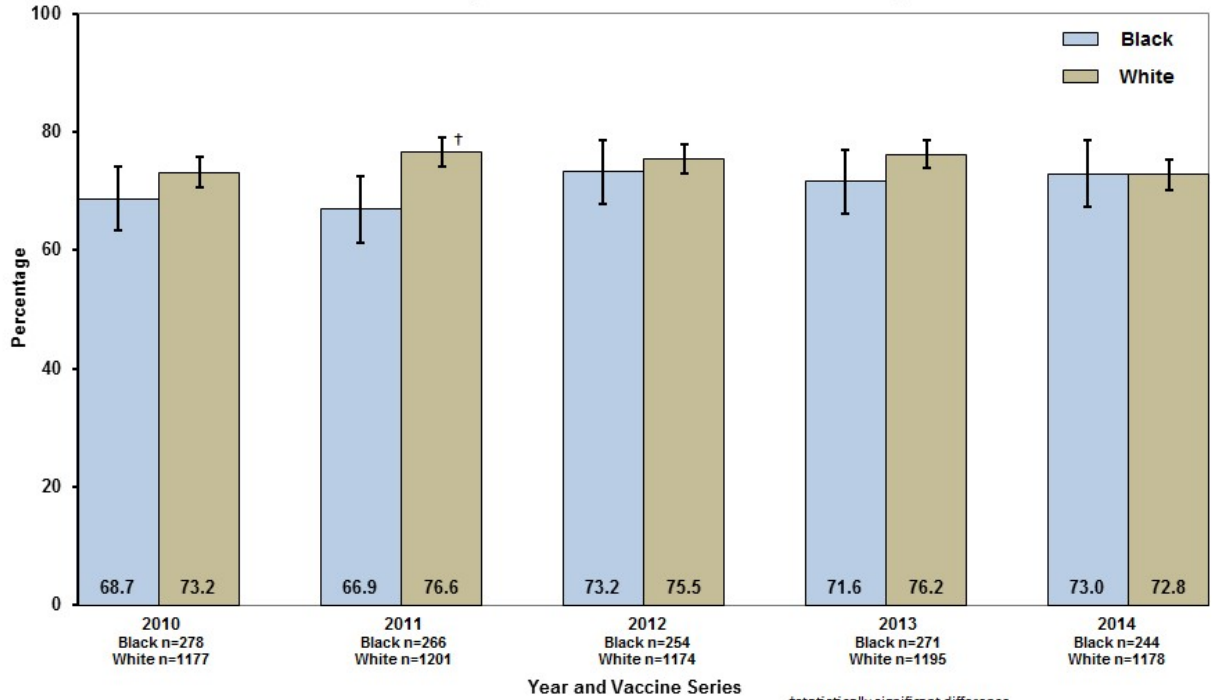
†statistically significant difference from State point estimate
 *dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

2014 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=1424)



†statistically significant difference from State point estimate
 *dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

2014 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)



†statistically significant difference
 *Full Hib series requires 3 or 4 doses depending on product

Appendix 5

2014 Immunization Status Survey of 24-Month-Old Children in Tennessee

Data Tables for Selected Analyses

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

Region	Yes		No		Total
	n=	%	n=	%	n=
Northeast TN	86	74.8%	29	25.2%	115
East TN	76	71.0%	31	29.0%	107
Southeast TN	85	78.0%	24	22.0%	109
Upper Cumberland	82	71.3%	33	28.7%	115
Mid-Cumberland	81	77.1%	24	22.9%	105
South Central	74	67.9%	35	32.1%	109
West TN	79	69.3%	35	30.7%	114
Shelby County	77	73.3%	28	26.7%	105
Davidson County	80	74.1%	38	25.9%	108
Knox County	90	85.7%	15	14.3%	105
Hamilton County	70	64.8%	38	35.2%	108
Madison County	89	80.1%	22	19.8%	111
Sullivan County	72	63.7%	41	36.3%	113
Total	1041	73.1%	383	26.9%	1424

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

Region	Public			Private			Both		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	6	7	85.7%	67	81	82.7%	13	25	52.0%
East TN	1	1	100.0%	55	81	67.9%	20	25	80.0%
Southeast TN	1	1	100.0%	60	72	83.3%	24	34	70.6%
Upper Cumberland	4	7	57.1%	69	91	75.8%	9	14	64.3%
Mid-Cumberland	0	2	0.0%	75	94	79.8%	6	8	75.0%
South Central	4	6	66.7%	46	69	66.7%	24	33	72.7%
West TN	7	8	87.5%	50	68	73.5%	22	37	59.5%
Shelby County	3	3	100.0%	57	79	72.2%	17	23	73.9%
Davidson County	0	1	0.0%	70	90	77.8%	10	14	71.4%
Knox County	0	2	0.0%	82	93	88.2%	8	9	88.9%
Hamilton County	0	1	0.0%	63	96	65.6%	7	9	77.8%
Madison County	4	6	66.7%	65	73	89.0%	20	32	62.5%
Sullivan County	4	6	66.7%	62	94	66.0%	6	13	46.2%
Total	34	51	66.7%	821	1081	75.6%	186	276	67.3%

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

Region	White			Black			Other		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	85	114	74.6%	1	1	100.0%	0	0	0.0%
East TN	74	103	71.8%	1	3	33.3%	1	1	100.0%
Southeast TN	81	104	77.9%	3	4	75.0%	1	1	100.0%
Upper Cumberland	82	115	71.3%	0	0	0.0%	0	0	0.0%
Mid-Cumberland	74	97	76.3%	5	5	100.0%	2	3	66.7%
South Central	67	99	67.7%	7	10	70.0%	0	0	0.0%
West TN	60	91	65.9%	16	20	80.0%	3	3	100.0%
Shelby County	26	34	76.5%	49	69	71.0%	2	2	100.0%
Davidson County	55	74	74.3%	22	30	73.3%	3	4	75.0%
Knox County	78	90	86.7%	9	11	81.8%	3	4	75.0%
Hamilton County	49	81	60.5%	15	20	75.0%	6	7	85.7%
Madison County	57	67	85.1%	31	43	72.1%	1	1	100.0%
Sullivan County	69	109	63.3%	2	2	100.0%	1	2	50.0%
Total	857	1178	72.8%	161	218	73.8%	23	28	82.1%

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

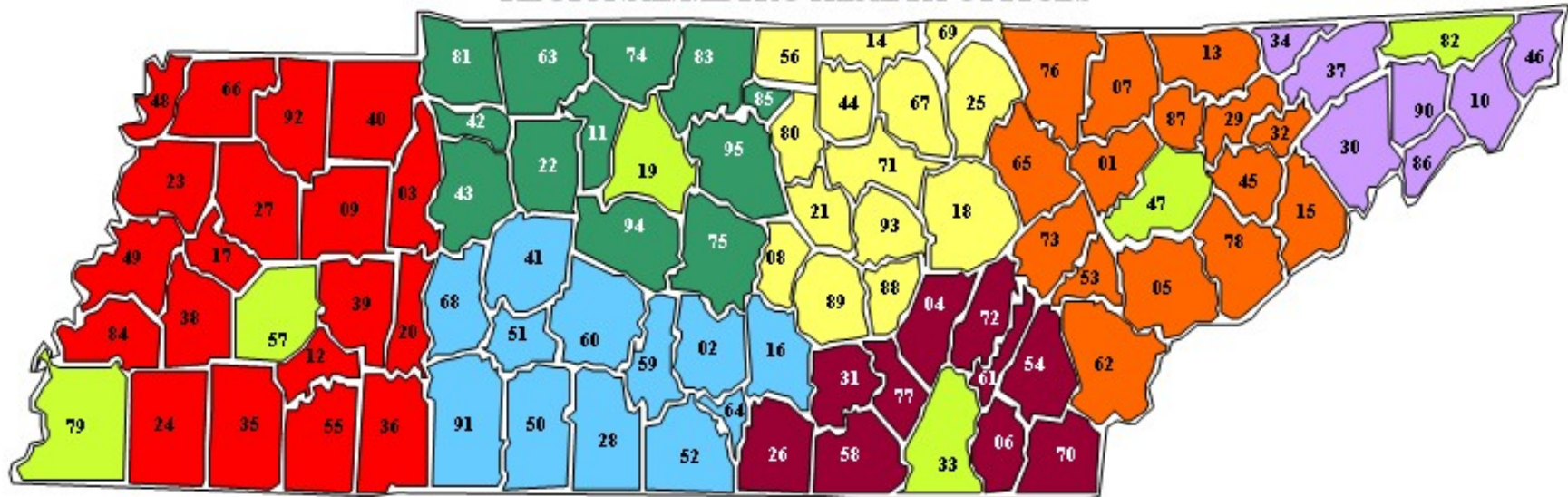
Region	0 Siblings			1 Siblings			2+Siblings		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	39	51	76.5%	29	40	72.5%	18	24	75.0%
East TN	35	48	72.9%	30	37	81.1%	11	22	50.0%
Southeast TN	35	45	77.8%	32	41	78.1%	18	23	78.3%
Upper Cumberland	45	56	80.4%	16	26	61.6%	21	33	63.6%
Mid-Cumberland	35	42	83.3%	26	35	74.3%	19	26	73.1%
South Central	32	42	76.2%	23	37	62.2%	19	30	63.3%
West TN	30	42	71.4%	27	36	75.0%	22	36	61.1%
Shelby County	30	38	79.0%	16	25	64.0%	31	42	73.8%
Davidson County	39	45	86.7%	24	33	72.7%	14	24	58.3%
Knox County	47	51	92.2%	30	36	83.3%	13	18	72.2%
Hamilton County	38	49	77.6%	21	33	63.6%	11	26	42.3%
Madison County	40	48	83.3%	29	36	80.6%	20	27	74.1%
Sullivan County	35	54	64.8%	25	36	69.4%	12	23	52.2%
Total	480	611	78.6%	328	451	72.7%	229	354	64.7%

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

Region	Enrolled			Not Enrolled		
	Yes	Total	%	Yes	Total	%
Northeast TN	48	68	70.6%	38	47	80.9%
East TN	54	82	65.9%	22	25	88.0%
Southeast TN	59	73	80.8%	26	36	72.2%
Upper Cumberland	44	64	68.8%	38	51	74.5%
Mid-Cumberland	30	37	81.1%	51	68	75.0%
South Central	51	77	66.2%	23	32	71.9%
West TN	57	84	67.9%	22	30	73.3%
Shelby County	52	71	73.2%	25	34	73.5%
Davidson County	28	40	70.0%	52	68	76.5%
Knox County	38	46	82.6%	52	59	88.1%
Hamilton County	34	59	57.6%	36	49	73.5%
Madison County	54	68	79.4%	35	43	81.4%
Sullivan County	39	56	69.6%	33	57	57.9%
Total	588	825	71.3%	453	599	75.6%

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	Mauvy	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												