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Results of the 2011 Immunization Status Survey Of 24-Month-Old Children in Tennessee

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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)

March 15, 2012 Erratum: The data label for the on-time 4:3:1:3:3:1:4 vaccine coverage for Hamilton County has been corrected to 79.1% (Figure 2a, pg. 7).

Results of the 2011 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's (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 with each of 10 vaccines, protecting against the following 14 diseases: diphtheria, tetanus, pertussis, (combined as DTaP); poliomyelitis (IPV); measles, mumps, rubella (combined as MMR); *Haemophilus influenzae* type B (HIB); hepatitis B (HBV); varicella (VAR); *Streptococcus pneumoniae*, also known as Pneumococcus (PCV); hepatitis A (HAV); rotavirus (RTV) and influenza (FLU).

This survey uses the same definitions for its population as the Centers for Disease Control and Prevention (CDC) National Immunization Survey (NIS), which assesses 19-35 month old children. Beginning in 2010, the CDC added complete PCV vaccination (4 doses) to the aggregate immunization coverage rate it reports from the NIS. Thus, complete immunization in the 2011 survey is defined as having received four doses of DTaP, three doses of IPV, one dose of MMR, three doses of HIB, three doses of HBV, one dose of VAR and four doses of PCV (abbreviated hereafter as the **4:3:1:3:3:1:4** series). Tennessee's surveys conducted from 2002-2009 reported coverage rates for the **4:3:1:3:3:1** series, excluding PCV. Although the report focuses on the new NIS standard, 4:3:1:3:3:1 rates are provided for comparison with the results of past years.

Recommended vaccines not included in the 4:3:1:3:3:1:4 series are reported individually. Influenza vaccine (FLU) is considered complete with 2 or more doses. Hepatitis A vaccine (HAV) is complete with 2 doses, although the recommended dose spacing of 6-18 months means that children who have 1 dose by the second birthday are not behind schedule; in order to acknowledge that children with one dose at 24 months are not behind schedule, beginning with this year's analysis, the survey will report 1-dose HAV coverage as the primary measure with 2-dose coverage as a secondary value. Rotavirus vaccine (RTV) is considered complete with at least 2 doses because this survey does not capture the brand of vaccine given (one rotavirus vaccine requires 2 doses and the other requires 3 doses). Coverage levels are typically lower for these vaccines because they are newer additions to the immunization schedule.

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. The Tennessee Department of Health aims to achieve 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 80% are appropriately immunized against influenza. In addition to these objectives HP 2020 objectives also include having 85% of all children receive their first dose of hepatitis B vaccine within 3 days of life.

The 2011 sample population:

The 2011 statewide sample consisted of 1,599 children born in the first quarter of 2009 (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 2009 in that region. The oversampled records (n=26 of the 1,599) were included only in the state-level analysis of black-white racial disparities; two of these were excluded because the children had moved out of state, leaving 24 oversampled records in the final racial analysis. Of the 1,573 children in the primary sample, 108 were excluded from the analysis for one of the following

reasons: parents refused to participate (n=14), the child had moved out of state (n = 92) or the child had died (n=2). After exclusions, 1,465 children remained in the primary sample (1,465 + 24 = 1,489 total records). See Appendix 1 for a table showing the number of oversampled records used for racial disparity assessment in each region.

Unable to locate:

Of the 1,489 total children, 18 children could not be located or confirmed as having moved out of state. By protocol, these children are included in the analysis with any immunization data recorded in the state immunization registry: 9 had documentation of either zero doses, or no more than one dose other than a birth dose of HBV; 9 had more doses recorded in the state immunization registry but remained incomplete. See Appendix 1 for a regional breakdown of children unable to be located.

Vaccine refusal:

Of the 1,489 children, 26 children (1.7%) had parents who confirmed that they refused vaccine for religious, philosophical or medical reasons. Parents of the 22 children who had received zero immunizations cited religious (n=10), personal philosophical (n=9), or medical (n=3) reasons for not vaccinating the child. The parents of 4 additional children who refused vaccination after their children had received one or more doses of vaccine cited philosophical (1) or medical (3) reasons. The validity of the medical exemptions is unknown because the medical reasons for refusal were not investigated. The number of children whose parents refused immunization impacted regional coverage rates to different degrees, varying from 0 to 6 children per region: see Appendix 1 for a regional breakdown of vaccine refusal.

Statistical notes:

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

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

Minimum intervals:

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

Additional information on specific vaccines:

Hepatitis B vaccine (HBV) birth dose

For the first time, this report includes information about the proportion of children receiving a birth dose of hepatitis B vaccine (given within 3 days of life). Widespread adoption of a routine birth dose in hospitals is a key strategy in national efforts to eliminate transmission of hepatitis B virus in the United States. These rates reflect the policies and practices of the delivery hospitals in each region. Data are provided in Figure 3.

Influenza vaccine (FLU)

Children born in the first quarter of 2009 who received every influenza vaccine on time could have received 3 doses of seasonal influenza vaccine and 2 doses of the monovalent 2009 H1N1 vaccine by their second birthday. This survey reports the percentage of children who received at least 2 doses of *seasonal* influenza vaccine. 2009 H1N1 vaccine doses may have been administered in non-traditional sites and may have been less well-documented. If available, regional staff conducting the survey wrote in the information on 2009 H1N1 vaccine; however, because 2009 H1N1 vaccine was not part of the annual survey tool, rates are not reported here. 2009 H1N1 vaccine coverage levels in states were assessed by the CDC and published elsewhere.

Haemophilus influenzae type B vaccine (HIB)

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

From December 2007 through mid-2009, Merck HIB vaccine (2 doses plus 1 booster) was unavailable due to production problems. During this time, the CDC recommended deferral of the booster dose in healthy children. For this reason, the 2009 survey (only) classified children with 2 or more doses as complete. The CDC restored the booster dose to the schedule in the summer of 2009. Children in the 2011 survey were no more than 6 months of age when the shortage ended and all were eligible to receive the booster dose on time.

Rotavirus vaccine (RTV)

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

Statewide Results and Trend Analysis:

Vaccine specific on-time immunization coverage

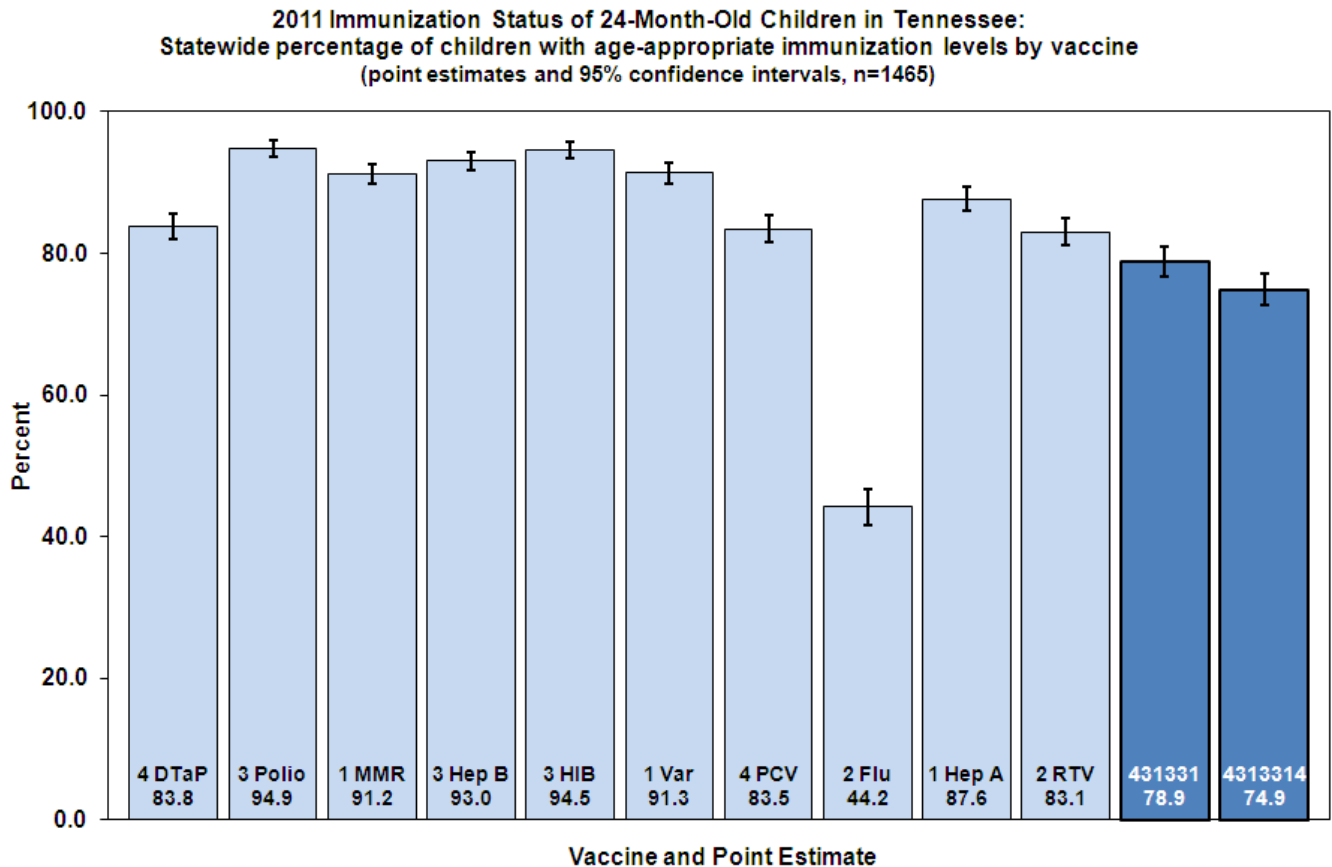
The proportion of children in the survey fully immunized on-time for each vaccine is in Figure 1 below. The HP 2020 objective of 90% on time coverage was met or exceeded for 5 out of 7 vaccines in the 4:3:1:3:3:1:4 series. The two vaccines requiring 4 doses, DTaP and PCV, failed to reach 90%; however, the percentages of children who had received 3 or more doses were 95.7% for DTaP and 93.9% for PCV (See Appendix 1).

The HP 2020 objective of 80% coverage with 2 or more doses of rotavirus vaccine was exceeded: 83.1% of children had at least 2 doses of RTV. For HAV, 51% of children had already completed the 2 dose series (HP 2020 objective is 60% completion by 35 months of age) and 87.6% had received the first dose, still on track to complete the series within 18 months of the first dose. Influenza vaccination rates remain low.

The two vaccine series rates (4:3:1:3:3:1 and 4:3:1:3:3:1:4) both fell short of the 80% HP 2020 objectives, driven by the DTaP completion rate (which slipped down a percentage point from 84.8% in 2010), and the PCV rate (despite its one percentage point rise from 82.5% in 2010). Completion of the 4:3:1:3:3:1 series dipped below 80% for the second year in a row: it had exceeded 80% between 2004 and 2009 (Figure 4).

Appendix 1 of this report contains charts of on-time immunization coverage rates in each region for each vaccine.

Figure 1



Complete immunization levels statewide and by public health region

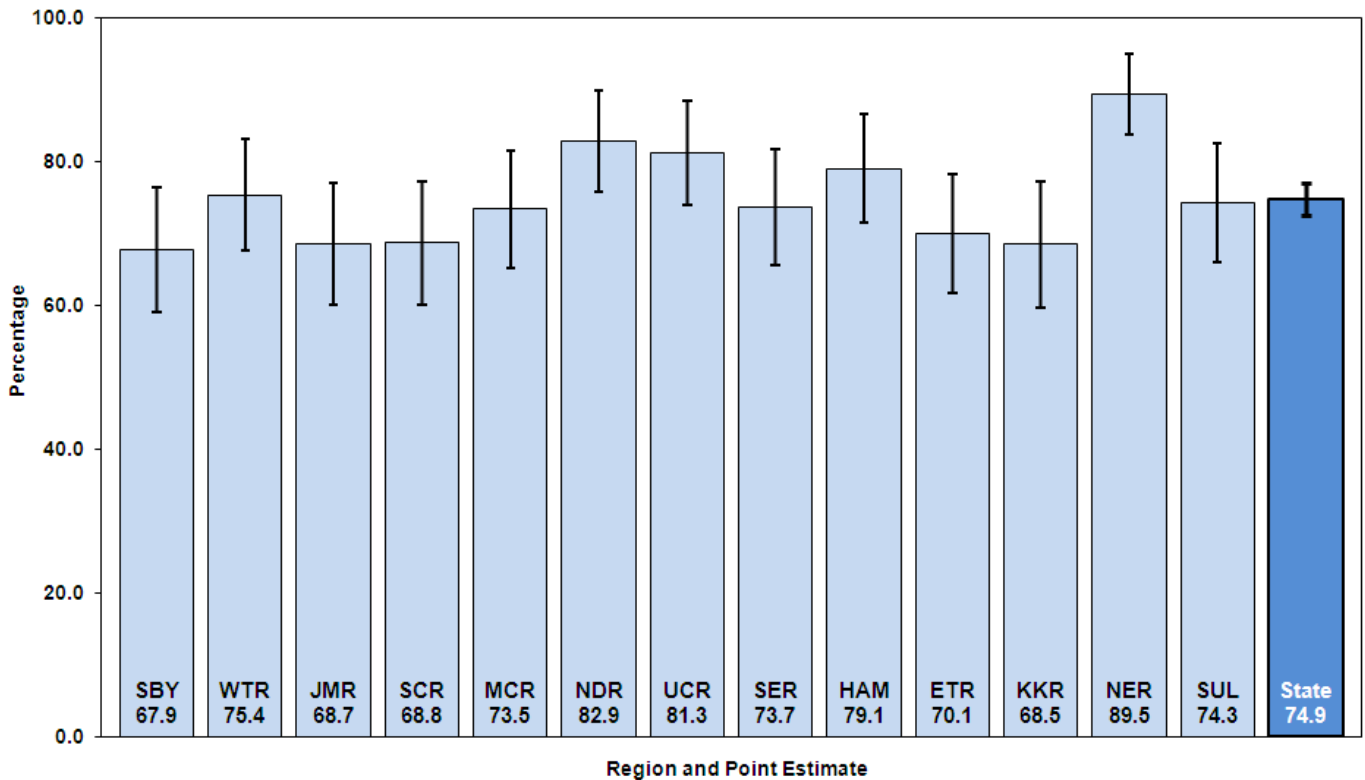
The percentage of children immunized on time with all vaccines in 4:3:1:3:3:1:4 series, statewide and by public health region, is shown in Figure 2a. To allow comparison with previous years, Figure 2b shows the same data for the more limited 4:3:1:3:3:1 series. Statewide 4:3:1:3:3:1:4 coverage reached 74.9% (95% CI: 72.7-77.1%). Although with wide confidence intervals, the point estimates in three regions (Nashville/Davidson [NDR], Upper Cumberland [UCR] and Northeast [NER]) exceeded the HP 2020 objective of 80% coverage. The Northeast Region (NER) rate of 89.5% was statistically significantly higher than the state as a whole. Other regional 4:3:1:3:3:1:4 completion rates were not significantly higher or lower than the overall state rate.

Figure 3 compares the statewide coverage rates measured statewide in 2010 and 2011. Statistically significant improvements were detected for HIB and for RTV. The improvement of HIB coverage may be explained by the complete resolution of that vaccine shortage in mid-2009. That shortage may have had a lingering effect on children surveyed in 2010. Rotavirus vaccine coverage, first recommended in 2006, continues its rapid acceptance.

Appendix 2 of this report contains charts for each public health region displaying the percentage of children in each region who were immunized on-time for each of the vaccines and for the 4:3:1:3:3:1:4 aggregate series.

Figure 2a

**2011 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=1465)**



March 15, 2012 Erratum: The data label for the on-time 4:3:1:3:3:1:4 vaccine coverage for Hamilton County has been corrected to 79.1% (Figure 2a, above).

Figure 2b

**2011 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=1465)

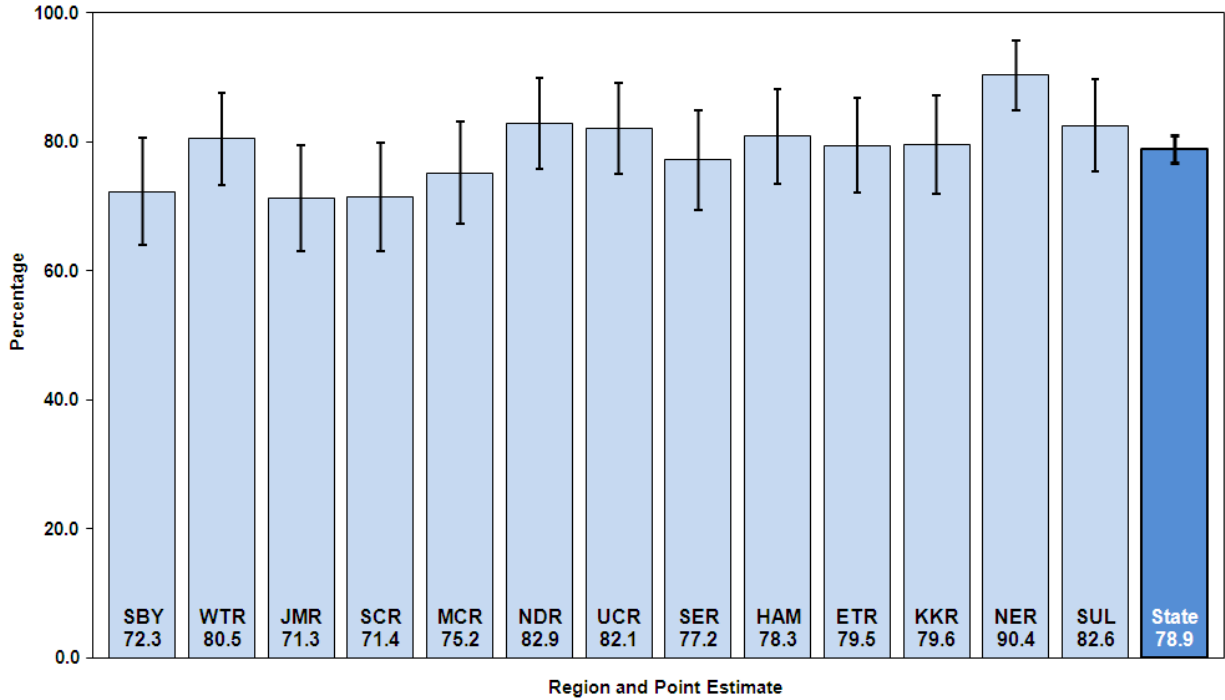
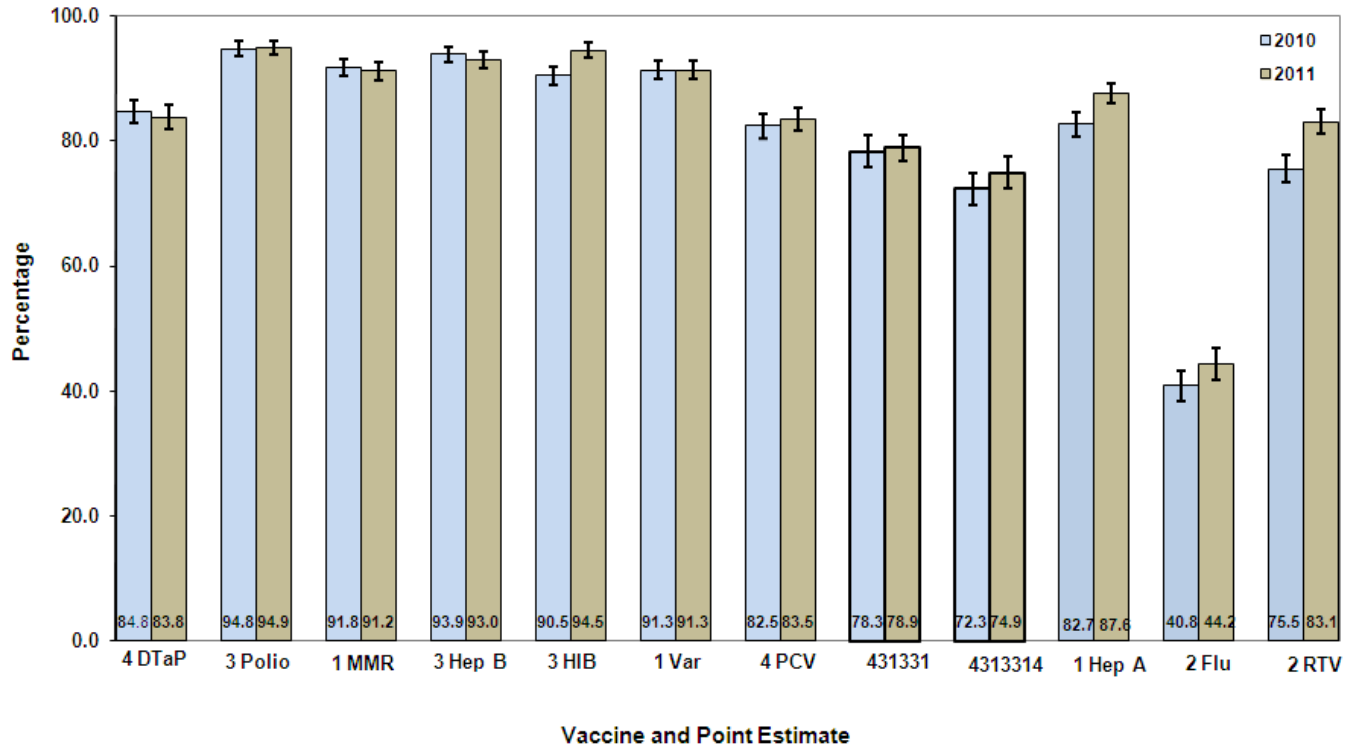


Figure 3

**2011 Immunization Status of 24-Month-Old Children in Tennessee:
Statewide percentage of children with age-appropriate immunization levels
by vaccine in 2010 and 2011**
(point estimates and 95% confidence intervals, n=1465)

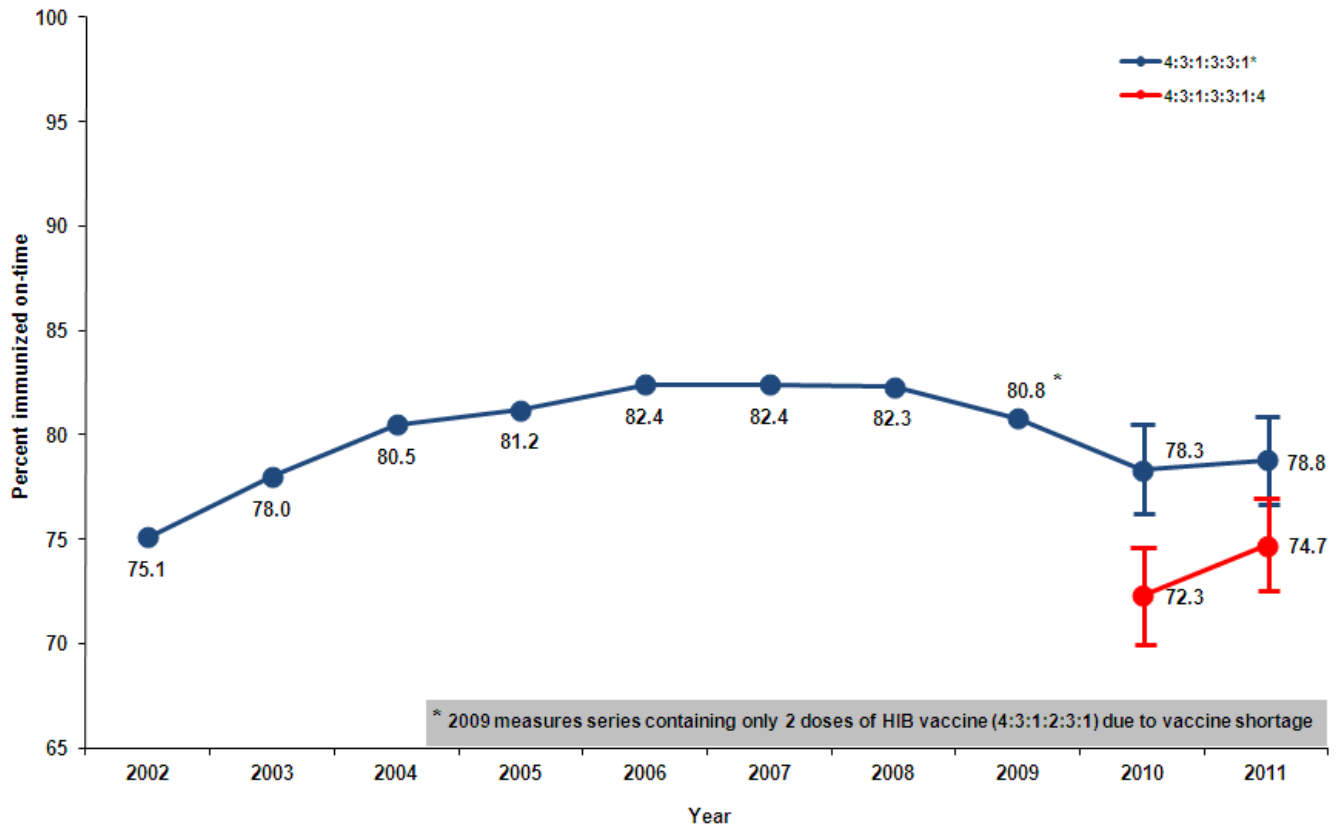


Series completion trends over time

Figure 4 below shows the trend over time of the 4:3:1:3:3:1 series completion rate from 2002 to 2011, as well as the 4:3:1:3:3:1:4 completion rate from 2010 to 2011.

Figure 4

**2011 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 2011
(point estimates and 95% confidence interval, n=1465)**



Hepatitis B birth dose

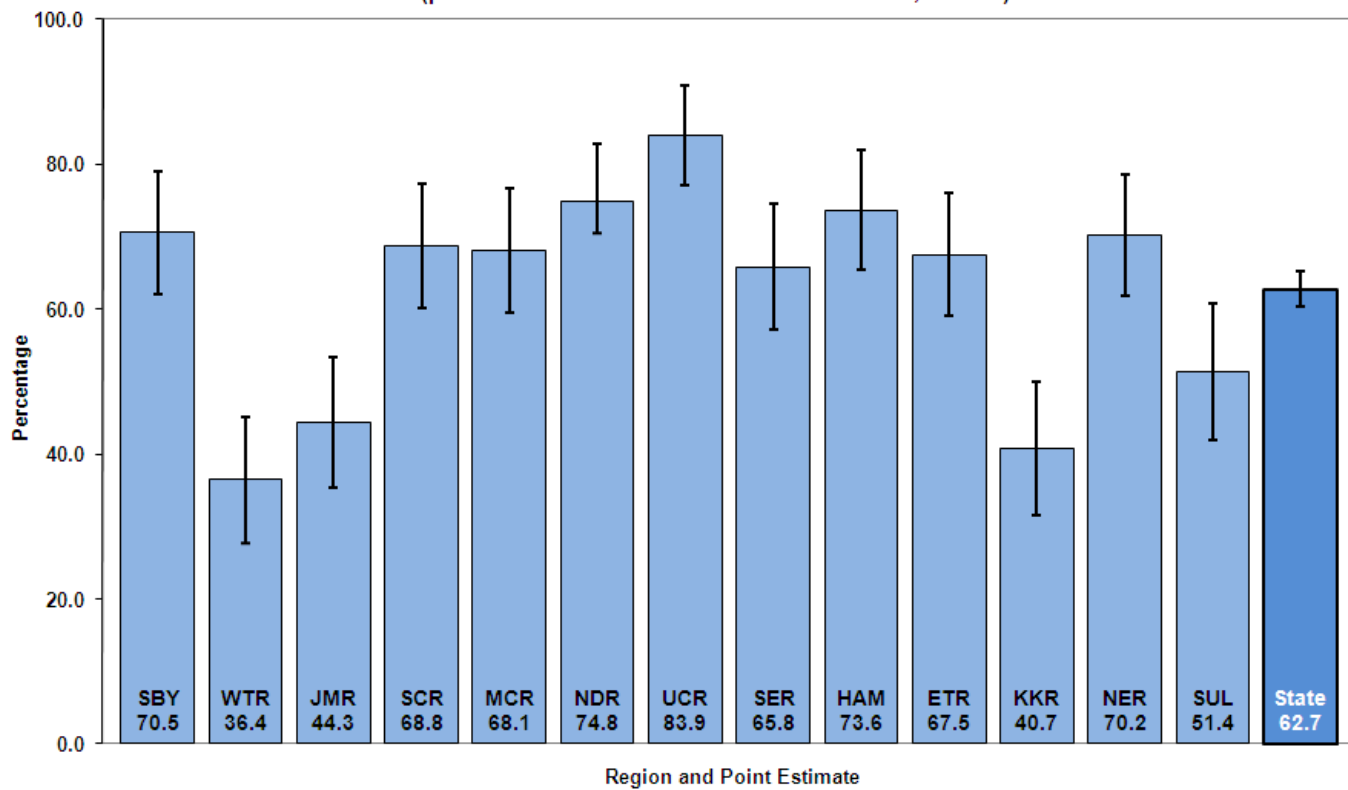
Figure 5 shows the wide-ranging percentage of children assessed in each region who received a birth dose of hepatitis B vaccine (a dose given by day 3 of life). Without medical intervention, mother to child transmission of hepatitis B virus occurs in 70-90% of infants, with a high risk to the infant of chronic infection, leading to liver damage, cirrhosis or liver cancer later in life. Infants born to mothers known to be infected should be given vaccine and immunoglobulin within 12 hours of life, which can reduce the risk of infant infection by up to 95%. Infants born to mothers of unknown status also should receive vaccine within 12 hours. As a safety net, the CDC recommends that all other newborns be vaccinated before discharge. This will help protect the neonate if the mother’s infection is not detected by laboratory tests or if the newborn experiences another type of perinatal exposure to the virus.

The HP 2020 objective is that 85% of infants receive a birth dose of hepatitis B vaccine. The most recent national birth dose (up to day 3 of life) coverage rate, according to the 2010 NIS data released September 2011 at http://www.cdc.gov/vaccines/stats-surv/nis/data/tables_2010.htm is 64.1% (95% CI: +/- 1.3%). Although the state rate of 62.7% is close to that, regional rates within the state vary widely, likely due to differences in policies concerning birth dose hepatitis B vaccination at delivery hospitals. The CDC recommends strict adherence to a birth

dose policy: “in rare circumstances, the first dose may be delayed until after hospital discharge for an infant who weighs >2,000 g and whose mother is HBsAg [hepatitis B surface antigen] negative, but only if a physician’s order to withhold the birth dose and a copy of the mother’s original HBsAg-negative laboratory report are documented in the infant’s medical record.” For details, see Table 3 in the CDC’s 2005 Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States,” available at <http://www.cdc.gov/mmwr/PDF/rr/rr5416.pdf>.

Figure 5

**2011 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=1465)**



Racial disparities

The differences measured between black and white children in on-time completion of the 4:3:1:3:3:1 series have been small or statistically insignificant in recent years. This year the comparison was made between black (n = 266) and white (n=1,201) children; because of small numbers, children of other races (n=22) are excluded from this analysis.

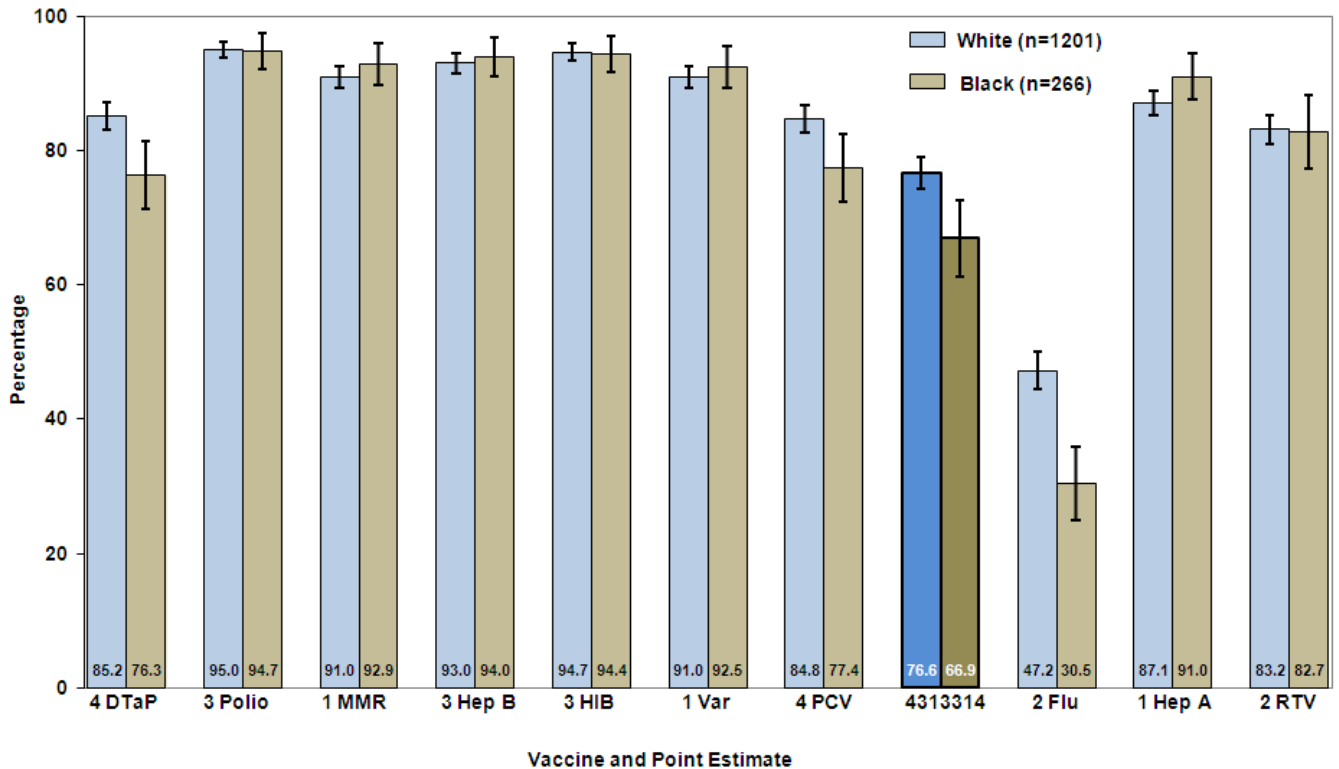
This year a significant difference of 9.7 percentage points was detected between black and white children in the 4:3:1:3:3:1:4 series: this resulted from new significant differences measured in 4-dose coverage of DTaP (8.9 percentage points) and PCV (7.4 percentage points). There were no differences in rates of completion for other vaccines in the series. A comparison of the trends in on-time series completion by race from 2004-2011 can be found in Appendix 3.

Figure 6 shows the rates of on-time immunization of black and white children for each vaccine assessed. In addition to the DTaP and PCV differences, the influenza vaccine gap is the widest of all (16.7 percentage points).

Although absolute coverage rates for influenza vaccine have crept up very gradually each year for both black and white children, the large racial disparity in those rates has been relatively stable since influenza vaccine was first assessed in this survey in 2008. In 2008, a 15 percentage point gap was identified between coverage rates for influenza vaccine in white and black children, remained steady in 2009 and widened to a 20-point difference in 2010. In the current survey, that gap is 16.7 percentage points. Compared to 2010, influenza vaccine coverage rates increased by just 6.4 percentage points in black children and 2.8 percentage points in white children, far from the HP 2020 objective of 80% coverage.

Figure 6

2011 Immunization Status of 24-Month-Old Children in Tennessee: Statewide percentage of children with age-appropriate immunization levels by vaccine and race (point estimates and 95% confidence intervals)



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 (greater than 120 days of age), or having two or more siblings. In the past, racial disparities made black race an important risk factor, though race has become less predictive of late immunization, other than for influenza vaccination. Having more than one sibling or starting routine immunizations late remain characteristics most likely to result in not being immunized on time.

The survey examines other groups of interest, as well. Immunization provider type (public, private or both), TennCare (Medicaid) participation, and enrollment in the Women, Infants and Children (WIC) nutrition program is captured for each child in the survey. Because only a small number of children (114 of 1,435) were immunized in health departments, the point estimate for complete immunization has wide confidence intervals. Infants in WIC have immunization records reviewed at WIC visits. Beginning in mid-2008, targeted education and telephone follow-up, rather than restricted monthly WIC voucher pick up, became the primary tools used to encourage catch-up immunization of WIC infants.

Children who begin routine immunizations after 4 months (120 days) of age are at very high risk of failing to catch up and be fully immunized on time. We single out children who receive their first routine vaccination other than rotavirus or birth dose hepatitis B vaccine after 120 days of age: just 36 children (2.5%) met these criteria. Table 1 below summarizes the 2011 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 2011 Survey of 24-Month-Old Children: Selected Characteristics			
Provider Type	Public n=77/114	Private n=843/1071	Both n=177/250
	67.5% ± 8.59	78.7% ± 2.45	70.8% ± 5.64
TennCare Enrollment	Enrolled n=671/892	Not Enrolled n=426/573	
	75.2% ± 2.83	74.3% ± 3.58	
WIC Enrollment	Enrolled n=723/967	Not Enrolled n=374/498	
	74.8% ± 2.74	75.1% ± 3.80	
Other Siblings	None n=492/603	One n=373/504	Two or more n=229/355
	81.6% ± 3.09	74.0% ± 3.83	64.5% ± 4.98
Age at First Immunization*	≤120 days n=1083/1396	120 days n=14/36	
	77.6% ± 2.19	38.9% ± 15.92	

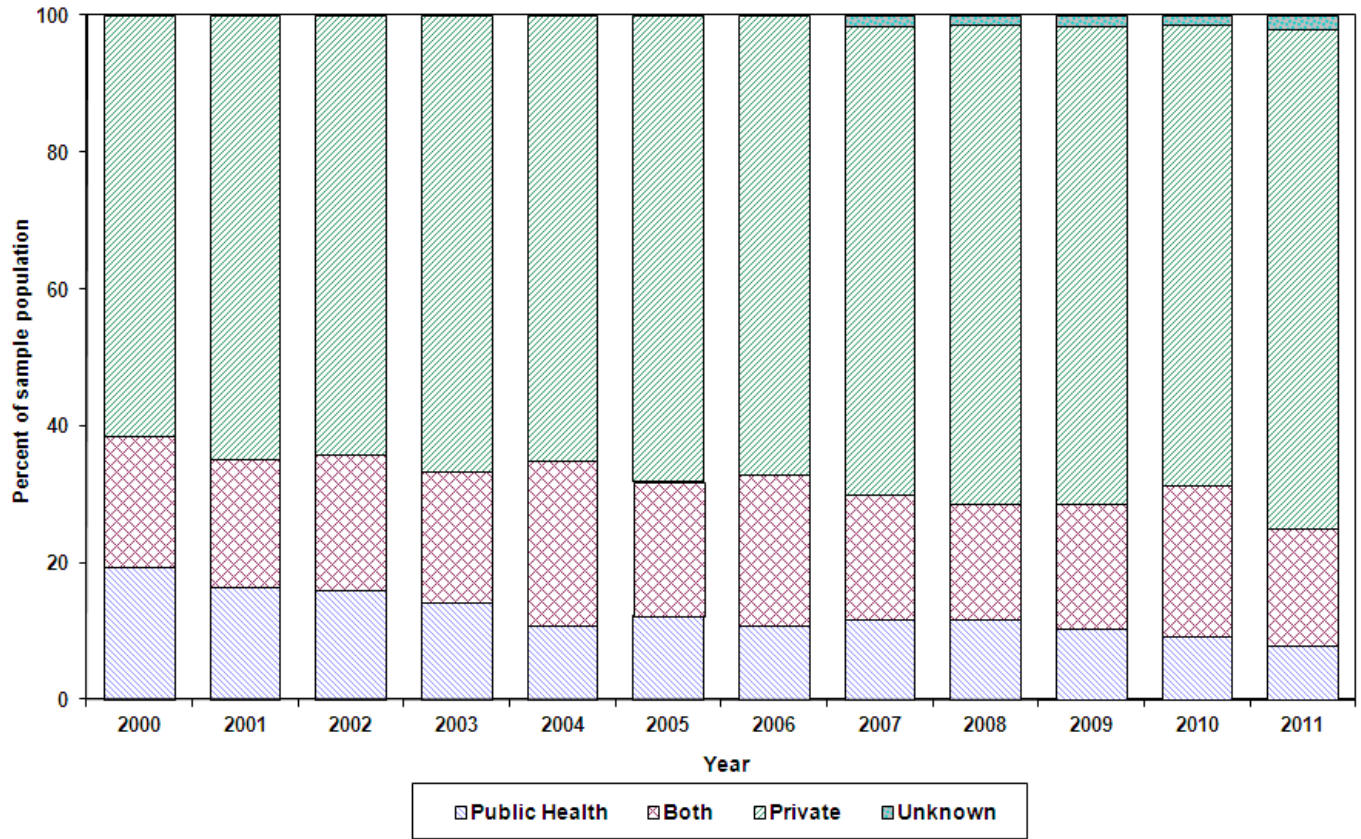
*the first dose of a vaccine other than oral rotavirus vaccine or the birth dose of hepatitis B vaccine

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 poor children to receive immunizations in a private medical home. In 2011, 73.1% of children surveyed were immunized exclusively in private clinic settings, 17.1% received immunizations in a combination of private and public health clinics, 7.8% of children surveyed received their immunizations exclusively at a public health department, and the setting was unknown for 2%. Figure 7 below shows the trends in these proportions over time.

Figure 7

**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Source of Immunizations from 2000 to 2011 (n=1465)**



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

Table 2

Prevalence of risk factors for delayed immunizations in the survey population by provider type			
Risk Factor	Health Department	Both Private and Public	Private Only
Black (risk for influenza)	26.3% (30/114)	16.4% (41/250)	16.0% (171/1071)
2 or more siblings	39.5% (45/114)	26.8% (67/250)	21.3% (228/1068)
Age at first dose >120 days	11.4% (13/114)	2.8% (7/249)	1.5% (16/1069)
Any of above risk factors	51.8% (59/114)	39.6% (99/250)	34.0% (364/1071)

Summary of Key Findings:

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

Measurement	HP 2020 Objective (19-35 months)	TN 2011 (24 months)
Complete 4:3:1:3:3:1:4 series	80%	74.9%
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 5 of 7, except: 4 doses of DTaP (83.8%) and 4 doses of PCV (83.5%)
3 doses DTaP and PCV	<i>None: this is a process measure</i>	3 DTaP (95.7%) and 3 PCV (93.9%) [could reach goals by closing gap in 3 dose and 4 dose coverage]
Hepatitis A vaccine	60% 2 doses by 35 months	51% 2 doses; 86.7% 1 dose
Influenza vaccine	80% appropriately immunized	44%
Rotavirus vaccine	80% with 2 doses	83.1%
Hepatitis B birth dose	85%	62.7%

2. The HIB coverage rate of 94.5% with at least 3 doses marked a recovery from recent low measurements, which had been caused by the national shortage and deferral of booster doses between December 2007 and July 2009.
3. The hepatitis B birth dose rate is well below the goal and rates vary widely by region.
4. Influenza vaccine 2-dose coverage remains low and increased only slightly over 2010 to 44.2%. Although the gap has narrowed, wide regional disparities in coverage persist with regions in the western third of the state consistently showing significantly lower coverage rates than the other grand divisions (see Appendix 1 for influenza coverage by region).
5. The racial disparity in influenza vaccine coverage remains stable and large, although absolute coverage rates among both black and white children have increased slightly each year (47.2% in white children versus 30.5% in black children).
6. The racial disparities in coverage rates for the DTaP and pneumococcal series were statistically significant this year, resulting in a statistically significant difference in the aggregate immunization series rates. Gaps have not reached significance in recent years. The 2012 survey will be important to determine if this is a one-time anomaly or a reversal of gains made in eliminating disparity.
7. Children enrolled in TennCare and WIC had immunization rates for the 4:3:1:3:3:1:4 series equivalent to children never enrolled in these programs. With some individual vaccines (MMR, varicella, HBV), their enrollees had a higher percentage of on-time coverage; however, they were lower in influenza coverage.
8. The rates of oral rotavirus vaccine coverage have risen rapidly, already exceeding national 2020 goals. This is remarkable, especially contrasted with the uptake of influenza vaccine that has been recommended for the same period of time for the same population. It was first recommended in 2006 and has dramatically reduced diarrheal illness and hospitalization rates of children in the US.

Next Steps:

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

1. State immunization requirements updated in 2010 continue to improve age-appropriate immunization with PCV and HAV. As of 2011, children starting Kindergarten are required to have 2 doses of HAV.
2. No shortages of routine vaccine have occurred since mid 2009. Such shortages have periodically disrupted immunization schedules over the last decade.
3. TIP will continue to create monthly reports of children immunized in health departments aged 20-24 months who do not have registry records showing that they have received all 4 doses of DTaP. These reports are sent to key staff at regional health departments to facilitate active follow up of those with late 4th dose vaccines.

4. In 2012, the Perinatal Hepatitis B Prevention Program (PHBP) within the Immunization Program will conduct evaluation and outreach visits to the hospitals that deliver most infants in Tennessee. Included will be a review of hospital birth dose hepatitis B protocols and policies, as well as education for hospitals about the importance of having a strong routine birth dose program to minimize risks of perinatal infection. The objective of this effort is to increase the number of delivery hospitals that enforce standard birth dose hepatitis B protocols to minimize the risk of mother to child transmission of hepatitis B infection.
5. TIP will continue to collaborate with healthcare providers willing to submit immunization records into the state Immunization Registry. Interest in electronic data exchange has increased as a result of ongoing improvements in technology and Federal financial incentives, known as “Meaningful Use” grants from the Centers for Medicaid and Medicare Services (CMS), given to qualified healthcare providers. One way providers can meet their obligations under these grants is to establish data exchange with the state immunization registry.
6. TIP will continue to encourage providers to give the third DTaP at 6 months of age so the fourth DTaP may be administered as soon as the 12 month visit. The risk of incomplete immunization goes up after the first birthday among children already at risk for falling behind schedule.
7. TIP also will emphasize in its education of private providers the importance of having a system to recall patients who have missed doses of vaccine, especially using DTaP and PCV as sentinel vaccines for tracking.
8. TIP will share survey findings with WIC and TennCare leadership, highlighting influenza vaccine coverage. There is a 2-3 week delay between arrival of private influenza vaccine shipments and VFC influenza vaccine shipments; however, in 2011 almost all vaccine doses were available by November, which should reduce any adverse impact of shipping schedules on immunization coverage in the current influenza season.
9. Patients enrolled in WIC continue to receive immunization education, reminder and follow-up phone calls. These remain important to assure that WIC infant immunization rates remain equivalent, or exceed, those of children who do not qualify for WIC.
10. TIP will continue to conduct the annual Immunization Spring Review, free to all healthcare providers enrolled in the VFC program, and other educational outreach, including site visits to the offices of VFC vaccine providers. All immunization providers should know risk factors for delayed immunization and the importance of reminder-recall systems to help families keep up with current immunization recommendations.
11. TIP will conduct site visits in 50% of VFC participating offices annually to evaluate compliance with VFC Program requirements and to provide education.
10. The 2012 survey will again assess the 4:3:1:3:3:1:4 series, influenza, HAV, and RTV vaccine.

Appendix 1

2011 Immunization Status Survey Of 24-Month-Old Children in Tennessee

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

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Details of Regional Samples (oversampled, vaccine refusal, child not located)	... 17
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2011 Immunization Status Survey of 24-Month-Old Children in Tennessee

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

Region	Records analyzed ¹ (oversampled) ²	Total vaccine refusals	Reason given for refusing vaccine ³			Total % Refusal	Children who could not be located ⁴	Total % not located
			Religious	Philosophical	Medical			
Northeast TN	114 (0)	0	-	-	-	-	0	-
East TN	117 (3)	3	-	3	-	2.6%	2	1.7%
Southeast TN	114 (6)	6	3	3	-	5.3%	0	-
Upper Cumberland	112 (0)	0	-	-	-	-	1	0.9%
Mid-Cumberland	113 (1)	1	-	-	1	0.9%	6	4.4%
South Central	112 (4)	4	3	-	1	3.6%	1	0.9%
West TN	118 (4)	4	3	-	1	3.4%	0	-
Shelby County	112 (1)	1	-	-	1	0.9%	1	0.9%
Davidson County	111 (0)	0	-	-	-	-	3	2.7%
Knox County	108 (3)	3	-	2	1	2.8%	0	-
Hamilton County	110 (4)	4	1	2	1	3.6%	0	-
Madison County	115 (0)	0	-	-	-	-	4	3.5%
Sullivan County	109 (0)	0	-	-	-	-	0	-
TOTAL	1465 (24)	26 of 1465	10	10	6	1.8%	18 of 1465	1.3%

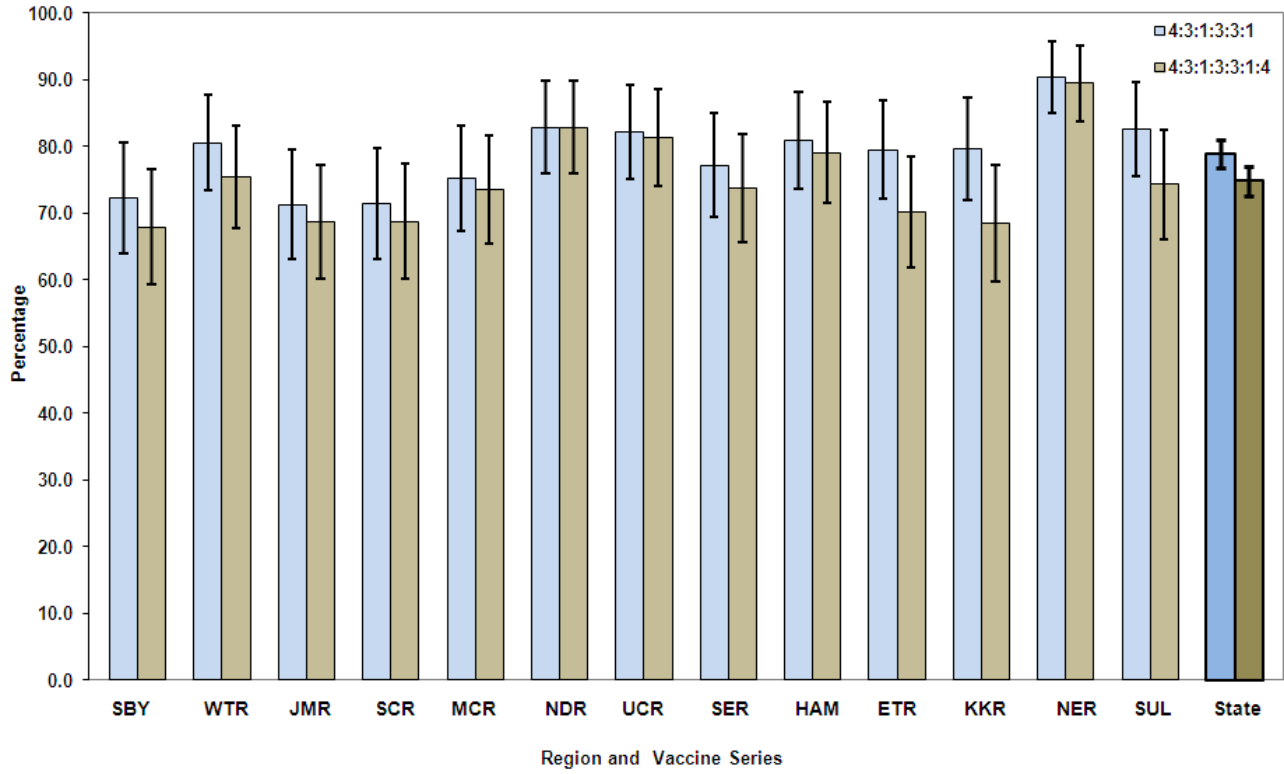
¹Total records included in analysis, excluding children in the original sample who had moved out of state or refused to participate.

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

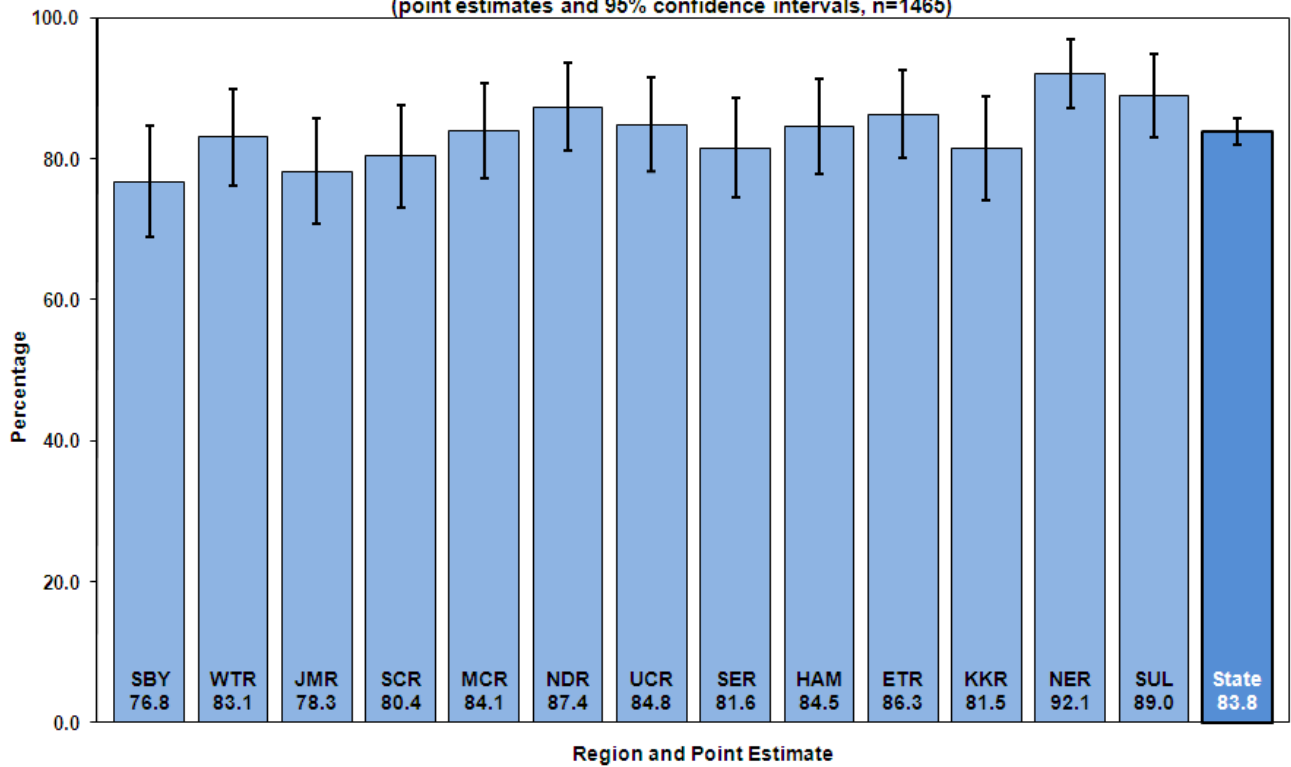
³Of the 26 who refused vaccination, 24 had received ≤ 2 doses and 2 (both in Hamilton) had received >2 doses. Specific medical reasons for refusing further doses of vaccine were not recorded, so the validity of the medical exemptions cannot be determined.

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. Of these, 9 had ≤ 2 or fewer doses in the registry, 9 had >2 doses in the registry.

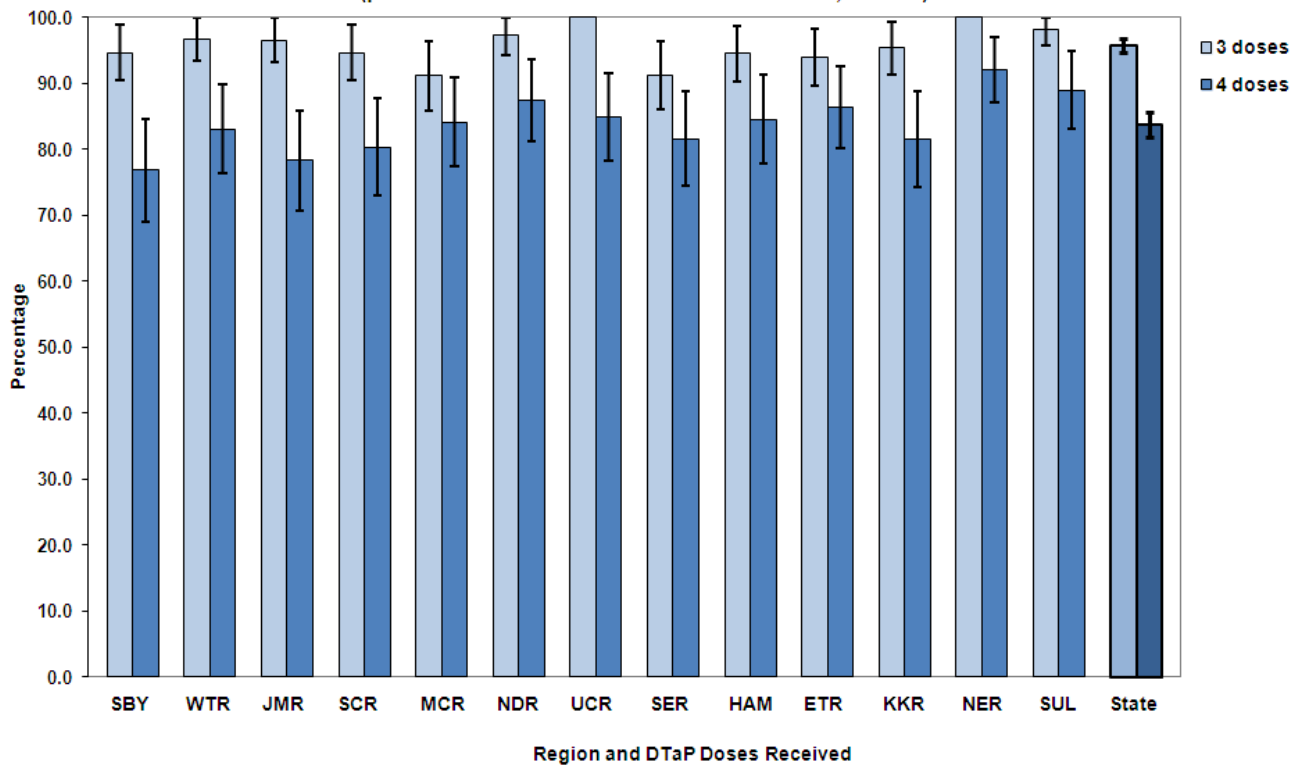
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage (%) of children complete for 4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series
 by health department region
 (point estimates and 95% confidence intervals, n=1465)**



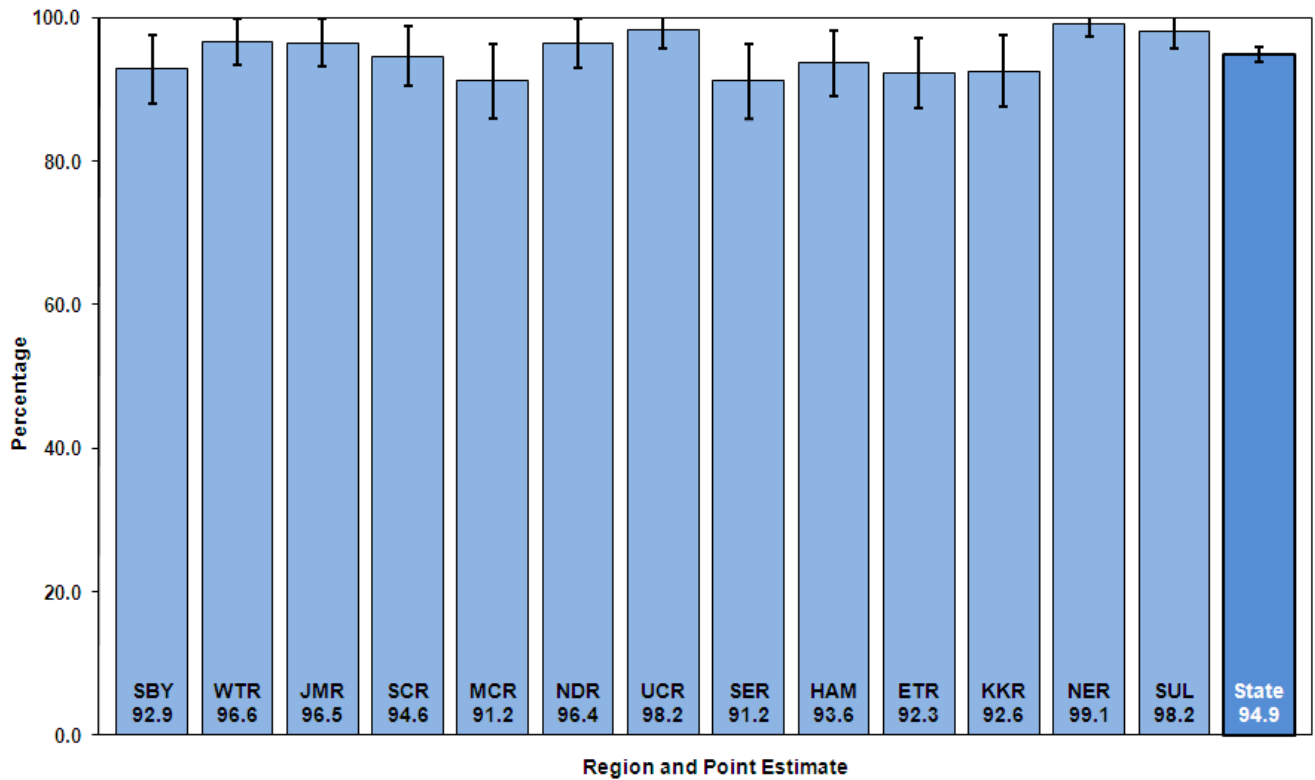
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with complete diphtheria, tetanus and acellular pertussis (DTaP) series
(4 doses) by health department region
(point estimates and 95% confidence intervals, n=1465)**



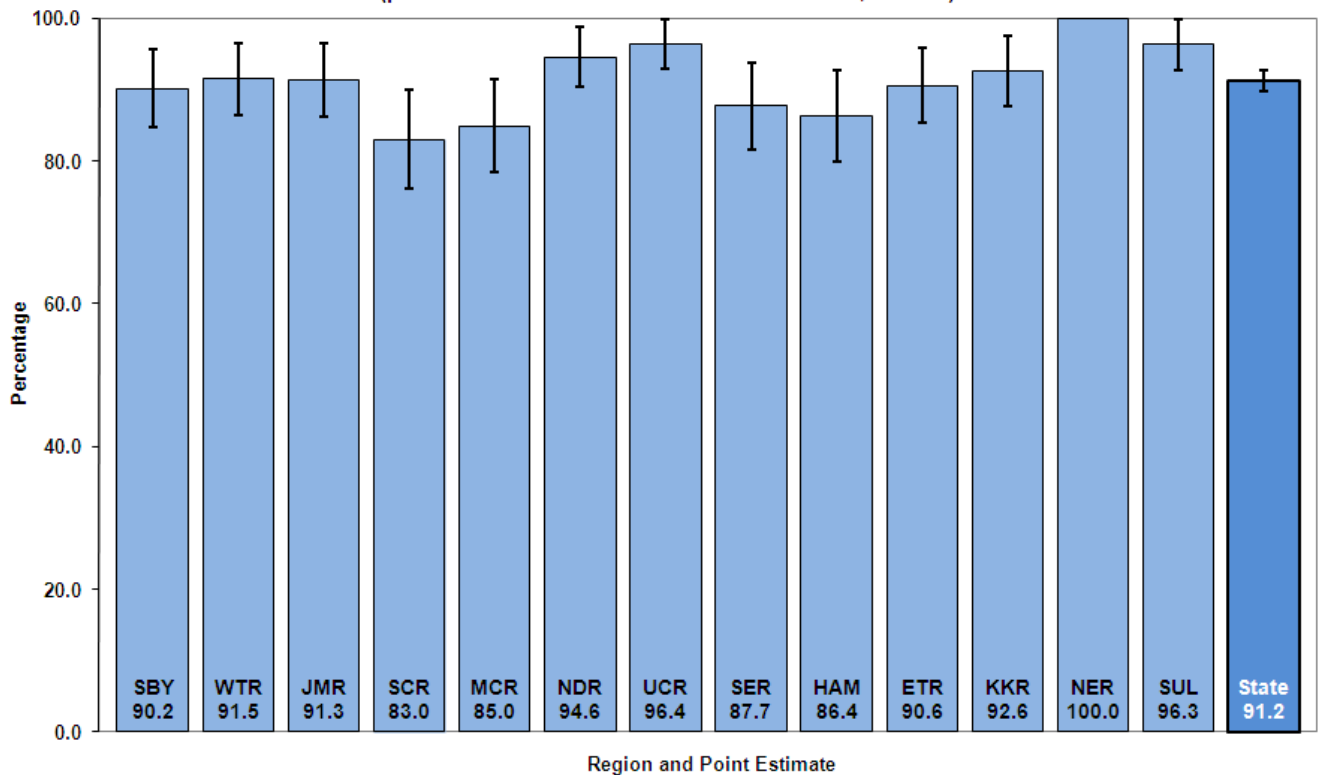
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee: Percentage of
children with 3 or 4 doses of diphtheria, tetanus and acellular pertussis (DTaP)
by health department region
(point estimates and 95% confidence intervals, n=1465)**



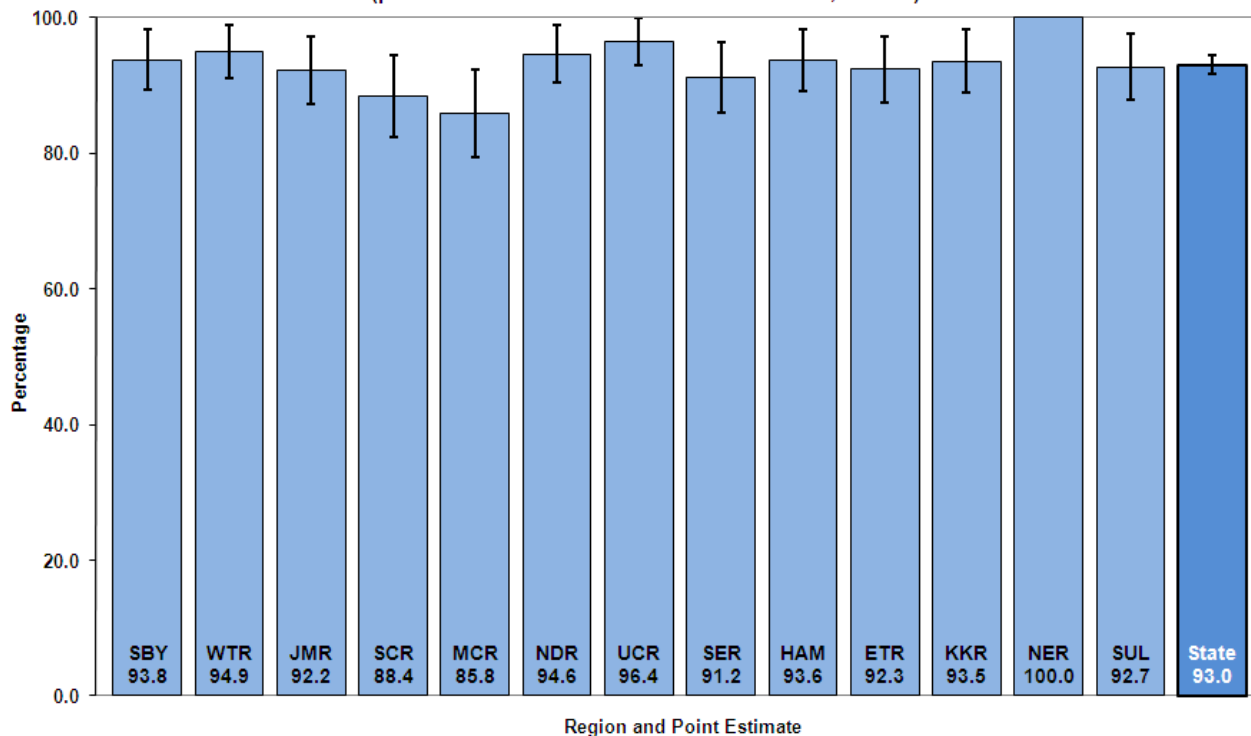
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete polio (IPV) series (3 doses) by health department region
 (point estimates and 95% confidence intervals, n=1465)



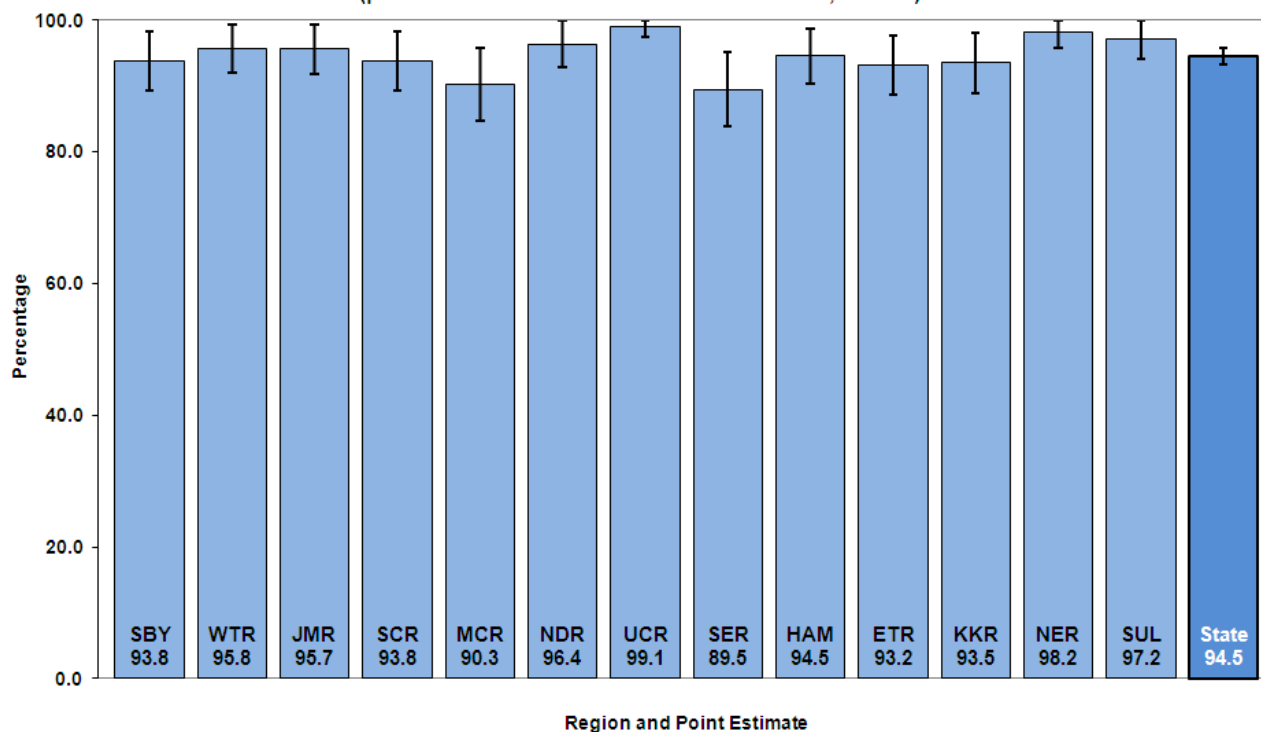
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete measles, mumps, and rubella (MMR) series (1 dose)
 by health department region
 (point estimates and 95% confidence intervals, n=1465)



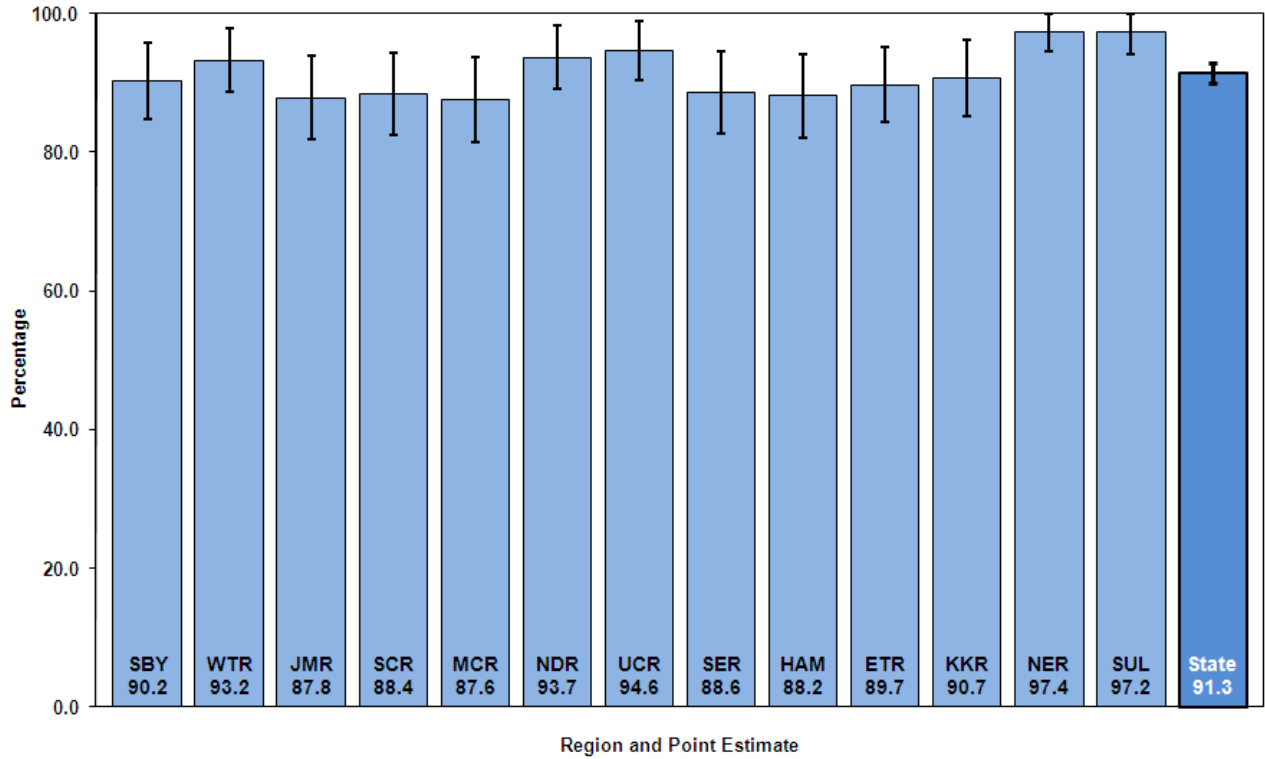
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete Hepatitis B (HBV) series (≥ 3 doses)
 by health department region
 (point estimates and 95% confidence intervals, n=1465)



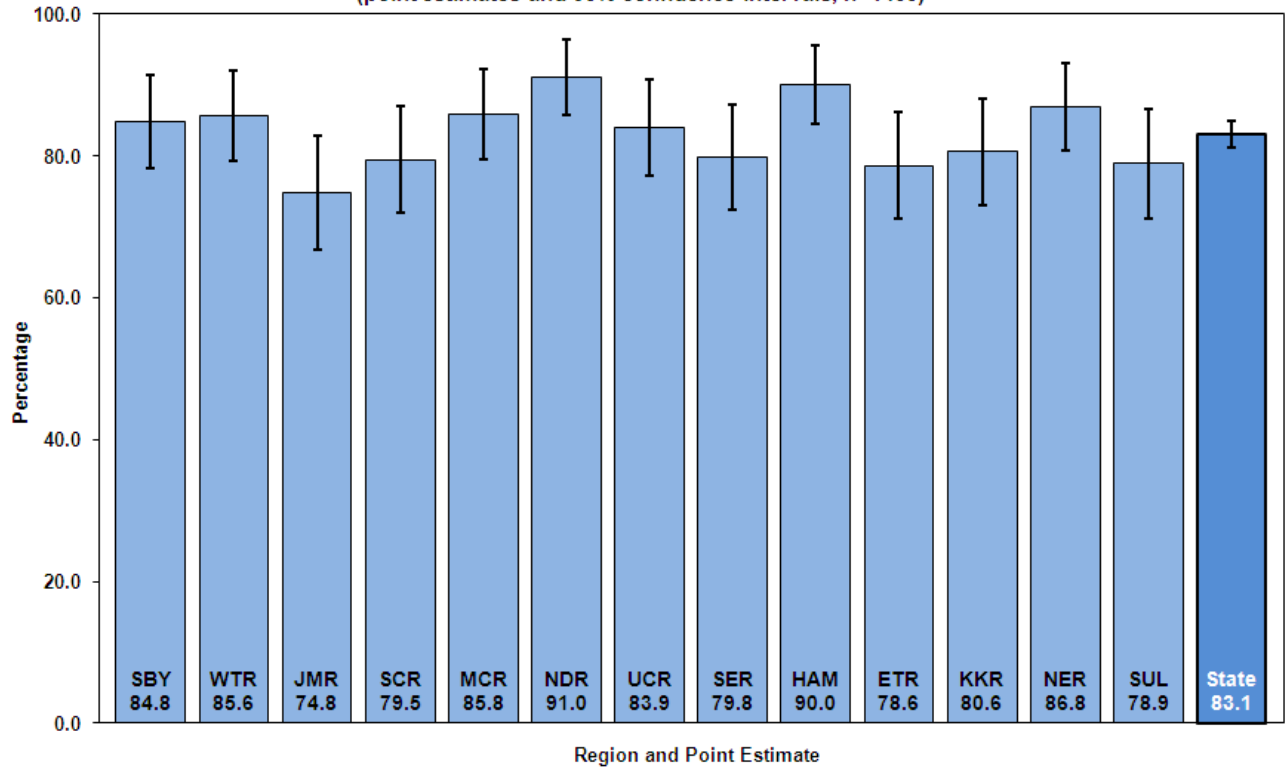
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children with complete *Haemophilus influenzae* type B (Hib) series (≥ 3 doses)
 by health department region
 (point estimates and 95% confidence intervals, n=1465)



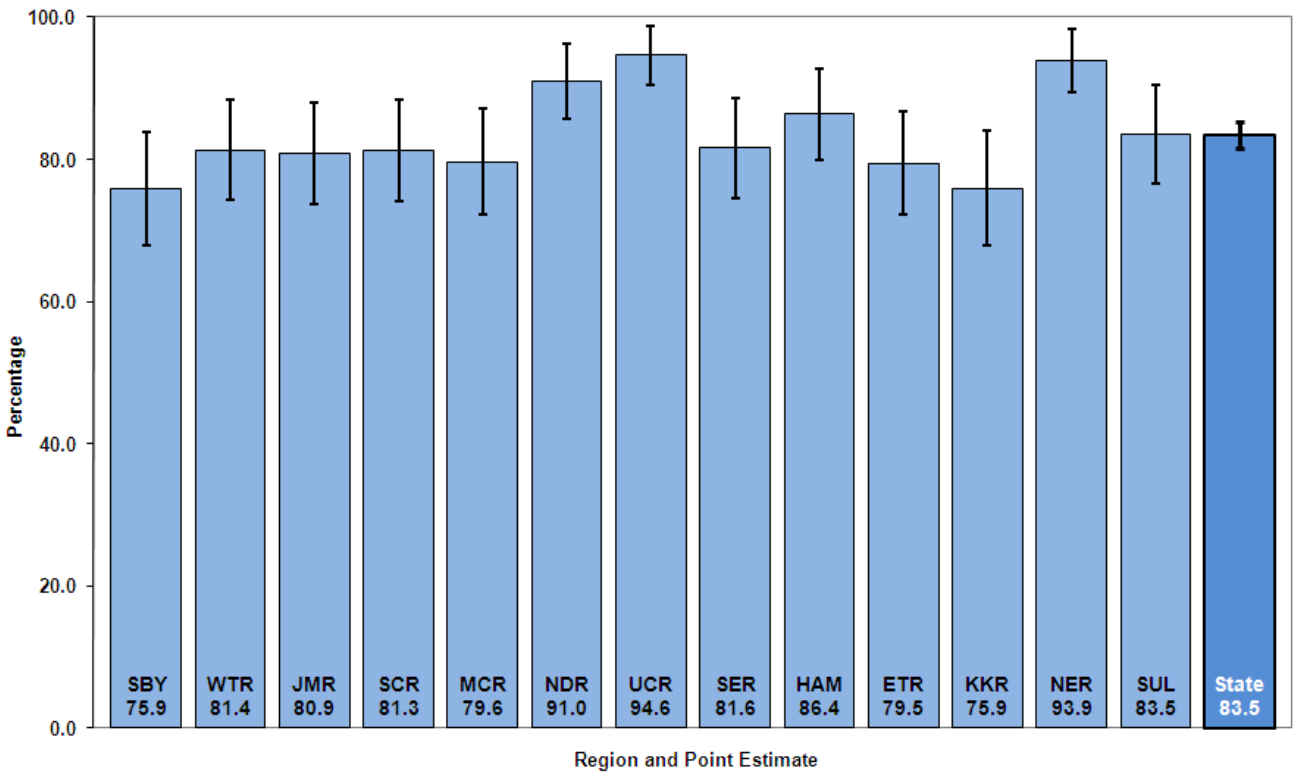
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with complete varicella series (1 dose) by health department region
(point estimates and 95% confidence intervals, n=1465)**



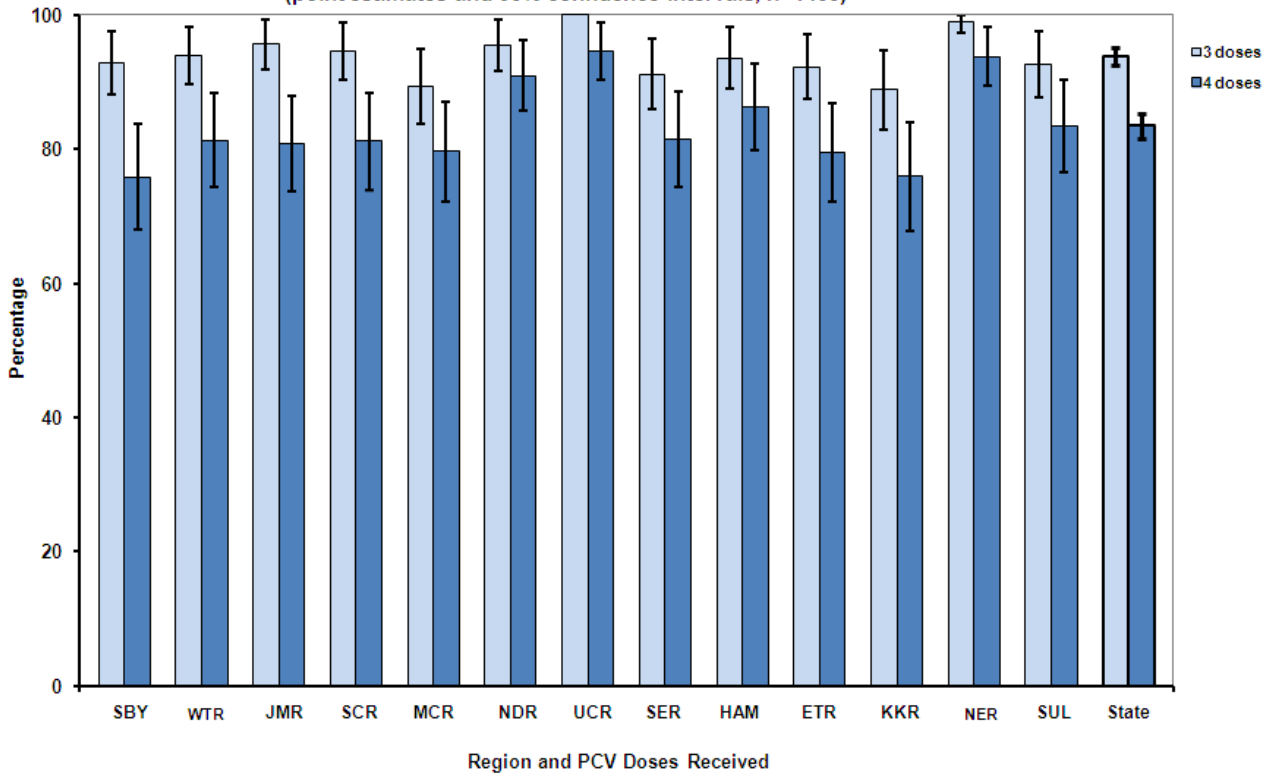
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with complete Rotavirus (RTV) series (≥2 doses)
by health department region
(point estimates and 95% confidence intervals, n=1465)**



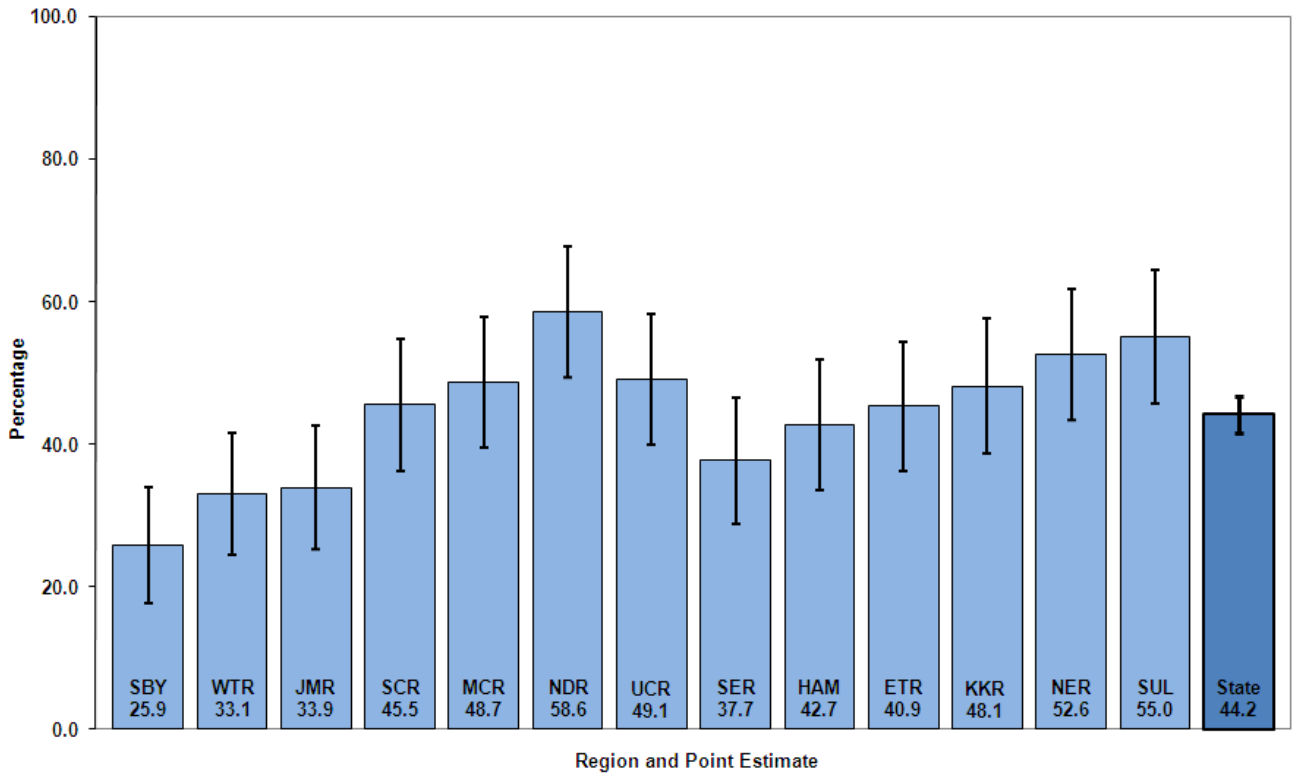
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with complete PCV series (4 doses) by health department region
(point estimates and 95% confidence intervals, n=1465)**



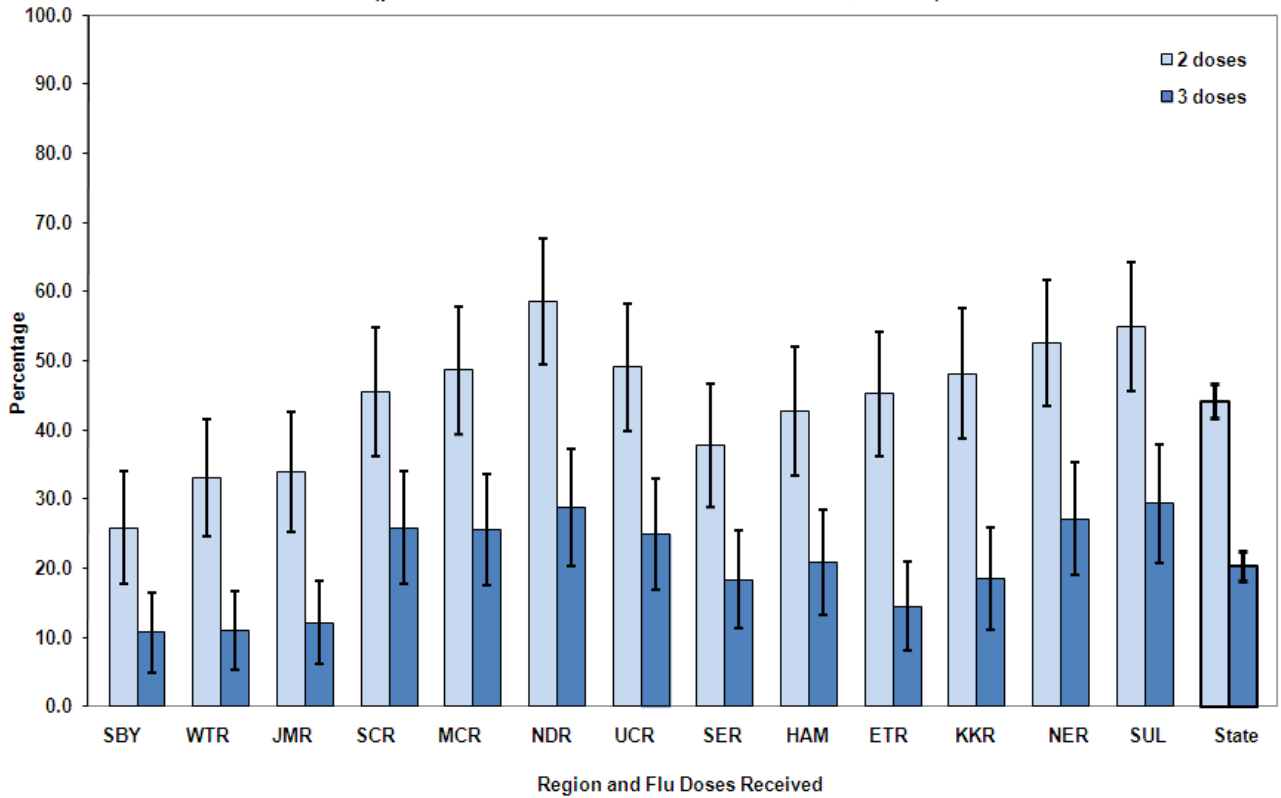
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with 3 or 4 doses of PCV by health department region
(point estimates and 95% confidence intervals, n=1465)**



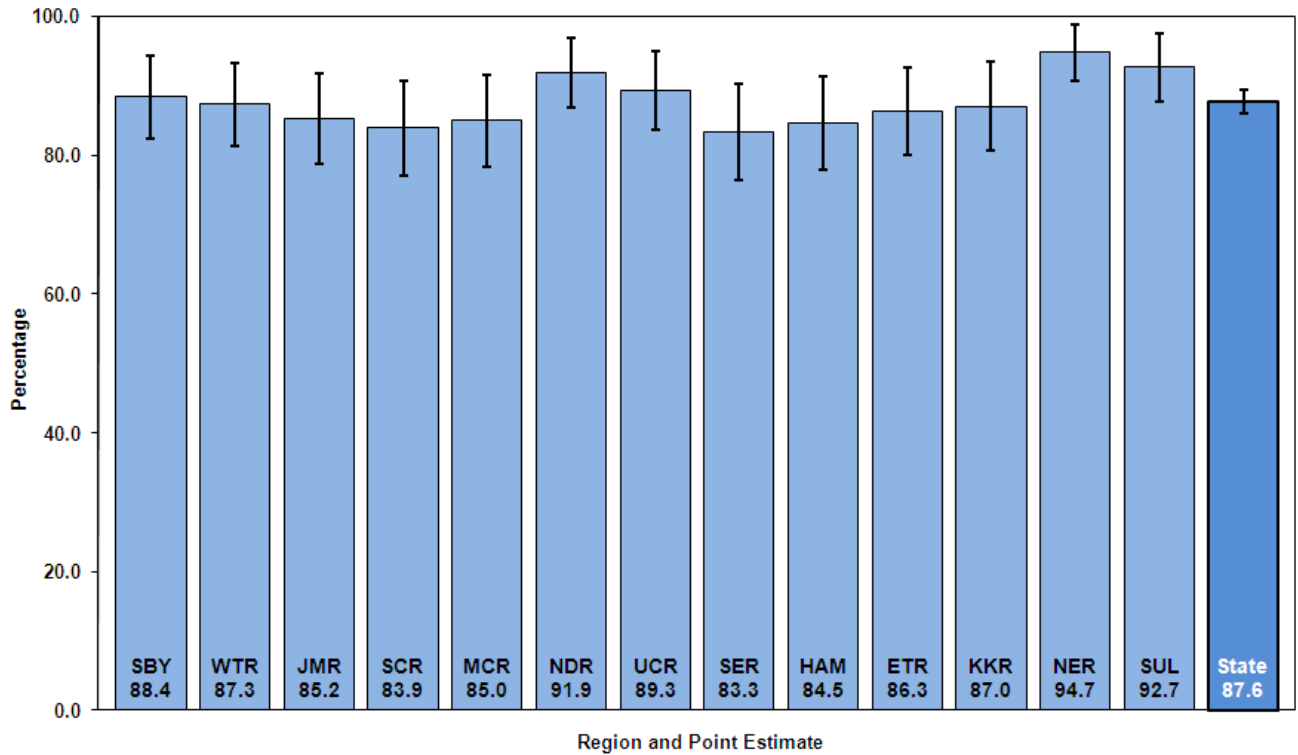
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with 2 doses of influenza vaccine by health department region
(point estimates and 95% confidence intervals, n=1465)**



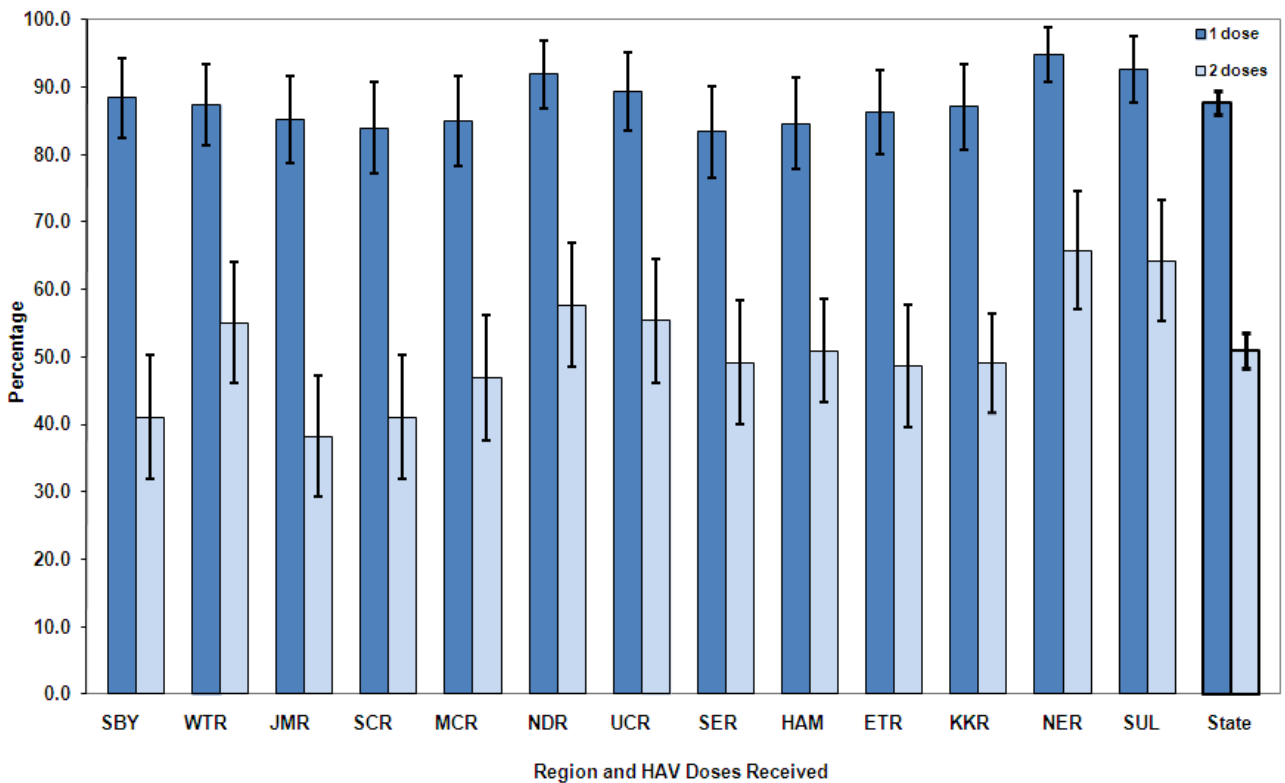
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children with 2 or 3 doses of Influenza vaccine by health department region
(point estimates and 95% confidence intervals, n=1465)**



**2011 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=1465)**



**2011 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=1465)**

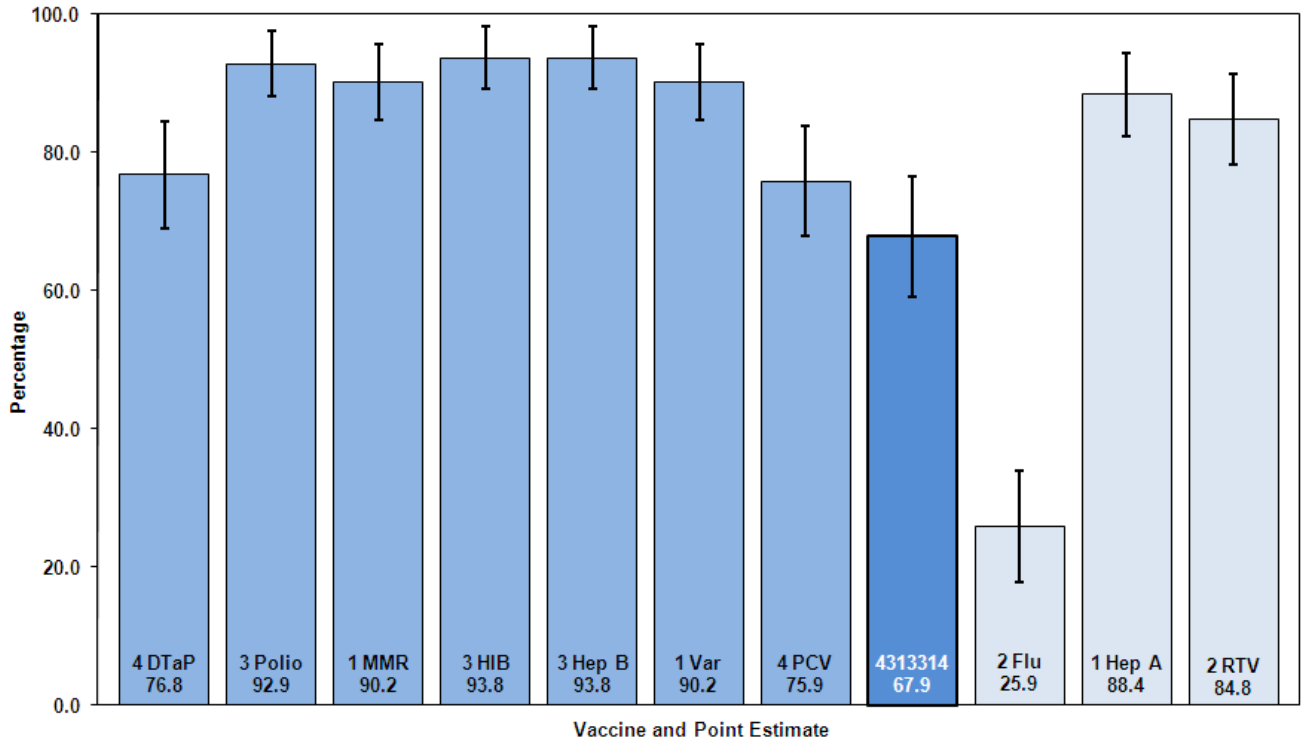


Appendix 2
2011 Immunization Status Survey
Of 24-Month-Old Children in Tennessee

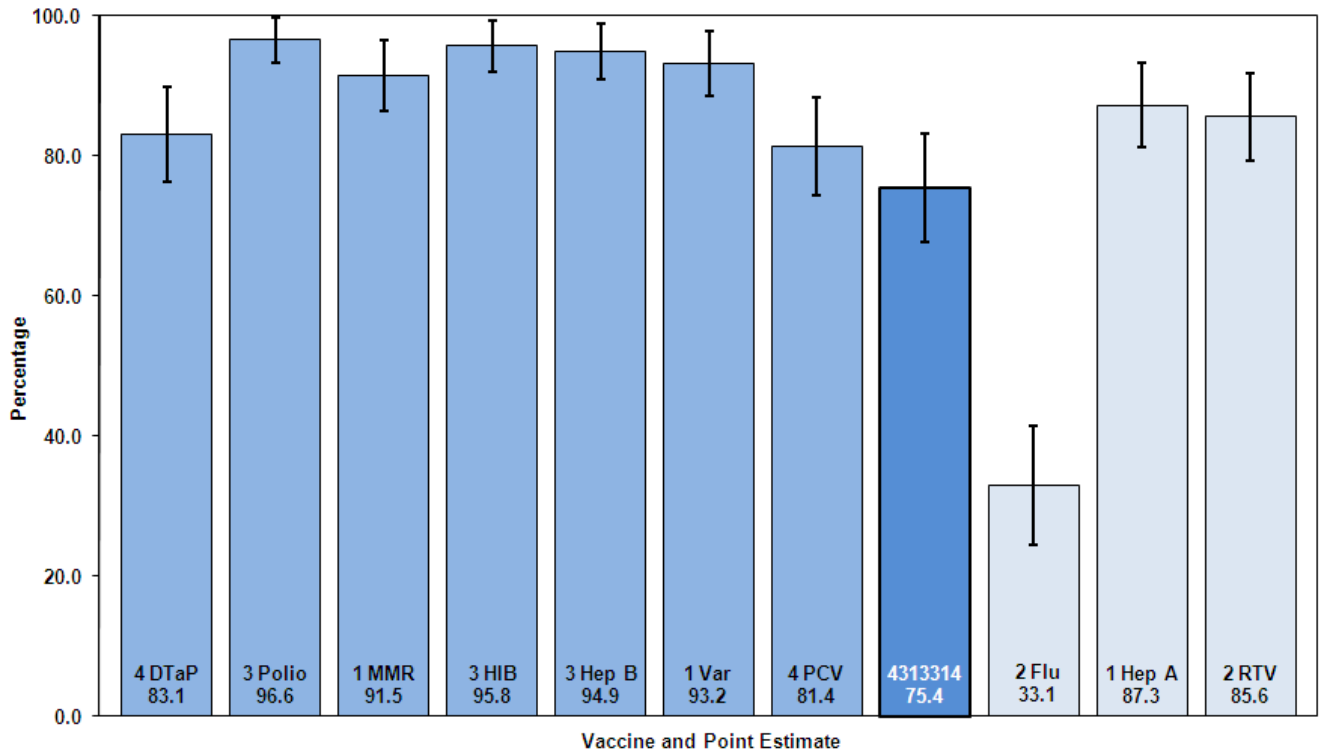
**Individual Health Department Region Charts with Coverage Rates for All
Vaccines Assessed**

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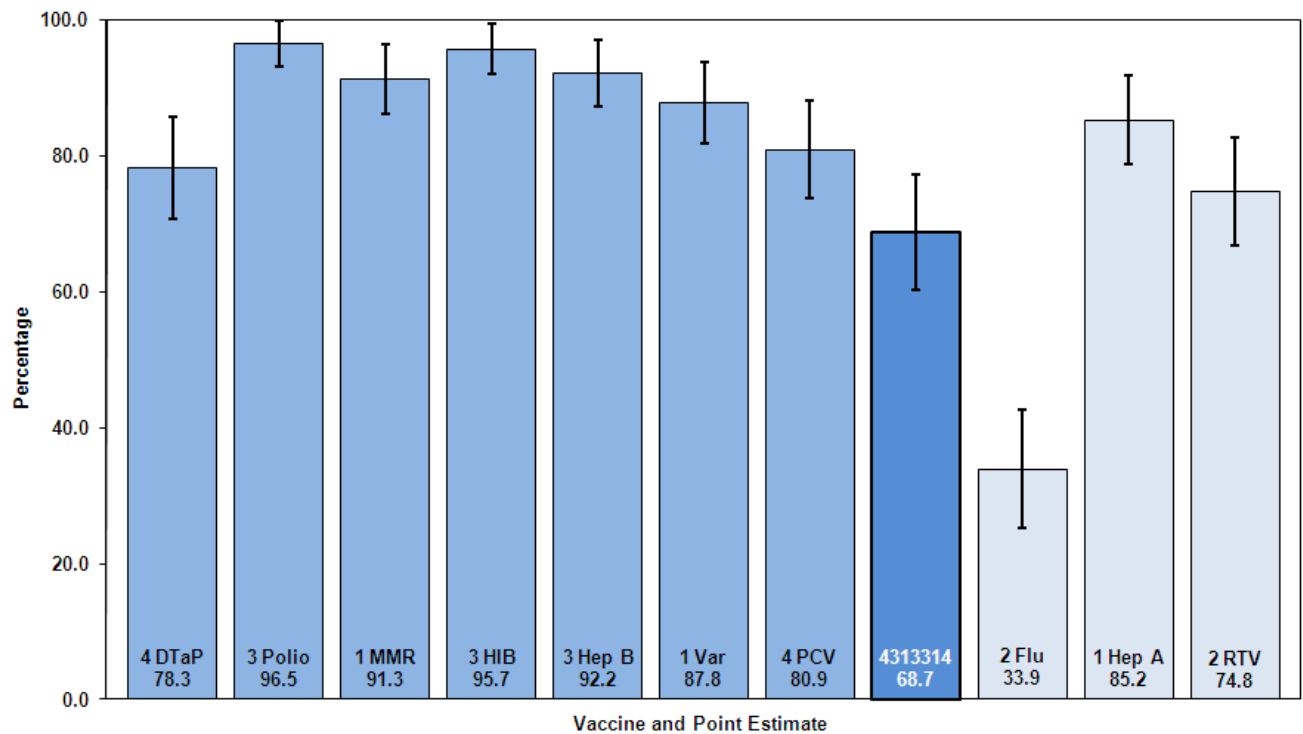
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children complete in Shelby County (SBY) by vaccine
 (point estimates and 95% confidence intervals, n=112)



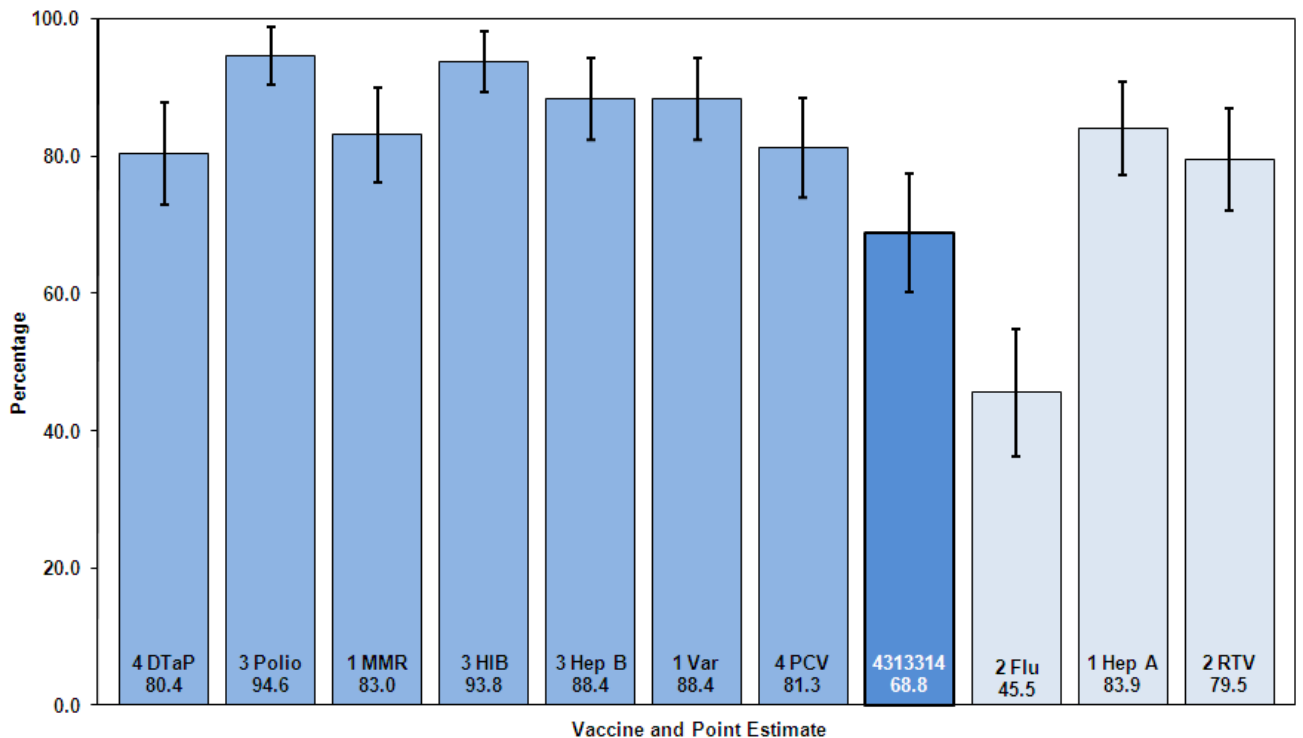
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children complete in West Tennessee Region (WTR) by vaccine
 (point estimates and 95% confidence intervals, n=118)



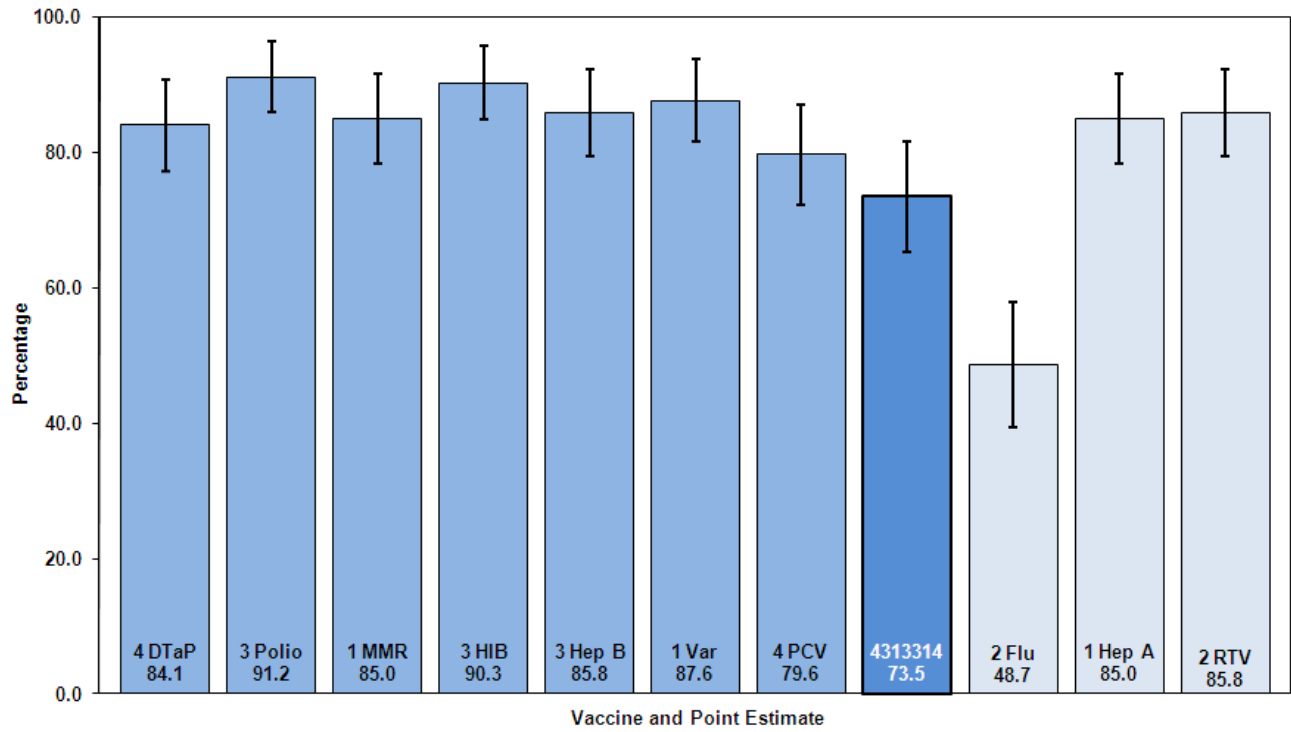
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Jackson-Madison Region (JMR) by vaccine
(point estimates and 95% confidence intervals, n=115)**



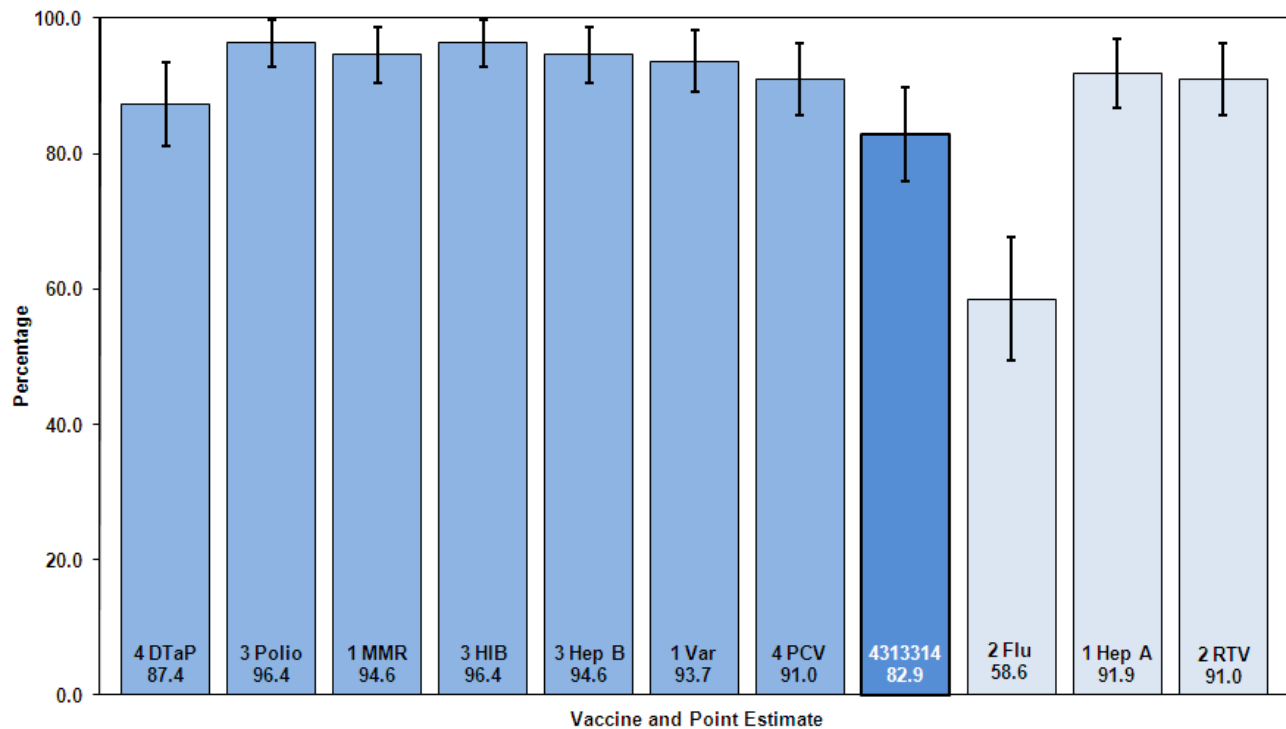
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in South Central Region (SCR) by vaccine
(point estimates and 95% confidence intervals, n=112)**



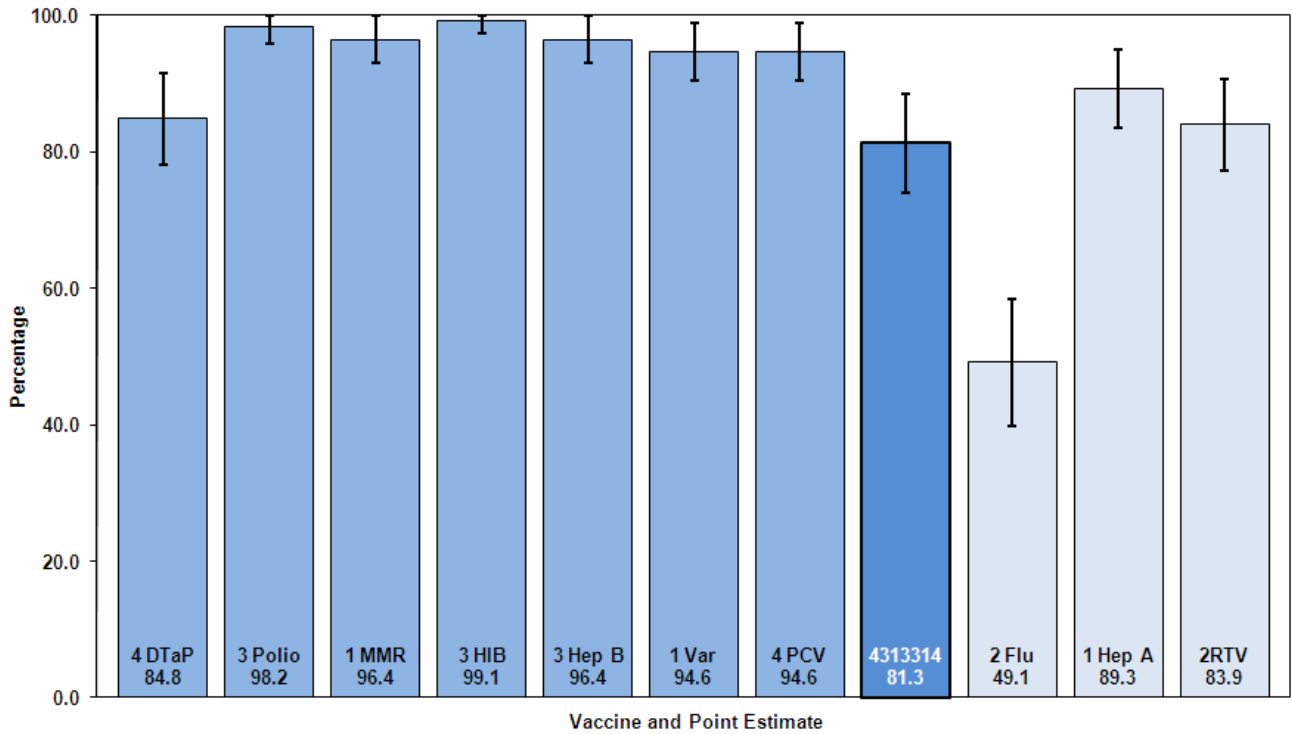
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Mid-Cumberland Region (MCR) by vaccine
(point estimates and 95% confidence intervals, n=113)**



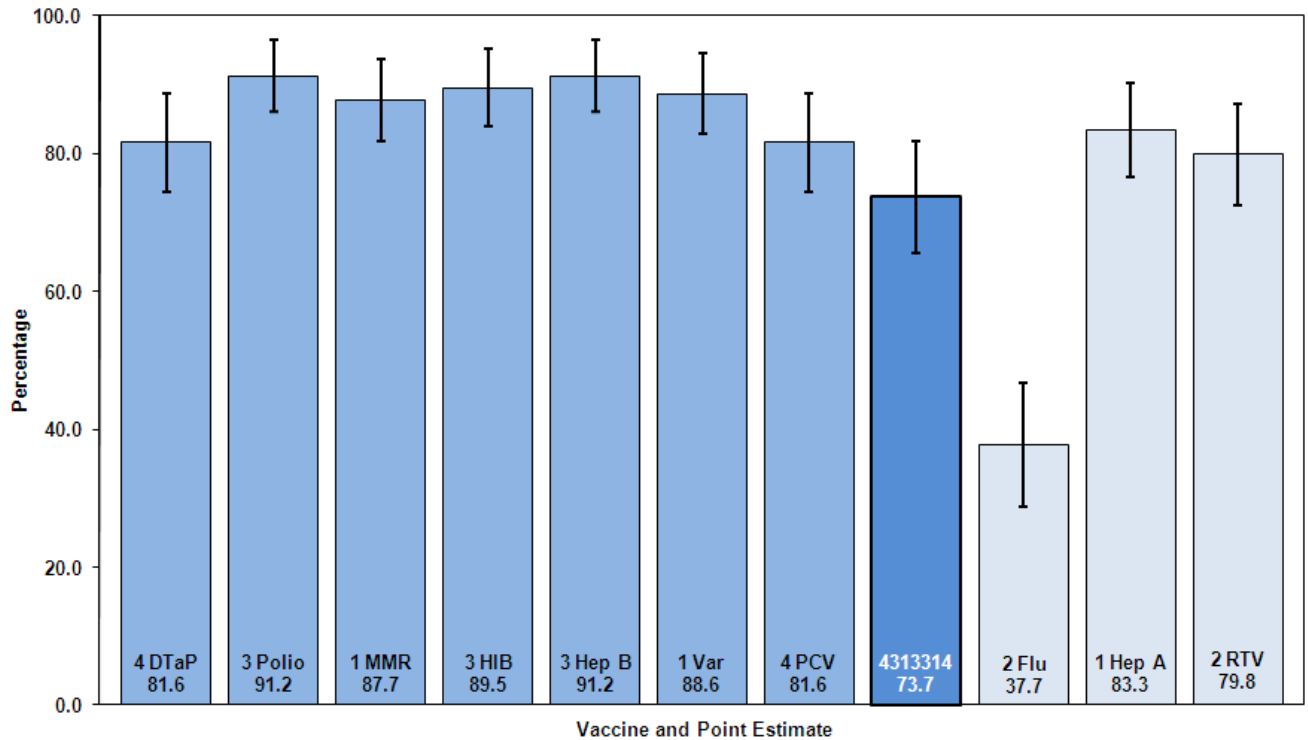
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Nashville-Davidson Region (NDR) by vaccine
(point estimates and 95% confidence intervals, n=111)**



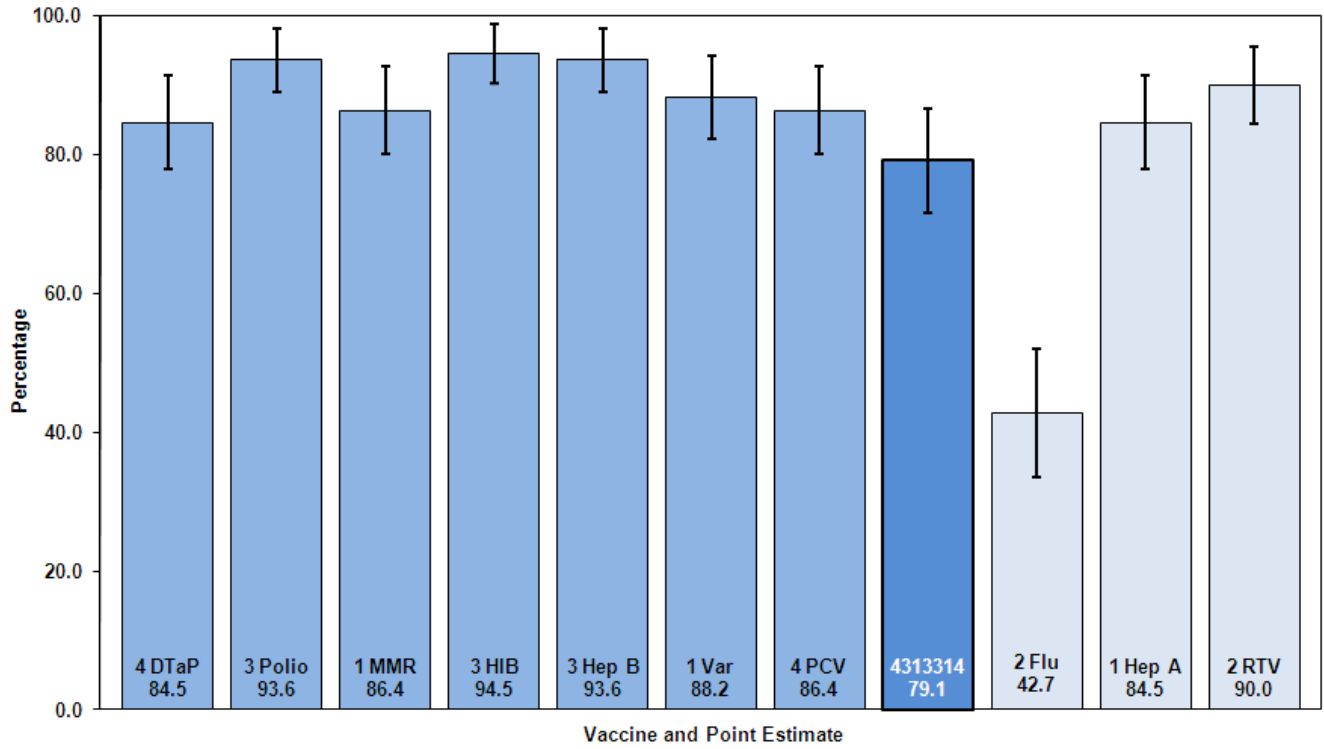
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children complete in Upper Cumberland Region (UCR) by vaccine
 (point estimates and 95% confidence intervals, n=112)



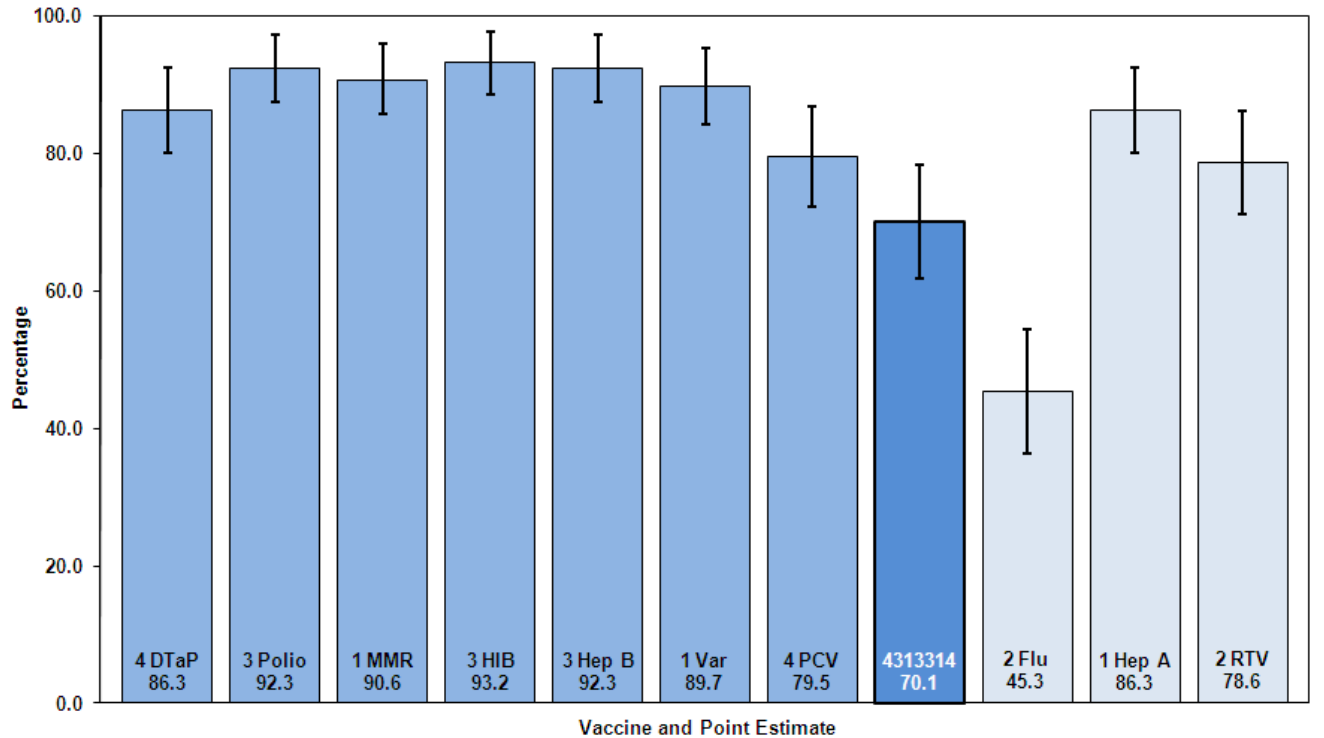
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children complete in Southeast Region (SER) by vaccine
 (point estimates and 95% confidence intervals, n=114)



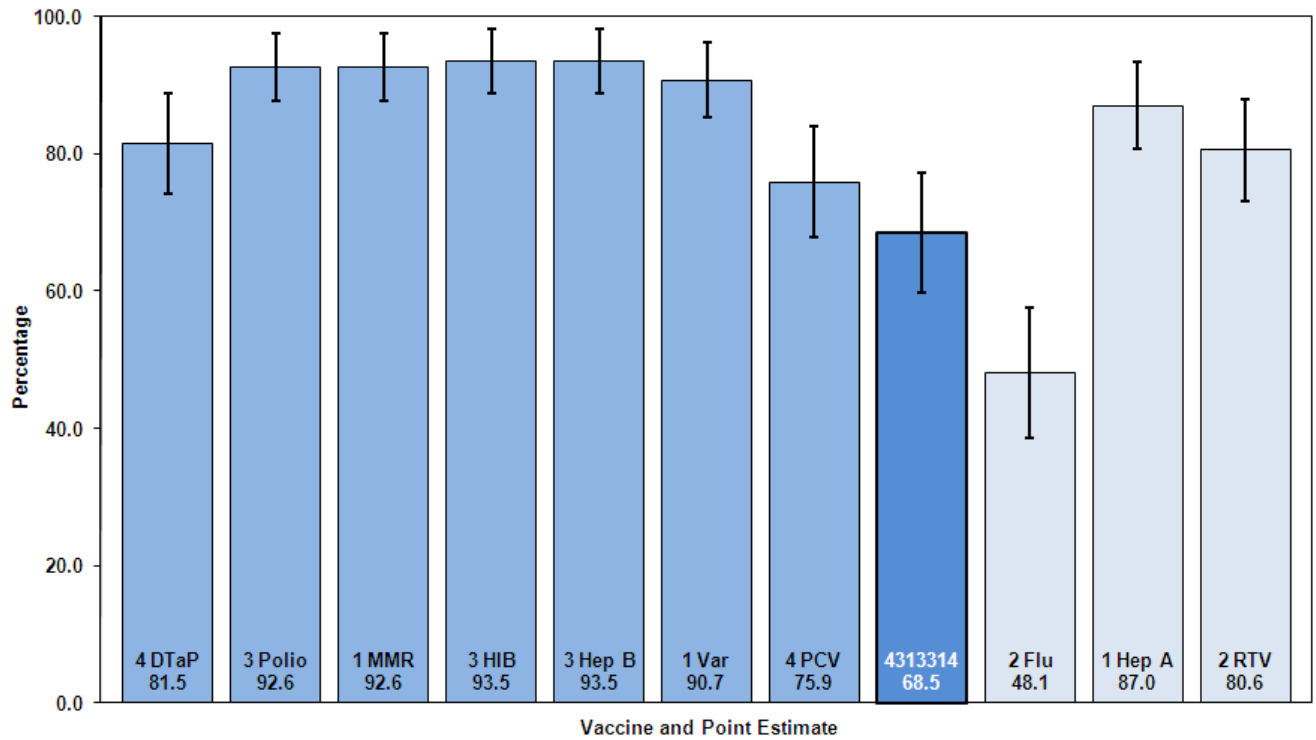
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in Hamilton County (HAM) by vaccine
(point estimates and 95% confidence intervals, n=110)**



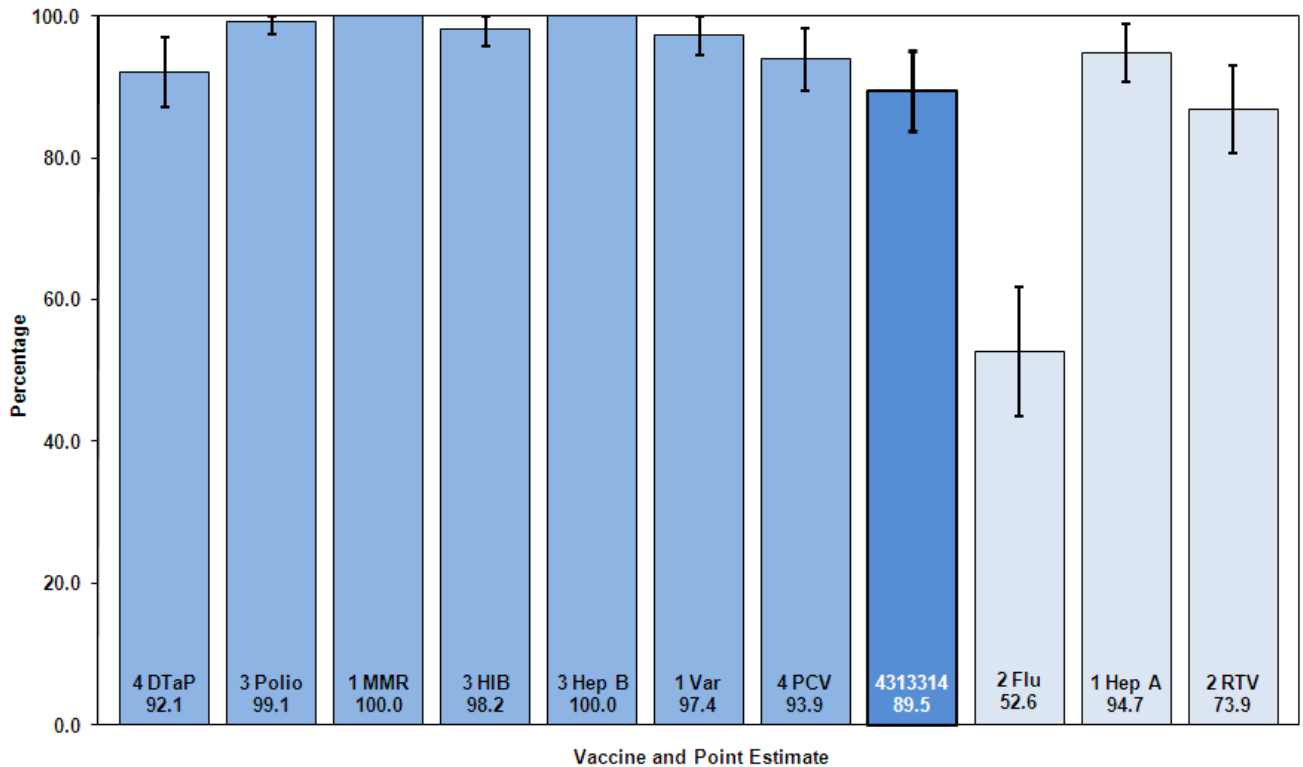
**2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
Percentage of children complete in East Tennessee Region (ETR) by vaccine
(point estimates and 95% confidence intervals, n=117)**



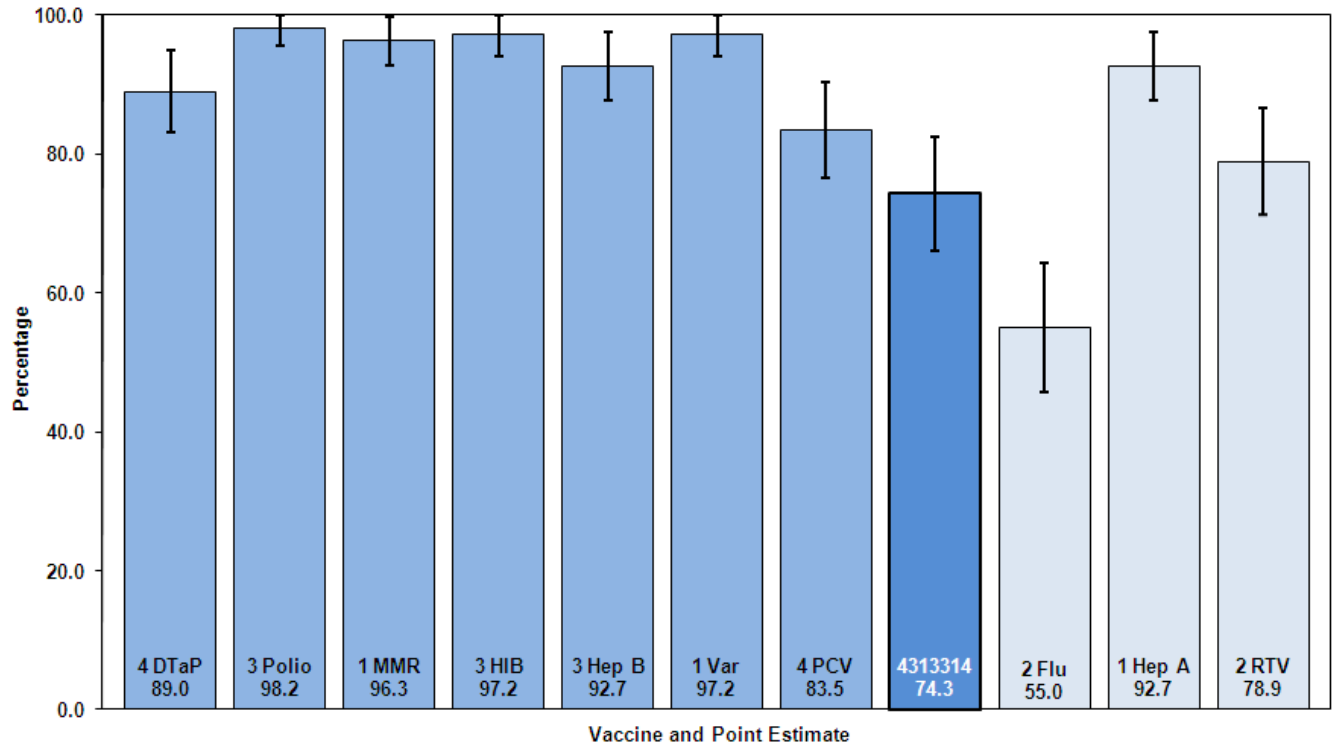
2011 Immunization Status Survey of 24-Month-Old Children in Tennessee:
 Percentage of children complete in Knoxville-Knox Region (KKR) by vaccine
 (point estimates and 95% confidence intervals, n=108)



2011 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=114)



2011 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=109)



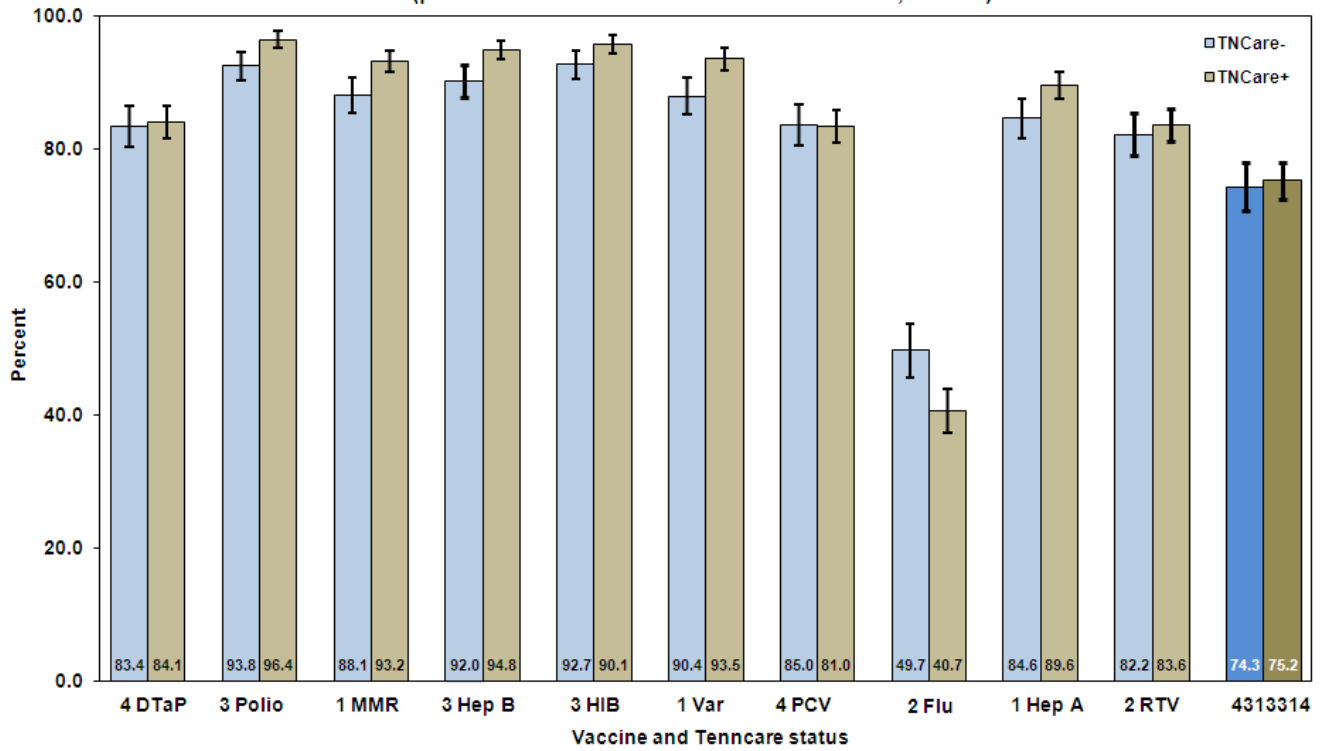
Appendix 3

2011 Immunization Status Survey Of 24-Month-Old Children in Tennessee

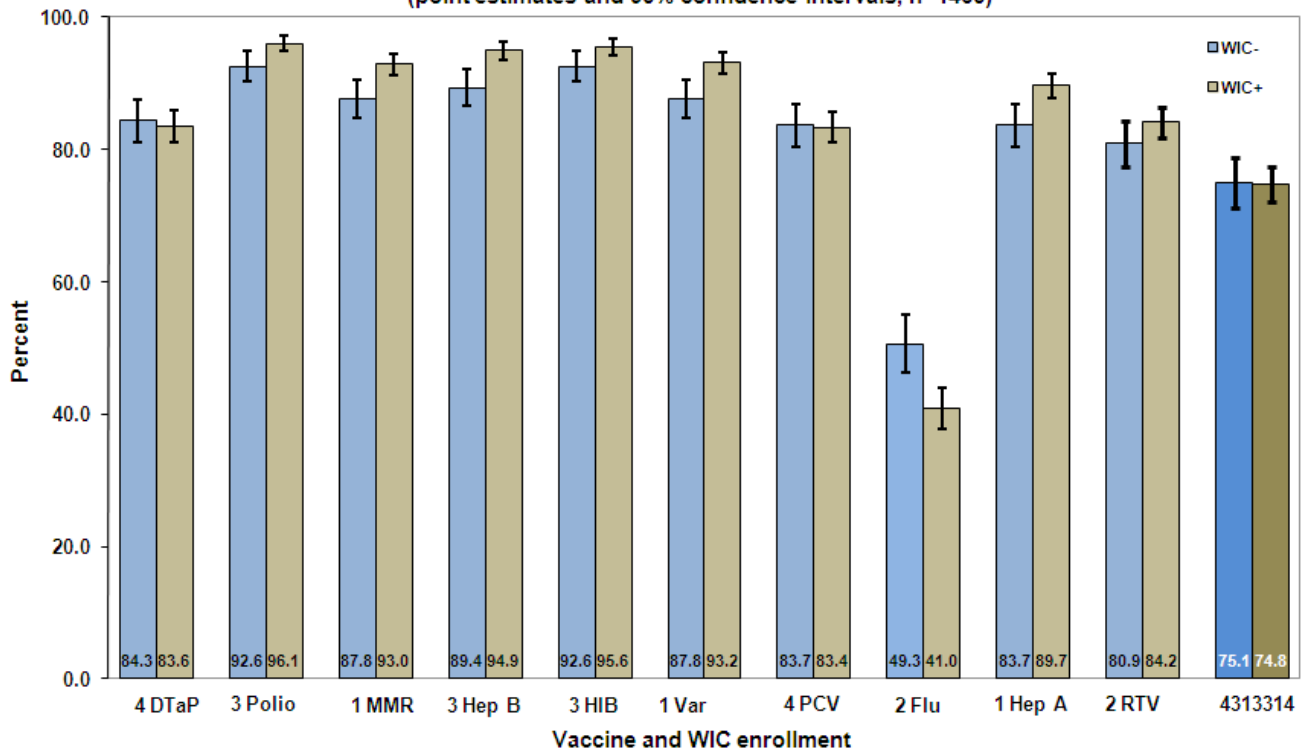
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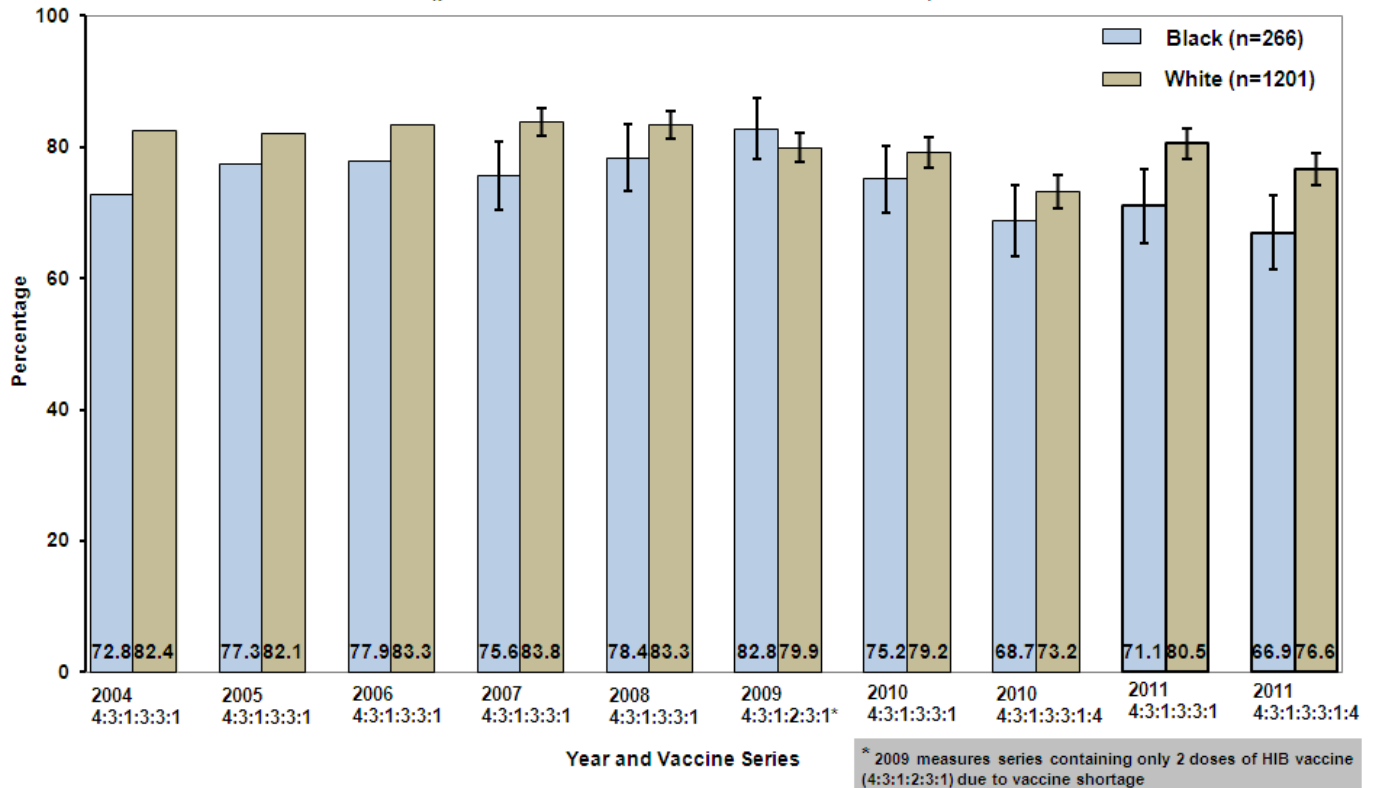
**2011 Immunization Status of 24-Month-Old Children in Tennessee:
Statewide percentage of children with age-appropriate immunization levels
by vaccine and TennCare enrollment status
(point estimates and 95% confidence intervals, n=1465)**



**2011 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=1465)**



**2011 Immunization Status of 24-Month-Old Children in Tennessee:
Statewide percentage of children with age-appropriate immunization levels
by vaccine series and race
(point estimates and 95% confidence intervals)**



Appendix 4

2011 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) by Provider Type	... 38
Series Complete (4:3:1:3:3:1:4) by Race	... 39
Series Complete (4:3:1:3:3:1:4) by Number of Older Siblings	... 39
Series Complete (4:3:1:3:3:1:4) by TennCare Enrollment	... 40

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

Region	Yes		No		Total
	n=	%	n=	%	n=
Northeast TN	102	89.5%	12	10.5%	114
East TN	82	70.1%	35	29.9%	117
Southeast TN	84	73.7%	30	26.3%	114
Upper Cumberland	91	81.3%	21	18.7%	112
Mid-Cumberland	83	73.5%	30	26.5%	113
South Central	77	68.7%	35	31.3%	112
West TN	89	75.4%	29	24.6%	118
Shelby County	76	67.9%	36	32.1%	112
Davidson County	92	82.9%	19	17.1%	111
Knox County	74	68.5%	34	31.5%	108
Hamilton County	87	79.1%	23	20.9%	110
Madison County	79	68.7%	36	31.3%	115
Sullivan County	81	74.3%	28	26.7%	109
Total	1097	74.9%	358	25.1%	1465

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	9	66.7%	79	83	95.1%	17	22	77.3%
East TN	3	7	42.9%	71	93	76.3%	8	13	61.5%
Southeast TN	7	7	100.0%	60	76	78.9%	17	25	68.0%
Upper Cumberland	2	3	66.7%	75	91	82.4%	14	18	77.8%
Mid-Cumberland	0	1	0.0%	74	95	77.9%	9	12	75.0%
South Central	10	10	100.0%	54	76	71.1%	13	22	59.1%
West TN	21	28	75.0%	49	62	79.0%	19	25	76.0%
Shelby County	2	5	40.0%	56	77	72.7%	18	28	64.3%
Davidson County	2	4	50.0%	84	98	85.7%	6	8	75.0%
Knox County	2	3	66.7%	60	86	69.8%	12	16	75.0%
Hamilton County	1	2	50.0%	71	87	81.6%	15	19	78.9%
Madison County	15	23	65.2%	47	64	73.4%	17	28	60.7%
Sullivan County	6	12	50.0%	63	83	75.9%	12	14	85.7%
Total	77	114	67.5%	843	1071	78.7%	177	250	70.8%

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

Region	White			Black			Other		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	99	111	89.2%	3	3	100.0%	0	0	0.0%
East TN	80	113	70.8%	2	3	66.7%	0	1	0.0%
Southeast TN	82	110	74.6%	1	4	25.0%	1	1	100.0%
Upper Cumberland	90	110	81.8%	1	2	50.0%	0	0	0.0%
Mid-Cumberland	78	101	77.2%	7	12	58.3%	1	3	33.3%
South Central	72	105	68.6%	5	6	83.3%	1	2	50.0%
West TN	76	97	78.4%	15	24	62.5%	1	1	100.0%
Shelby County	23	33	69.7%	51	77	66.2%	2	2	100.0%
Davidson County	66	78	84.6%	29	36	80.6%	3	4	75.0%
Knox County	60	86	69.8%	11	17	64.7%	3	5	60.0%
Hamilton County	70	87	80.5%	16	26	61.5%	2	2	100.0%
Madison County	48	66	72.7%	32	51	62.8%	1	1	100.0%
Sullivan County	76	104	73.1%	5	5	100.0%	0	0	0.0%
Total	920	1201	76.6%	178	266	66.9%	15	22	68.2%

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

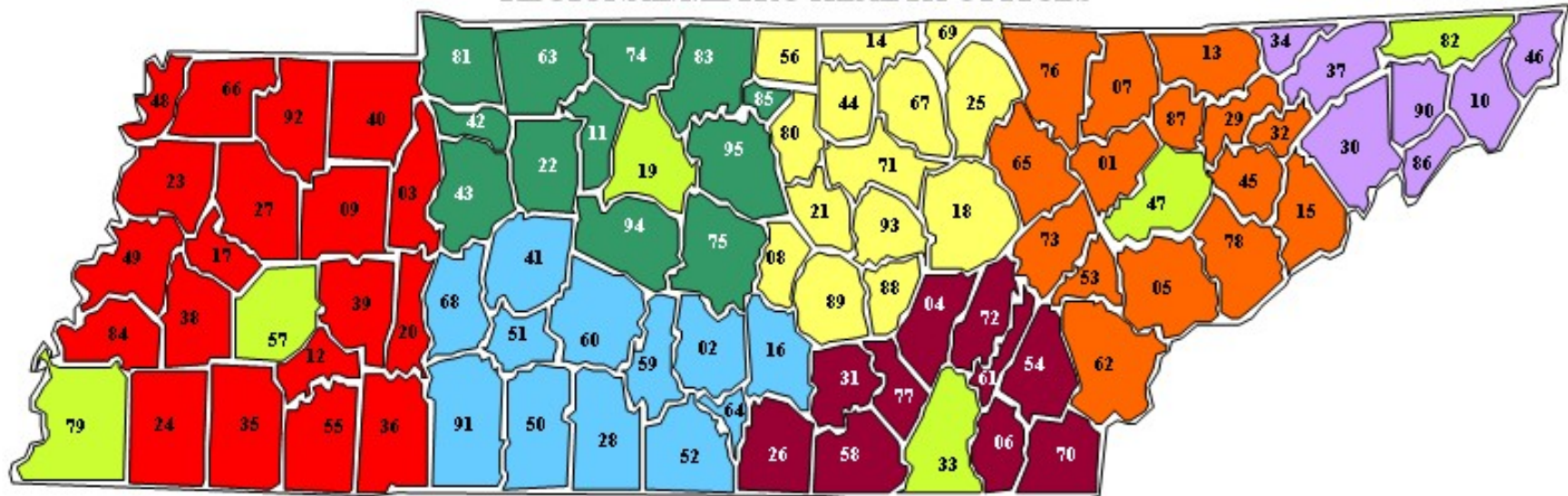
Region	0 Siblings			1 Siblings			2+Siblings		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	48	53	90.6%	35	38	92.1%	19	23	82.6%
East TN	34	48	70.8%	32	46	69.6%	15	22	68.2%
Southeast TN	36	41	87.8%	31	41	75.6%	17	32	53.1%
Upper Cumberland	42	48	87.5%	36	41	87.8%	13	23	56.5%
Mid-Cumberland	44	52	84.6%	23	37	62.2%	16	24	66.7%
South Central	25	32	78.1%	28	39	71.8%	24	41	58.5%
West TN	42	52	80.8%	31	40	77.5%	16	26	61.5%
Shelby County	24	35	68.6%	32	48	66.7%	20	29	69.0%
Davidson County	40	43	93.0%	27	35	77.1%	23	31	74.2%
Knox County	33	45	73.3%	23	36	63.9%	18	27	66.7%
Hamilton County	45	48	93.8%	29	37	78.4%	13	25	52.0%
Madison County	39	54	72.2%	23	33	69.7%	17	28	60.7%
Sullivan County	40	52	76.9%	23	33	69.7%	18	24	75.0%
Total	492	603	81.6%	373	504	74.0%	229	355	64.5%

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

Region	Enrolled			Not Enrolled		
	Yes	Total	%	Yes	Total	%
Northeast TN	62	72	86.1%	40	42	95.2%
East TN	56	79	70.9%	26	38	68.4%
Southeast TN	47	63	74.6%	37	51	72.6%
Upper Cumberland	65	76	85.5%	26	36	72.2%
Mid-Cumberland	35	45	77.8%	48	68	70.6%
South Central	50	74	67.6%	27	38	71.1%
West TN	71	88	80.7%	18	30	60.0%
Shelby County	60	90	66.7%	16	22	72.7%
Davidson County	56	64	87.5%	36	47	76.6%
Knox County	31	49	63.3%	43	59	72.9%
Hamilton County	40	49	81.6%	47	61	77.1%
Madison County	48	77	62.3%	31	38	81.6%
Sullivan County	50	66	75.8%	31	43	72.1%
Total	671	892	75.2%	426	573	74.4%

Appendix 5

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	Mauzy	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												