

Results of the 2015 Immunization Status Survey of 24-Month-Old Children in Tennessee



**Prepared by the
Tennessee Immunization Program
Tennessee Department of Health
<http://tn.gov/health/article/cedep-reports>
Phone: 615-741-7247**

December 2015

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.

Photo provided by CDC Public Health Image Library (James Gathany).

Table of Contents

	Page
Executive Summary	... 4
Definitions of Abbreviations in Charts	... 7
General Information and Results:	... 8
Figure 1. Statewide percentage of children with age-appropriate immunization levels by vaccine	... 11
Figure 2. Percentage of children with on-time 4:3:1:3 [*] :3:1:4 immunization by region	... 12
Figure 3. Statewide percentage of age-appropriate vaccinations by vaccine, 2014 and 2015	... 13
Figure 4. 4:3:1:3:3:1:4 and 4:3:1:3:3:1 Immunization Level Trends: Tennessee 2000 to 2015	... 13
Figure 5a. Percentage of children with birth dose of hepatitis B vaccine by third day of life by region	... 14
Figure 5b. Percentage of children with birth dose of hepatitis B vaccine, 2014 and 2015	... 15
Figure 6. Statewide percentage of children with age-appropriate immunization levels by vaccine and race	... 16
Table 1. 4:3:1:3 [*] :3:1:4 Completion Levels of 24-Month-Old Children: Selected Characteristics	... 17
Figure 7. Source of Immunizations from 2000 to 2015	... 18
Table 2. Prevalence of risk factors for delayed immunizations by provider type	... 18
Summary of Key Findings and Next Steps	... 19
Appendix 1:	
Details of Regional Samples (oversampled, vaccine refusal, child not located)	... 21
Appendix 2: Vaccine Series and Individual Vaccine Charts	...22
On-time 4:3:1:3 [*] :3:1 and 4:3:1:3 [*] :3:1:4 vaccine series	... 23
DTaP (4-dose and 3-dose coverage)	... 24
<i>Haemophilus influenzae</i> type b & Hepatitis A (1-dose coverage)	... 25
Hepatitis A (2-dose coverage) & Hepatitis B	... 26
Influenza (2-dose and 3-dose coverage)	... 27
MMR & Pneumococcus (4-dose coverage)	... 28
Pneumococcus (PCV) (4-dose vs. 3-dose coverage) & Polio	... 29
Rotavirus & Varicella	... 30
Appendix 3: Individual Health Department Region Charts (West→East)	... 31
Shelby County	... 32
West Tennessee Region	... 32
Jackson-Madison County	... 33
South Central Region	... 33
Mid-Cumberland Region	... 34
Nashville-Davidson County	... 34
Upper Cumberland Region	... 35
Southeast Region	... 35
Hamilton County	... 36
East Tennessee Region	... 36
Knoxville-Knox County	... 37
Northeast Region	... 37
Sullivan County	... 38
Appendix 4: Additional Statewide Charts for Specific Groups	... 39
Immunization levels by vaccine and TennCare enrollment status	... 40
Immunization levels by vaccine and WIC enrollment status	... 40
Trends in on-time immunization coverage disparities (black vs. white) for 2010-2015	... 41
Appendix 5: Data Tables for Selected Analyses	... 42
Series Complete (4:3:1:3 [*] :3:1:4)	... 43
Series Complete (4:3:1:3 [*] :3:1:4) by Provider Type	... 43
Series Complete (4:3:1:3 [*] :3:1:4) by Race	... 44
Series Complete (4:3:1:3 [*] :3:1:4) by Number of Older Siblings	... 44
Series Complete (4:3:1:3 [*] :3:1:4) by TennCare Enrollment	... 45
Appendix 6: Regional Health Department Map	... 46

Executive Summary

The Tennessee Department of Health (TDH) conducts an annual survey of the on-time immunization status of 24 month old children. The Tennessee Immunization Program (TIP) uses the results to track progress toward achieving the national Healthy People (HP) 2020 objectives for immunization coverage with routinely recommended early childhood vaccines. HP2020 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. The federal Vaccines for Children (VFC) Program, implemented in 1994, assures affordable access to all routine vaccines for children without private insurance coverage. The CDC reported that the routine vaccines already given to U.S. 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 1,622 children was selected from birth certificates of children born in 2013 in each of six metropolitan counties and in the 7 rural multi-county TDH regions. Local or state public health staff attempted to locate each child and confirm immunization histories with parents or guardians and healthcare providers.

Children were excluded from the survey if:

- they were determined to have moved out of state
- their birth record was sealed (e.g. through adoption or placement in foster care)
- the parents or guardians refused to participate in the survey
- the child died

In total, 1,498 children participated. Immunization rates are provided statewide, for the 6 major metropolitan counties and for 7 rural multi-county regions. County rates within rural regions are not calculated because of the small number of children sampled.

The survey analysis was updated in 2014 to provide a more accurate assessment of *Haemophilus influenzae* type B (HIB) vaccination and rotavirus vaccination (RTV) rates. Past surveys classified the minimum number of doses necessary as complete although certain brands required more doses. For the second year, this 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. As a result, point estimates for HIB and RTV coverage rates in 2015, though lower than if calculated using the old method, are more accurate and better match methods now used by the CDC. For this reason, the text will indicate the 2015 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 2015 (24 months)
Diphtheria, Tetanus, Pertussis	90%	83.8%
Poliomyelitis	90%	93.0%
Measles, Mumps, Rubella	90%	90.2%
Hepatitis B	90%	94.2%
Hepatitis B, birth dose	85%	81.8%
<i>Haemophilus influenzae</i> , type B	90%	83.0%
Varicella (Chickenpox)	90%	91.0%
Pneumococcus	90%	83.9%
All of above	80%	75.7%
Hepatitis A	60% complete	1 dose: 89.9%
Influenza	70%	51.4%
Rotavirus	80%	75.3%

Other Key Findings:

- Unvaccinated children: Thirty-eight (2.5%) of 1,498 children surveyed had not received a single dose of vaccine. Nine of the 38 were children who could not be located and had no immunization records in the state immunization information system (TennIIS). Of the 29 children whose parents were contacted, 27 had not been vaccinated for religious or other personal reasons; two cited an unverified medical reason. An additional 5 children had received at least one vaccination but a parent gave a religious, personal or medical reason for ceasing immunization. In total, 2.3% had chosen not to vaccinate or to cease vaccinating their children, higher than previously measured.
- Birth dose of hepatitis B vaccine increases: A statistically significant increase in the administration of hepatitis B vaccine within three days of life (“birth dose”) was measured in 2015, at 81.8%, compared to 76.8% in 2014.
- Influenza racial disparity: As long as influenza vaccination has been measured in this survey, a significant racial disparity has been found. In 2015, 54.6% of white children had received at least 2 doses of influenza vaccine by age two, compared to 31.9% of black children.
- TennCare and WIC: Children who had ever been enrolled in either TennCare or Women, Infants and Children (WIC) programs were *less* likely than children never enrolled in these programs to have completed the full 4:3:1:3*:3:1:4 series by their second birthday.

Key strategy for improving rates: effective use of the Immunization Information System

- In November 2014, TDH implemented a new immunization information system, “TennIIS”, www.TennesseeIIS.gov, available to all immunization providers, including pharmacies. 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 helped improve immunization rates.
- TDH continues 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.

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 2015 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 on-time immunization status of young children 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 for on-time completion, according to the published CDC Recommended Childhood Immunization Schedule

[†] Doses required depend on the brand of vaccine administered

This survey uses the same vaccine series definitions as the Centers for Disease Control and Prevention (CDC) National Immunization Survey (NIS), which assesses 19-35 month old children. Complete on-time immunization in the 2015 survey of Tennessee 24 month olds 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; PCV (4) was added in 2010. Before 2014, HIB vaccination was complete with 3 doses: brand information was unavailable. From 2014 forward, if any documented dose was a 4-dose product, then 4 doses of HIB vaccine was considered complete on time; otherwise, 3 doses of HIB was classified as complete.

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; this survey measures the proportion of children with 2 or more doses by their second birthday.
- Hepatitis A vaccine (HAV) is complete with 2 doses, starting on or after the first birthday; the recommended dose spacing of 6-18 months means that children who have only 1 dose by the second birthday are still 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 in the series was known to be Rotateq[®]. If no brand information was available, 2 doses of rotavirus vaccine given before this time 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 HP2020:

- 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;
- 70% appropriately immunized against influenza; and
- 85% of all children receive their first dose of hepatitis B vaccine within 3 days of life.

The 2015 sample population:

The 2015 statewide sample consisted of 1,622 children born in the first quarter of 2013 (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 2013 in that region. Forty-nine (49) additional children of black race were randomly selected for inclusion in the racial disparity analysis.

Of the 1,622 sampled births, 124 were excluded from the analysis for one of the following reasons: parents refused to participate (n=29), the child had moved out of state (n = 86), the child had been adopted, put in foster care or was in state custody (n=7), or the child had died (n=2). Included in those excluded were two of the 49 oversampled records included only in the state-level racial disparity analysis.

After exclusions, 1,498 children remained in the primary sample (1,451 + 47 oversampled records =1,498 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 1,498 total children, 15 children with incomplete vaccination information could not be located and could not be confirmed as having left the state. Nine of these children had no shots recorded in the immunization registry; the other 6 had some shots recorded. By protocol, these children are included in the analysis with any available immunization records. See Appendix 1 for the regions of residence of these children.

The method of locating children included the use of Accurint, a subscription-based database compiling publicly available address information, to generate contact details for parents of each child. These were provided to local and regional health department staff at the beginning of the survey period.

Vaccine refusal:

Of the 1,498 children, 29 children with no immunizations (1.9%) had parents who confirmed that they did not vaccinate their children for religious (n=17), philosophical (n=10), or medical (n=2) reasons. Five more children who had received at least one immunization had parents who reported refusing additional immunizations for philosophical (n=2) or religious (n=3) reasons. Overall, 2.3% (34 of 1,498) of those surveyed did not vaccinate, or continue to vaccinate, for one of these reasons.

These children impacted regional coverage rates to different degrees: 3 regions had 0-1 child whose parents refused vaccination, while 4 regions had 4-6 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 defined in Appendix 6; however, the sample size within multi-county regions is too small to yield interpretable results at the county level 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 to be statistically significant. CIs were not calculated for surveys before 2007.

Minimum intervals limitation:

This survey may overestimate appropriate immunization because analysis is based on numbers of doses in a series and doses are not excluded if given before minimum acceptable intervals as defined by CDC.

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, defined as a dose given within the first three days of life. 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. 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 2013 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 in this survey are very small and a national standard for measurement of completeness is not yet routinely used. This 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 vaccine used. The full series (FS) of the Merck product requires 3 doses; the FS of the Sanofi Pasteur product requires 4 doses. Any mixed-brand schedule requires 4 doses.

Beginning in 2014, any child that received one or more doses of the 4-dose product had to have 4 doses before the 25th month of life to be classified as complete on-time; all others required 3 doses to classify as complete. Of the 1407 children who received any HIB doses, 860 required 4 doses and 547 were complete with 3 doses: 428 received the 3-dose product alone or in combination with unknown doses, 119 had no brand information available. This classification reduces, but does not completely eliminate, the past degree of overestimation in on-time completion. Charts specific to HIB completion are located in Appendix 2.

Rotavirus vaccine (RTV):

Like HIB vaccine, two 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.

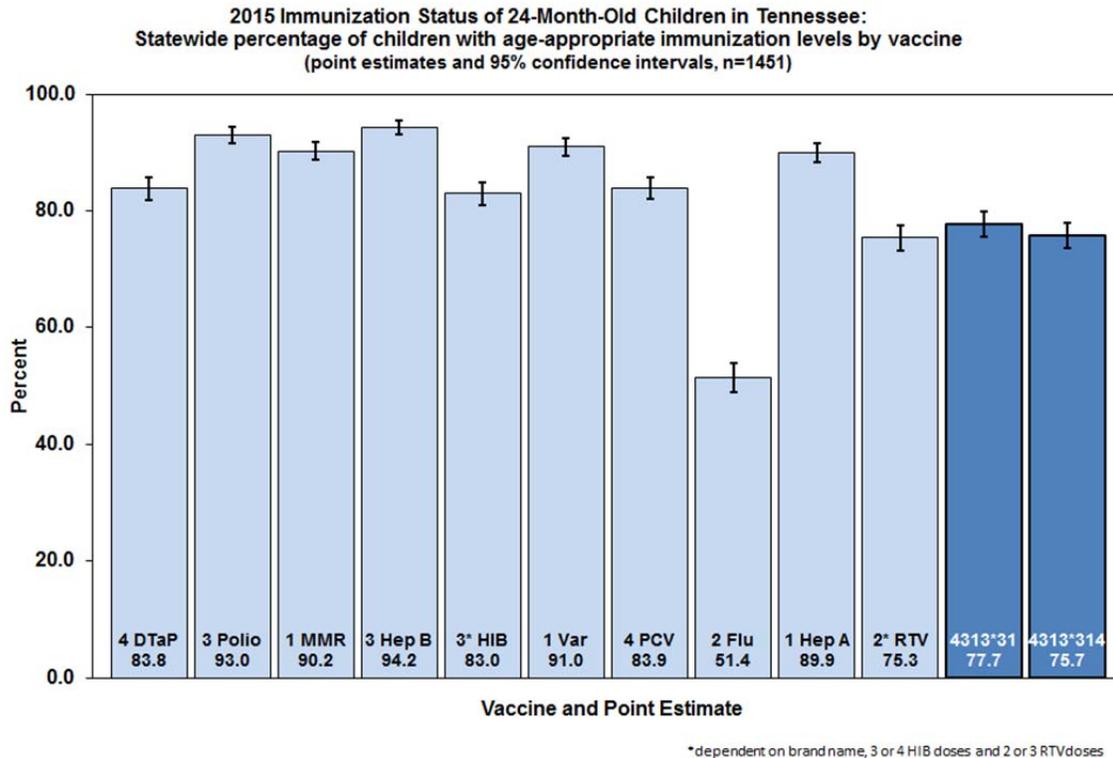
Of the children surveyed in 2015, 901 received at least one dose of Rotateq[®] and were classified as complete on-time only if they had received 3 doses. Of the 407 classified as complete on-time after receiving two doses of RTV, 339 had received 2 doses of Rotarix[®] or Rotarix[®] and an unknown dose, and 68 had received 2 doses of unknown brand. Coverage rate charts specific to rotavirus are located in Appendix 2.

Statewide Results and Trend Analysis:

Vaccine specific on-time immunization coverage

The HP2020 objective of 90% on time coverage was exceeded for 4 out of 7 vaccines in the 4:3:1:3*:3:1:4 series (Figure 1). The measurements for DTaP and PCV, two vaccines requiring 4 doses for on-time completion, failed to reach 90%. This target is within reach, because the percentages of children who had received 3 or more doses were 93.9% for DTaP and 93.4% for PCV (Appendix 2).

Figure 1



HIB, which may require either 3 or 4 doses for on-time completion, also failed to reach the 90% HP2020 coverage goal, at 83.0% on-time completion. The majority, 61%, had brand information indicating they received at least one dose of the 4-dose HIB formulation and required 4 doses to be classified as complete on-time. On-time completion among children requiring 4 doses (699 of 860, or 81.2%) was lower than on-time completion among those requiring 3 doses (505 of 547, or 92.3%).

Like HIB, RTV on-time completion requires 3 doses if any documented dose was the brand requiring a 3-dose series. Among children classified as complete on-time with 2 doses of RTV, 375 of 407 (92.1%) were complete; 718 of 901 (79.7%) children who required 3 doses of RTV were complete on-time. Overall, 75.3% of children were classified as complete on-time.

For hepatitis A vaccine, 89.9% were immunized on time with the first dose of vaccine by 24 months of age. In addition, 58.2% had already completed the 2-dose series (HP2020 objective: 60% complete by the 3rd birthday).

Influenza vaccination coverage was unchanged compared to 2014: 51.4% of children had received ≥ 2 doses.

The 4:3:1:3*:3:1:4 vaccine series on-time completion rate of 75.7% (95% CI, 73.5, 77.9) was 2.6 percentage points higher than the 2014 point estimate, but the difference did not reach statistical significance.

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

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 75.7% (95% CI, 73.5, 77.9). None of the regional 4:3:1:3*:3:1:4 point estimates were statistically significantly different than the state coverage rate. The point estimates in three public health regions (Southeast Region [SER], Knoxville-Knox [KKR] and Northeast Region [NER]) exceeded the HP2020 objective of 80% on-time completion of the entire series of vaccines.

Figure 3 compares the 2014 and 2015 statewide coverage rates by individual vaccine. Two individual vaccines had statistically significant decreases compared to 2014. One-dose MMR coverage was 90.2% (95% CI: 88.7, 91.7) compared to 93.3% (95% CI: 92.0, 94.6) in 2014. On-time RTV completion was 75.3% (95% CI: 73.1, 77.5) in 2015 compared to 79.8% (95% CI: 77.7, 81.9). These changes will be monitored over time to determine if they represent aberrations or important trends.

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

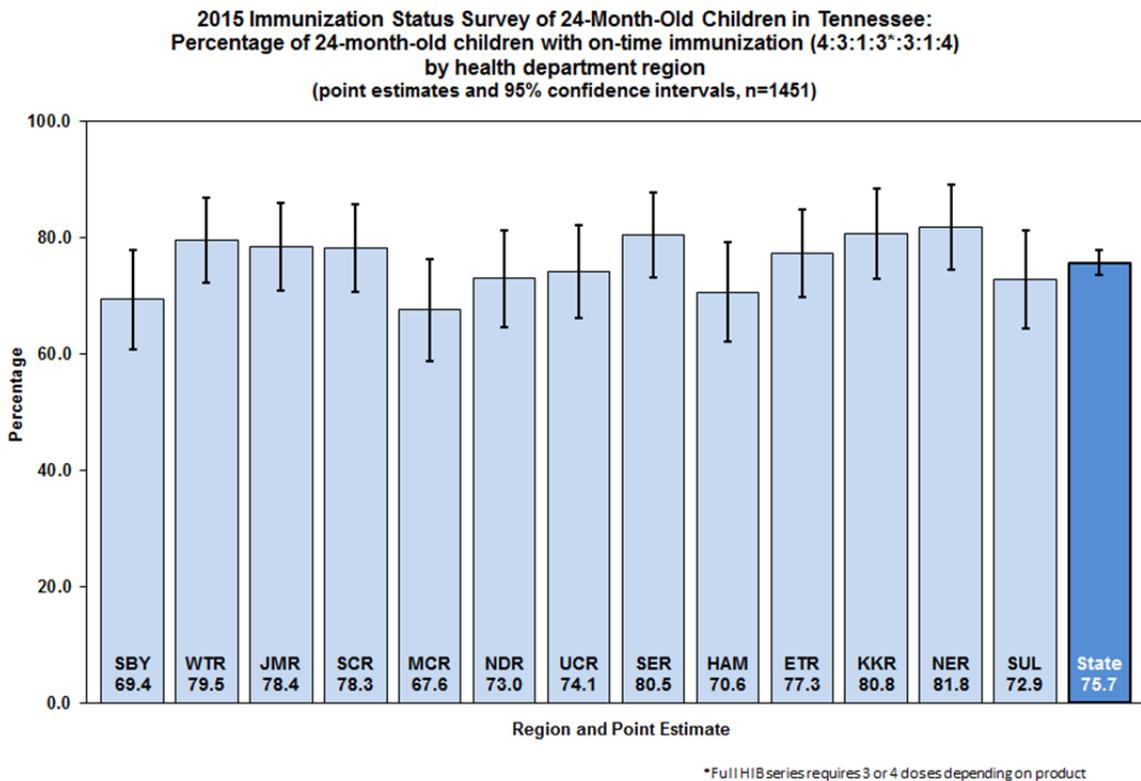
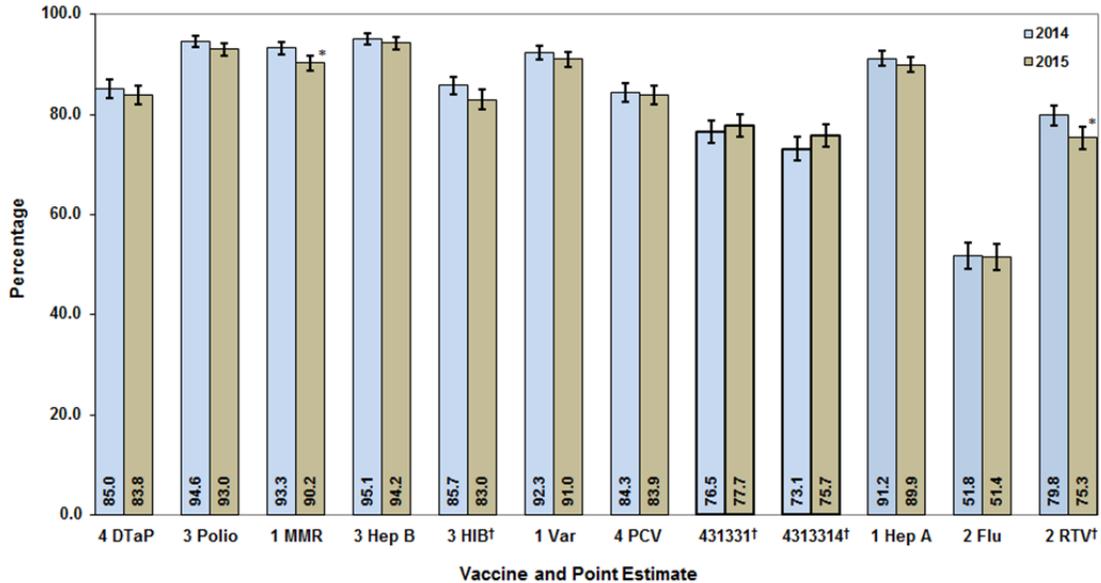


Figure 3

2015 Immunization Status of 24-Month-Old Children in Tennessee:
Statewide percentage of children with age-appropriate immunization levels
by vaccine in 2014 and 2015
 (point estimates and 95% confidence intervals, 2014 n=1424, 2015 n=1451)



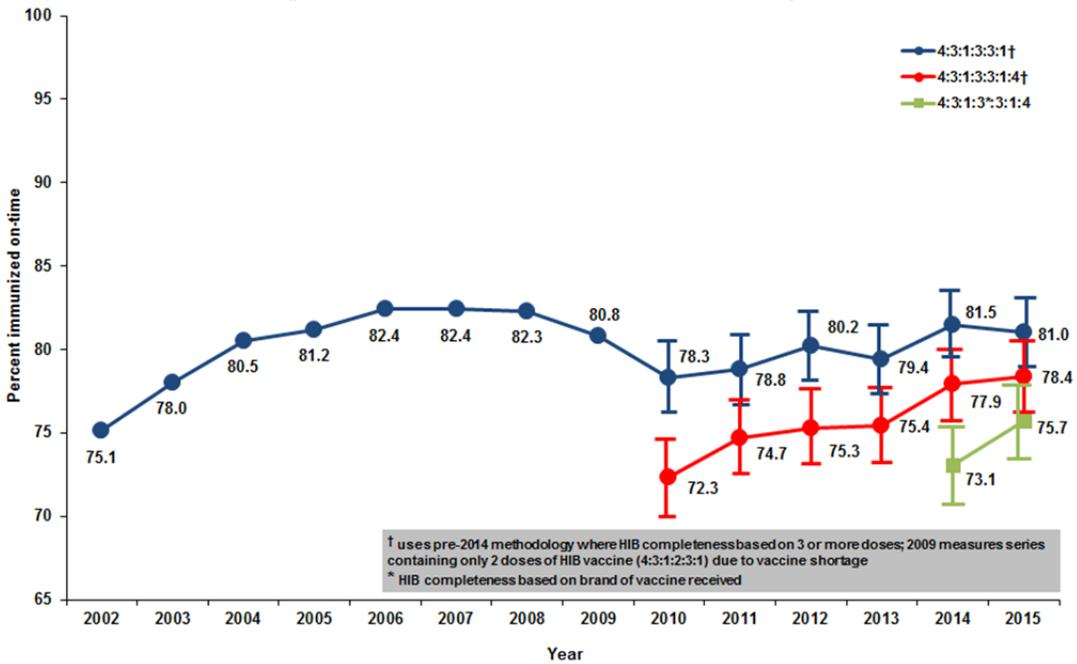
*statistically significant difference from prior year's point estimate
 †dependent on brand name, 3 or 4 Hib doses and 2 or 3 RTV doses

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 2015, 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 2014-2015.

Figure 4

2015 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 2015
 (point estimates and 95% confidence interval, 2015 n=1451)



† 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
 * Hib completeness based on brand of vaccine received

Hepatitis B vaccine birth dose

The percentage of children in each public health region who received a birth dose of HBV, defined as a dose given by day 3 of life, is shown below in Figure 5. Exposure to hepatitis B virus at the time of birth or in early infancy results in chronic, life-long infection for most infants. The CDC recommends that *all* newborns be vaccinated before discharge from the delivery hospital. This birth dose can help protect the neonate if a mother’s own hepatitis B infection is not detected or if the newborn is exposed to the virus in some other way.

The HP2020 objective is for 85% of infants to receive a birth dose of HBV. In 2015, 81.8% (95% CI: 79.8, 83.8) received a birth dose, a statistically significant 5 percentage point increase over 2014 (76.8%, 95% CI: 74.6, 79.0). Improvements were measured in 9 of 13 public health regions. Sullivan County (SUL) reported a significant increase of 27 percentage points. Across regions, only Memphis-Shelby County was significantly lower.

Because birth doses are administered at the delivery hospital, differences from year to year may be explained either by changes in hospital policies or protocols. In some cases, survey staff could not locate birth dose records that had not been copied into pediatrician or IIS records. The best way to improve birth dose rates is to strengthen hospital policy and implementation (Figure 5b).

Figure 5a
2015 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=1406)

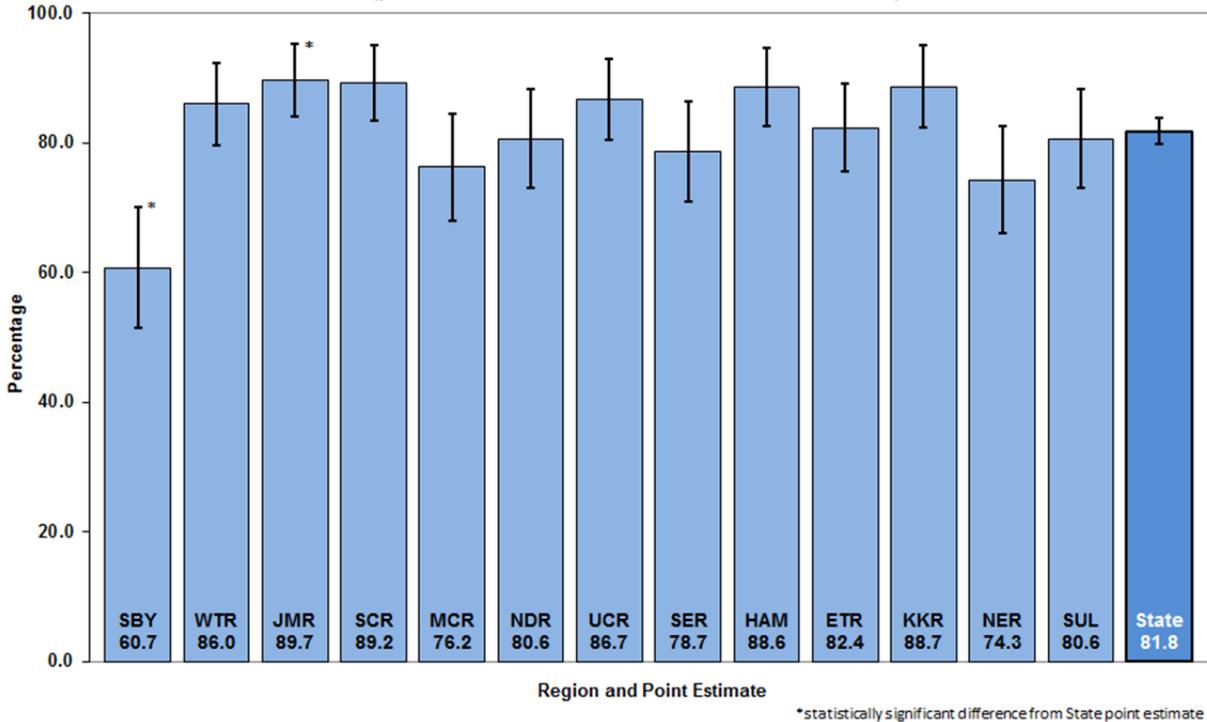
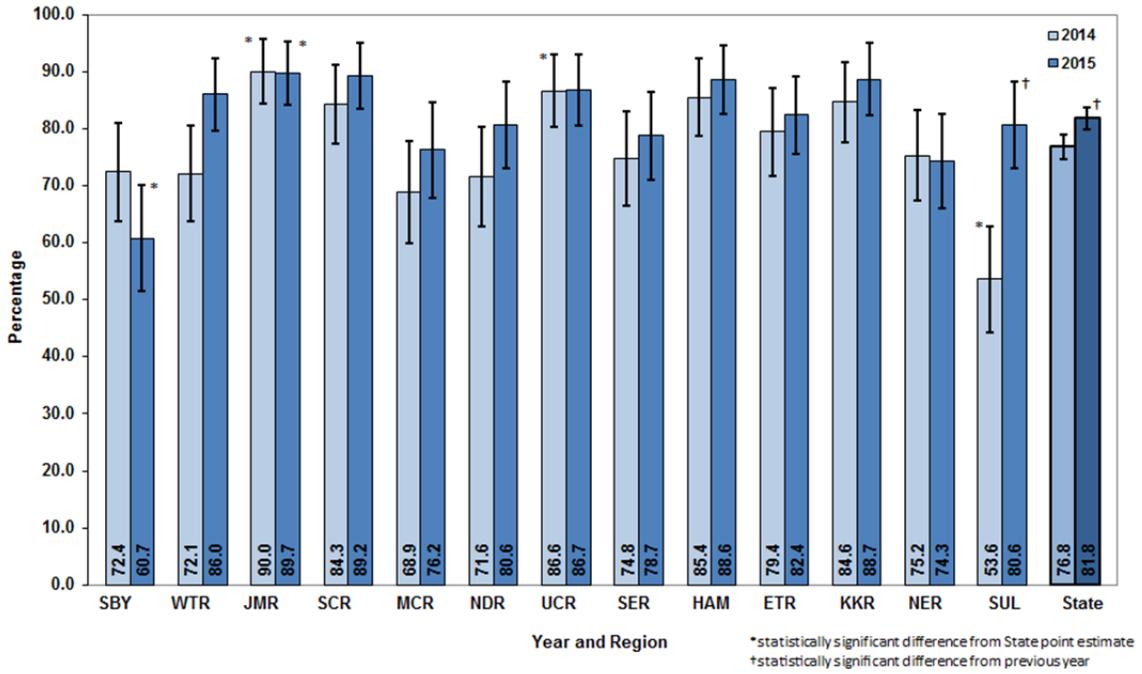


Figure 5b

**2015 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 2014 and 2015
 (point estimates and 95% confidence intervals, 2014 n=1397, 2015 n=1406)**



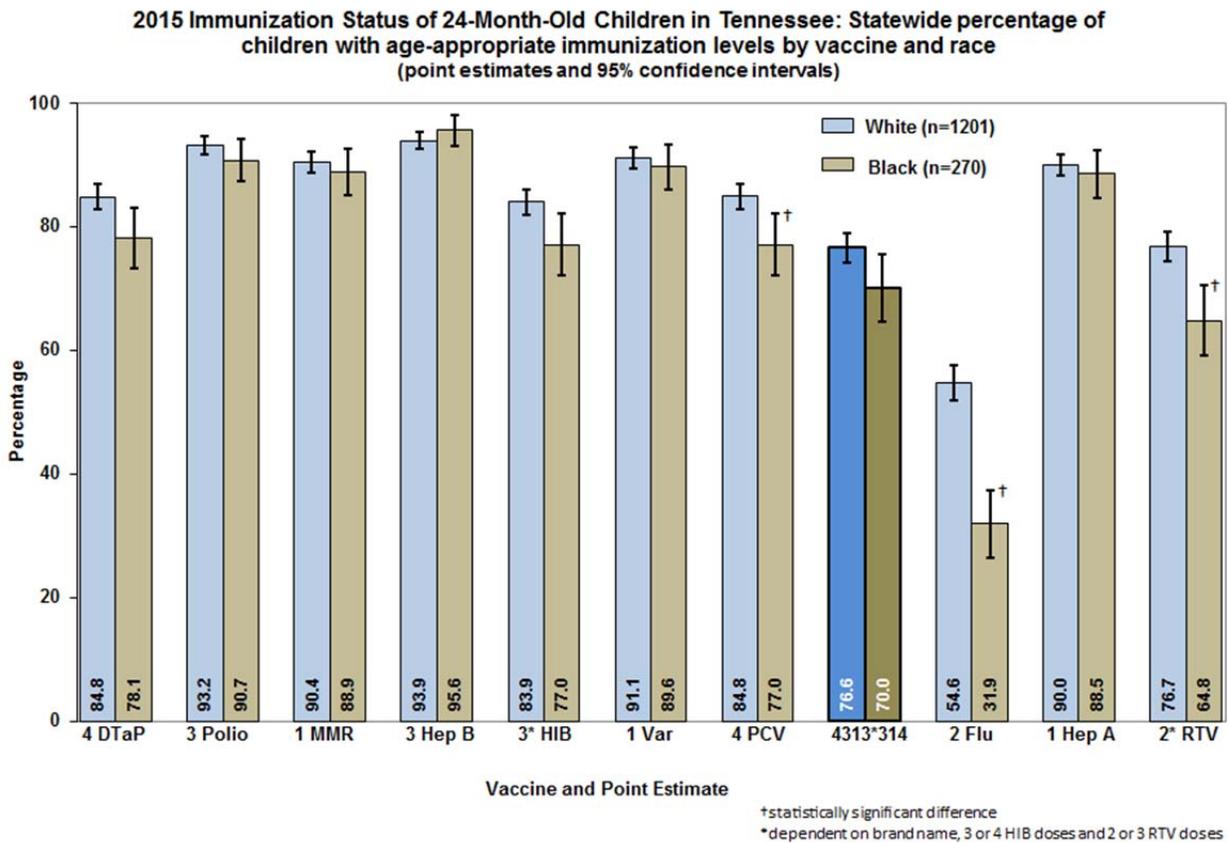
Racial disparities

Differences in on-time completion of the recommended vaccine series among black and white children have been small or insignificant in recent years, including this year. This year’s survey included 270 black and 1,201 white children. Children of other races (n=27) are excluded from this analysis due to small numbers. Figure 6 shows the rates of on-time immunization of black and white children for each vaccine assessed.

In 2015, black children were significantly less likely to have received the full series of 4 doses of PCV (84.8% vs. 77.0%). Trends in on-time series completion by race from 2010-2015 can be found in Appendix 4.

The most significant racial disparity is influenza vaccine coverage. A significantly smaller proportion of black children receive 2 or more doses of influenza vaccine by their second birthday: 54.6% vs. 31.9%. The large disparity has been documented since 2008 when influenza vaccine was first assessed. The 2015 estimate for black two-year olds declined by 3.3 percentage points while rates for white children were unchanged compared to 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 were greater; however, race is now less predictive of delayed immunizations other than influenza vaccine.

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. Only local public health department clinics are counted as “public” in this survey. Children are counted under TennCare or WIC if they were ever enrolled. Because only 85 of 1,394 children with a known source of vaccination received all shots in a public clinic, the point estimate for public provider coverage is imprecise.

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

Children who begin routine immunizations after 4 months (120 days) of age are at very high risk of failing to catch up. In this sample, 38 children received their first routine vaccination other than rotavirus or birth dose HBV after 120 days of age; few were caught up on time. Table 1 below summarizes the 2015 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 2015 Survey of 24 Month Old Children: Selected Characteristics (point estimate +/- 95 percent confidence intervals)			
Provider Type	Public n=65/85	Private N=865/1082	Both n=155/227
	76.5% ± 9.02	79.9% ± 2.39	68.3% ± 6.05
TennCare Enrollment	Enrolled n=536/749	Not Enrolled n=563/702	
	71.6% ± 3.23	80.2% ± 2.95	
WIC Enrollment	Enrolled n=660/902	Not Enrolled n=439/549	
	73.2% ± 2.89	80.0% ± 3.35	
Other Siblings	None n=491/598	One n=356/477	Two or more n=252/376
	82.1% ± 3.07	74.6% ± 3.90	67.0% ± 4.75
Age at First Immunization**	≤120 days n=1084/1373	120 days n=15/38	
	79.0% ± 2.16	39.5% ± 15.54	

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.

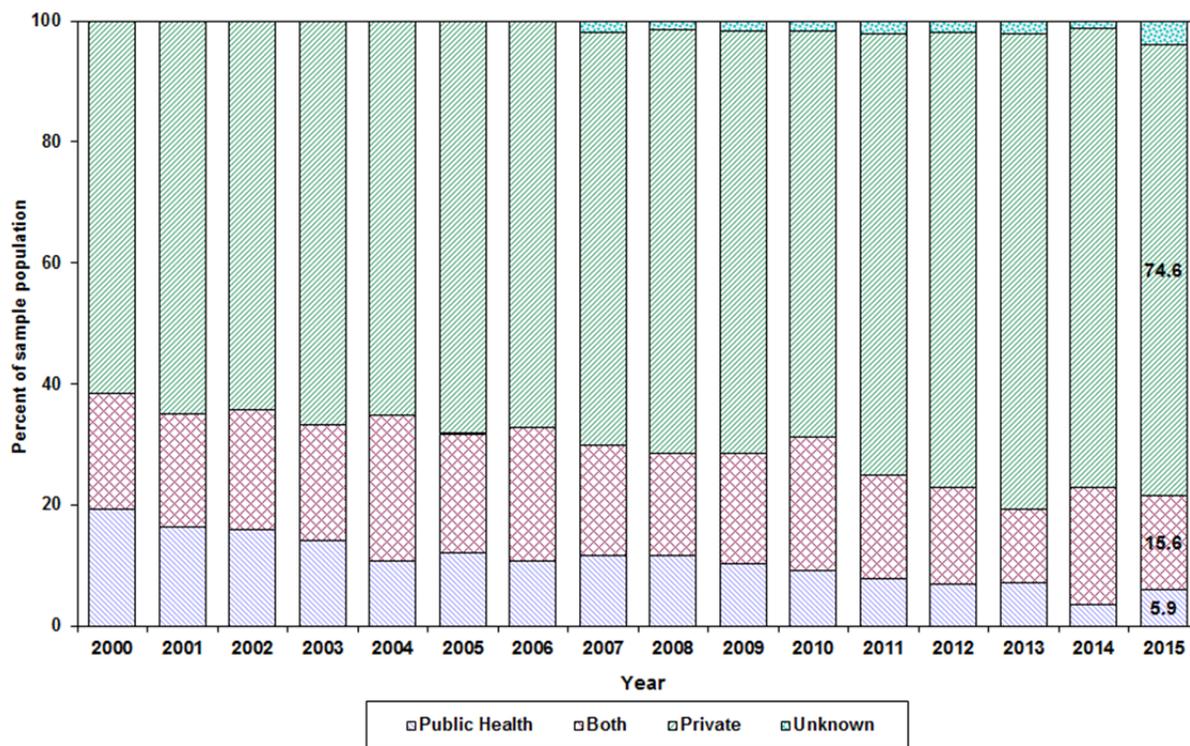
**the first dose of a vaccine other than oral rotavirus vaccine or the birth dose of hepatitis B vaccine

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 2015 survey, 74.6% were immunized exclusively in private clinic settings, 15.6% received immunizations in a combination of private and public health clinics, and 5.9% received their immunizations exclusively at a public health department. Data were unavailable for 3.9% of children. Figure 7 below shows the trends in these proportions over time.

Figure 7

**2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Source of Immunizations from 2000 to 2015 (n=1451)**



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>)	22.4% (19/85)	18.9% (43/227)	14.2% (154/1082)
2 or more siblings	30.6% (26/85)	30.8% (70/227)	24.4% (264/1082)
Age at first dose >120 days*	5.9% (5/85)	4.0% (9/227)	2.2% (24/1082)
Any of above risk factors	47.1% (40/85)	44.5% (101/227)	35.4% (383/1082)

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

Summary of Key Findings:

1. Below is the summary of coverage rates measured in this report relative to Health People (HP) 2020 objectives:

Measurement	HP2020 Objective (19-35 months)	TN 2015 (24 months)
Complete 4:3:1:3* :3:1:4 series	80%	75.7%
Each vaccine in 4:3:1:3* :3:1:4 (DTaP, IPV, MMR, Hib, HBV, VAR, PCV)	90% rate for each of the 7 vaccines	Exceeded 90% for 4 of 7, except: 4 doses of DTaP (83.8%), full series (3 or 4) of HIB (83.0%) and 4 doses of PCV (83.9%)
3 doses DTaP and PCV	<i>None: this is a process measure</i>	3 DTaP (93.9%) and 3 PCV (93.4%): <i>HP2020 goal achievable by closing gap between 3rd and 4th doses</i>
Hepatitis A vaccine	60% 2 doses by 35 months	2 HAV (58.2%); 1 HAV (89.9%): <i>not comparable to HP2020</i>
Influenza vaccine	70% appropriately immunized	51.4%
Rotavirus vaccine	80% with 2 doses	75.3%
Hepatitis B birth dose	85%	81.8%

2. Tennessee is close to achieving the HP2020 objective for HBV birth dose. In 2015, a statistically significant 5 percentage point increase was seen over the 2014 rate. 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 HP2020 target of 80% coverage for the 4:3:1:3*:3:1:4 series for all children. Though not statistically significant, point estimates for 2015 increased by 2.6 percentage points from 2014. Continued focus on the drop from around 95% coverage with 3 of 4 necessary doses to about 84% coverage with all 4 doses can achieve the target. Most incompletely vaccinated children are just one immunization visit away from complete on-time coverage.
4. Racial disparities in coverage rates for specific vaccines between blacks and whites:
 - a. The wide disparity in 2+ dose influenza vaccination, 31.9% for black children vs. 54.6% for whites, persists and points to barriers specific to influenza vaccine, including parental acceptance.
 - b. Disparities in RTV and PCV detected in this survey have not been present consistently and will be observed to determine whether these signals represent an important trend requiring focused intervention.
5. Influenza vaccine 2-dose coverage is stable compared to 2014. Adequate influenza vaccination remains a major area for improvement, due to the significant benefits of annual influenza immunization in this age group.
6. The point estimates of 4:3:1:3* :3:1:4 series and some of the other recommended vaccines (influenza, rotavirus, DTaP) were significantly lower for children who had ever been enrolled in TennCare and/or WIC, although they were more likely to have completed hepatitis B vaccination. See Appendix 4 for details.

Next Steps:

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

1. Many children who are incomplete could be completed with one more immunization visit in the second year of life to ensure on-time administration of the 4th dose of DTaP, PCV and the booster dose of HIB. If clinics were to track the on-time 4th dose of DTaP as a sentinel vaccine and administer all recommended vaccines at that visit, including the 4th PCV and the HIB booster, immunization coverage 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 that have improved immunization completion rates in other states. In 2015, TDH TennIIS staff began training providers to use TennIIS to enhance clinical practice and immunization quality and timeliness:
 - a. When a healthcare provider opens a child’s TennIIS record, a forecasting tool displays each vaccine due or overdue.
 - b. A reminder/recall tool is available to practices using TennIIS to generate reminders of vaccination appointments and recall children behind on vaccines.

As more clinics record immunizations in TennIIS, automatic reminders in TennIIS will be more effective at forecasting due and overdue vaccines for clinicians. Additional enhancements related to clinic-level quality assessments available to all clinic users are being developed for introduction in 2017.

3. TDH staff will continue to make connections with clinic electronic health record (EHR) systems to allow seamless updating of TennIIS with immunizations administered by clinics without requiring a person to enter information into TennIIS manually. TennIIS also is capable of updating EHR systems with records of immunizations administered by other healthcare providers. At the end of 2015, about 1,300 facilities automatically update TennIIS, and more are being added weekly.
4. TIP provides local health departments (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 facilitate active LHD follow up of these children to complete 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. TIP shares survey findings with WIC and TennCare leadership; they support immunization promotion. The gradual decline in immunization coverage among children ever enrolled in these programs will be characterized and shared with partners during 2016.
7. Patients enrolled in WIC will continue to receive immunization education and follow-up phone calls.
8. TIP will conduct its annual Immunization Spring Review in April 2016 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.
9. TIP staff located in each public health region will conduct site visits in 2016 to at least 50% of healthcare provider offices that participate in the federal VFC Program. These visits will include vaccine education and an assessment of clinic-level immunization coverage rates so practices can better identify and address their individual quality improvement issues.

Appendix 1

2015 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	111 (1)	1	0	1	0	0.9%	0	-
East TN	121 (2)	1	0	1	0	0.8%	1	0.8%
Southeast TN	115 (2)	6	5	1	0	5.2%	0	-
Upper Cumberland	117 (1)	2	1	1	0	1.7%	1	0.9%
Mid-Cumberland	108 (0)	4	1	3	0	3.7%	3	2.8%
South Central	118 (3)	4	3	1	0	3.4%	1	0.8%
West TN	117 (0)	3	2	1	1	2.6%	0	-
Shelby County	120 (9)	2	2	0	0	1.7%	2	1.7%
Davidson County	115 (4)	1	0	0	1	0.9%	7	6.1%
Knox County	101 (2)	2	0	2	0	2.0%	0	-
Hamilton County	118 (9)	5	3	1	1	4.2%	0	-
Madison County	130 (14)	0	0	0	0	-	0	-
Sullivan County	107 (0)	3	3	0	0	2.8%	0	-
TOTAL	1498 (47)	34 of 1498	20	12	2	2.3%	15 of 1498	1.0%

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 47 oversampled records analyzed, all were located and none had refused vaccine.

³Five of the 34 children whose parents gave a reason for not vaccinating had received some doses (range 1-5 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. Six of these children had ≥ 10 doses documented in the registry.

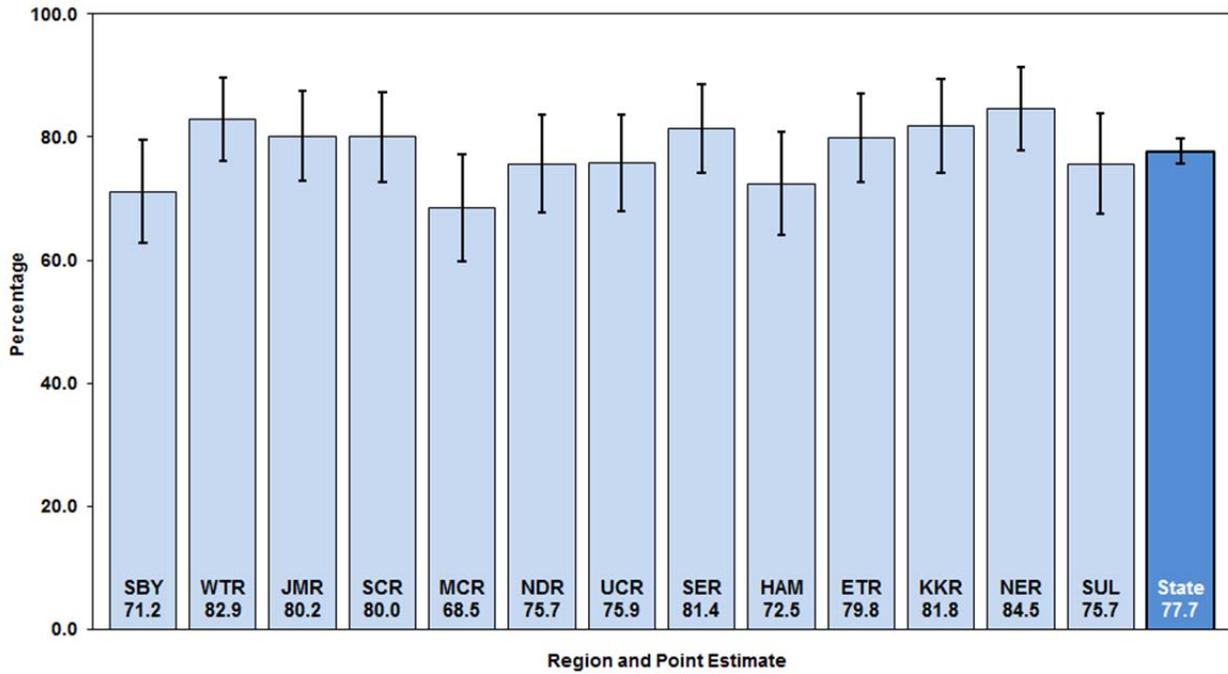
Appendix 2

2015 Immunization Status Survey of 24-Month-Old Children in Tennessee

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

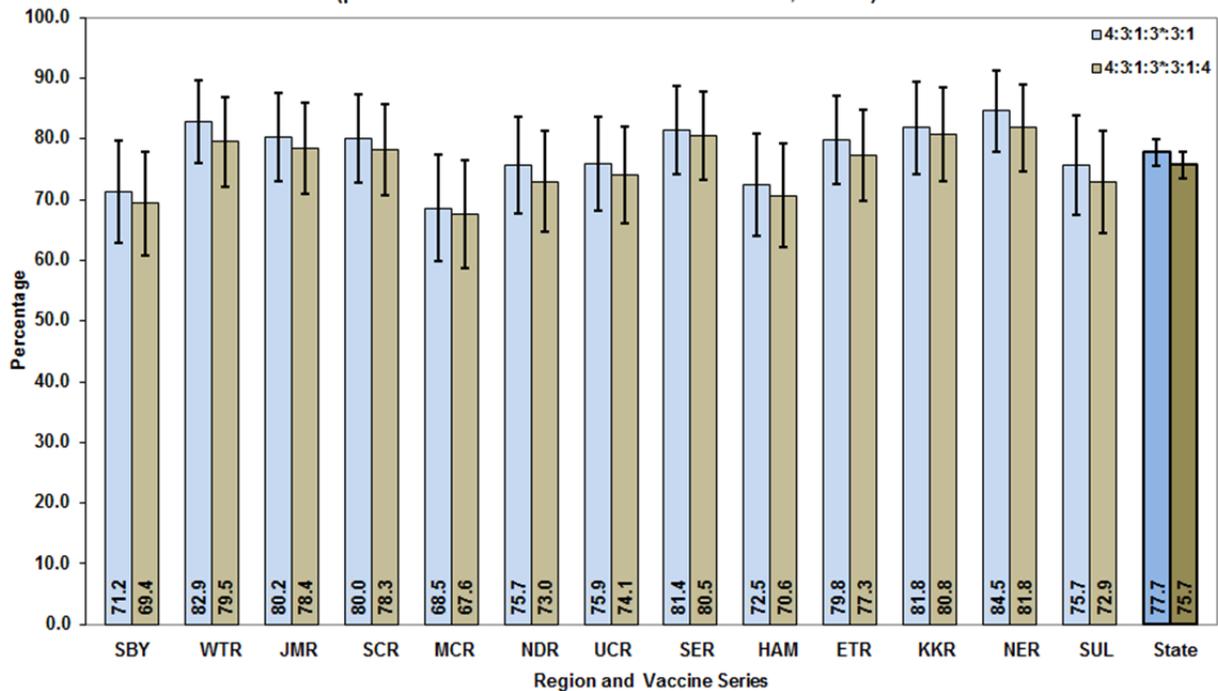
	Page
On-time 4:3:1:3* :3:1 and 4:3:1:3* :3:1:4 vaccine series	... 23
DTaP (4-dose and 3-dose coverage)	... 24
<i>Haemophilus influenzae</i> type b & Hepatitis A (1-dose coverage)	... 25
Hepatitis A (2-dose coverage) & Hepatitis B	... 26
Influenza (2-dose and 3-dose coverage)	... 27
MMR & Pneumococcus (4-dose coverage)	... 28
Pneumococcus (PCV) (4-dose vs. 3-dose coverage) & Polio	... 29
Rotavirus & Varicella	... 30

2015 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=1451)



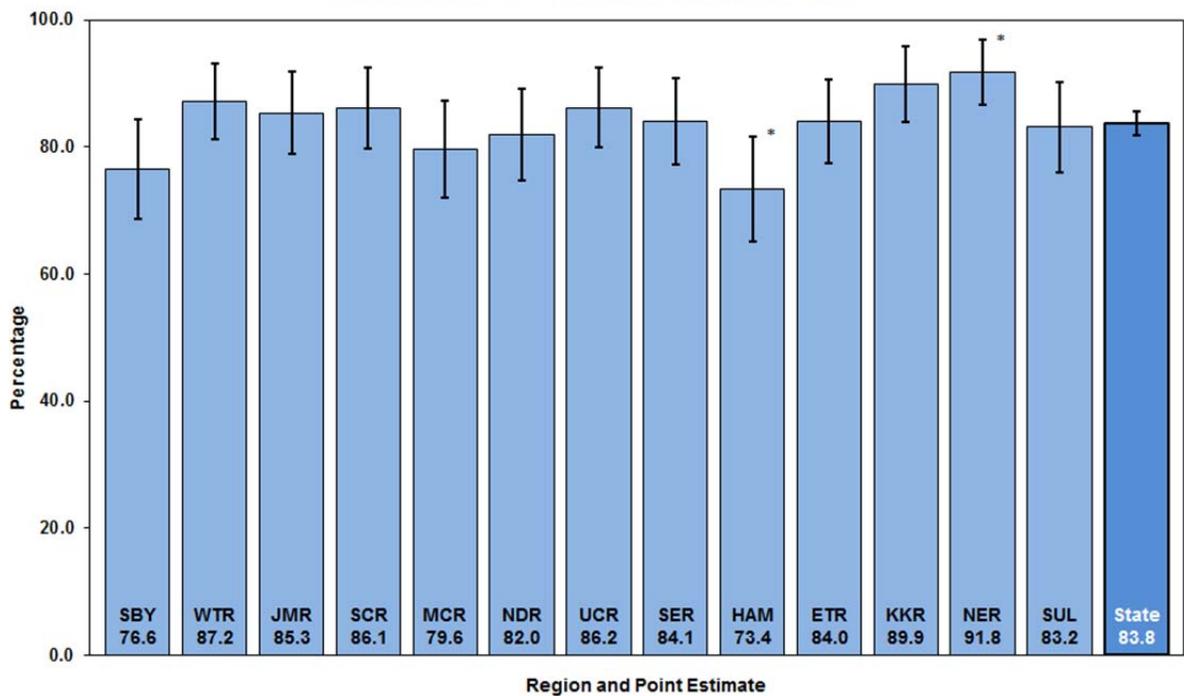
*Full Hib series requires 3 or 4 doses depending on product

2015 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=1451)



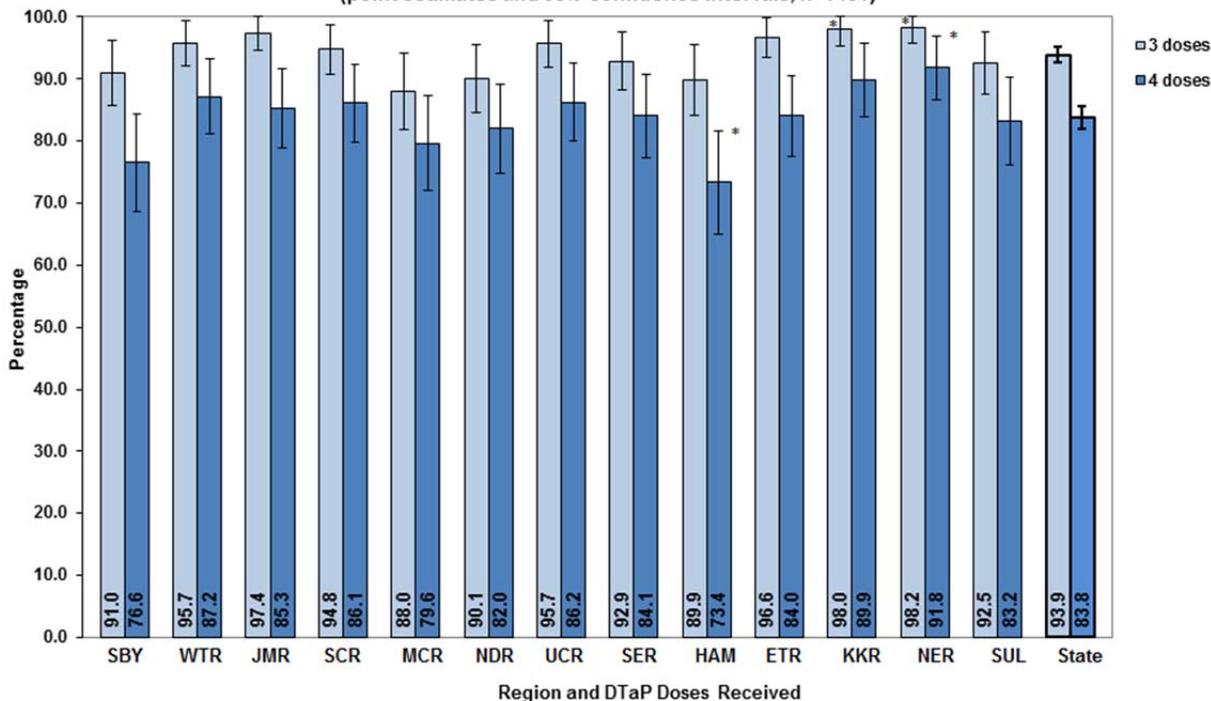
*Full Hib series requires 3 or 4 doses depending on product

2015 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=1451)



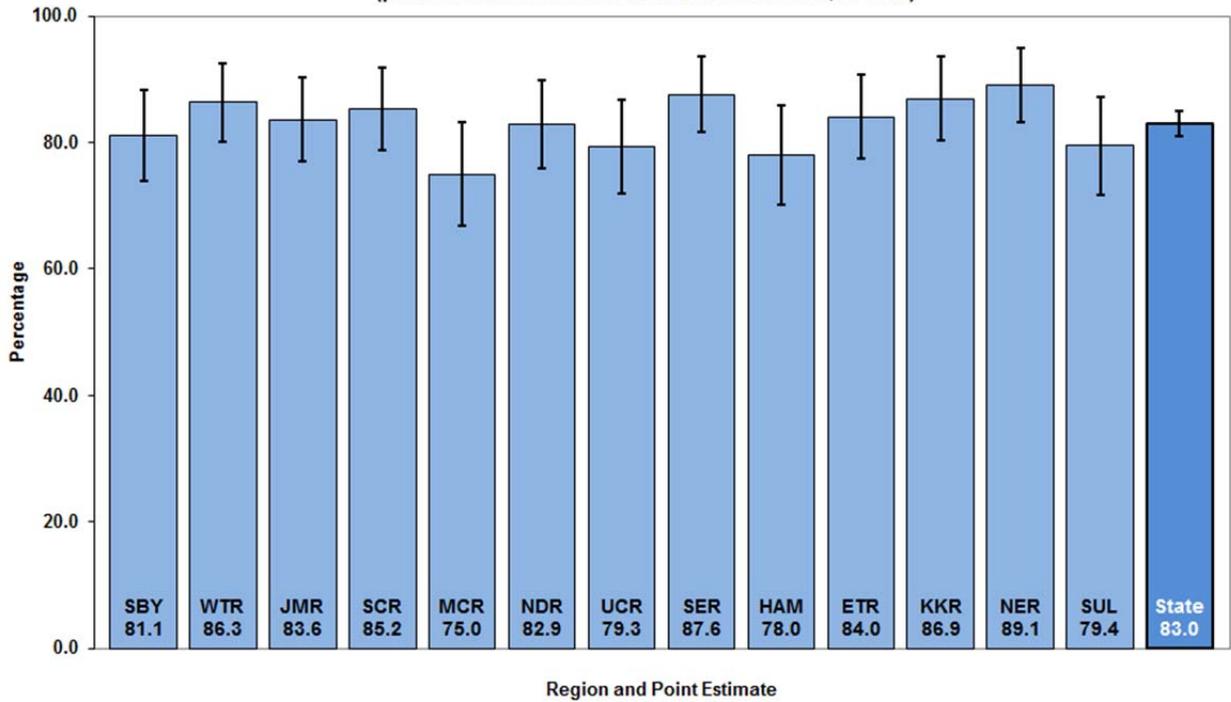
*statistically significant difference from State point estimate

2015 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=1451)

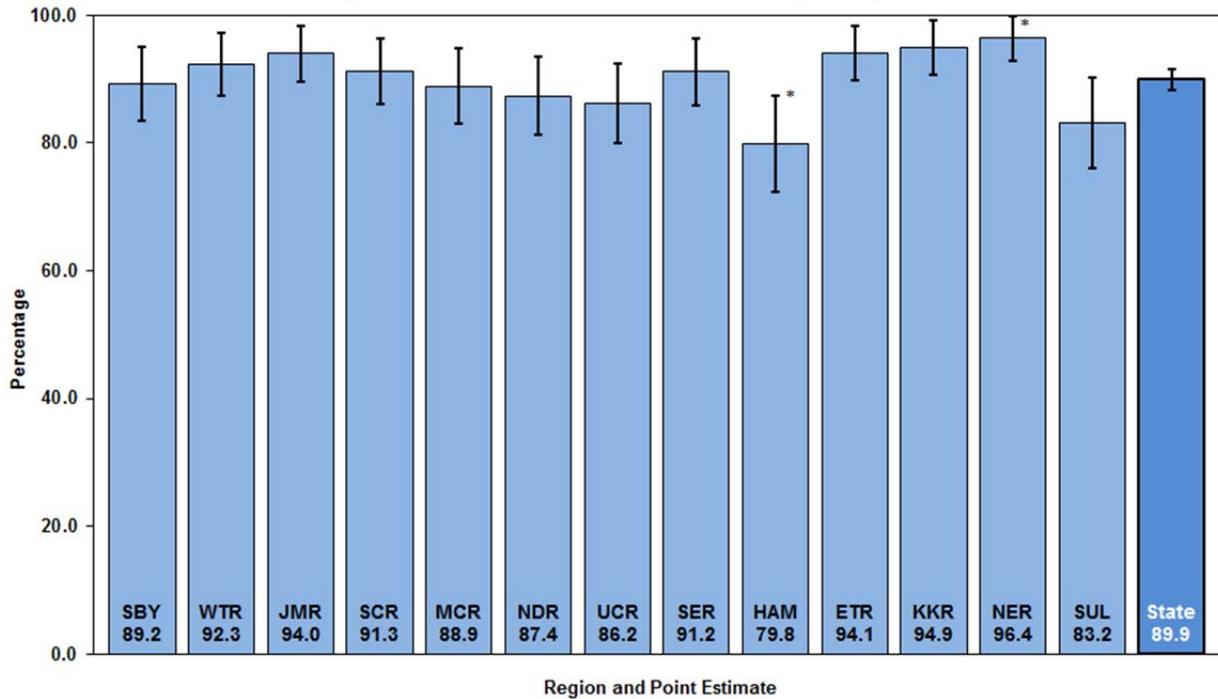


*statistically significant difference from State point estimate

2015 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 intervals, n=1451)

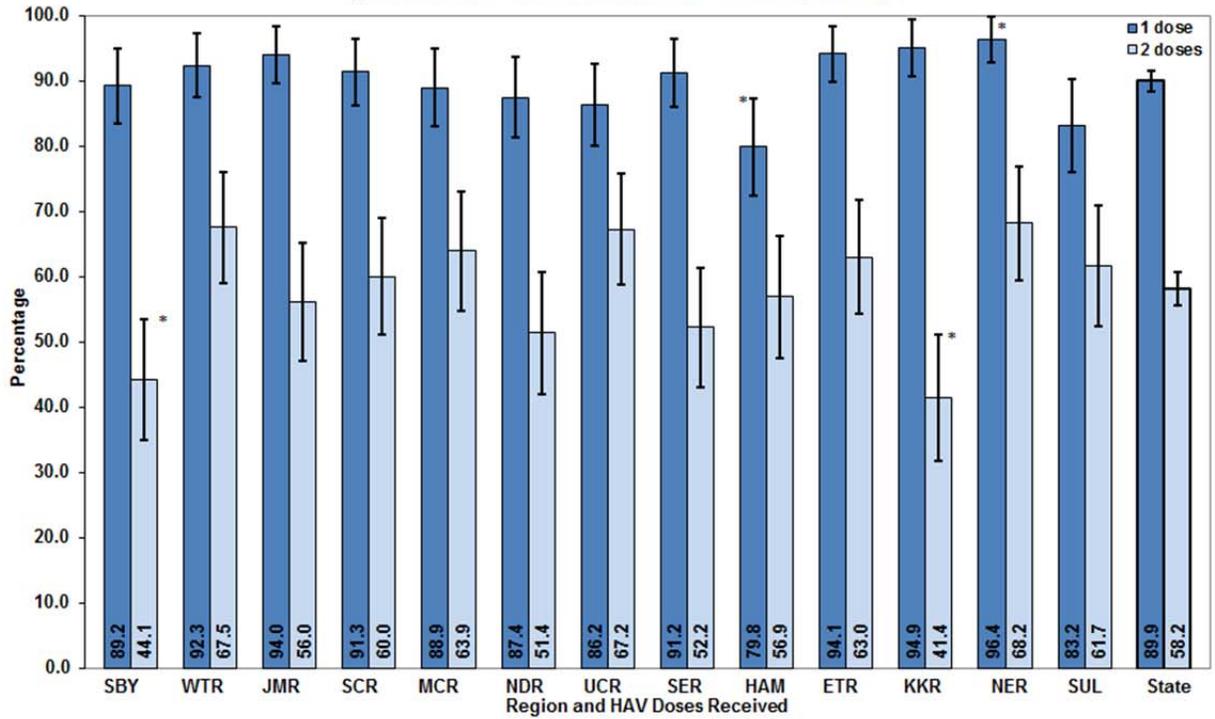


2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with at least one dose of Hepatitis A (HAV)
 by health department region
 (point estimates and 95% confidence intervals, n=1451)



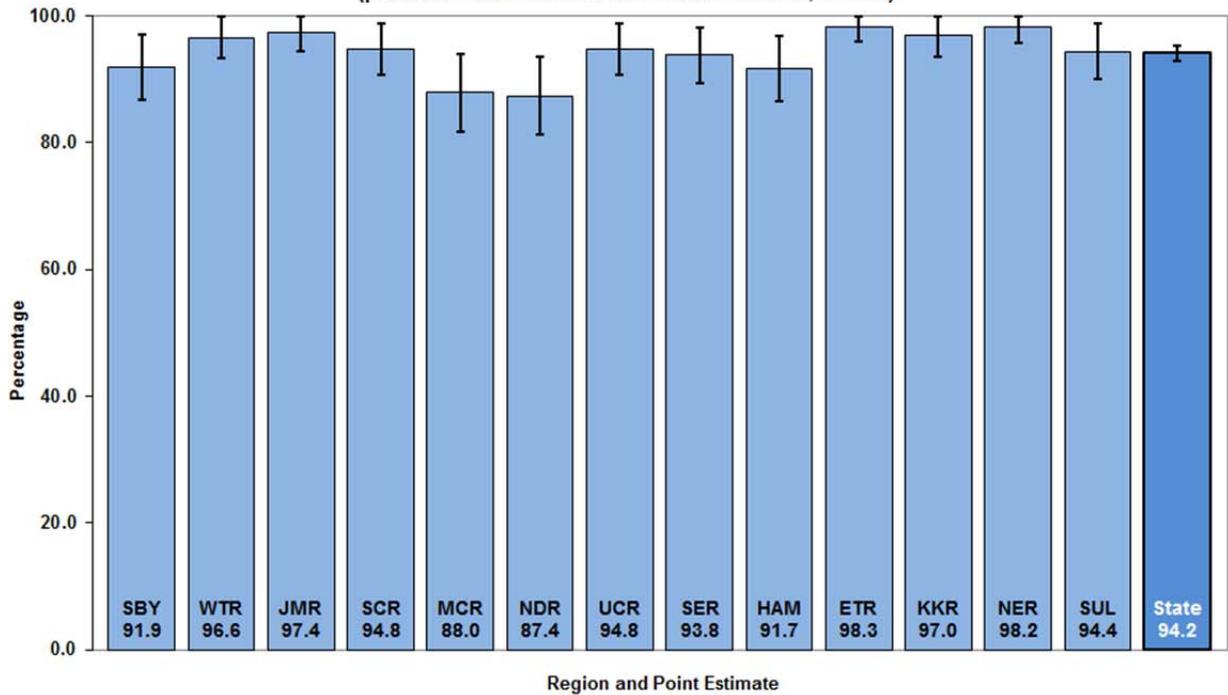
*statistically significant difference from State point estimate

**2015 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=1451)**

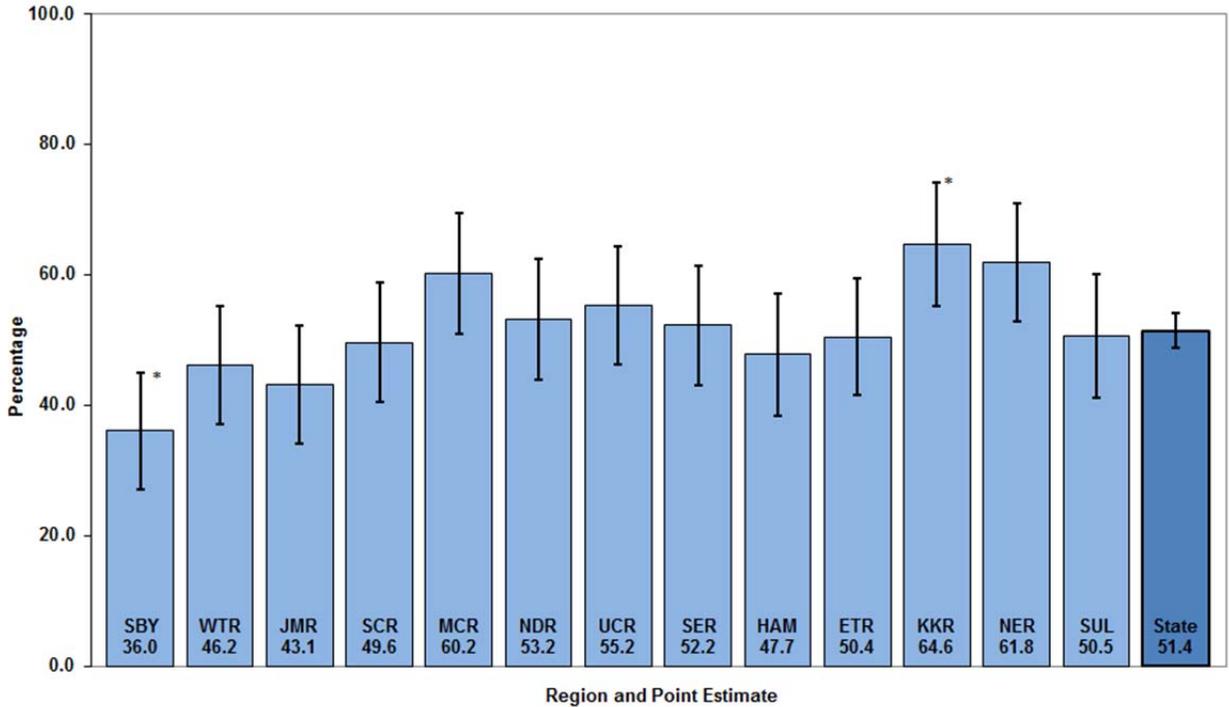


*statistically significant difference from State point estimate

**2015 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=1451)**

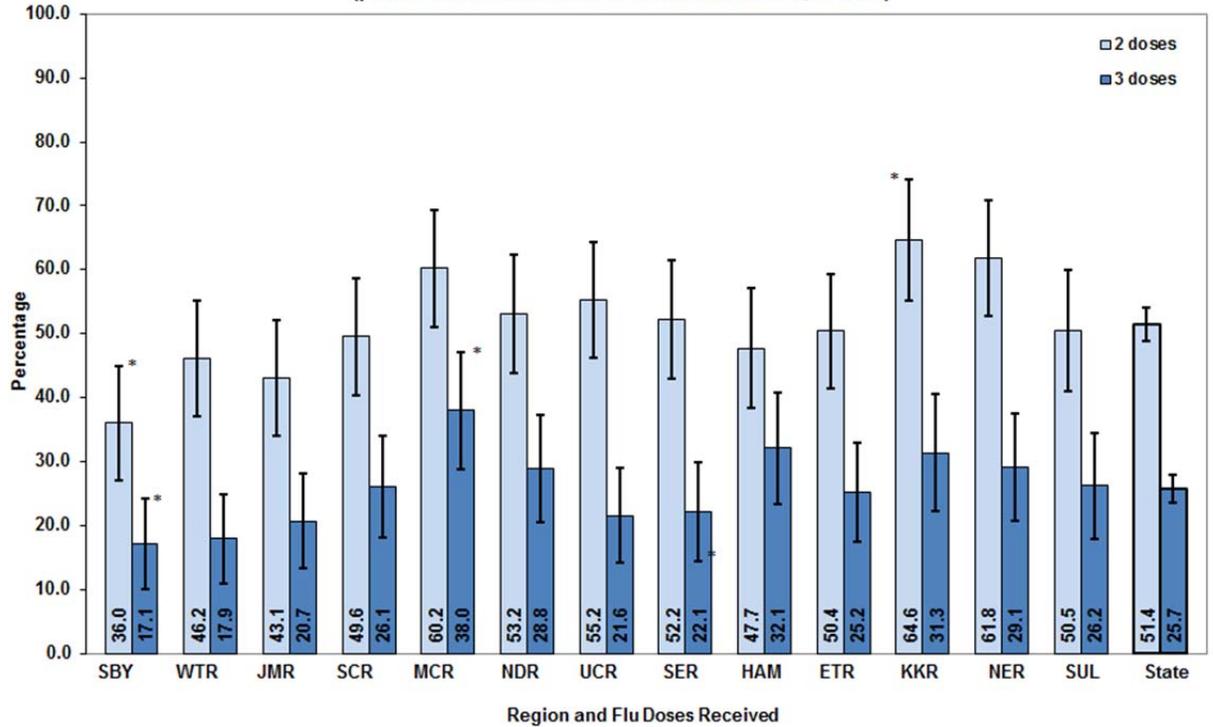


**2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with 2 doses of Influenza vaccine by health department region
(point estimates and 95% confidence intervals, n=1451)**



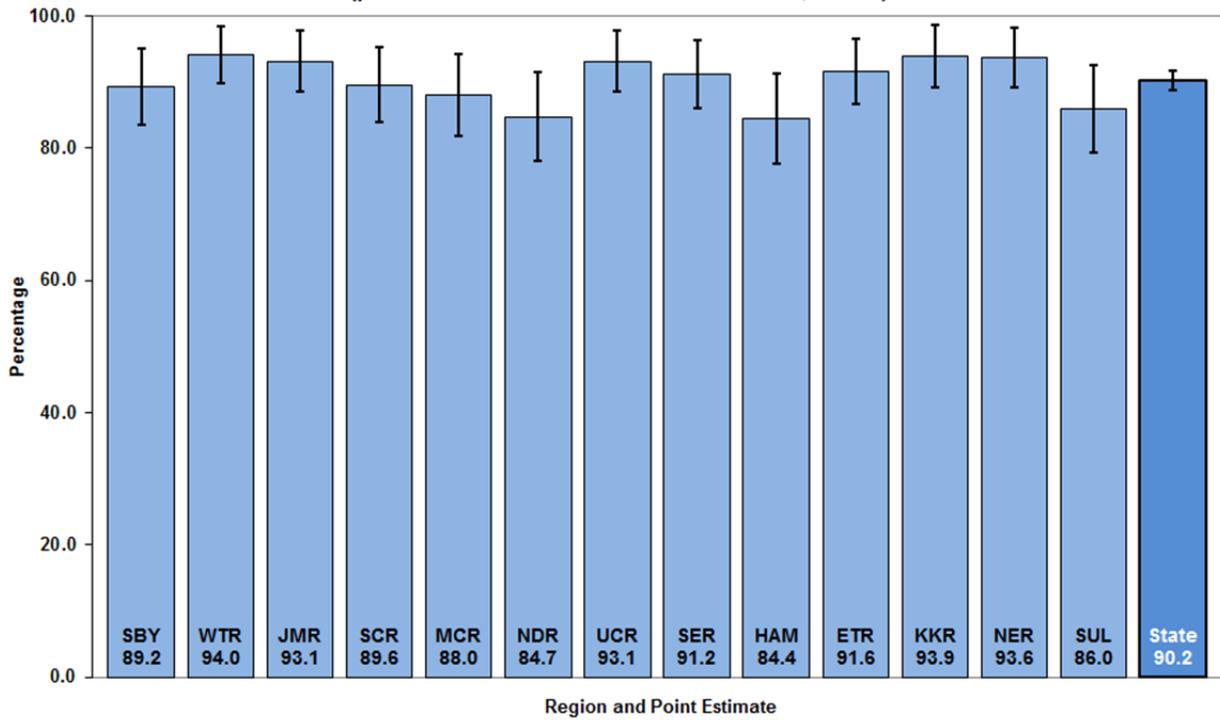
*statistically significant difference from State point estimate

**2015 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=1451)**

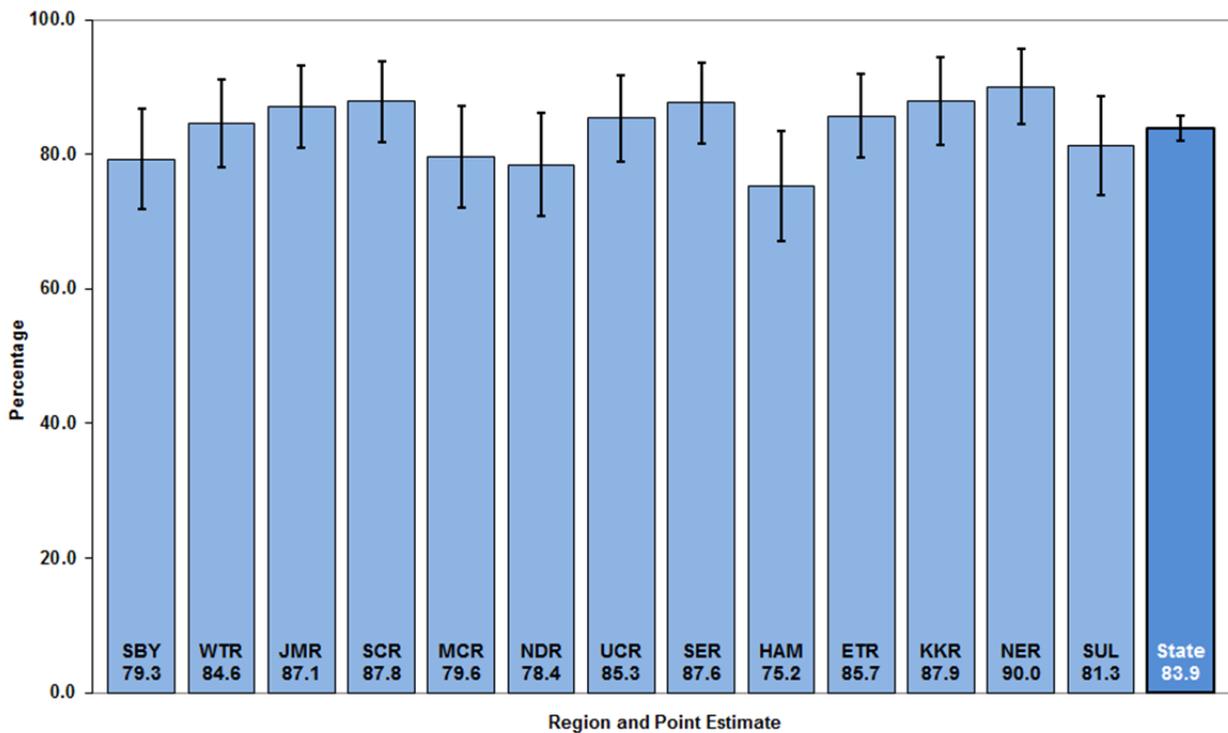


*statistically significant difference from State point estimate

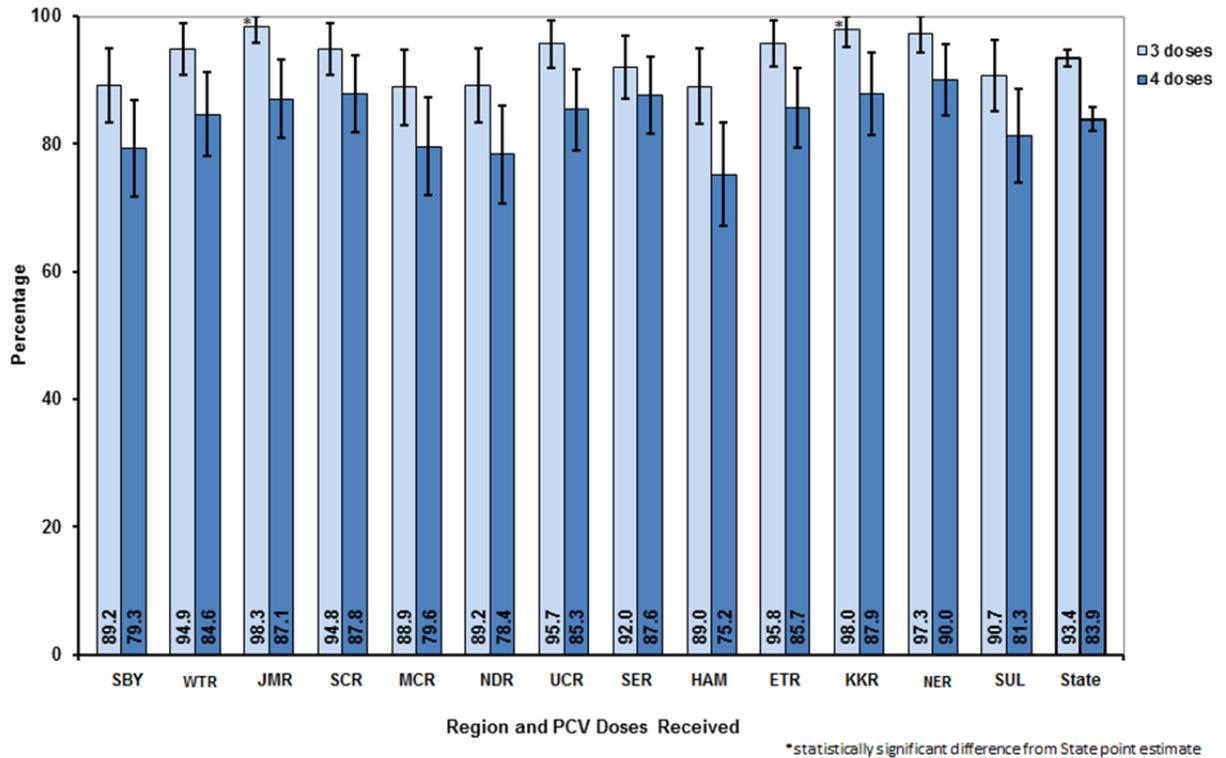
**2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete measles, mumps, and rubella (MMR) series (1 dose)
 by health department region
 (point estimates and 95% confidence intervals, n=1451)**



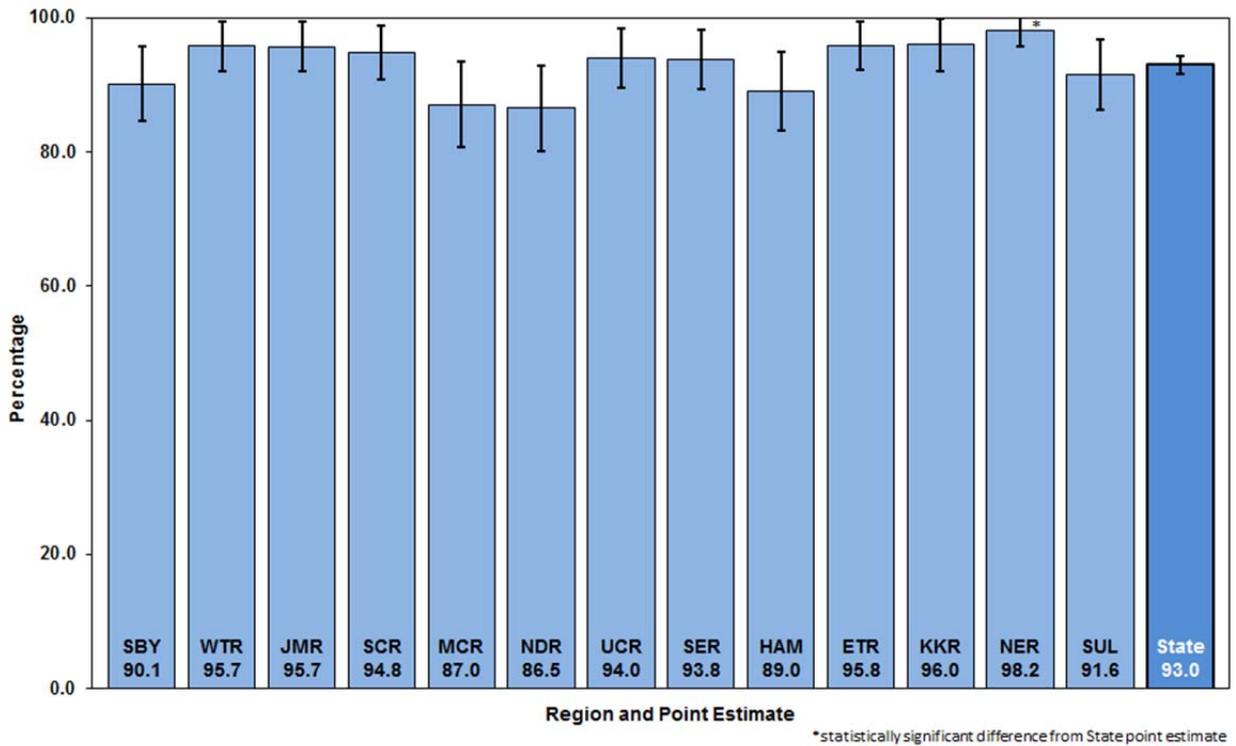
**2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete PCV series (4 doses) by health department region
 (point estimates and 95% confidence intervals, n=1451)**



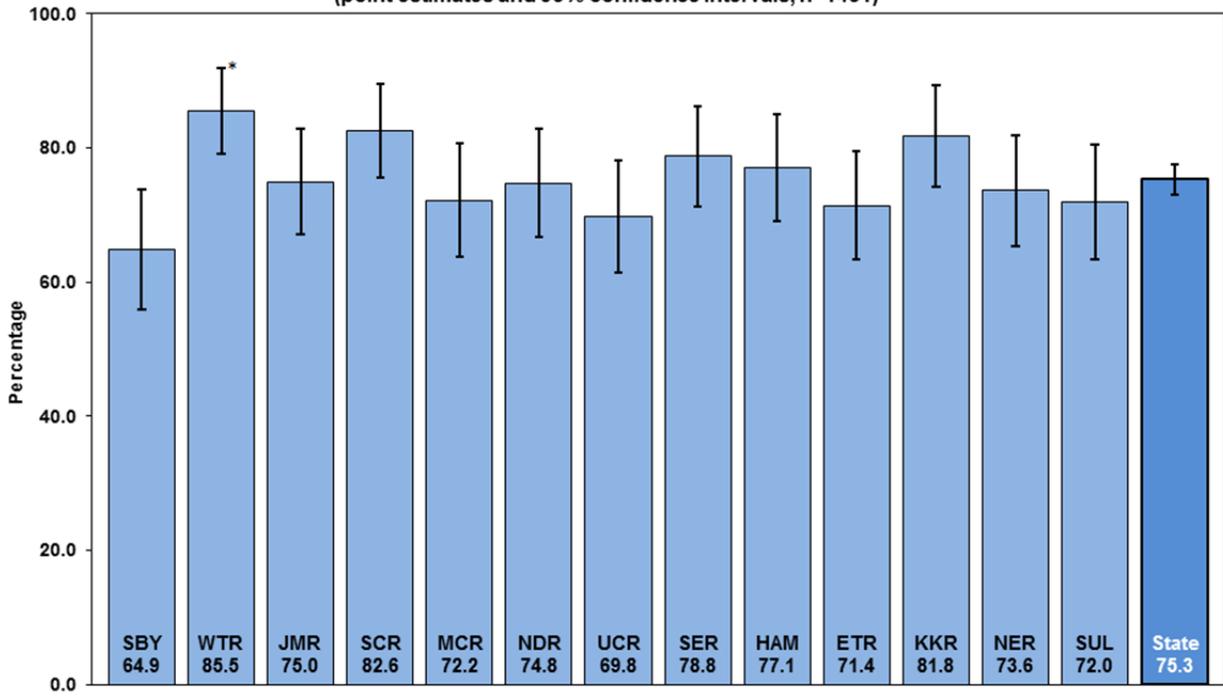
2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with 3 or 4 doses of PCV by health department region
 (point estimates and 95% confidence intervals, n=1451)



2015 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=1451)



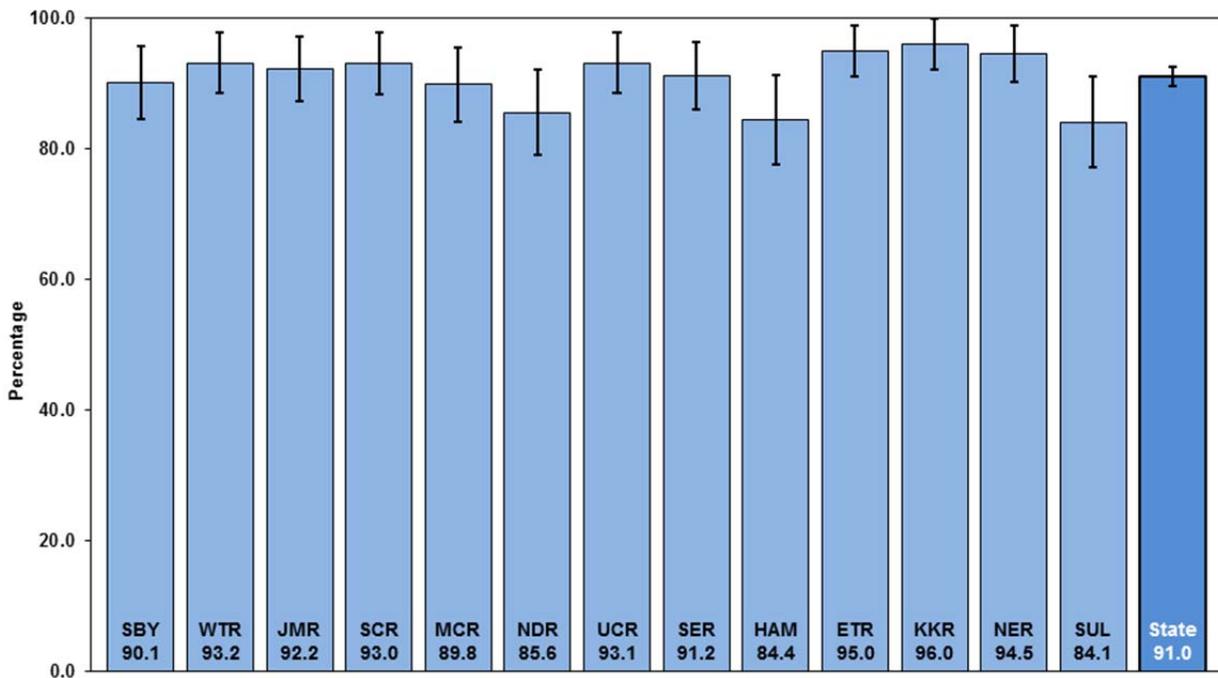
2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete Rotavirus (RTV) series
 (either ≥ 2 or ≥ 3 doses depending on brand) by health department region
 (point estimates and 95% confidence intervals, n=1451)



Region and Point Estimate

*statistically significant difference from State point estimate

2015 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=1451)



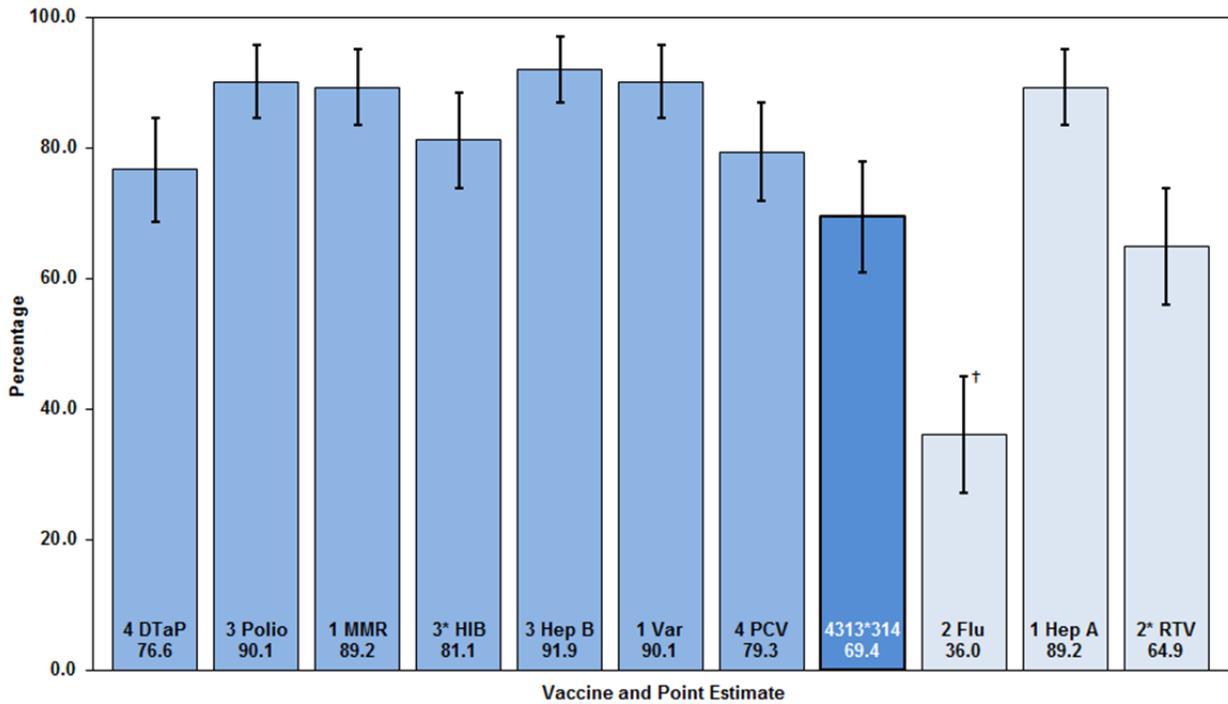
Region and Point Estimate

Appendix 3
2015 Immunization Status Survey
of 24-Month-Old Children in Tennessee

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

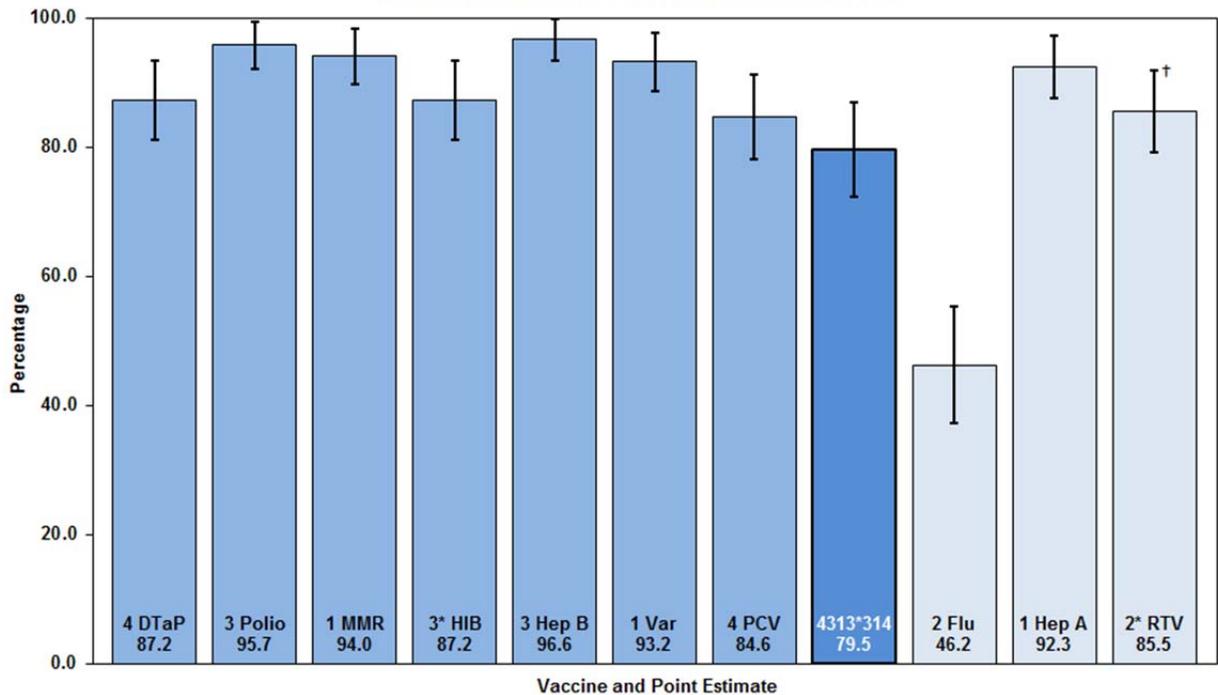
	Page
Shelby County	... 32
West Tennessee Region	... 32
Jackson-Madison County	... 33
South Central Region	... 33
Mid-Cumberland Region	... 34
Nashville-Davidson County	... 34
Upper Cumberland Region	... 35
Southeast Region	... 35
Hamilton County	... 36
East Tennessee Region	... 36
Knoxville-Knox County	... 37
Northeast Region	... 37
Sullivan County	... 38

**2015 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=111)**



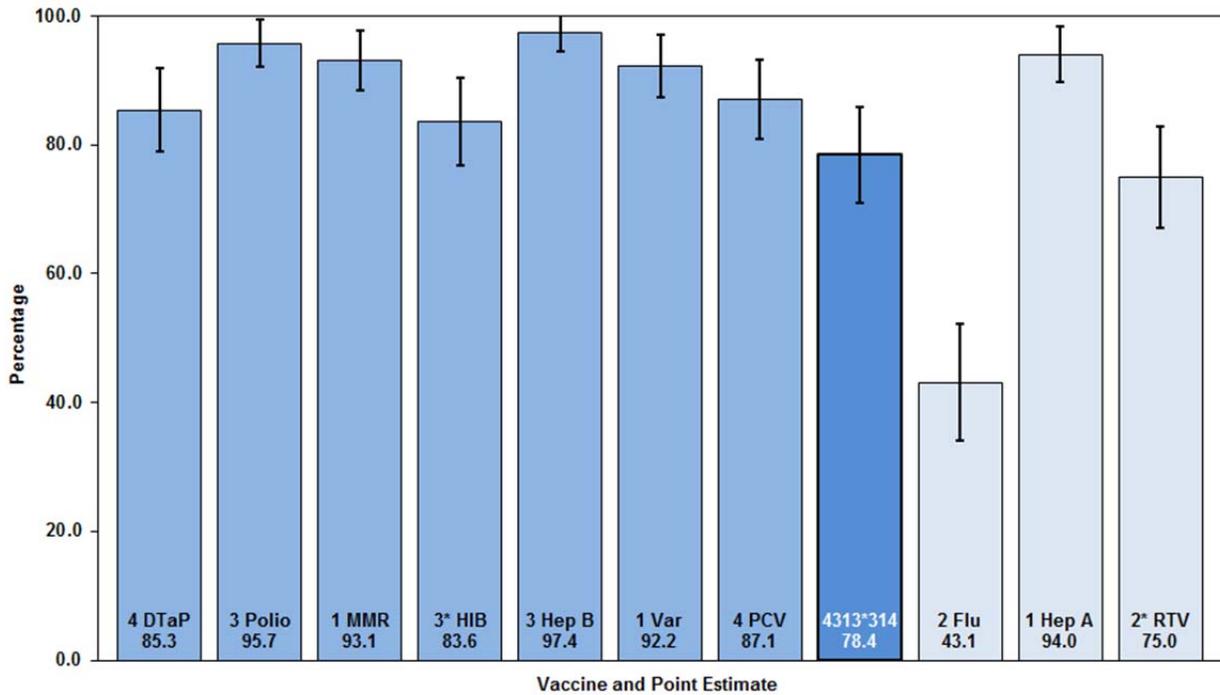
†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=117)**



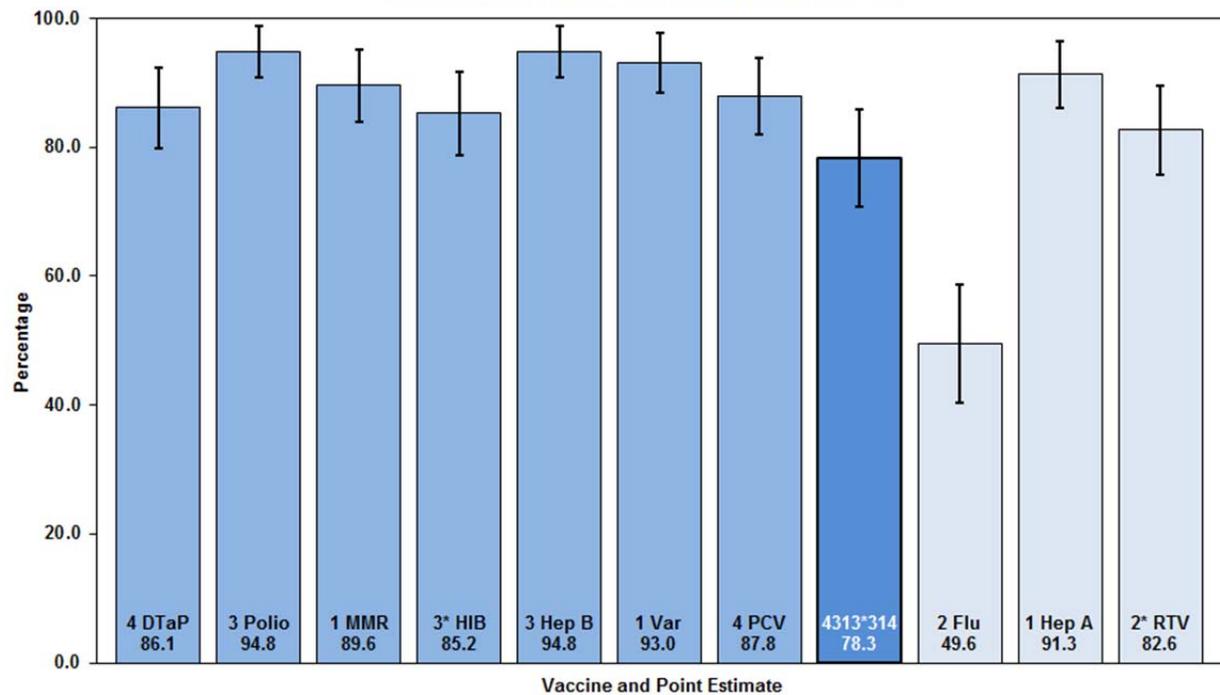
†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=116)**



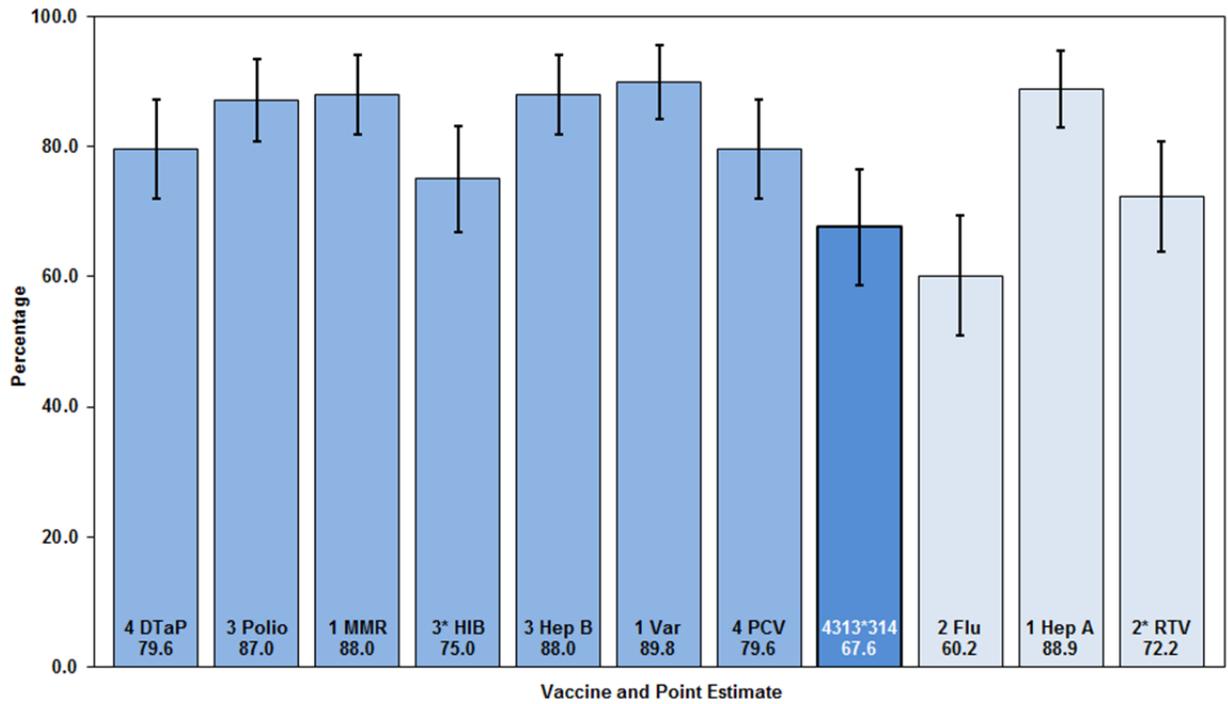
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=115)**



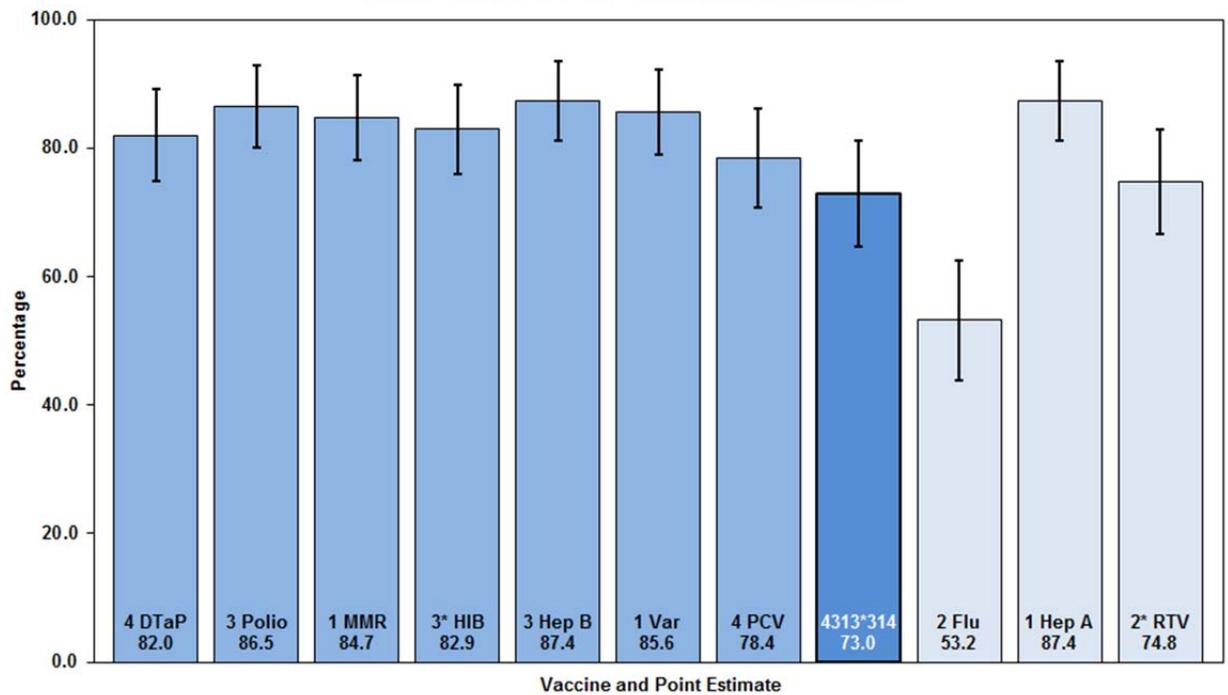
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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)**



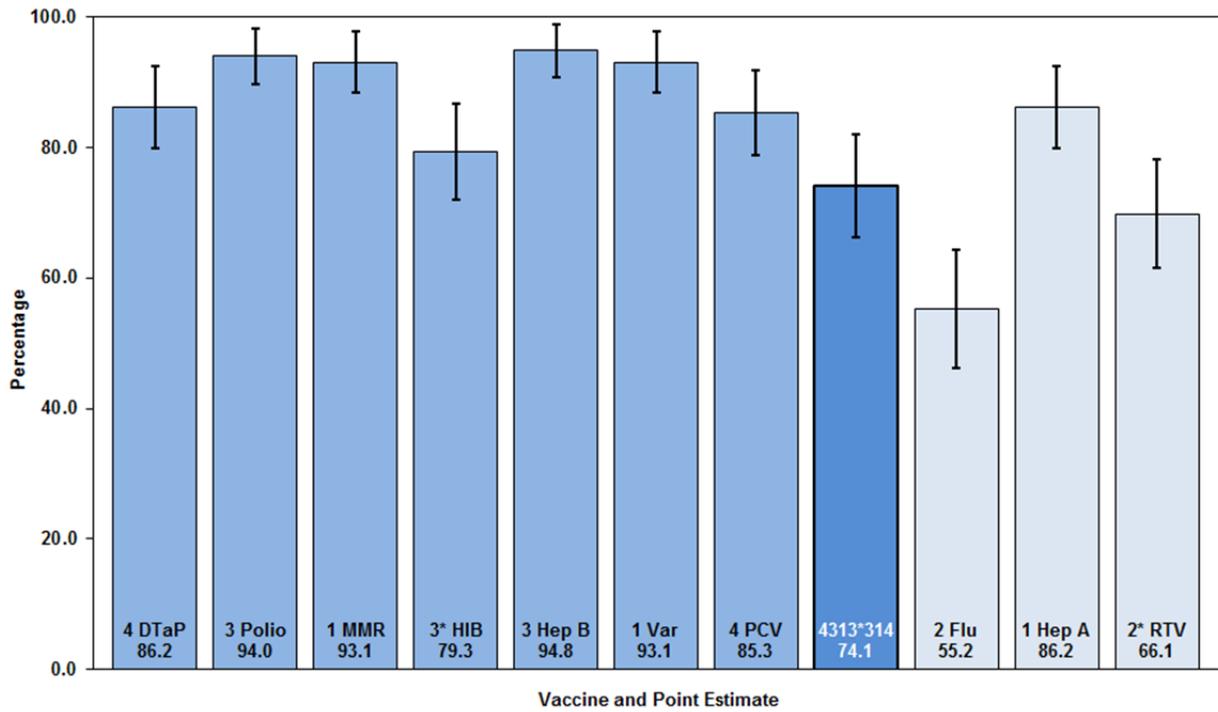
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=111)**



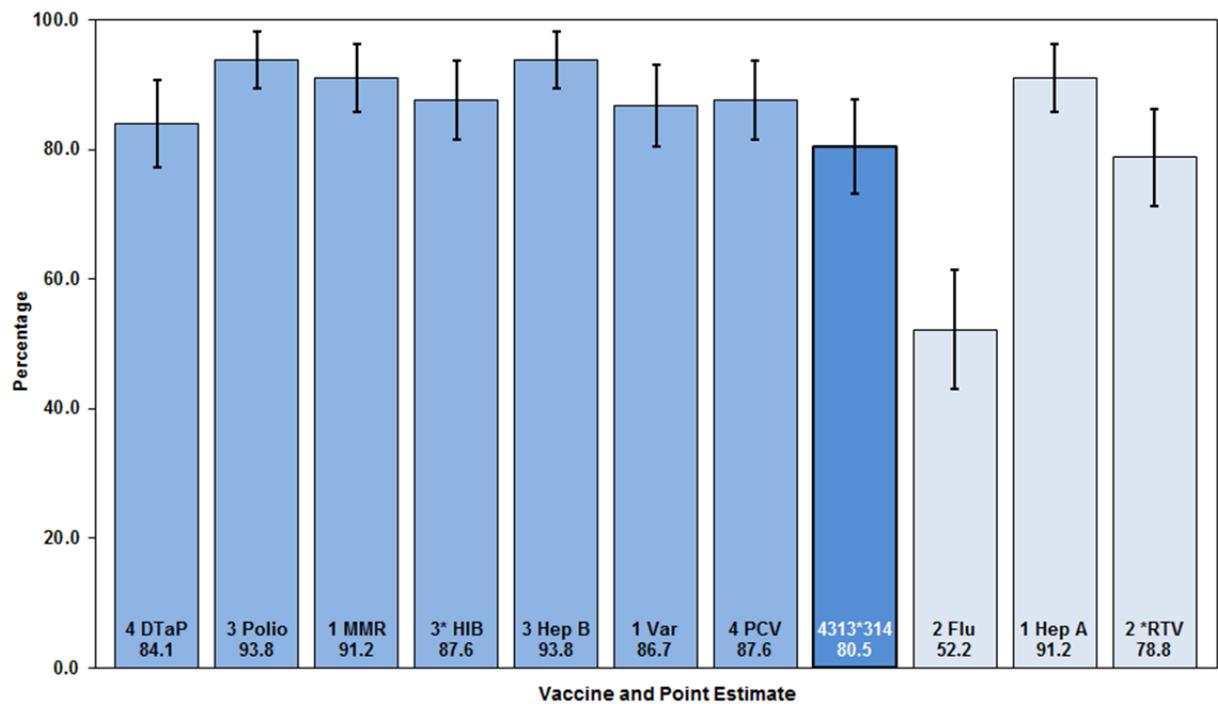
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=116)**



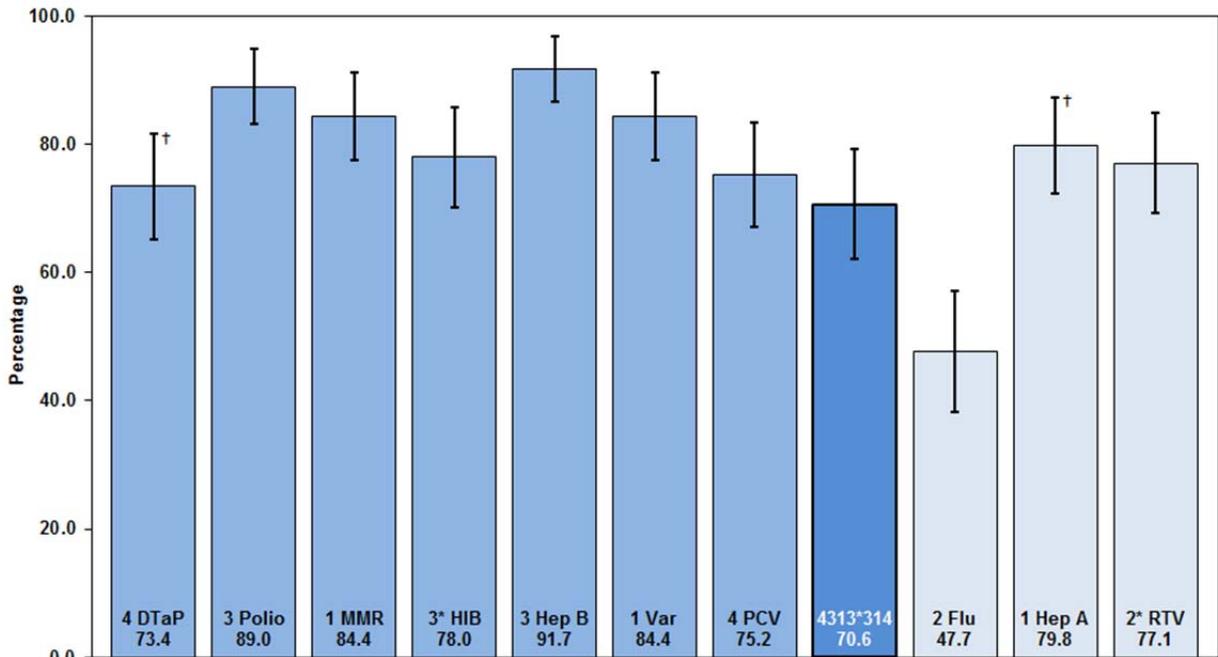
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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)**



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

**2015 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=109)**

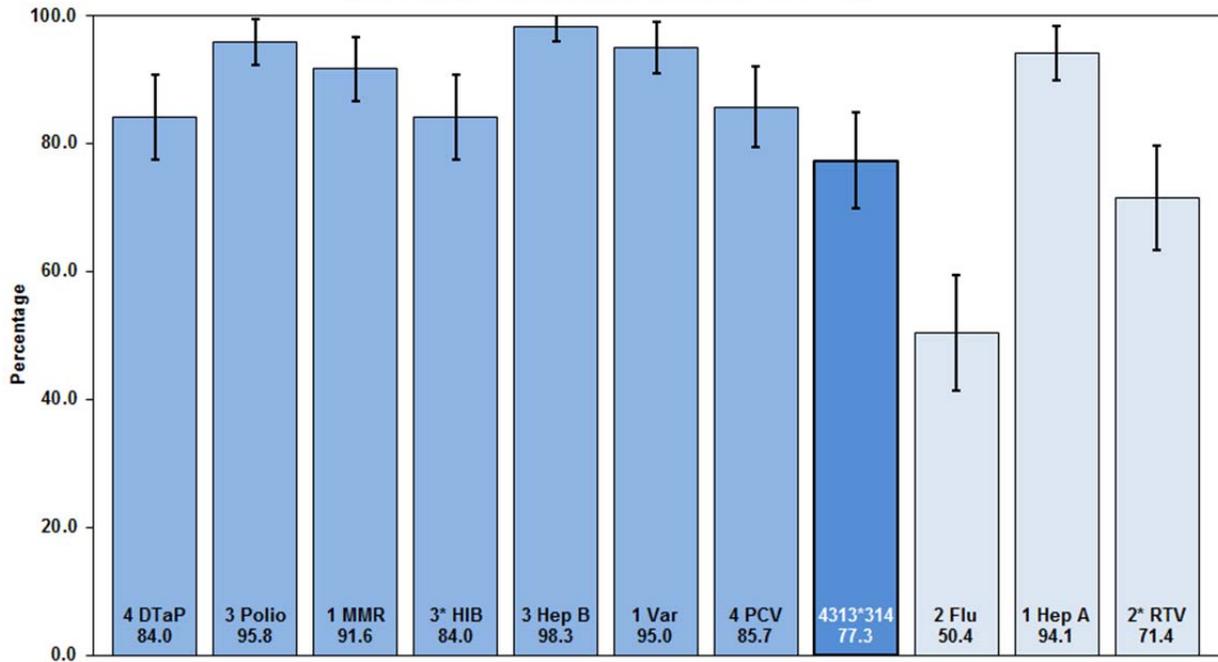


Vaccine and Point Estimate

†statistically significant difference from State point estimate

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

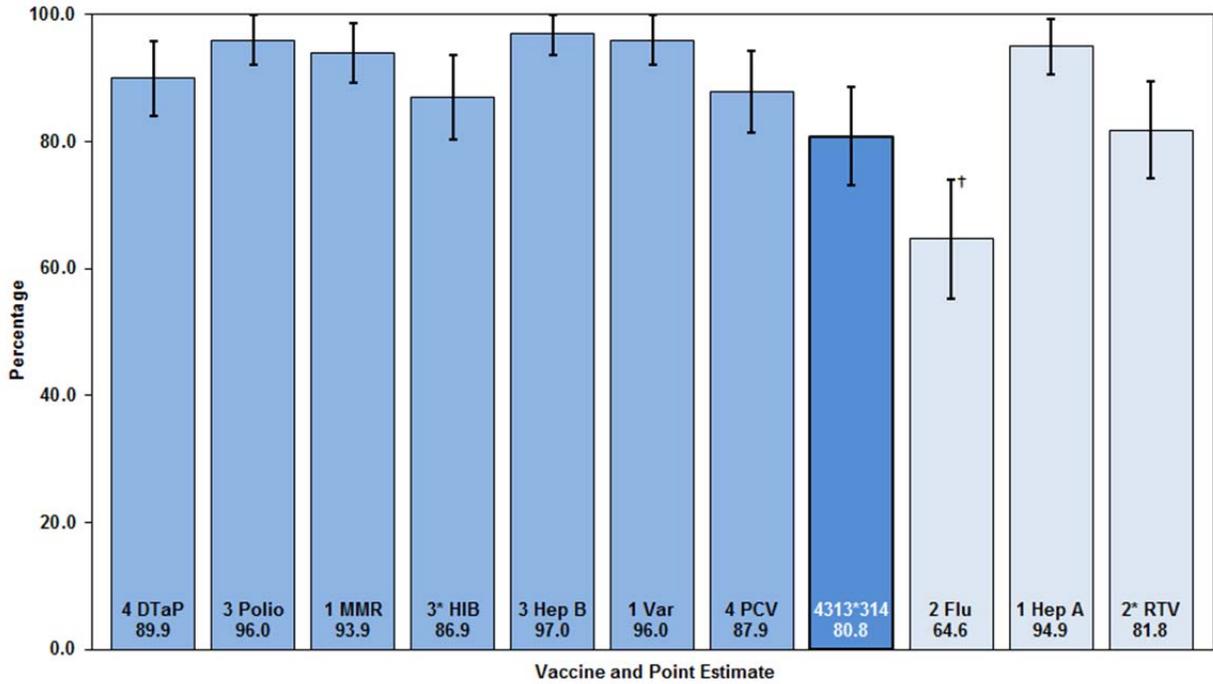
**2015 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in East Tennessee Region (ETR) by vaccine
(point estimates and 95% confidence intervals, n=119)**



Vaccine and Point Estimate

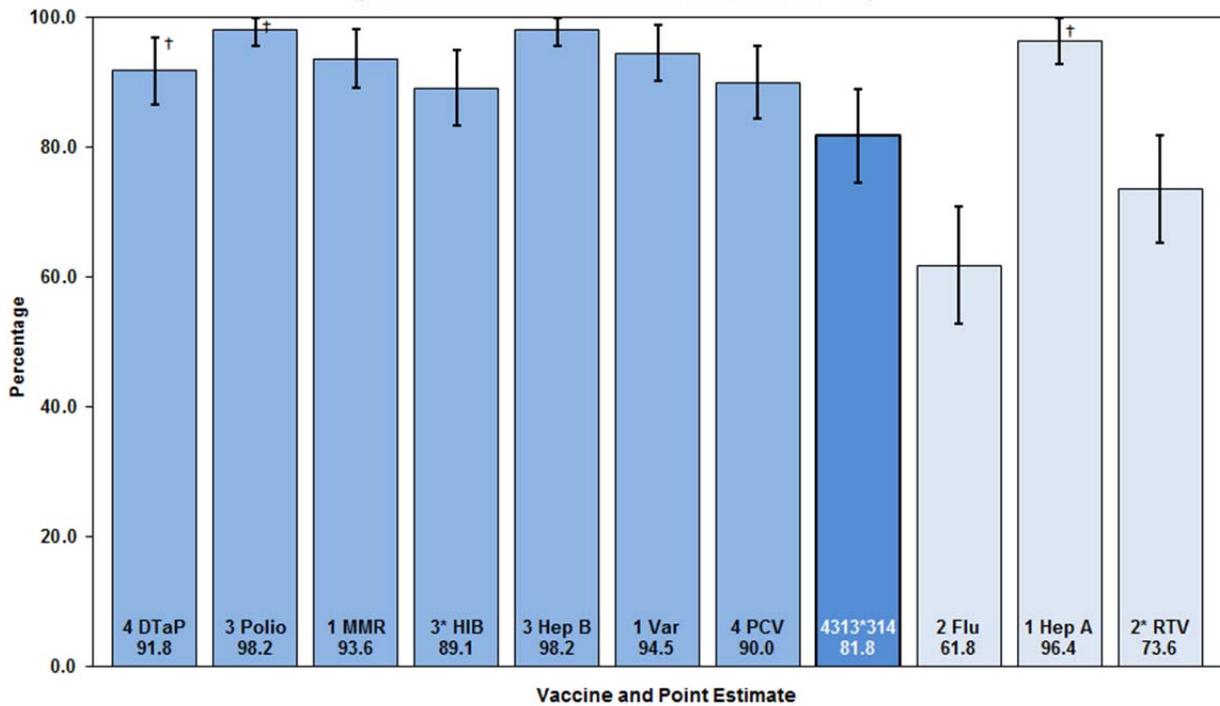
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=99)**



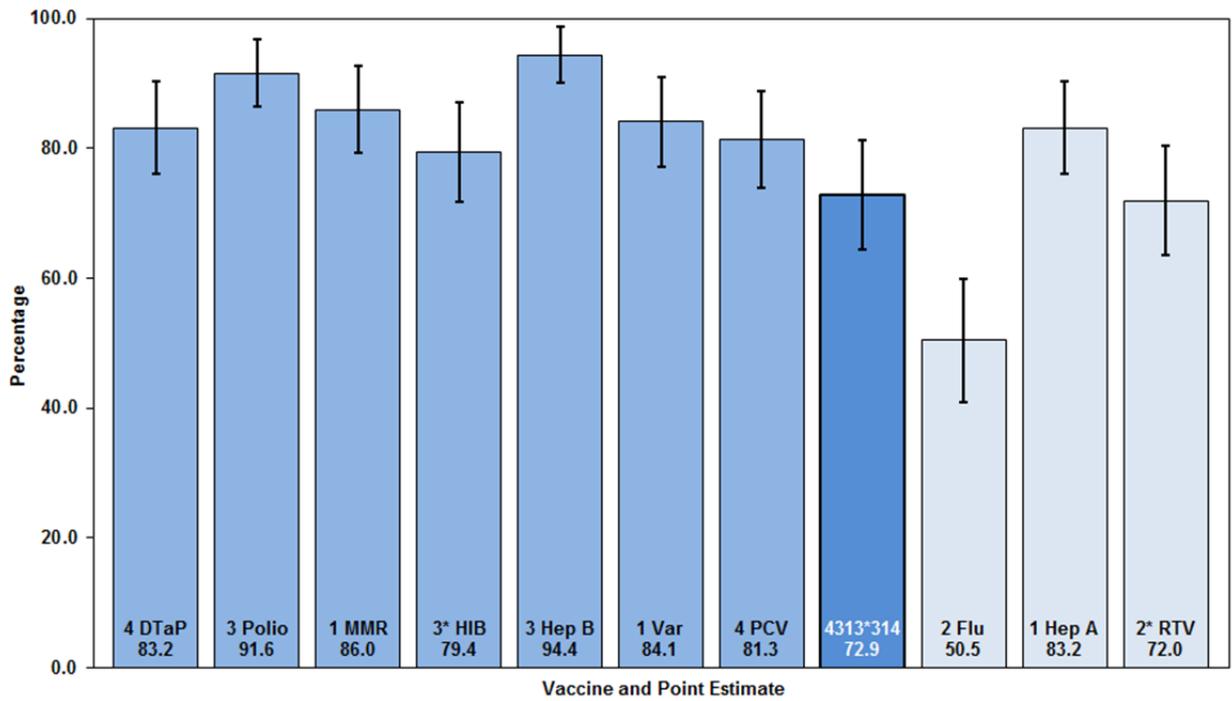
†statistically significant difference from State point estimate
*dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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=110)**



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

2015 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=107)



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

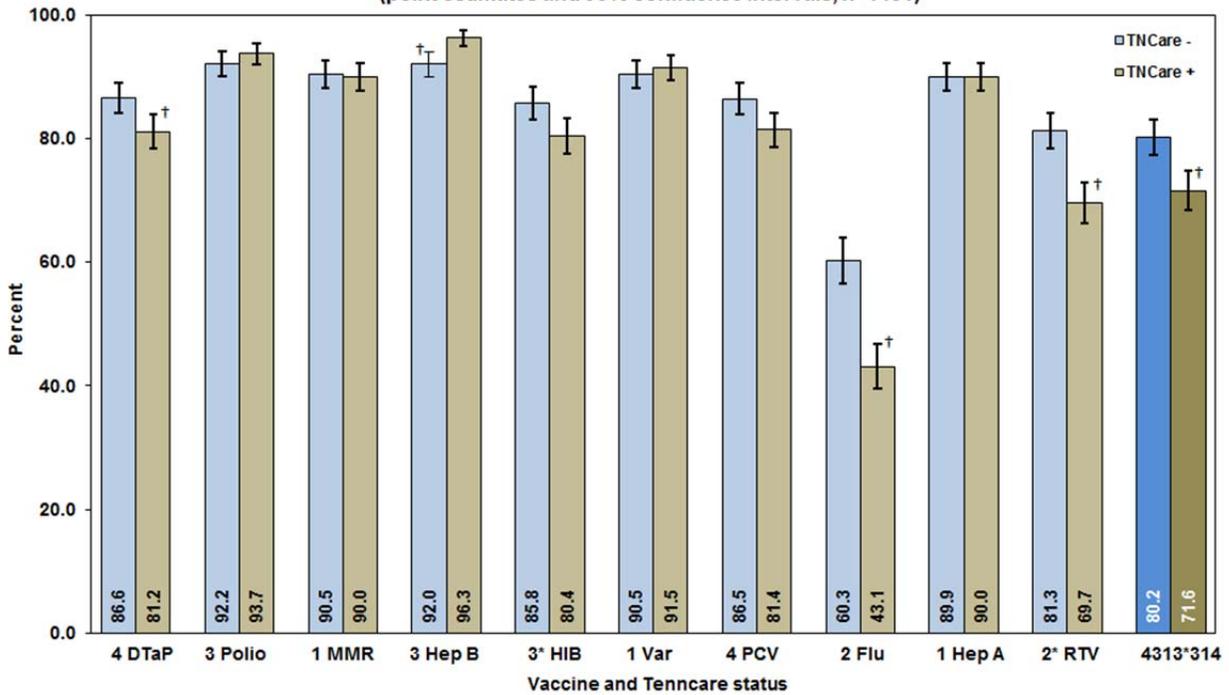
Appendix 4

2015 Immunization Status Survey of 24-Month-Old Children in Tennessee

Additional Statewide Charts for Specific Groups

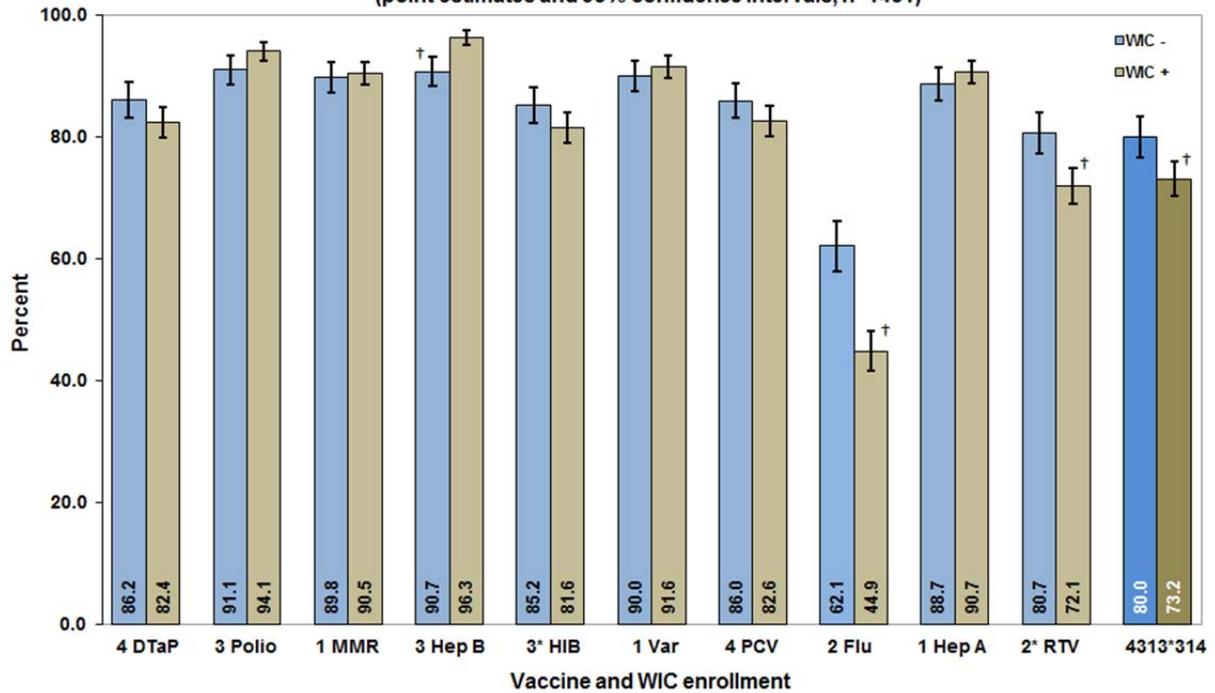
	Page
Immunization levels by vaccine and TennCare enrollment status	... 40
Immunization levels by vaccine and WIC enrollment status	... 40
Trends in on-time immunization coverage disparities (Black vs. White, 2010-2014)	... 41

2015 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=1451)



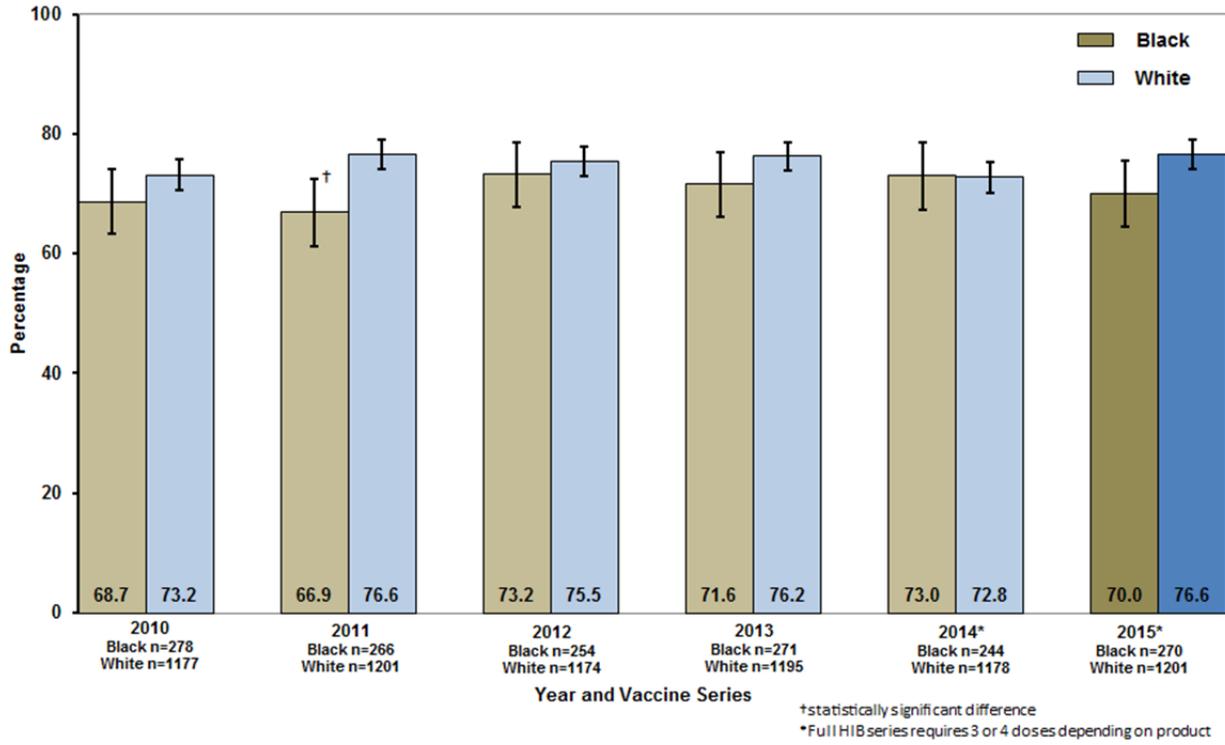
[†]statistically significant difference from comparison group
^{*}dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

2015 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=1451)



[†]statistically significant difference from comparison group
^{*}dependent on brand name, 3 or 4 HIB doses and 2 or 3 RTV doses

**2015 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

2015 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)	... 43
Series Complete (4:3:1:3* :3:1:4) by Provider Type	... 43
Series Complete (4:3:1:3* :3:1:4) by Race	... 44
Series Complete (4:3:1:3* :3:1:4) by Number of Older Siblings	... 44
Series Complete (4:3:1:3* :3:1:4) by TennCare Enrollment	... 45

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

Region	Yes		No		Total
	n=	%	n=	%	n=
Northeast TN	90	81.8%	20	18.2%	110
East TN	92	77.3%	27	22.7%	119
Southeast TN	91	80.5%	22	19.5%	113
Upper Cumberland	86	74.1%	30	25.9%	116
Mid-Cumberland	73	67.6%	35	32.4%	108
South Central	90	78.3%	25	21.7%	115
West TN	93	79.5%	24	20.5%	117
Shelby County	77	69.4%	34	30.6%	111
Davidson County	81	73.0%	30	27.0%	111
Knox County	80	80.8%	19	19.2%	99
Hamilton County	77	70.6%	32	29.4%	109
Madison County	91	78.5%	25	21.5%	116
Sullivan County	78	72.9%	29	27.1%	107
Total	1099	75.7%	352	24.3%	1451

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

Region	Public			Private			Both		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	4	11	36.4%	72	80	90.0%	14	18	77.8%
East TN	0	1	0.0%	80	99	80.8%	11	17	64.7%
Southeast TN	17	17	100.0%	58	73	79.5%	15	16	93.8%
Upper Cumberland	4	4	100.0%	62	84	73.8%	16	21	76.2%
Mid-Cumberland	4	6	66.7%	63	76	82.9%	6	20	30.0%
South Central	1	2	50.0%	74	89	83.6%	15	20	75.0%
West TN	14	16	87.5%	62	75	82.7%	17	23	73.9%
Shelby County	4	7	57.1%	59	80	73.8%	14	21	66.7%
Davidson County	2	3	66.7%	65	86	75.6%	7	13	53.9%
Knox County	1	1	100.0%	74	90	82.2%	5	7	71.4%
Hamilton County	0	0	0.0%	71	96	74.0%	6	9	66.7%
Madison County	7	8	87.5%	65	82	79.3%	19	25	76.0%
Sullivan County	7	9	77.8%	60	72	83.3%	10	21	47.6%
Total	65	85	76.5%	865	1082	79.9%	155	227	68.3%

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

Region	White			Black			Other		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	85	105	81.0%	3	3	100.0%	0	0	0.0%
East TN	90	117	76.9%	1	1	100.0%	1	1	100.0%
Southeast TN	88	109	80.7%	2	3	66.7%	1	1	100.0%
Upper Cumberland	82	112	73.2%	0	0	0.0%	4	4	100.0%
Mid-Cumberland	70	98	71.4%	3	10	30.0%	0	0	0.0%
South Central	83	107	77.6%	5	6	83.3%	2	2	100.0%
West TN	69	92	75.0%	23	24	95.8%	1	1	100.0%
Shelby County	36	45	80.0%	36	61	59.0%	5	5	100.0%
Davidson County	53	71	74.7%	23	33	69.7%	5	7	71.4%
Knox County	70	88	79.6%	9	10	90.0%	1	1	100.0%
Hamilton County	63	86	73.3%	12	20	60.0%	2	3	66.7%
Madison County	55	68	80.9%	36	48	75.0%	0	0	0.0%
Sullivan County	76	103	73.8%	2	4	50.0%	0	0	0.0%
Total	920	1201	76.6%	155	223	69.5%	24	27	88.9%

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

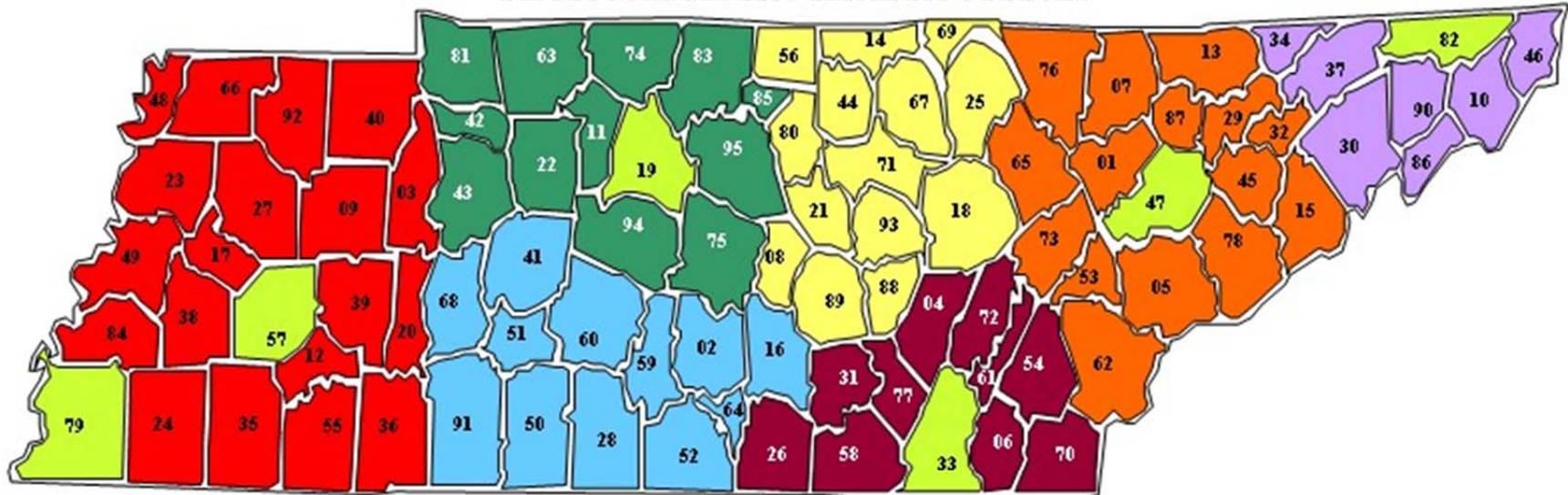
Region	0 Siblings			1 Siblings			2+Siblings		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	47	51	92.2%	22	33	66.7%	21	26	80.8%
East TN	41	50	82.0%	32	42	76.2%	19	27	70.4%
Southeast TN	41	47	87.2%	32	41	78.1%	18	25	72.0%
Upper Cumberland	35	42	83.3%	28	39	71.8%	23	35	65.7%
Mid-Cumberland	34	44	77.3%	23	35	65.7%	16	29	55.2%
South Central	39	46	84.8%	28	35	80.0%	23	34	67.7%
West TN	35	44	79.6%	36	42	85.7%	22	31	71.0%
Shelby County	30	41	73.2%	27	38	71.1%	20	32	62.5%
Davidson County	36	53	67.9%	24	29	82.8%	21	29	72.4%
Knox County	31	36	86.1%	33	41	80.5%	16	22	72.7%
Hamilton County	34	41	82.9%	24	35	68.6%	19	33	57.6%
Madison County	45	51	88.2%	28	36	77.8%	18	29	62.1%
Sullivan County	43	52	82.7%	19	31	61.3%	16	24	66.7%
Total	491	598	82.1%	356	477	74.6%	252	376	67.0%

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

Region	Enrolled			Not Enrolled		
	Yes	Total	%	Yes	Total	%
Northeast TN	57	75	76.0%	33	35	94.3%
East TN	61	83	73.5%	31	36	86.1%
Southeast TN	52	63	82.5%	39	50	78.0%
Upper Cumberland	38	56	67.9%	48	60	80.0%
Mid-Cumberland	24	47	51.1%	49	61	80.3%
South Central	45	62	72.6%	45	53	84.9%
West TN	60	78	76.9%	33	39	84.6%
Shelby County	40	62	64.5%	37	49	75.5%
Davidson County	7	13	58.9%	74	98	75.5%
Knox County	30	41	73.2%	50	58	86.2%
Hamilton County	35	58	60.3%	42	51	82.4%
Madison County	61	76	80.3%	30	40	75.0%
Sullivan County	26	35	74.3%	52	72	72.2%
Total	536	749	71.6%	563	702	80.2%

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	Cocke	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												