

# Results of the 2010 Immunization Status Survey Of 24-Month-Old Children in Tennessee

## Table of Contents

	Page
<b>Results of the 2010 Immunization Status Survey of 24-Month-Old Children in Tennessee...</b>	<b>3</b>
Figure 1. Statewide percentage of children with age-appropriate immunization levels by vaccine	... 5
Figure 2a. Percentage of children with on-time 4:3:1:3:3:1:4 immunization by health department region	... 6
Figure 2b. Percentage of children with on-time 4:3:1:3:3:1:4 immunization by health department region	... 7
Figure 3. Statewide percentage of age-appropriate vaccinations by vaccine, 2009 and 2010	... 7
Figure 4. 4:3:1:3:3:1:4 and 4:3:1:3:3:1 Immunization Level Trends: Tennessee 2000 to 2010	... 8
Figure 5. Trends in on-time immunization coverage disparities (Black vs. White): Tennessee 2004-2010	... 9
Figure 6. Statewide percentage of children with age-appropriate immunization levels by vaccine and race	... 10
Table 1. 4:3:1:3:3:1:4 Completion Levels of 24-Month-Old Children: Selected Characteristics	... 11
Figure 7. Source of Immunizations from 2000 to 2010	... 12
Table 2. Prevalence of risk factors for delayed immunizations by provider type	... 12
Summary of Key Findings	... 13
<b>Appendix 1: Individual Vaccine Charts</b>	<b>... 14</b>
4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series	... 15
DTaP	... 16
Polio & MMR	... 17
Hepatitis B & <i>Haemophilus influenzae</i> type b	... 18
Varicella	... 19
Pneumococcus (PCV)	... 20
Influenza	... 21
Hepatitis A	... 22
Rotavirus	... 23
<b>Appendix 2: Individual Health Department Region Charts</b>	<b>... 24</b>
Shelby County	... 25
West Tennessee Region	... 25
Jackson-Madison County	... 26
South Central Region	... 26
Mid-Cumberland Region	... 27
Nashville-Davidson County	... 27
Upper Cumberland Region	... 28
Southeast Region	... 28
Chattanooga-Hamilton County	... 29
East Tennessee Region	... 29
Knoxville-Knox County	... 30
Northeast Region	... 30
Sullivan County	... 31
<b>Appendix 3: Additional Statewide Charts for Specific Groups</b>	<b>... 32</b>
Immunization levels by vaccine and TennCare enrollment status	... 33
Immunization levels by vaccine and WIC enrollment status	... 33
<b>Appendix 4: Data Tables for Selected Analyses</b>	<b>... 34</b>
Series Complete (4:3:1:3:3:1:4)	... 35
Series Complete (4:3:1:3:3:1:4) by Provider Type	... 35
Series Complete (4:3:1:3:3:1:4) by Race	... 36
Series Complete (4:3:1:3:3:1:4) by Number of Older Siblings	... 36
Series Complete (4:3:1:3:3:1:4) by TennCare Enrollment	... 37
<b>Appendix 5: Regional Health Department Map</b>	<b>... 38</b>

## 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. **CHR:** Chattanooga-Hamilton County
  - iv. **NDR:** Nashville-Davidson County
  - v. **JMR:** Jackson-Madison County
  - vi. **SBY:** Shelby County (Memphis area)

# Results of the 2010 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:*

TIP's goal is for 90% of Tennessee's children to be completely immunized with each of 7 vaccines which protect against the following 11 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) and pneumococcus (PCV).

This survey uses the same definitions for complete immunization in 24 month old children 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 2010 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 we will focus 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), considered complete with 2 or more doses; hepatitis A vaccine (HAV), which requires 2 doses; and, rotavirus vaccine (RTV), which is considered complete with at least 2 doses, because brand type is not captured (one rotavirus vaccine requires 2 doses and the other requires 3 doses). Like other vaccines, our goal is to reach at least 90% coverage for each of these vaccines, although coverage levels are typically lower because they are newer.

### *The 2010 sample population:*

The 2010 statewide sample consisted of 1590 children born in the first quarter of 2008 (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 2008 in that region. The oversampled children (n=17 of the 1590) were included only in state-level analysis of black-white disparities. Of the 1590, 110 were excluded from the analysis for one of the following reasons: parents refused to participate (n=9) or the child had moved out of state (n=101). After exclusions, 1480 children remained in the sample (including the 17 oversampled records).

Of the 1480, no documentation of vaccination could be found for 20 children (1.35%). Parents of these children cited a religious (n=8) or philosophical (n=12) reason for not vaccinating their children; none gave a medical reason for not vaccinating their child. Four children whose parents reported intentionally not vaccinating their child had received at least one dose of vaccine. Incomplete vaccination records were available for 11 children who could not be located or verified as out-of-state by health department staff. By protocol, all of these children are included in the analysis.

### *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 among samples cannot be confidently reported as statistically valid differences. CIs were not calculated for surveys before 2007.

***Minimum intervals:***

On-time immunization may be overestimated because analysis does not take into account whether dose intervals or ages meet Centers for Disease Control and Prevention (CDC) recommendations. Minimum intervals have not been assessed in previous surveys, and to add these criteria would limit the ability to compare current and past survey results.

**Additional information on specific vaccines:**

***Influenza vaccine (FLU)***

Children born in the first quarter of 2008 who received every influenza vaccine on time could have received 3 doses of seasonal influenza vaccine and 2 doses of the unique monovalent 2009 H1N1 vaccine by the second birthday. This survey reports the percentage of children who received at least 2 doses of seasonal influenza vaccine. 2009 H1N1 vaccine doses were often administered in non-traditional sites and may have been less well-documented. If documentation was found, 2009 H1N1 vaccine doses administered were handwritten on individual survey records. Because 2009 H1N1 vaccine was not part of the annual survey tool, it is not reported here. 2009 H1N1 vaccine coverage levels in states have been 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 definition misclassifies 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 essentially unavailable due to production problems. During this time, the CDC stretched available supplies by recommending deferral of the booster dose in healthy children. For this reason, the 2009 survey classified children with 2 or more doses as complete. The standard definition has been restored in 2010. Most children born in early 2008 would have received the Sanofi (3 doses plus 1 booster) vaccine. The CDC began recommending catch-up booster immunization in late summer of 2009. Children in the 2010 survey were about 18 months of age when the shortage ended.

***Rotavirus vaccine (RTV)***

The 2010 survey is 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 percentage of children with on-time immunization documented for each vaccine in the target vaccine series was over 90% for 5 of 7 vaccines in the 4:3:1:3:3:1:4 vaccine series. The two vaccines requiring 4 doses, DTaP and PCV, failed to reach 90%; however, the percentages of children who had received 3 doses were 96% for DTaP and 94.4% for PCV.

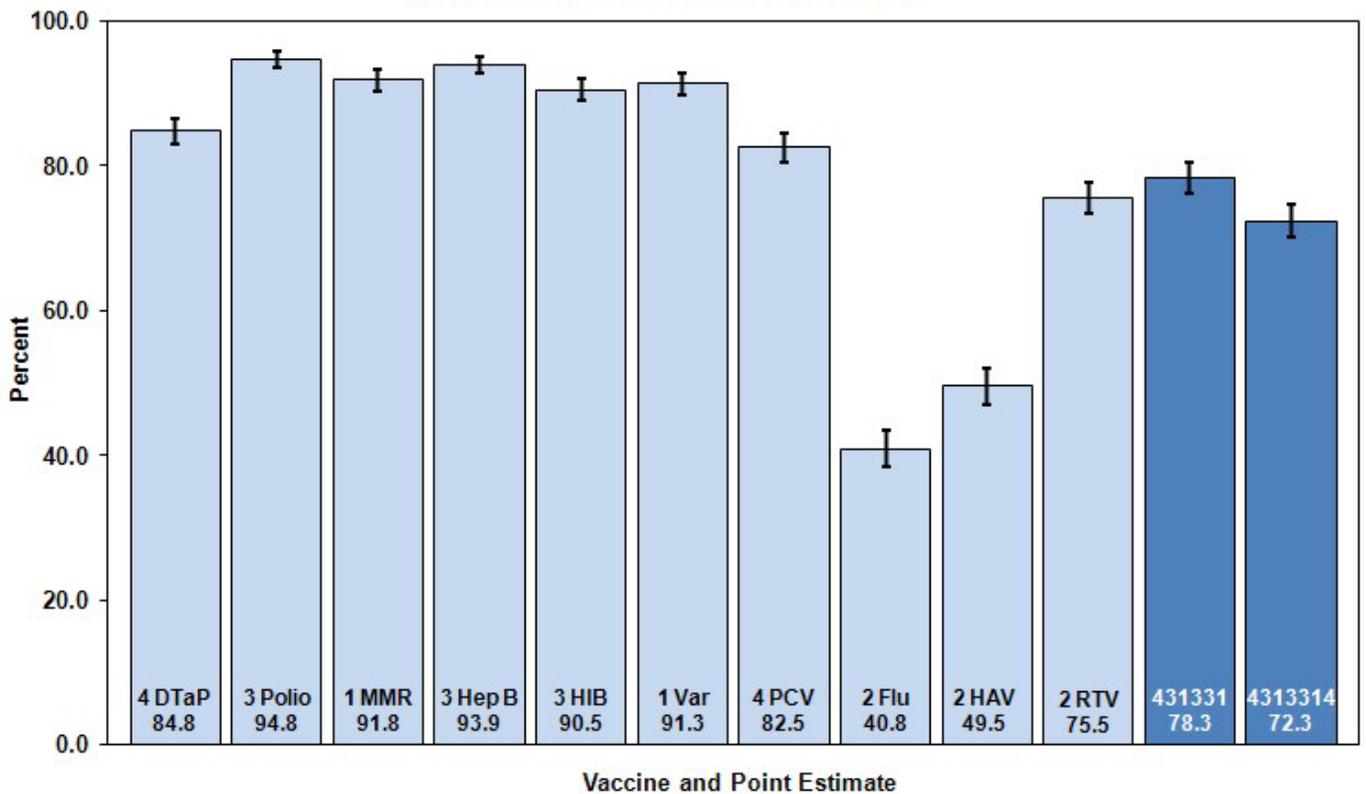
Of note, despite its limited use in infants less than 8 months of age, over 75% of children had at least 2 doses of RTV. The rate of completion of the 2-dose HAV series remained below 50%; however, 82.7% of surveyed children had received the first dose. Influenza vaccination rates remain low.

Completion of the 4:3:1:3:3:1 series dipped below 80% for the first time since 2003, in part because of lower than usual 3-dose HIB coverage. The HIB vaccine coverage level was 90.5%; all previous surveys back to 2005 found HIB coverage at 93.4% or higher. The percentage of children who completed 4:3:1:2:3:1 coverage in 2010 (with only 2 instead of 3 HIB doses) was 80.7%, equivalent to the 80.8% coverage reported in 2009.

Appendix 1 of this report contains charts of on-time immunization coverage rates in each region for each vaccine. A chart of regional and statewide uptake of one or more doses of HAV (one dose being required for enrollment in childcare) also is provided in Appendix 1.

**Figure 1**

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



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

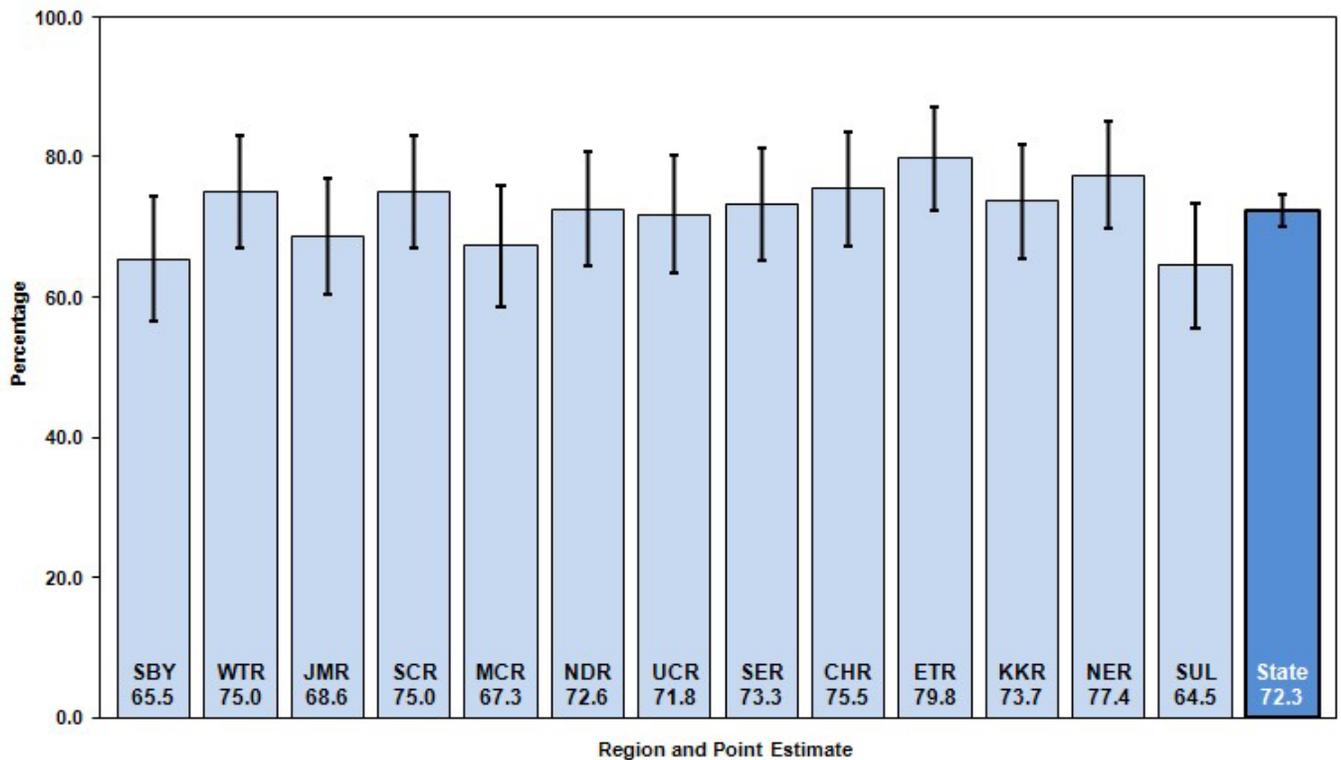
The percentage of children fully immunized on time with vaccines in both the new 4:3:1:3:3:1:4 series and the old 4:3:1:3:3:1 series statewide and in each public health region, are presented in Figures 2a and 2b below. Statewide 4:3:1:3:3:1:4 coverage was 72.3% (95% CI: 70.0-74.6%); although point-estimates varied, no regional rate differed statistically significantly from the state rate.

The state 4:3:1:3:3:1 rate was 78.3% (95% CI: 76.2-80.4%), with no regional rate statistically significantly different than the state rate. See Appendix 2 for a chart of the side-by-side comparison of the regional and statewide coverage rates for the 4:3:1:3:3:1 and 4:3:1:3:3:1:4 series.

Figure 3 compares 2009 and 2010 coverage rates for each vaccine and the 4:3:1:3:3:1 series. The decline in HIB coverage may be explained by resumption of the 3+ dose definition of completion in 2010, after using a 2+ dose definition in 2009, as explained previously. The only significant increase was in influenza vaccine coverage.

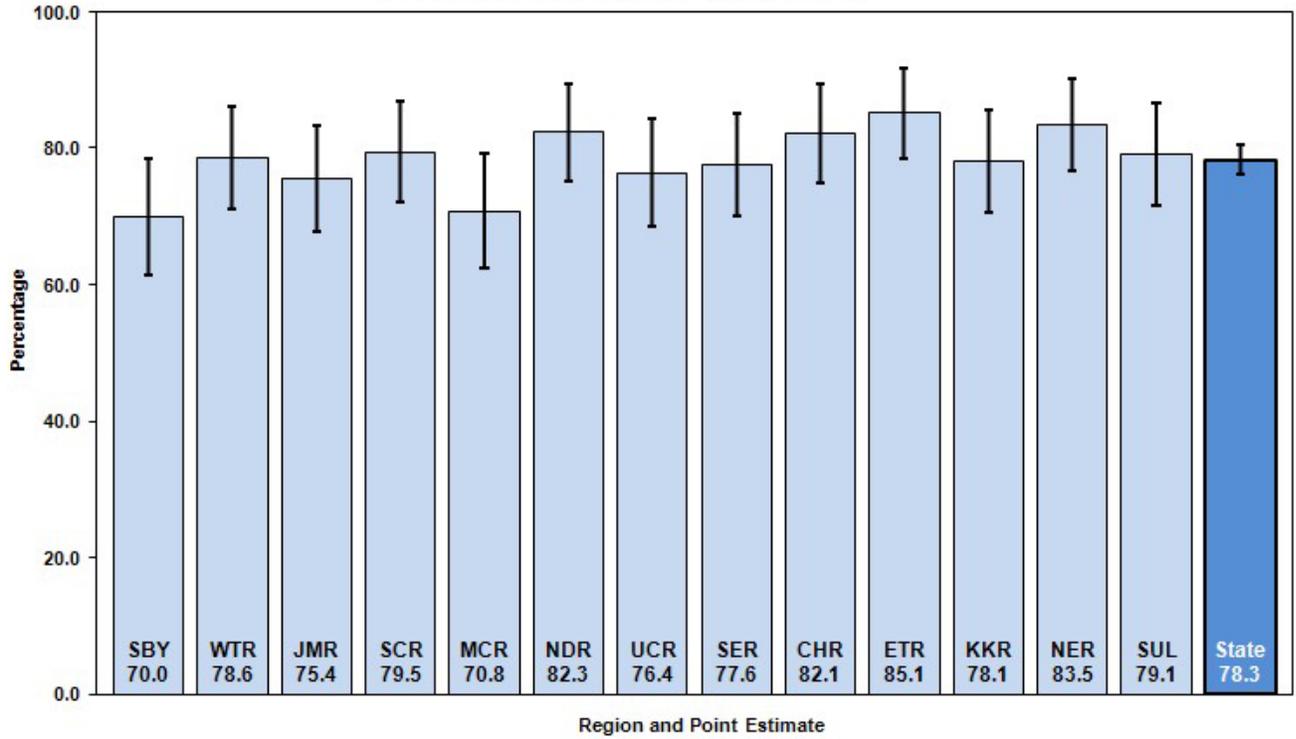
Appendix 2 of this report contains charts for each public health region displaying the percentage of children in each region who were immunized on-time for each of the vaccines and for the 4:3:1:3:3:1:4 aggregate series.

**Figure 2a**  
**2010 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)



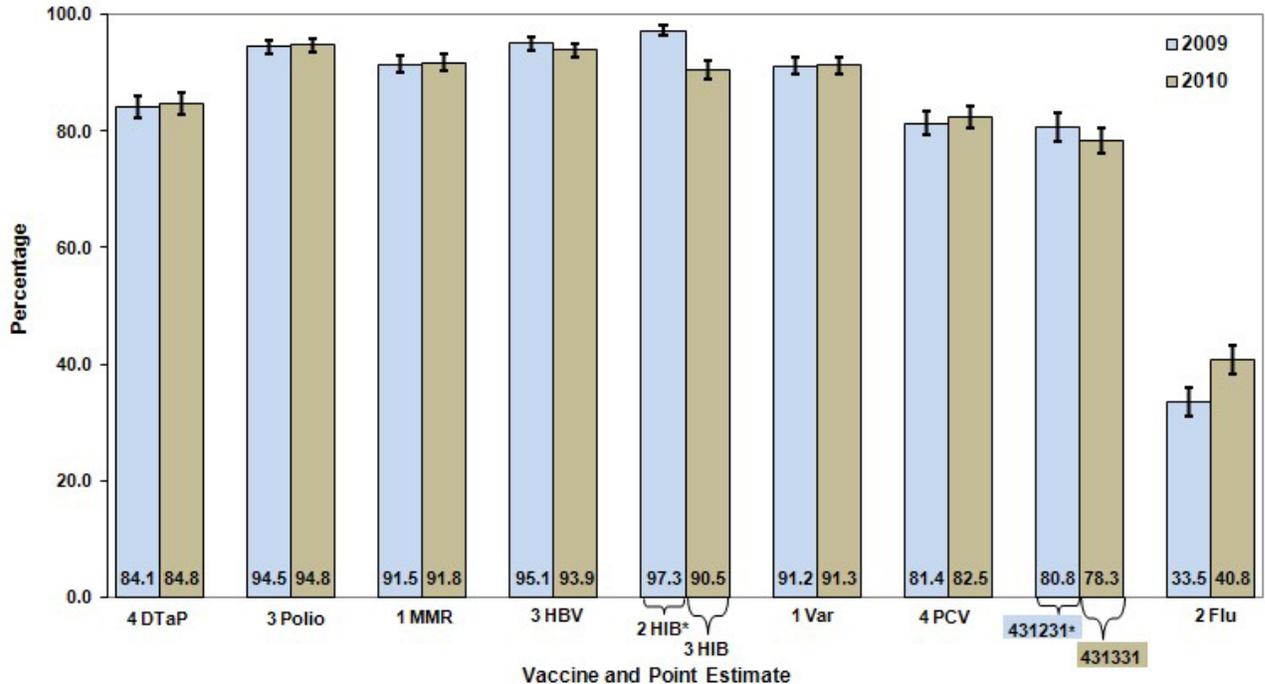
**Figure 2b**

**2010 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)**



**Figure 3**

**2010 Immunization Status of 24-Month-Old Children in Tennessee:  
Statewide percentage of children with age-appropriate immunization levels  
by vaccine in 2009 and 2010  
(point estimates and 95% confidence intervals)**

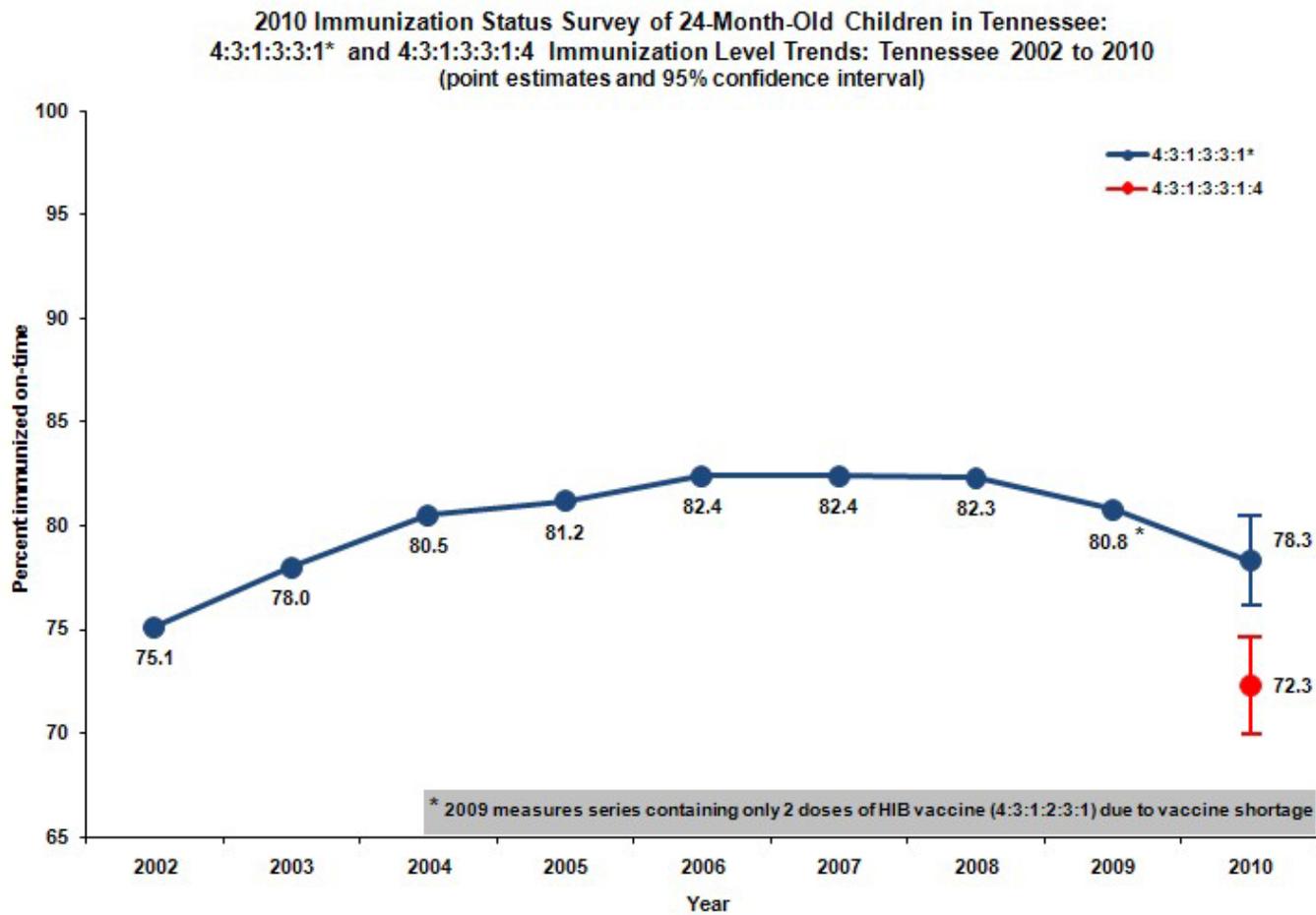


\* 2009 measures series containing only 2 doses of HIB vaccine (4:3:1:2:3:1) due to vaccine shortage

*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 2009, as well as the 4:3:1:3:3:1:4 completion rate in 2010.

**Figure 4**



**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 narrow or statistically insignificant in recent years. In 2010, no significant difference was seen between black and white children in either the 4:3:1:3:3:1 or the 4:3:1:3:3:1:4 series. Children of other races (n=25) were excluded from the analysis. Figure 5 shows the differences between black and white children in on-time completion of the 4:3:1:3:3:1 series from 2004-2010, and the 4:3:1:3:3:1:4 series in 2010.

**Figure 5**

**2010 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)**

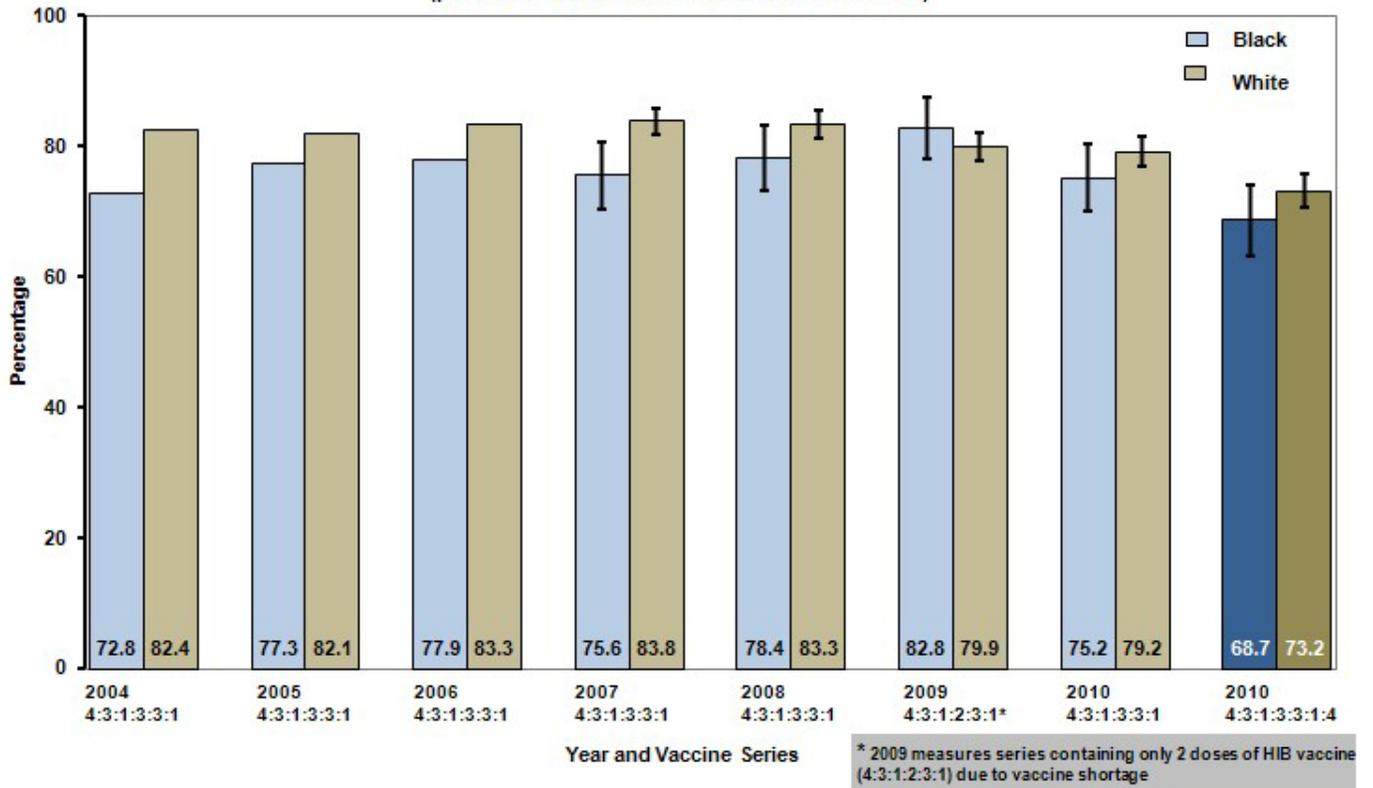
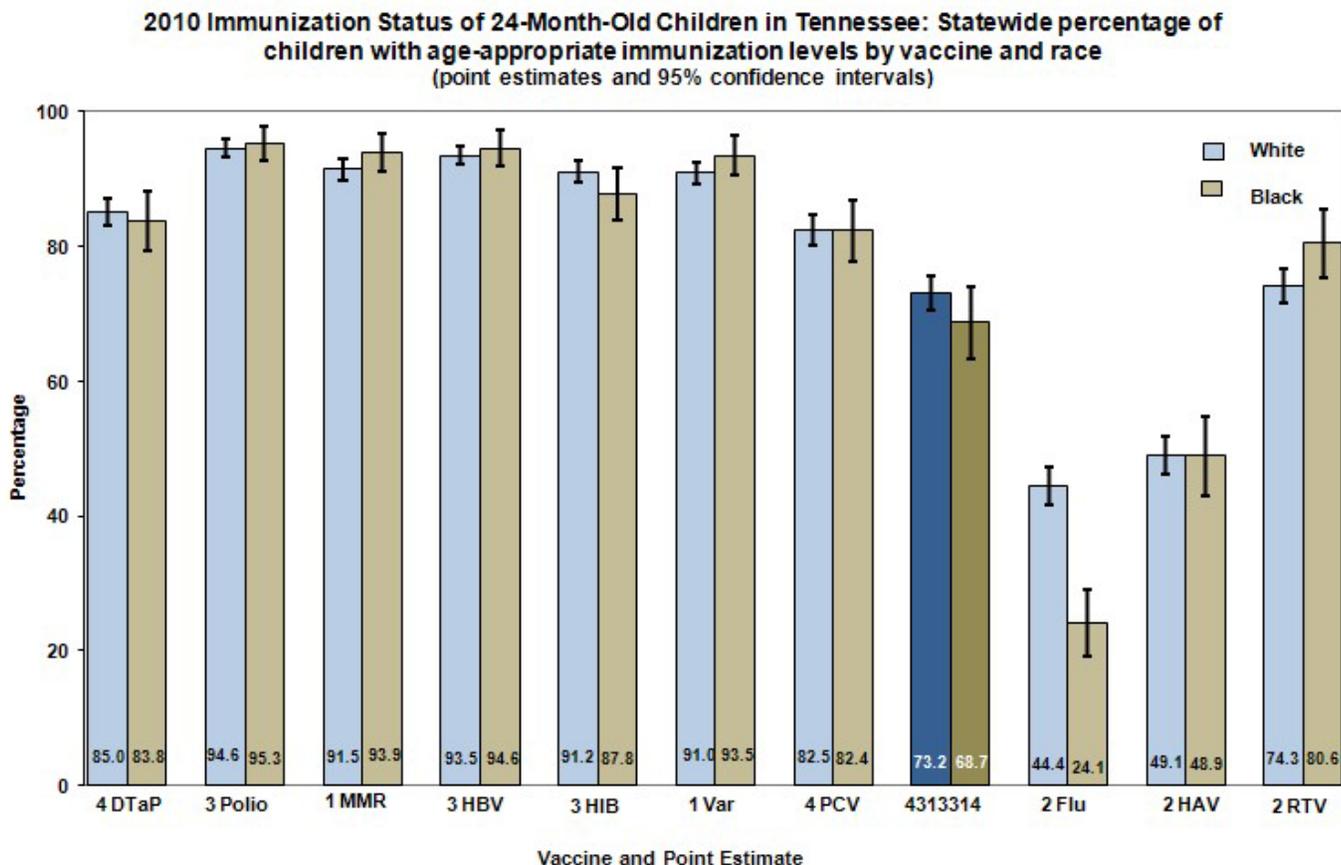


Figure 6 shows the rates of on-time immunization of black and white children for each vaccine assessed, including those not in the 4:3:1:3:3:1:4 series. Influenza vaccine is the only vaccine with a significant disparity in completion. When the survey began collecting data on influenza vaccine in 2008, a 15 percentage point gap was identified between coverage rates in white and black children, remaining steady in 2009. In the current survey, that gap has widened to 20 percentage points. Compared to 2009, influenza vaccine coverage increased by 8 percentage points in white children and only 2.8 percentage points in black children: the rate among black children is now just 54% of the rate among white children.

**Figure 6**



### *Immunization among selected sub-populations*

Certain risk factors are consistently associated with failure to complete the recommended series of immunizations on time, such as starting immunizations at greater than 120 days of life, or having two or more siblings. In the past, racial disparities made black race an important risk factor, though race has become a much less significant factor, 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. Wide confidence intervals, due to the small number of children immunized exclusively in health departments, resulted in a lack of statistically significant differences among children immunized in public and private facilities. Infants in WIC have immunization records reviewed at WIC visits; until summer 2008, those behind on immunizations could be issued one month of food vouchers (instead of 3) until the infant was caught up on vaccines. Beginning in mid-2008, targeted education and telephone follow-up became the primary tools used to encourage catch-up immunization of WIC infants.

After excluding the birth dose of hepatitis B vaccine and oral rotavirus vaccine, just 37 children (2.6%) in the survey began their routine immunizations after 120 days of life. Table 1 below summarizes the 2010 on-time completion rates for 4:3:1:3:3:1:4 in these groups.

**Table 1**

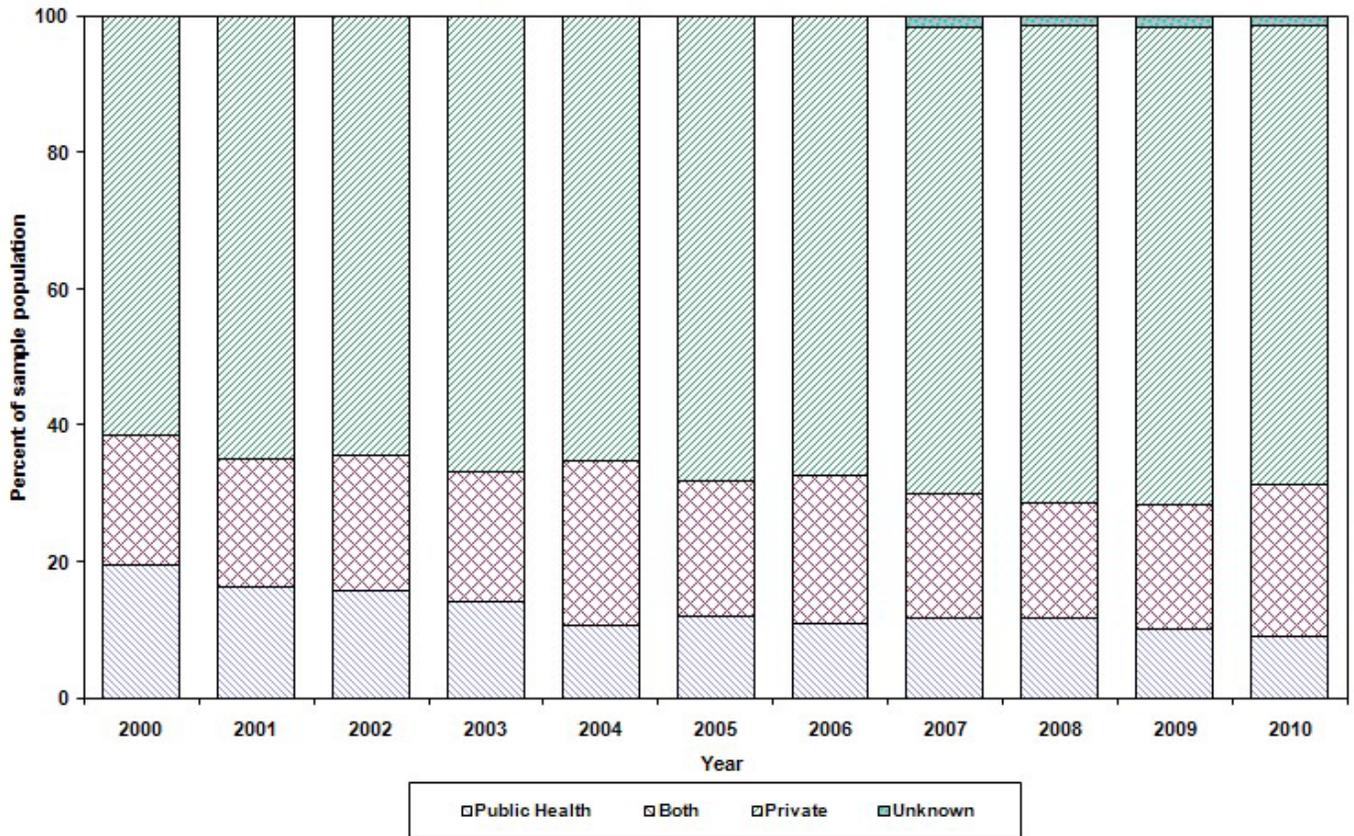
<b>4:3:1:3:3:1:4 Completion Levels in the 2010 Survey of 24-Month-Old Children: Selected Characteristics</b>			
<b>Provider Type</b>	Public n=90/132	Private n=732/985	Both n=236/324
	<b>68.2% ± 7.95</b>	<b>74.3% ± 2.73</b>	<b>72.8% ± 4.84</b>
<b>TennCare Enrollment</b>	Enrolled n=637/898	Not Enrolled n=421/565	
	<b>70.9% ± 2.97</b>	<b>74.5% ± 3.59</b>	
<b>WIC Enrollment</b>	Enrolled n=707/988	Not Enrolled n=351/475	
	<b>73.9% ± 2.81</b>	<b>77.5% ± 3.95</b>	
<b>Other Siblings</b>	None n=474/612	One n=357/505	Two or more n=224/343
	<b>77.5% ± 3.31</b>	<b>70.7% ± 3.97</b>	<b>65.3% ± 5.04</b>
<b>Age at First Immunization*</b>	≤120 days n=1038/1401	120 days n=17/37	
	<b>74.1% ± 2.29</b>	<b>45.9% ± 16.06</b>	

\*excluding oral rotavirus vaccine and birth dose hepatitis B vaccine

### *Immunization provider types and patient populations*

The proportion of children immunized in a public health setting began to decline in the late 1990s, once TennCare and the Vaccines for Children (VFC) Program enabled poor children to receive immunizations in their medical home. In 2010, just 9.0% of children surveyed received their immunizations exclusively at a public health facility, while 22.1% of children received vaccine in both public and private settings. The majority, 67.3%, were immunized exclusively in private clinic settings. Figure 7 below shows the trend over time.

**Figure 7**  
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:**  
**Source of Immunizations from 2000 to 2010**



Although only a small number of children surveyed were immunized exclusively in public health clinics, the population immunized in health departments tends to 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**

<b>Prevalence of risk factors for delayed immunizations in the survey population by provider type</b>			
<b>Risk Factor</b>	<b>Health Department</b>	<b>Both Private and Public</b>	<b>Private Only</b>
Black (risk for influenza)	<b>31.1% (31/132)</b>	<b>21.6% (70/324)</b>	<b>15.0% (148/985)</b>
2 or more siblings	<b>33.3% (44/132)</b>	<b>35.9% (116/323)</b>	<b>34.4% (338/983)</b>
Age at first dose >120 days	<b>0.8% (11/132)</b>	<b>0.03% (9/324)</b>	<b>1.2% (17/982)</b>
Any of above risk factors	<b>54.5% (72/132)</b>	<b>39.8% (129/324)</b>	<b>33.2% (327/985)</b>

### **Summary of key findings from the 2010 Survey:**

1. The statewide point estimate of on-time administration of all vaccines in the 4:3:1:3:3:1 series has declined for 2 consecutive years, after being level from 2006-2008 (82.3-82.4%). The most likely cause is the 18-month disruption in the supply of HIB that ended in late summer 2009. Children whose booster doses were deferred may have been slow to catch up after the booster dose was restored to the CDC recommended schedule and catch-up of children who had deferred the booster dose was recommended.
2. The HIB coverage rate of 90.5% with at least 3 doses was the lowest measured in recent years. Since 2005, HIB completion was measured at 93.4% or higher.
3. TDH's goal of reaching at least 90% on-time coverage with each vaccine included in the 4:3:1:3:3:1:4 series was achieved for 5 of 7 vaccines. This goal was not achieved for the vaccines requiring 4 doses: DTaP and PCV. A simple way to improve overall coverage rates is by targeting children still missing the 4<sup>th</sup> doses of these vaccines between 19 and 24 months of age.
4. The percentage of children with 4 doses of DTaP was 84.5%: 96% had received 3 doses.
5. The percentage of children with 4 doses of PCV was 82.5%: 94.4% had received 3 doses (see Appendix 1).
6. The percentage of children who had received at least 2 doses of influenza vaccine by 24 months increased modestly from 33.5% in 2009 to 40.8% in 2010. Annual modest increases have been measured since this survey began tracking influenza. Despite gains in most jurisdictions, regional disparities in coverage have grown more extreme; 80% coverage was measured in Sullivan County and 18.6% coverage in Jackson/Madison County (see Appendix 1 for influenza coverage by region). In addition to geographic disparity, the unique and substantial racial disparity in influenza vaccine coverage persists and has grown.
7. With the exception of influenza vaccine, no significant racial disparities in coverage rates for individual vaccines or series were measured in 2010.
8. Analyses of TennCare and WIC-enrolled children compared to those not enrolled showed *non-significant*, lower coverage rates with the 4:3:1:3:3:1:4 series. In immunization against influenza: children in both TennCare and WIC were less well-immunized against influenza.
9. Rotavirus vaccine, first recommended in 2006, has already reached 75% coverage with at least 2 doses among this sample: a very strong result for a new vaccine.

### **Proposed actions based on survey results:**

The Immunization Program (TIP) plans to take the following steps to improve on-time immunization of children.

1. The 2010 immunization requirements should improve age-appropriate immunization with PCV and HAV. In 2011, children starting Kindergarten will be required to have 2 doses of HAV.
2. TIP will share regular reports with regional health departments of children 19-24 months who have been immunized in public health clinics and are missing the 4<sup>th</sup> dose of DTaP in the immunization registry.
3. Increased electronic transmission of immunization records to the immunization registry, as a result of federal financial incentives and state registry improvements, should improve the ability of providers to track childhood immunization needs.
4. TIP will continue to encourage providers to give the third DTaP at 6 months of age so the fourth DTaP may be administered as soon as the 12 month visit.
5. TIP also will emphasize in its educational efforts to private providers the importance of having a system to recall patients who have missed doses of vaccine, such as those who are in need of DTaP and PCV.
6. TIP will share survey findings with WIC and TennCare leadership, highlighting influenza vaccine coverage. It is possible the 2-3 week delay between arrival of private influenza vaccine shipments and VFC influenza vaccine shipments contributes to the lower influenza vaccination rates in TennCare-enrolled children.
7. TIP will closely monitor coverage rates since the discontinuation of the restricted WIC monthly voucher pick-up program used to catch up infants overdue for vaccines, which was replaced with education, reminder and follow-up phone calls.
8. TIP will continue to conduct the annual Immunization Spring Review and other educational outreach to increase awareness among public and private providers of risk factors for delayed immunization, including black race (for influenza), having multiple siblings, and delayed start to immunization.
9. TIP will continue to educate public and private immunization providers in the VFC Program through site visits conducted in 50% of participant offices annually.
10. The 2011 survey will continue to report on the 4:3:1:3:3:1:4 series, influenza, HAV, and RTV vaccine.

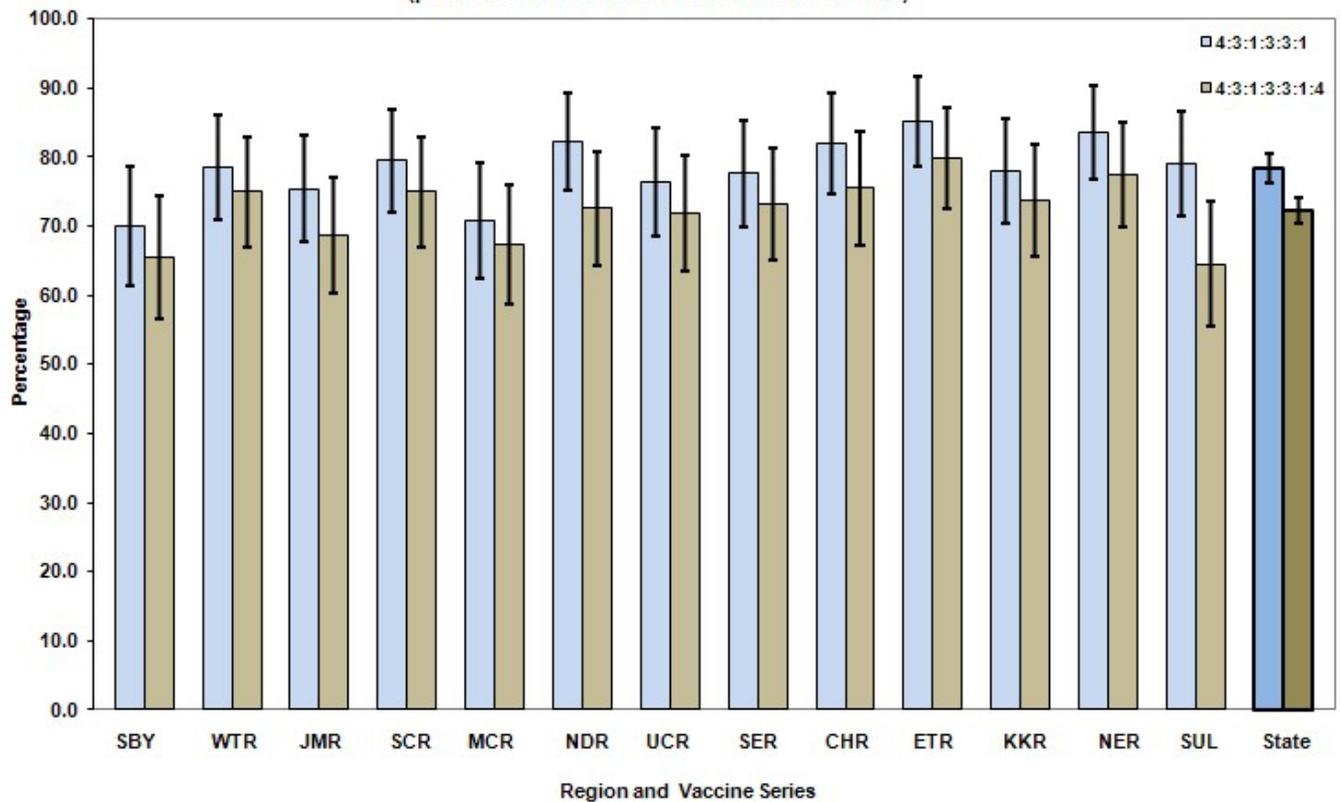
# Appendix 1

## 2010 Immunization Status Survey Of 24-Month-Old Children in Tennessee

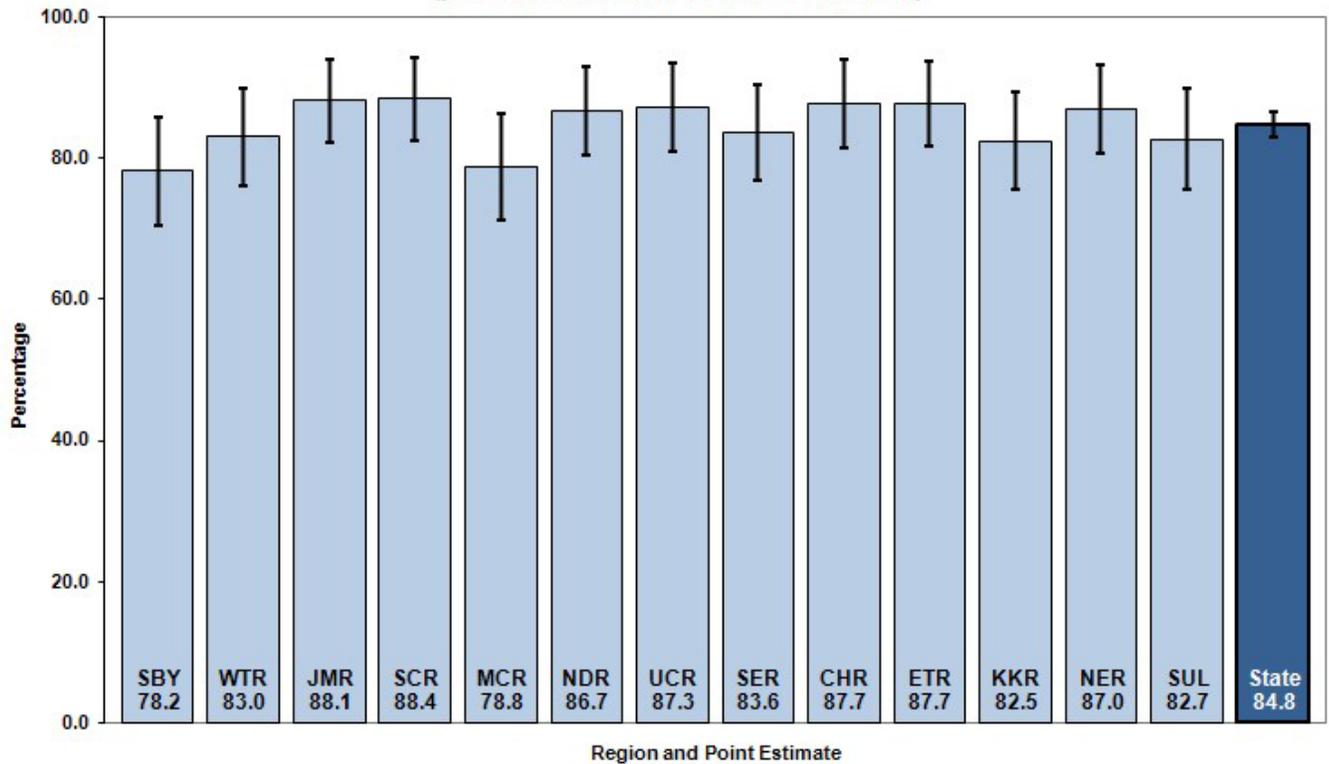
### Individual Vaccine Charts, with Coverage Rates Measured in Each Health Department Region and Statewide

	Page
4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series	... 15
DTaP 3- and 4- dose coverage	... 16
Polio & MMR	... 17
Hepatitis B & <i>Haemophilus influenzae</i> type b	... 18
Varicella	... 19
Pneumococcus (PCV) 3- and 4-dose coverage	... 20
Influenza 2- and 3-dose coverage	... 21
Hepatitis A 1- and 2-dose coverage	... 22
Rotavirus	... 23

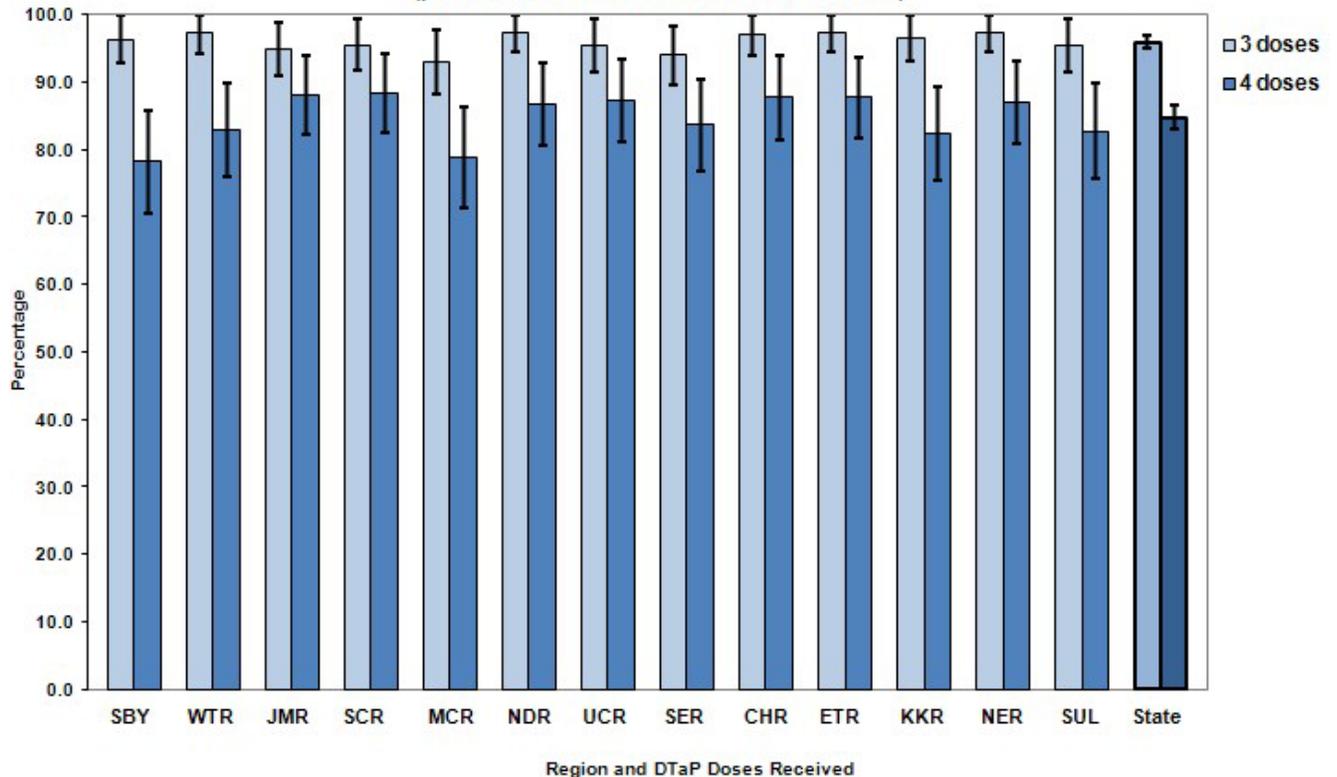
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage (%) of children complete for 4:3:1:3:3:1 and 4:3:1:3:3:1:4 vaccine series  
 by health department region  
 (point estimates and 95% confidence intervals)**



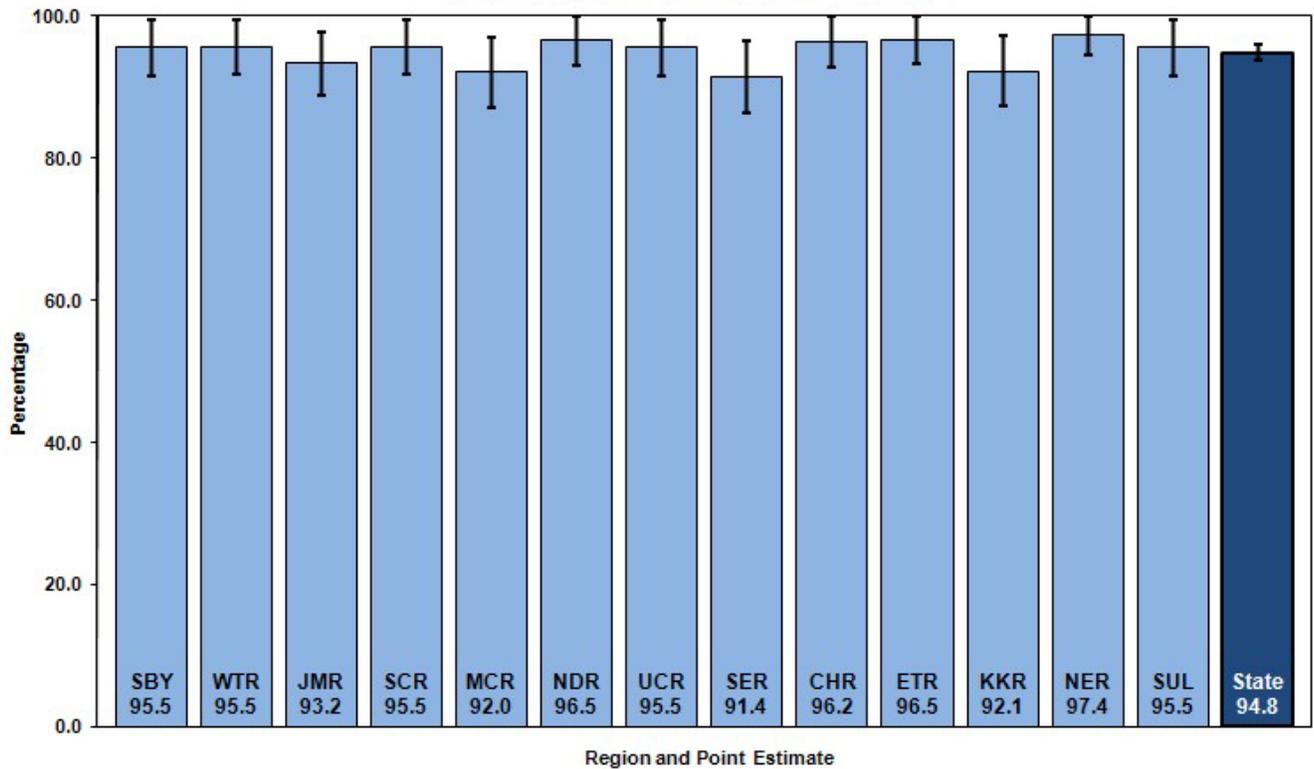
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete diphtheria, tetanus and acellular pertussis (DTaP) series  
 (4 doses) by health department region  
 (point estimates and 95% confidence intervals)



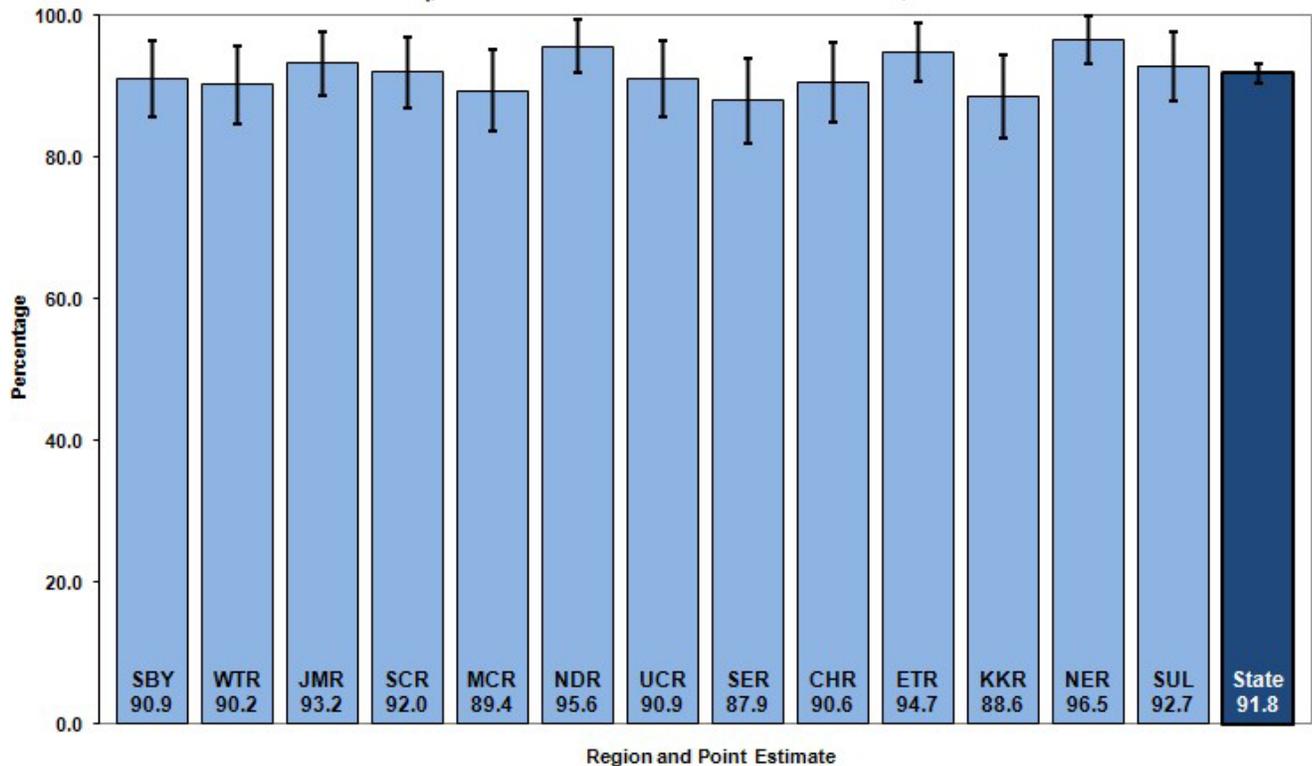
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee: Percentage of  
 children with 3 or 4 doses of diphtheria, tetanus and acellular pertussis (DTaP)  
 by health department region  
 (point estimates and 95% confidence intervals)



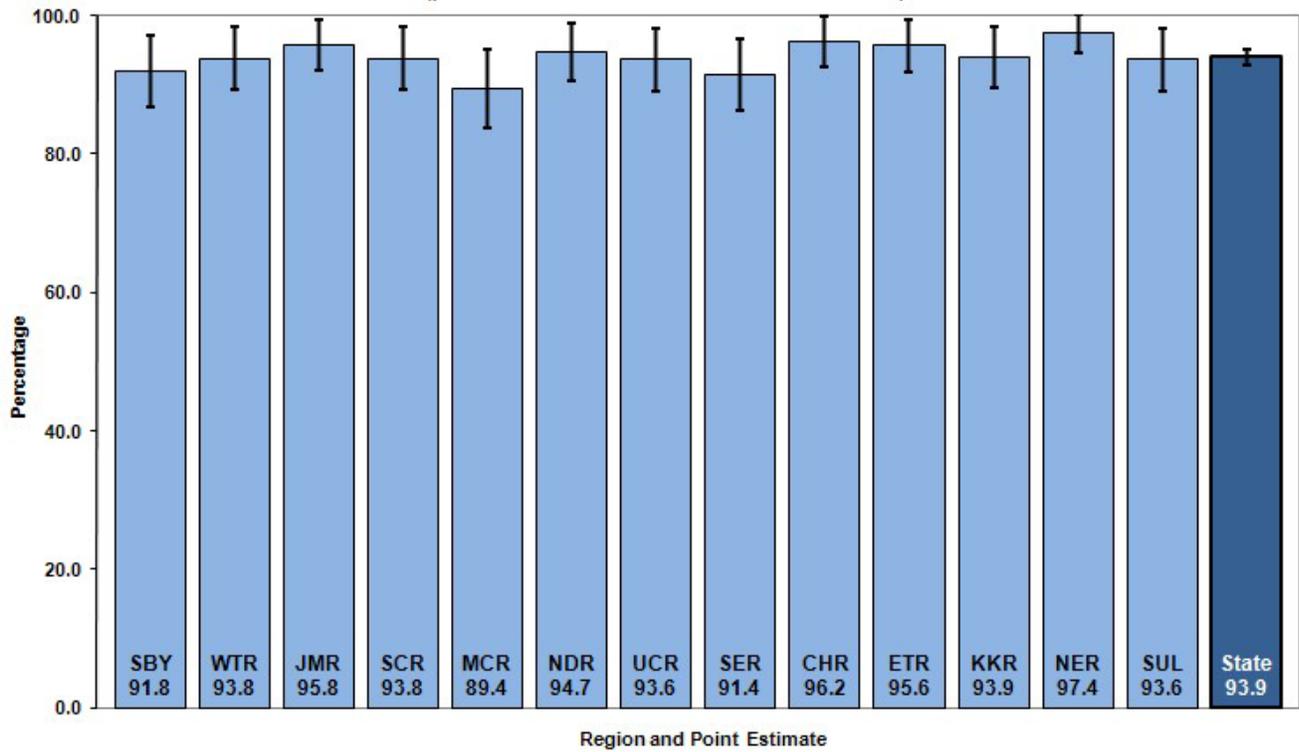
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete polio (IPV) series (3 doses) by health department region  
 (point estimates and 95% confidence intervals)



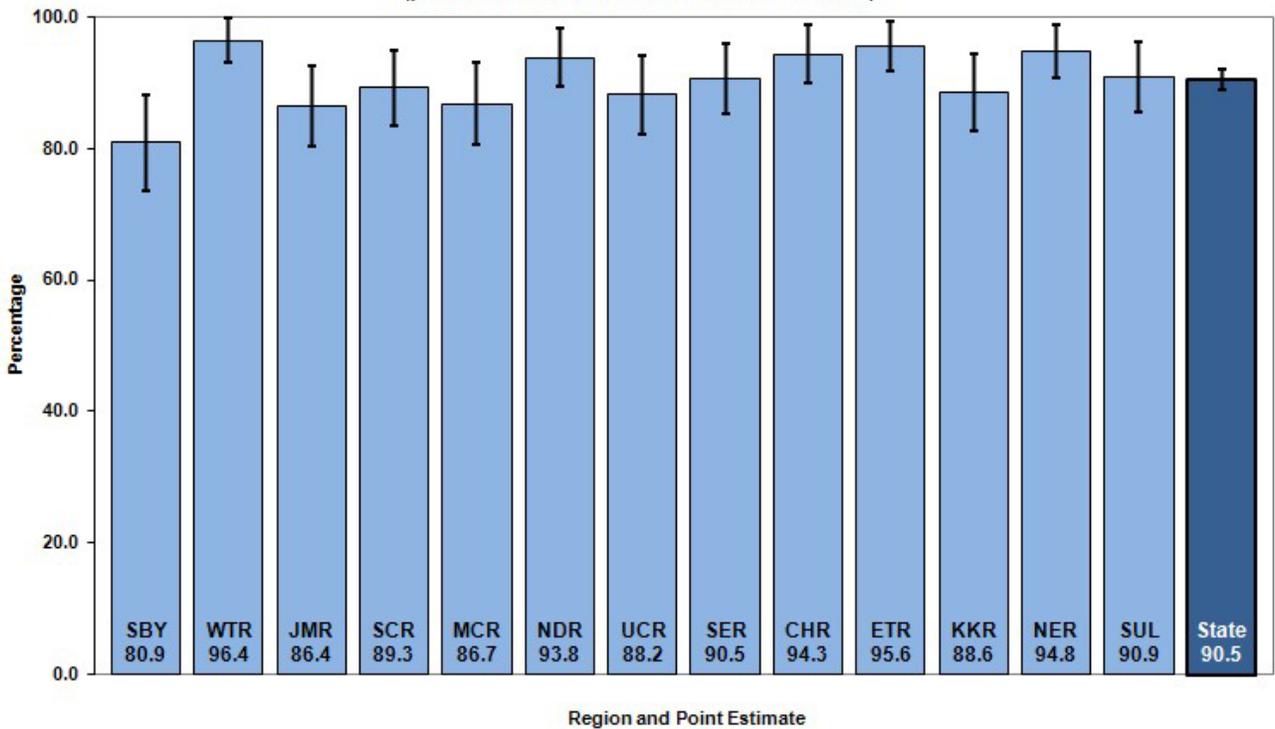
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete measles, mumps, and rubella (MMR) series (1 dose)  
 by health department region  
 (point estimates and 95% confidence intervals)



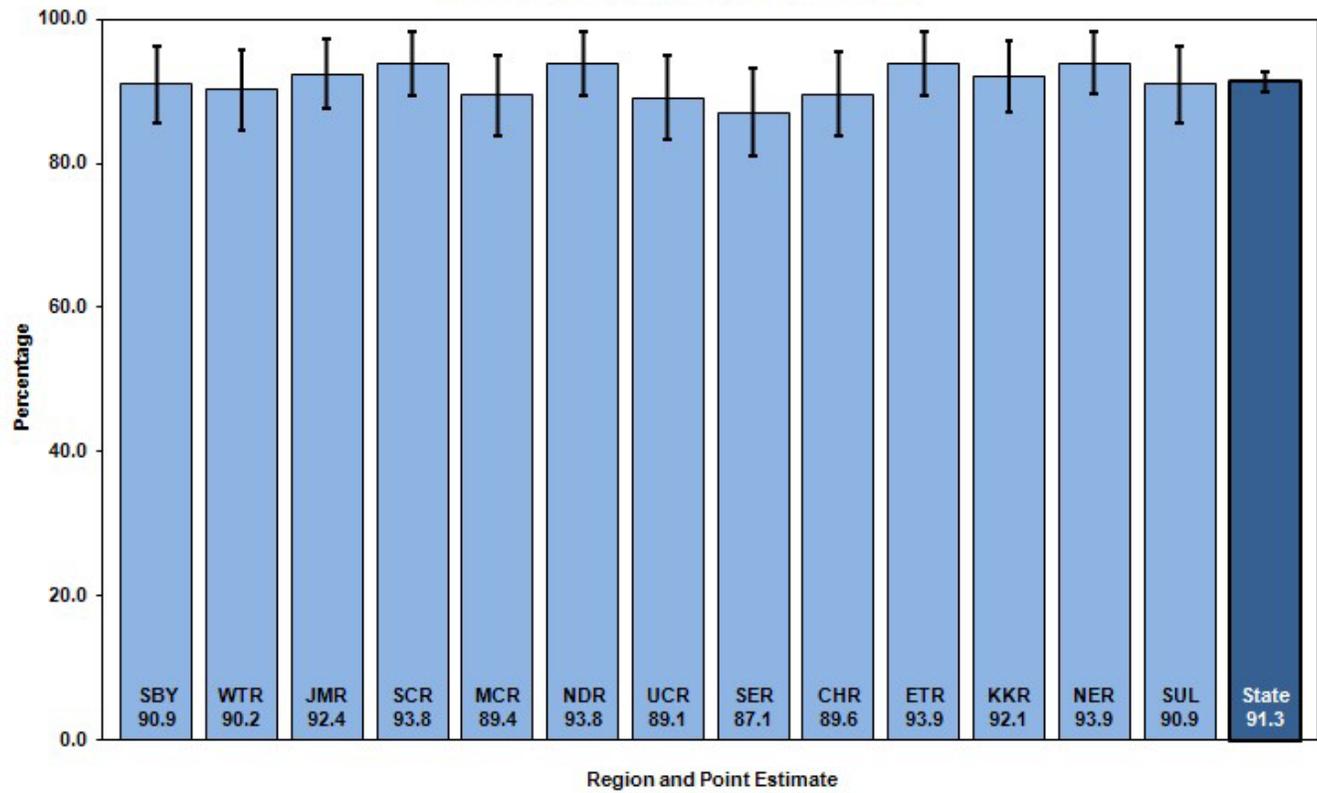
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete Hepatitis B (HBV) series ( $\geq 3$  doses)  
 by health department region  
 (point estimates and 95% confidence intervals)



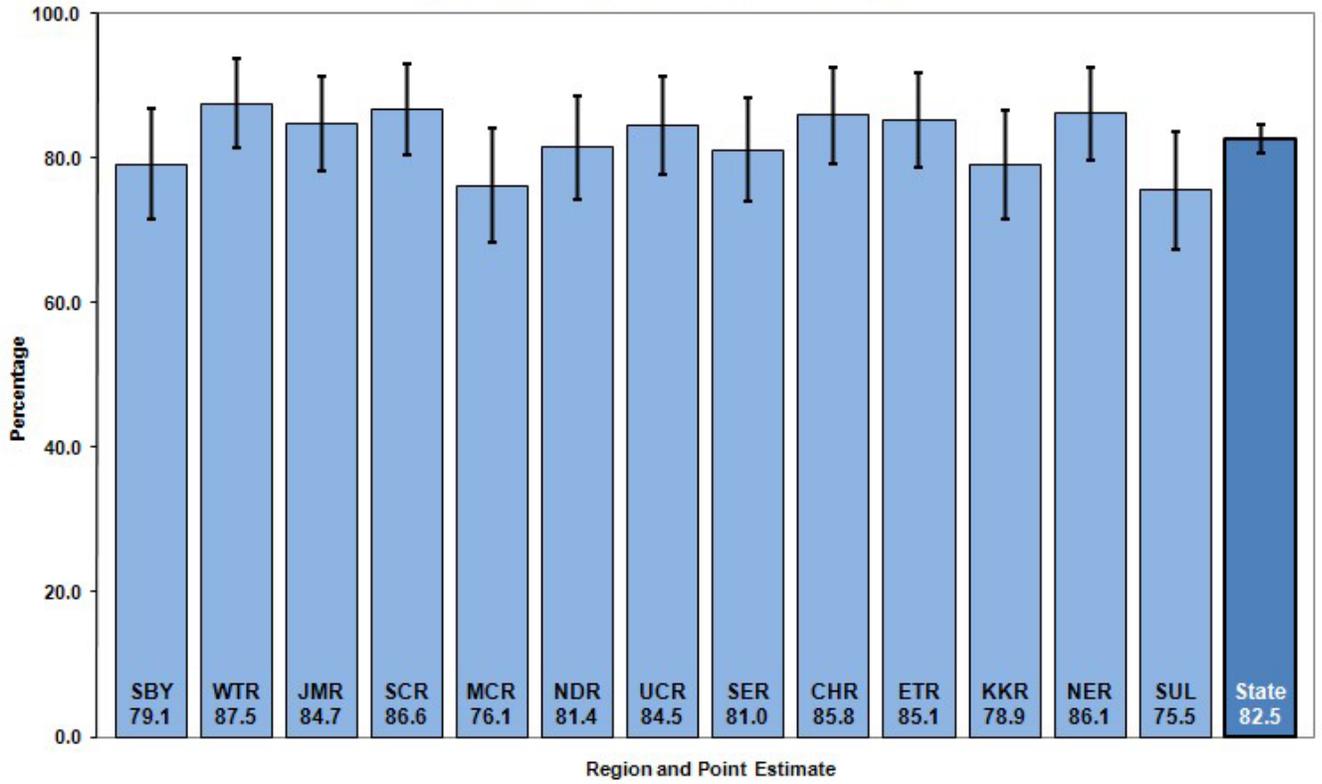
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete *Haemophilus influenzae* type B (Hib) series ( $\geq 3$  doses)  
 by health department region  
 (point estimates and 95% confidence intervals)



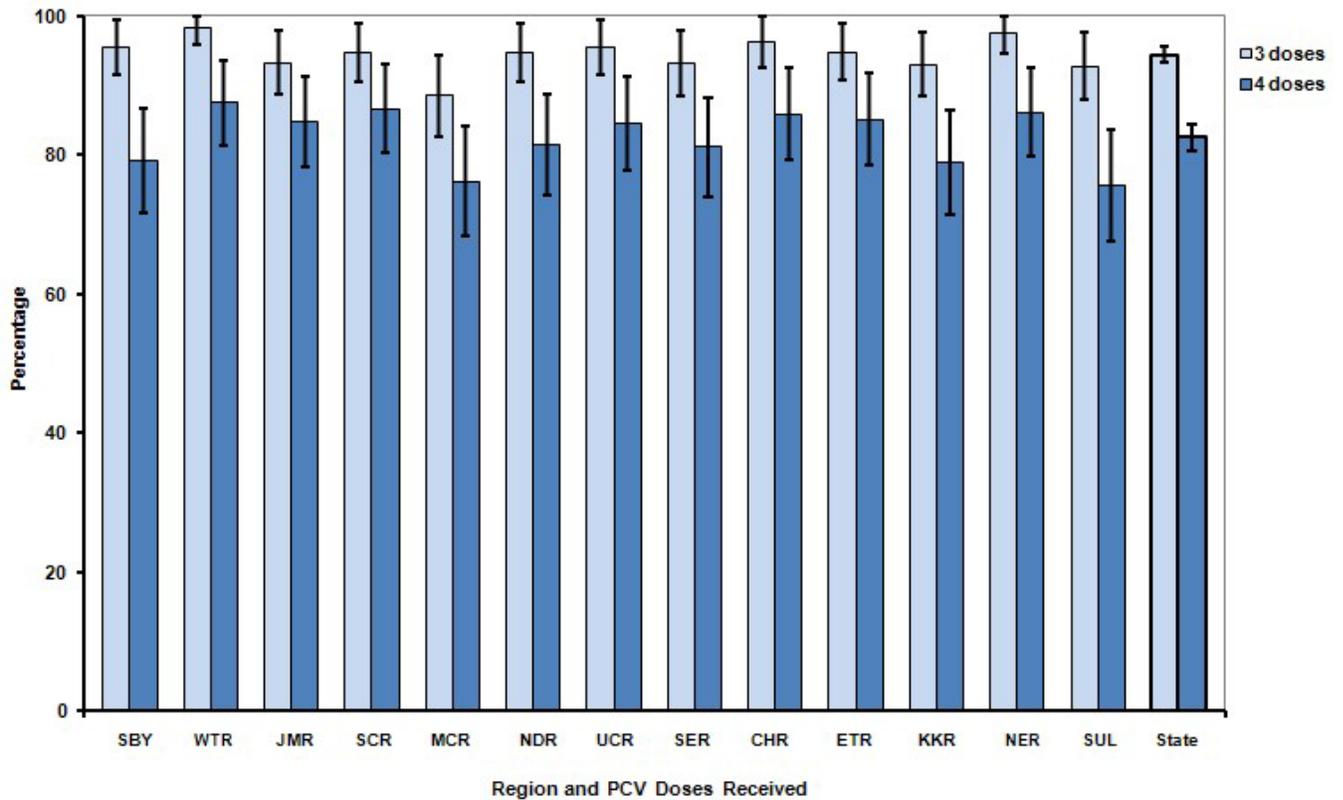
2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete varicella series (1 dose) by health department region  
 (point estimates and 95% confidence intervals)



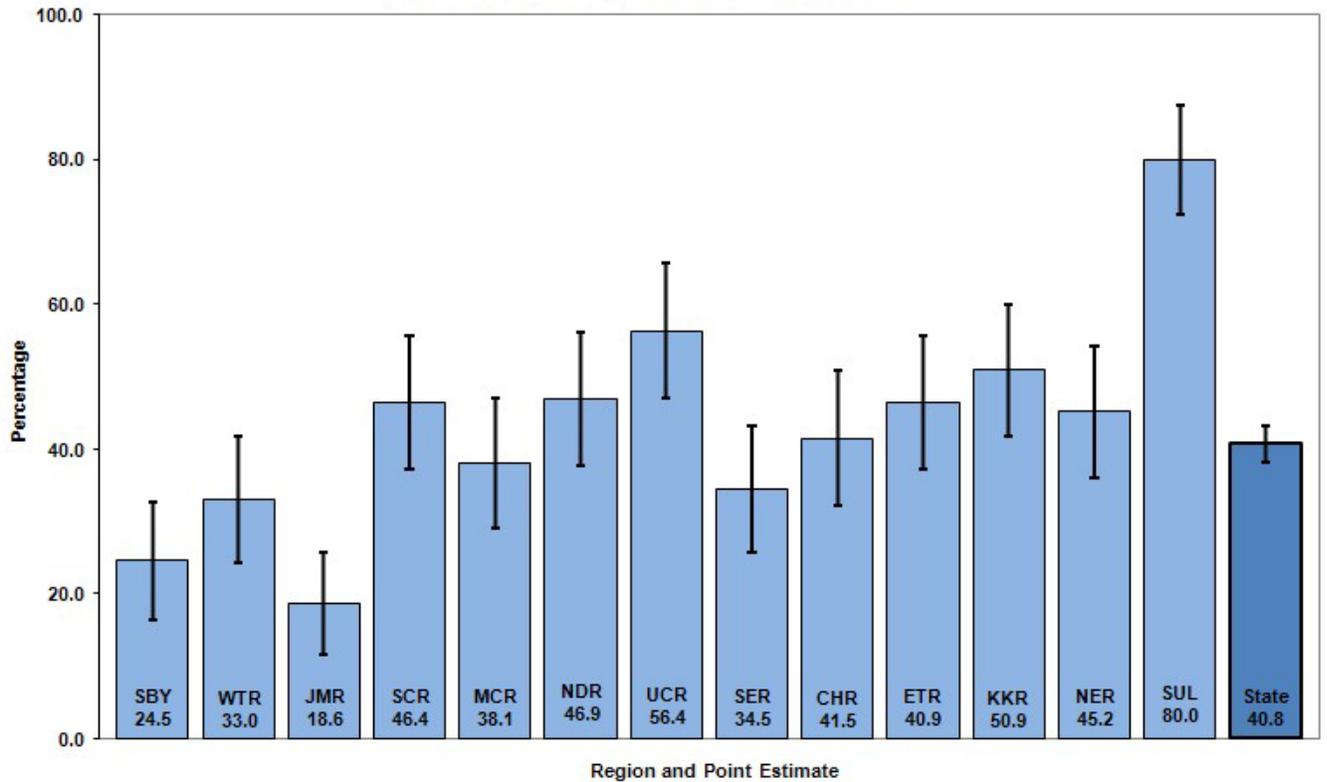
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with complete PCV series (4 doses) by health department region  
(point estimates and 95% confidence intervals)**



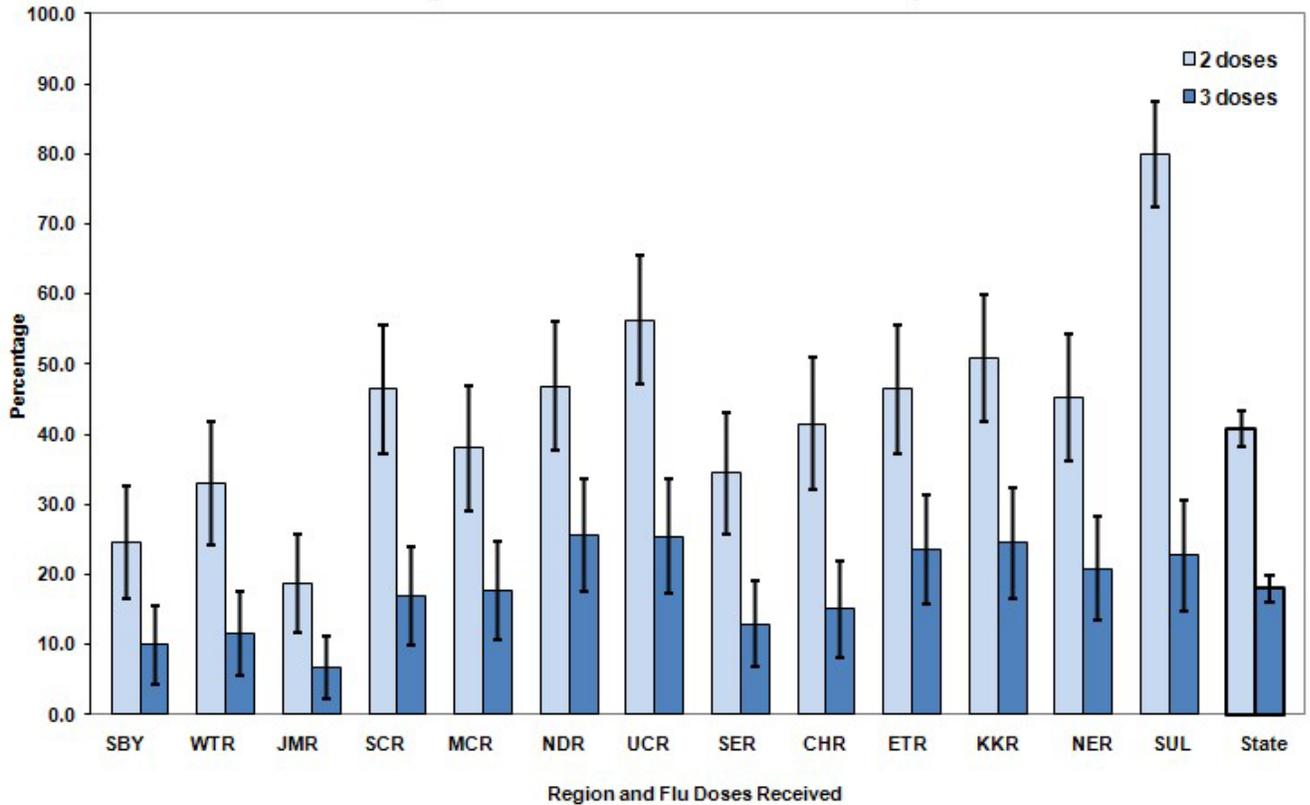
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with 3 or 4 doses of PCV by health department region**



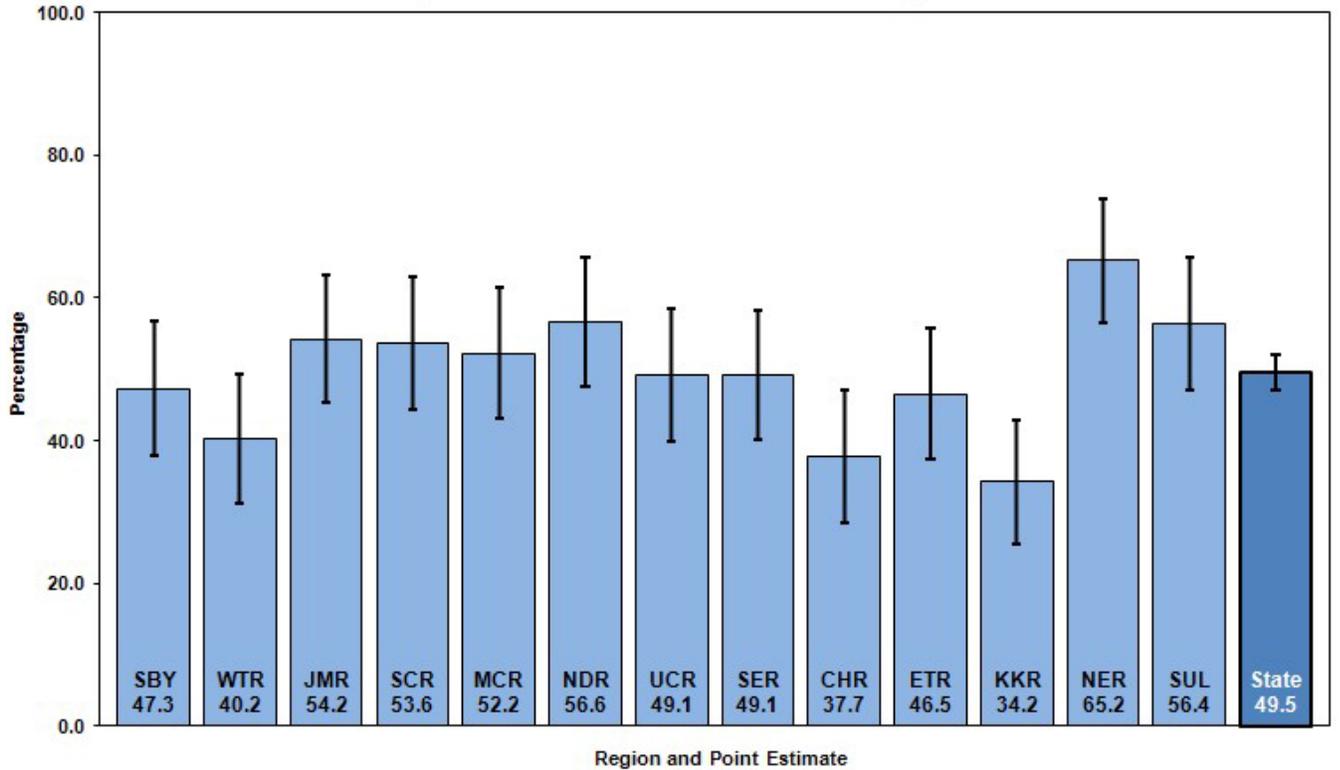
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with 2 doses of influenza vaccine by health department region  
(point estimates and 95% confidence intervals)**



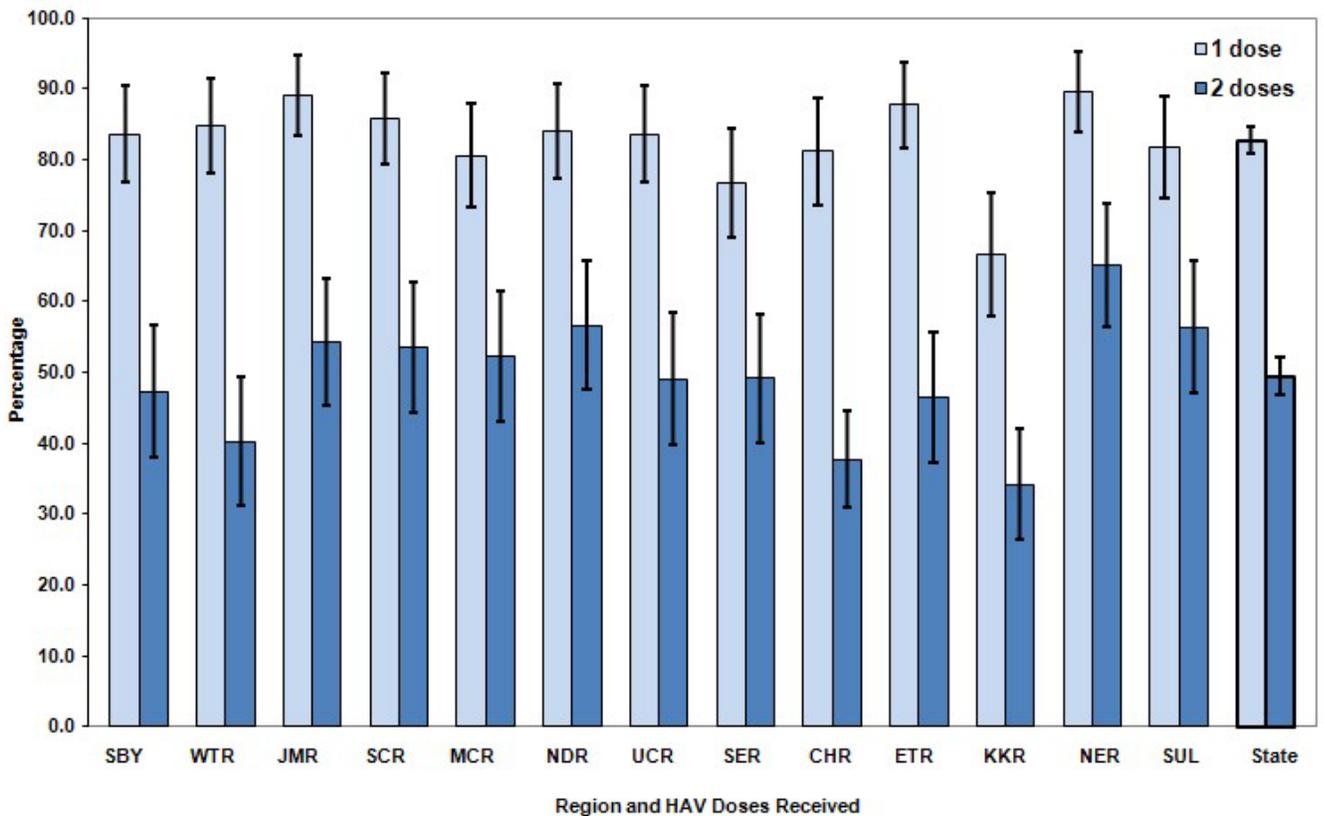
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with 2 or 3 doses of Influenza vaccine by health department region  
(point estimates and 95% confidence intervals)**



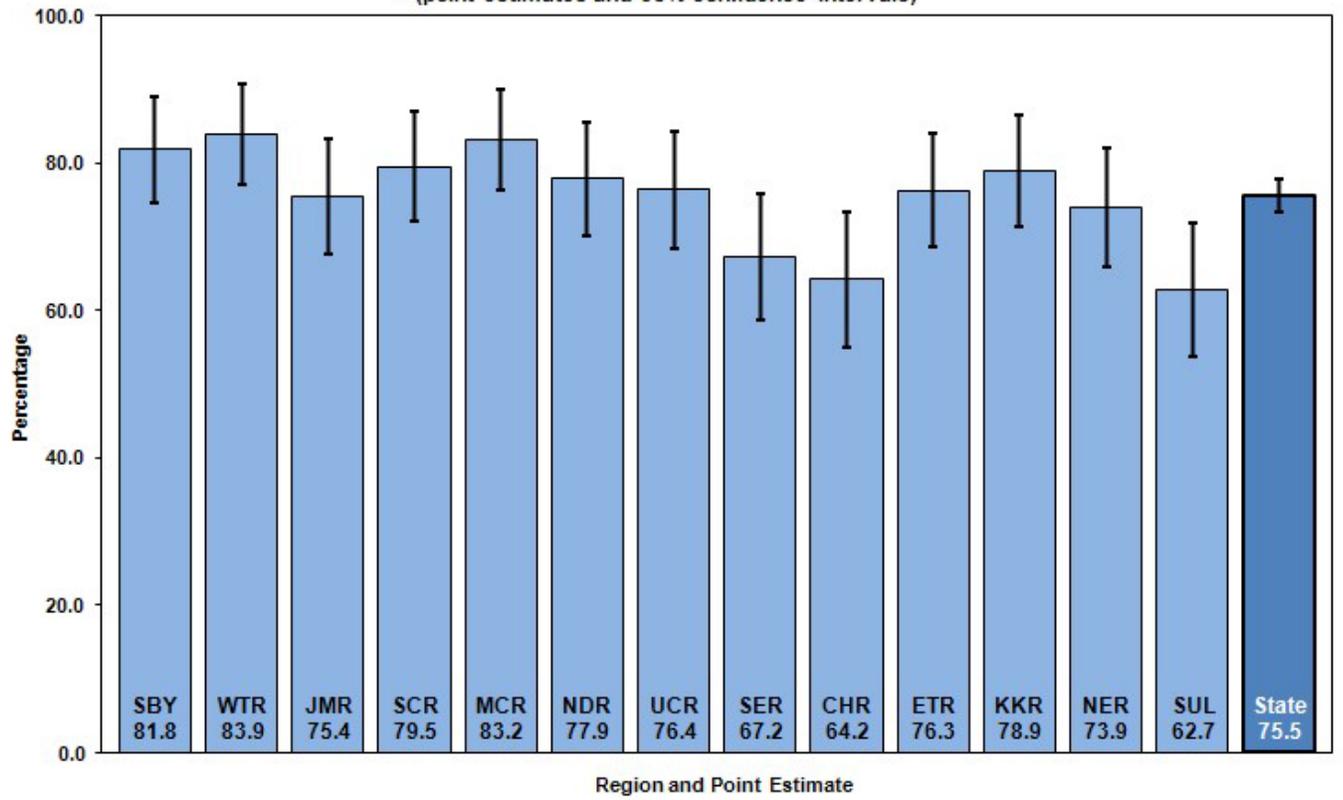
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children with complete Hepatitis A (HAV) series (2 doses)  
by health department region  
(point estimates and 95% confidence intervals)**



**2010 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)**



2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
 Percentage of children with complete Rotavirus (RTV) series ( $\geq 2$  doses)  
 by health department region  
 (point estimates and 95% confidence intervals)

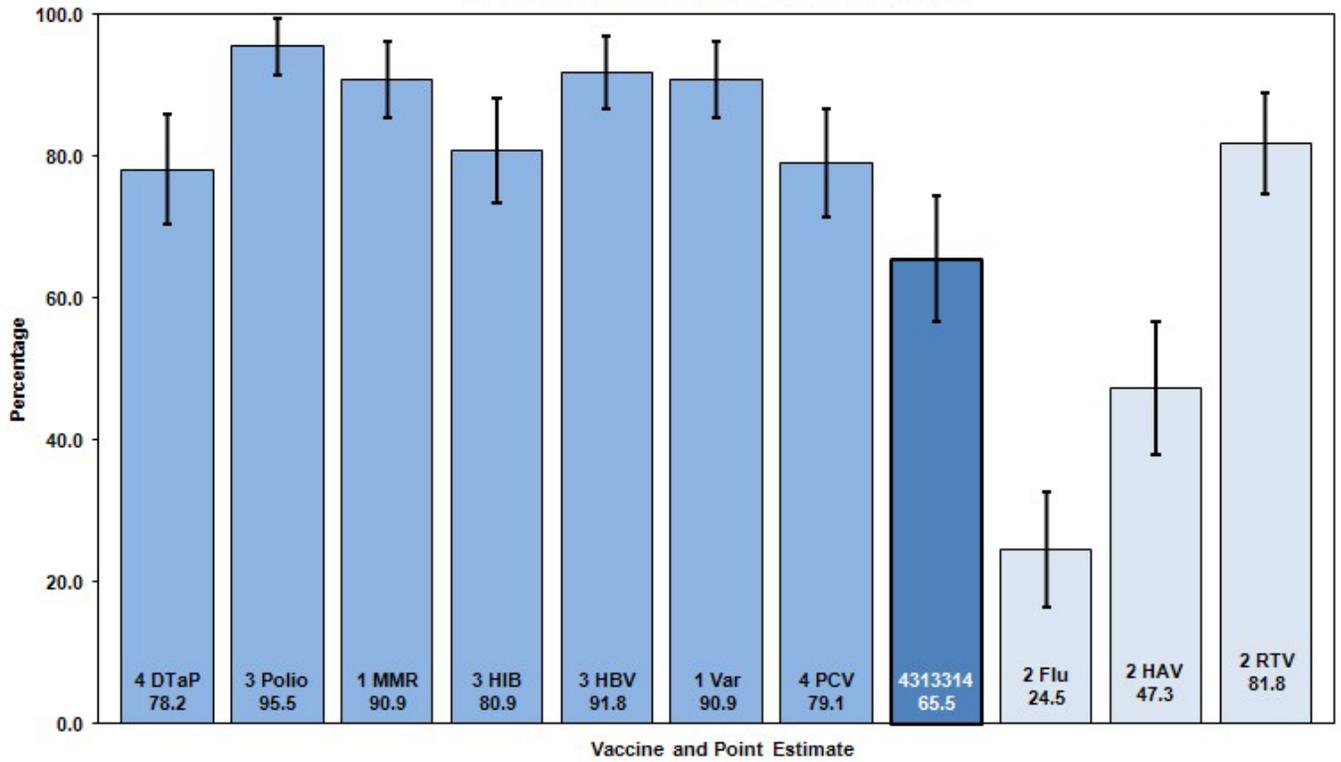


**Appendix 2**  
**2010 Immunization Status Survey**  
**Of 24-Month-Old Children in Tennessee**

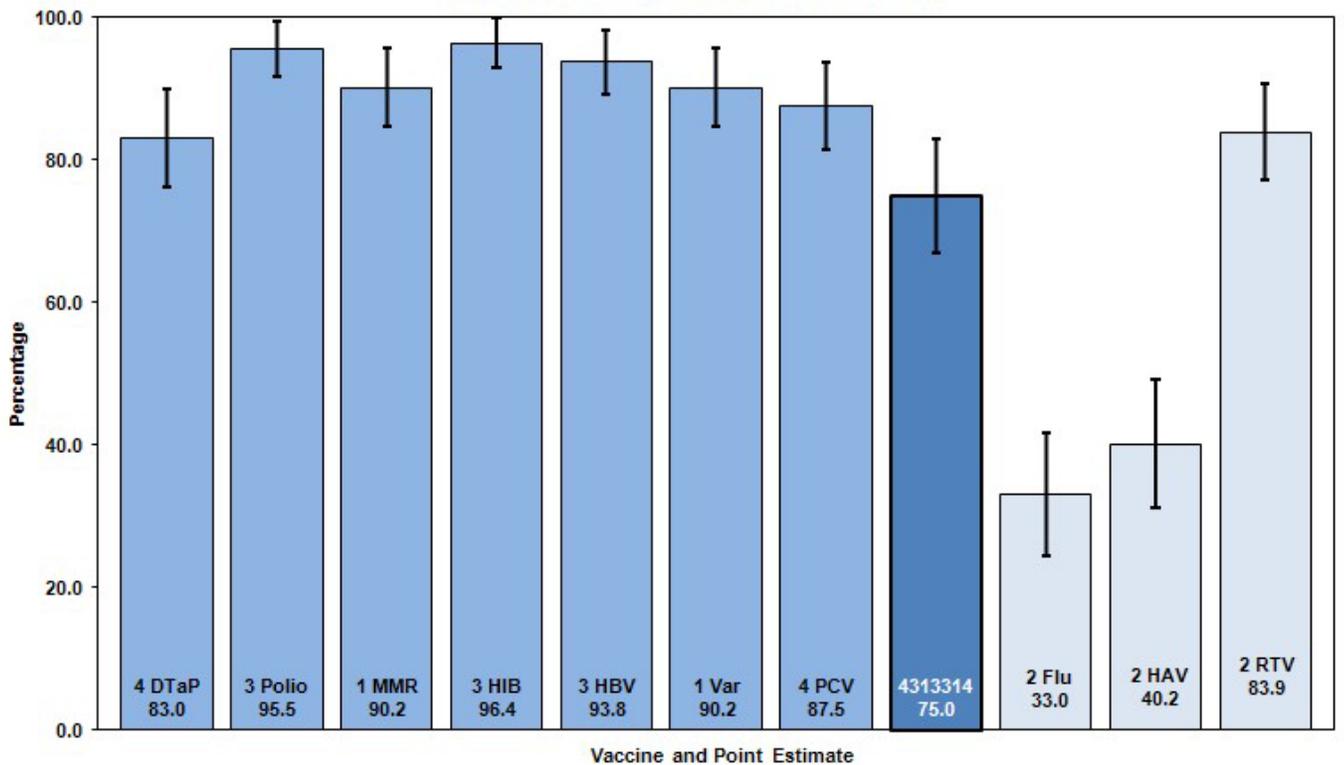
**Individual Health Department Region Charts with Coverage Rates for All  
Vaccines Assessed**

	Page
Shelby County (Memphis area)	... 25
West Tennessee Region	... 25
Jackson-Madison County	... 26
South Central Region	... 26
Mid-Cumberland Region	... 27
Nashville-Davidson County	... 27
Upper Cumberland Region	... 28
Southeast Region	... 28
Chattanooga-Hamilton County	... 29
East Tennessee Region	... 29
Knoxville-Knox County	... 30
Northeast Region	... 30
Sullivan County	... 31

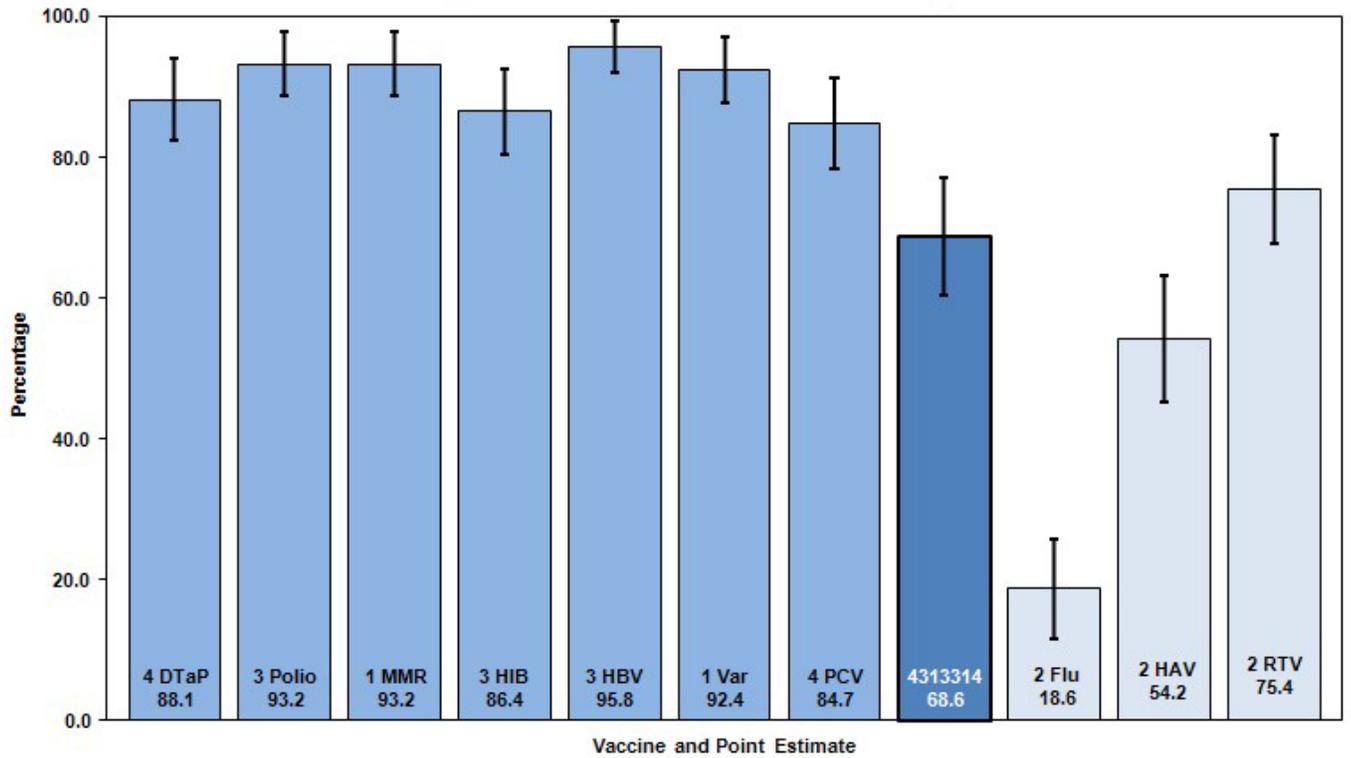
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Shelby County (SBY) by vaccine  
(point estimates and 95% confidence intervals)**



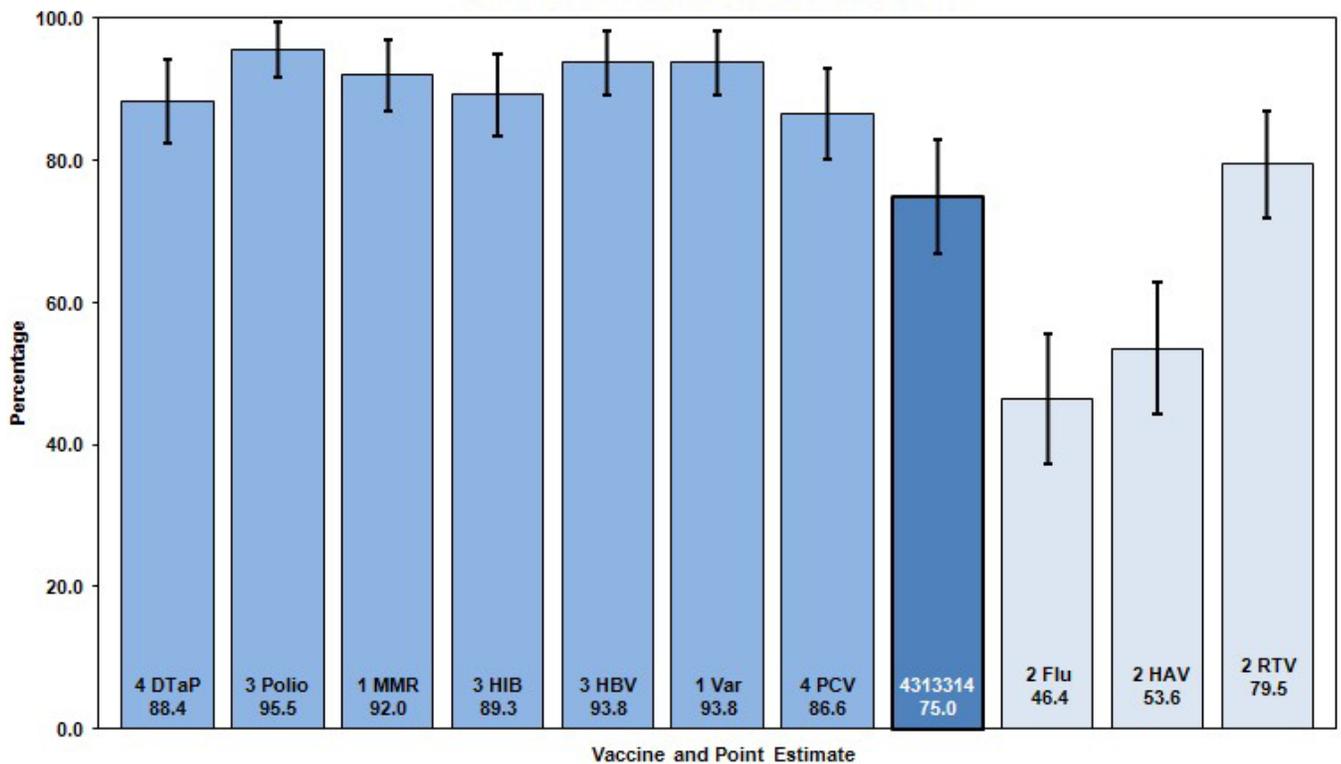
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in West Tennessee Region (WTR) by vaccine  
(point estimates and 95% confidence intervals)**



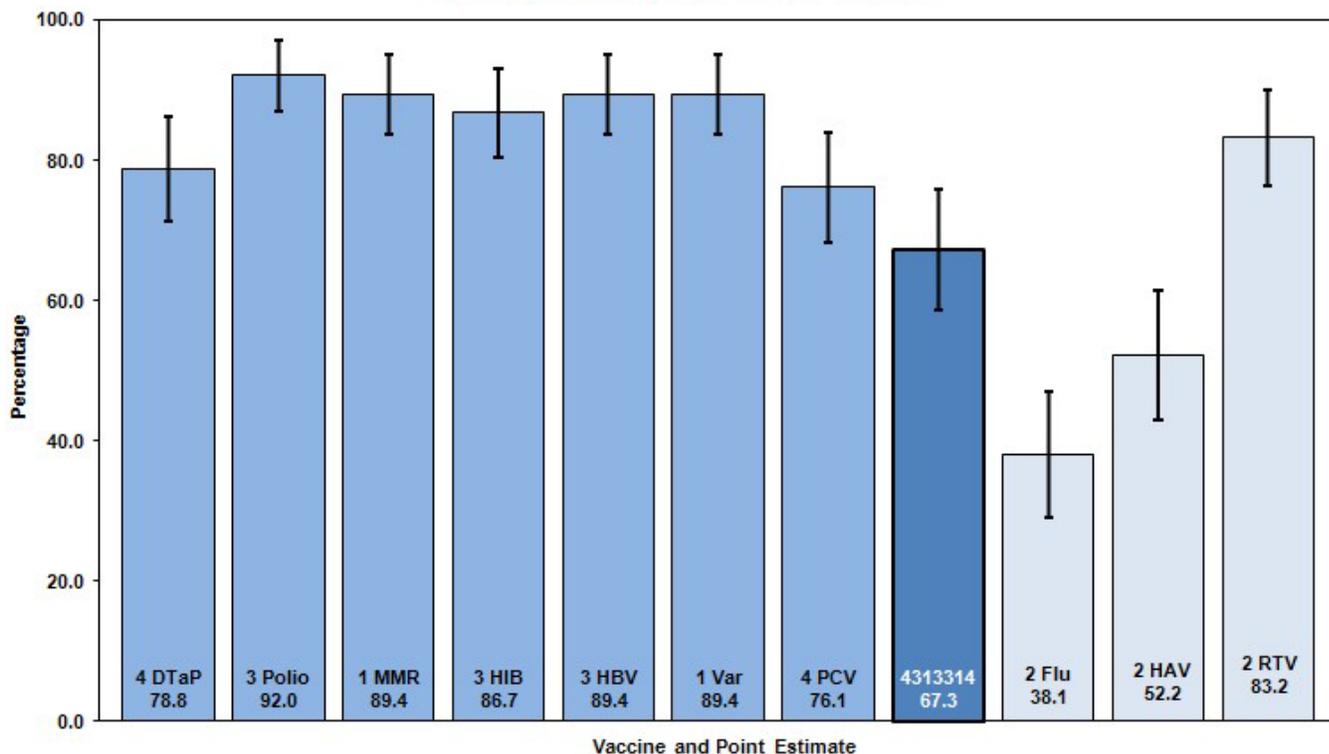
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Jackson-Madison Region (JMR) by vaccine  
(point estimates and 95% confidence intervals)**



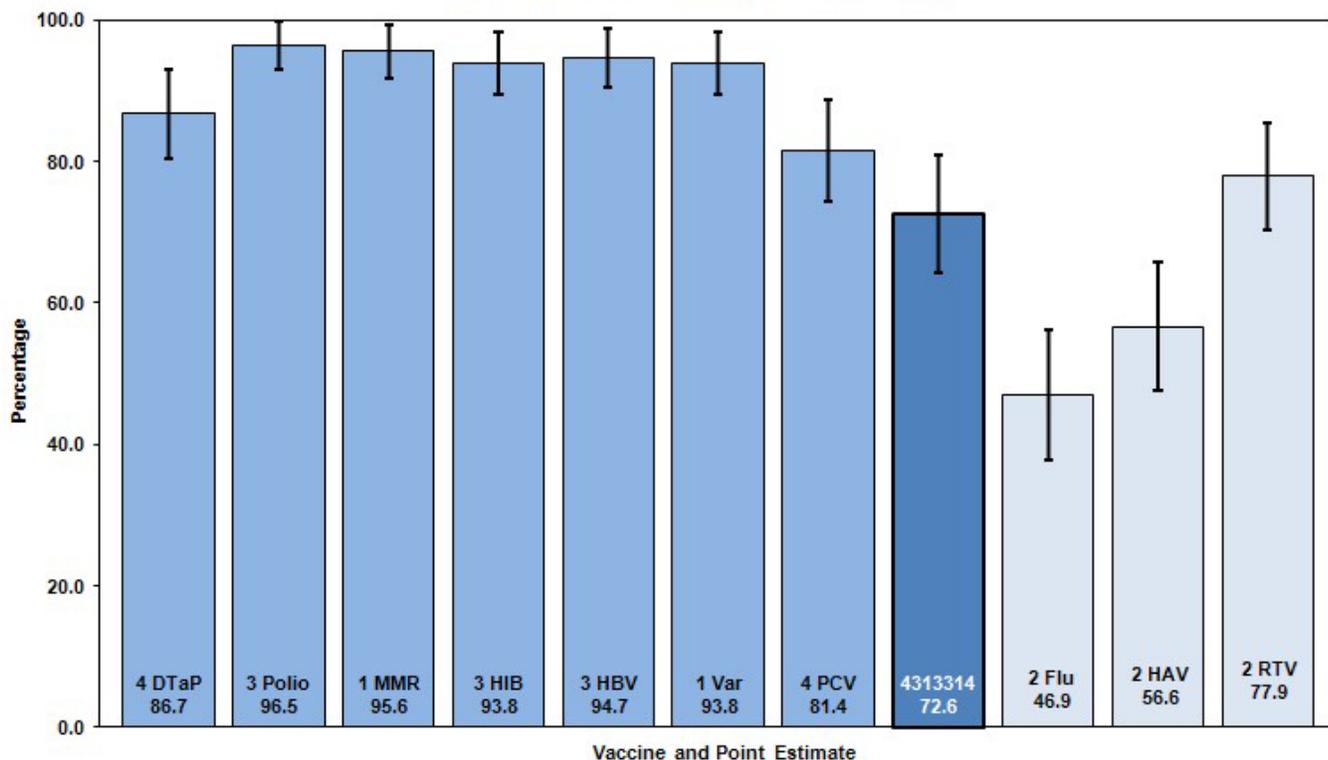
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in South Central Region (SCR) by vaccine  
(point estimates and 95% confidence intervals)**



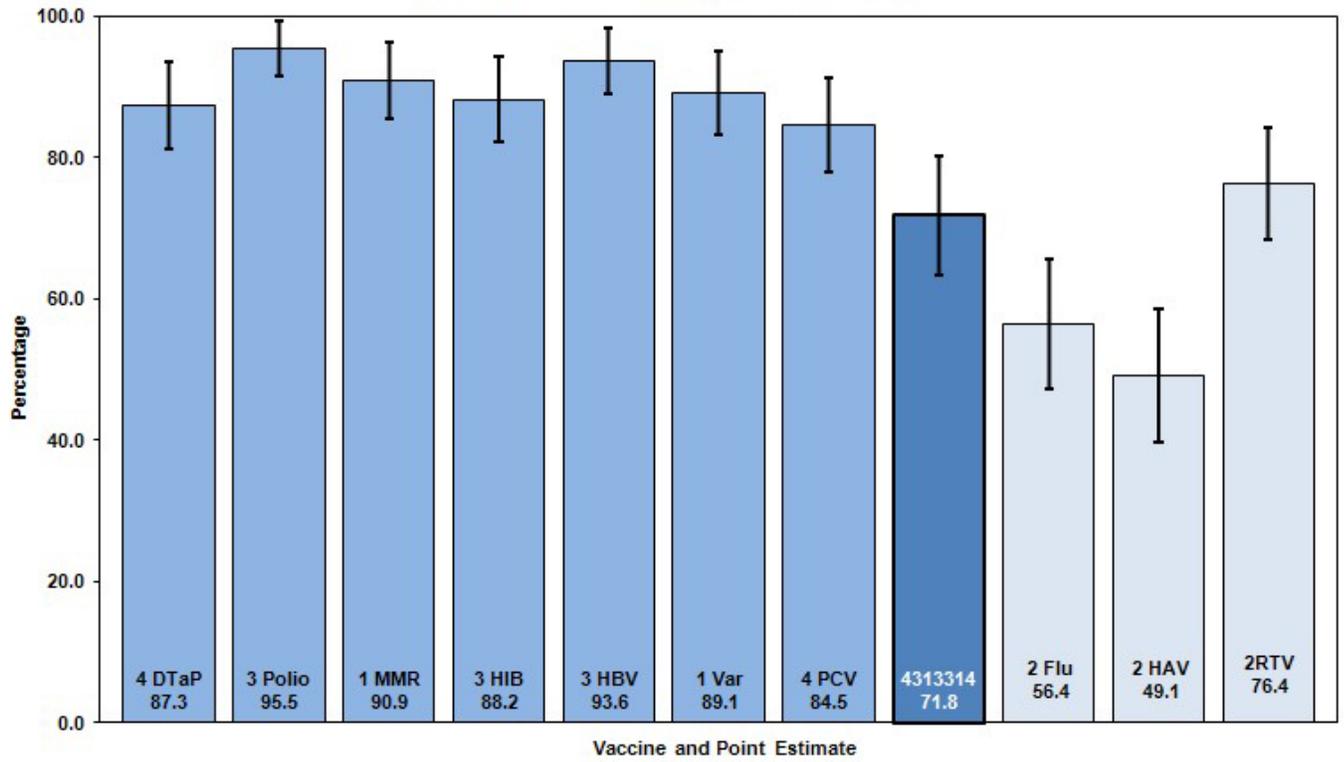
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Mid-Cumberland Region (MCR) by vaccine  
(point estimates and 95% confidence intervals)**



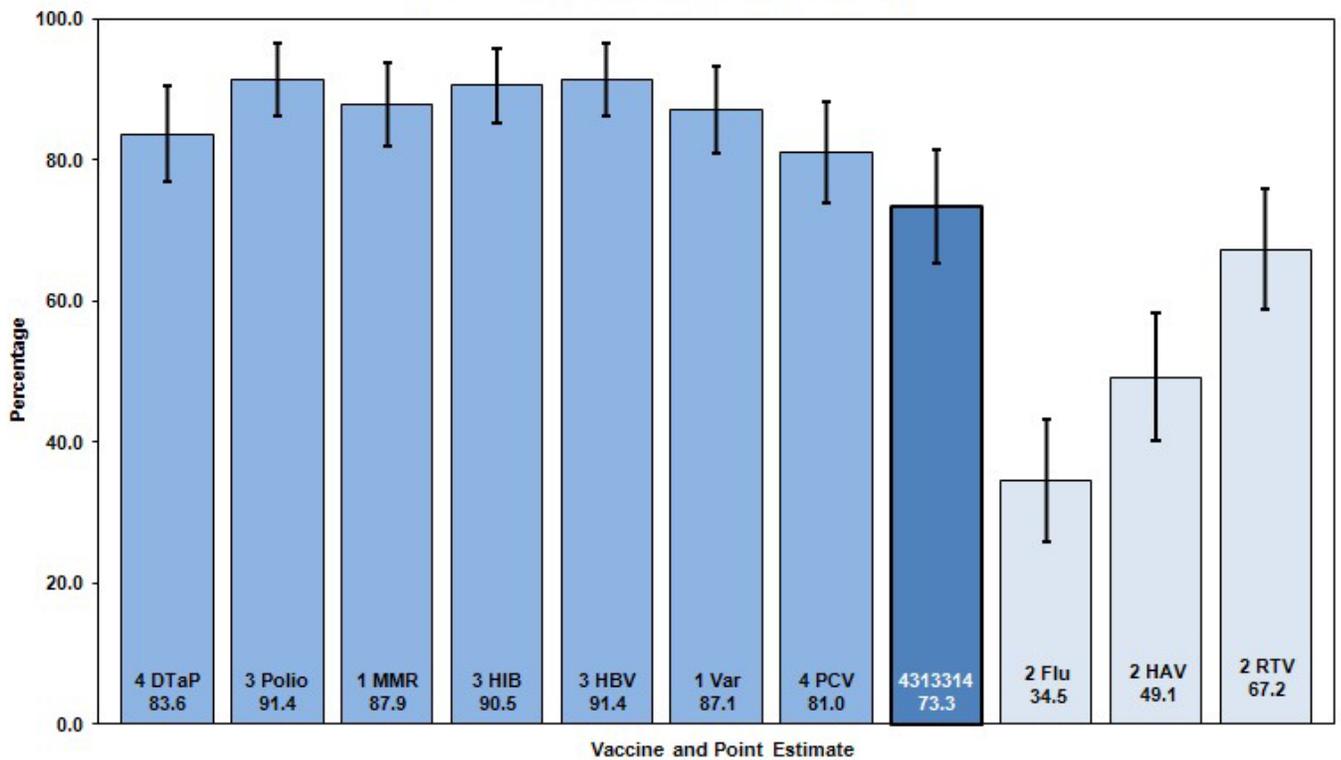
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Nashville-Davidson Region (NDR) by vaccine  
(point estimates and 95% confidence intervals)**



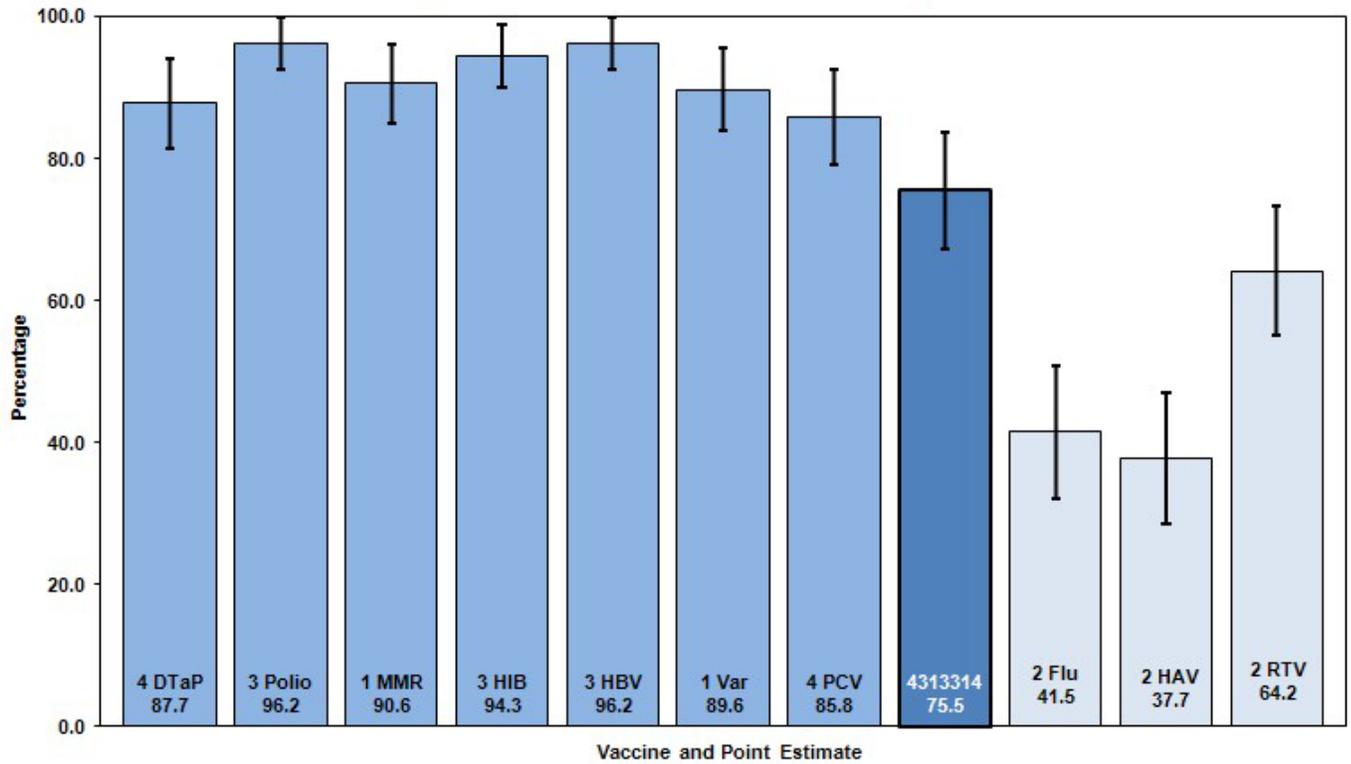
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Upper Cumberland Region (UCR) by vaccine  
(point estimates and 95% confidence intervals)**



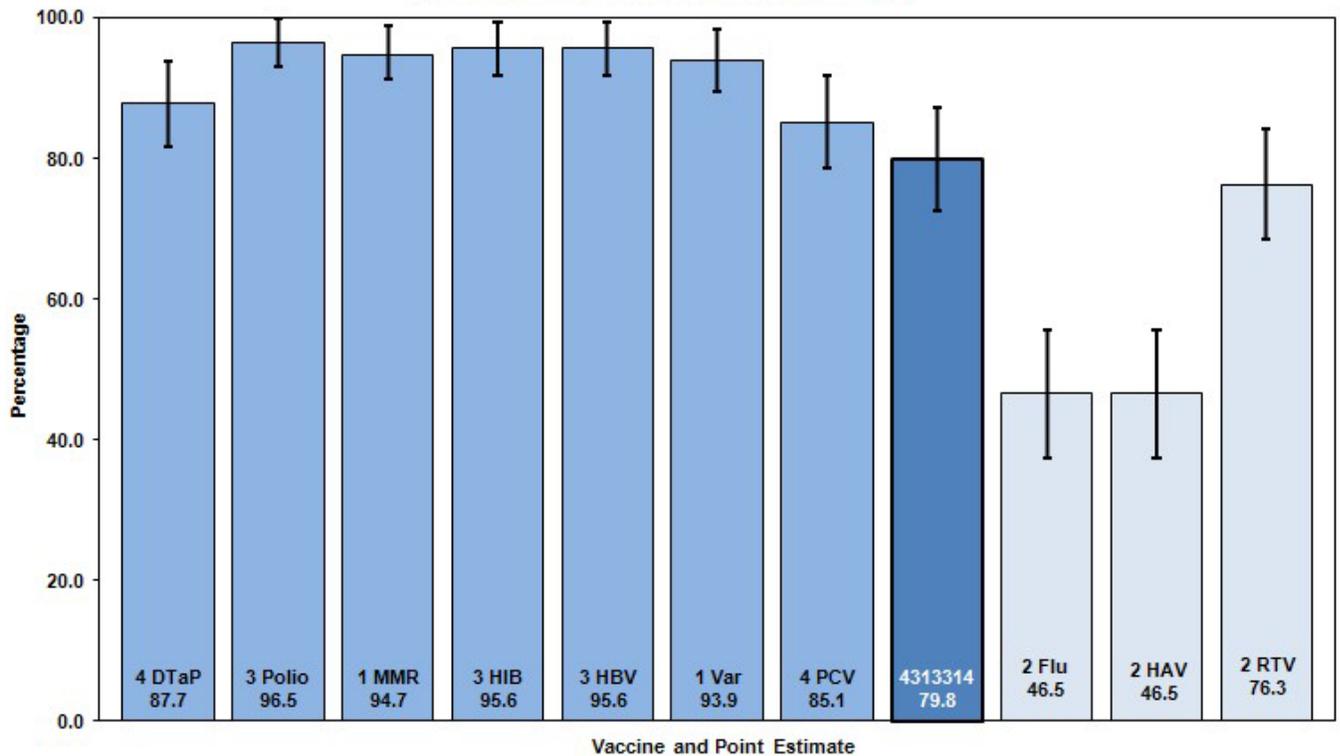
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Southeast Region (SER) by vaccine  
(point estimates and 95% confidence intervals)**



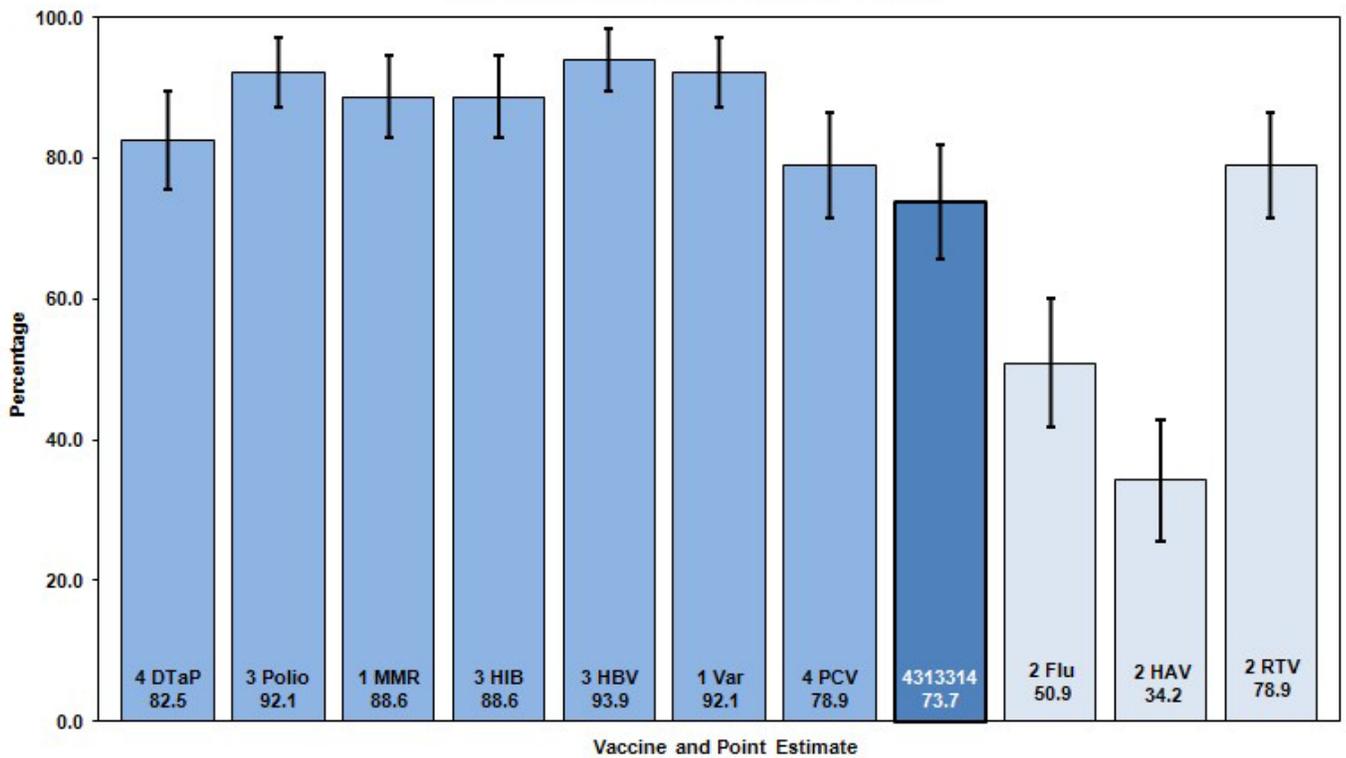
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Chattanooga-Hamilton Region (CHR) by vaccine  
(point estimates and 95% confidence intervals)**



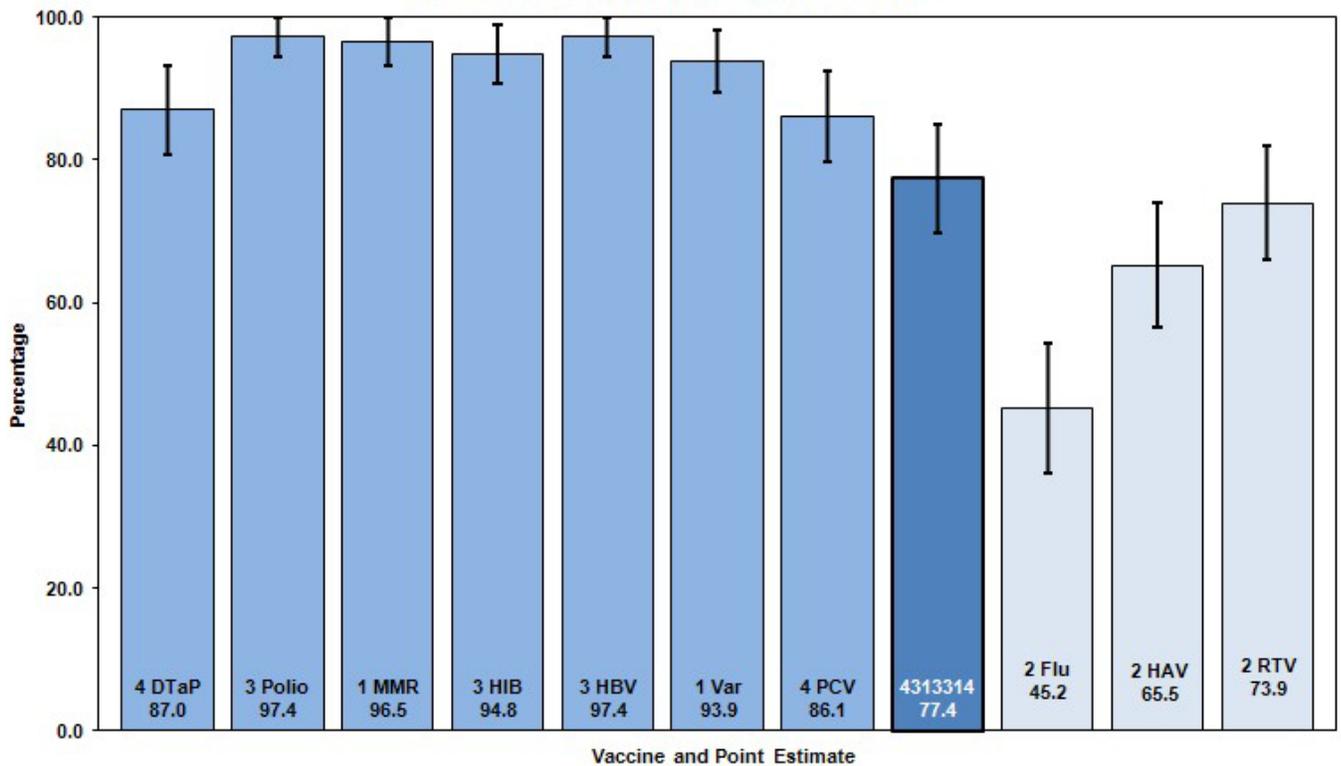
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in East Tennessee Region (ETR) by vaccine  
(point estimates and 95% confidence intervals)**



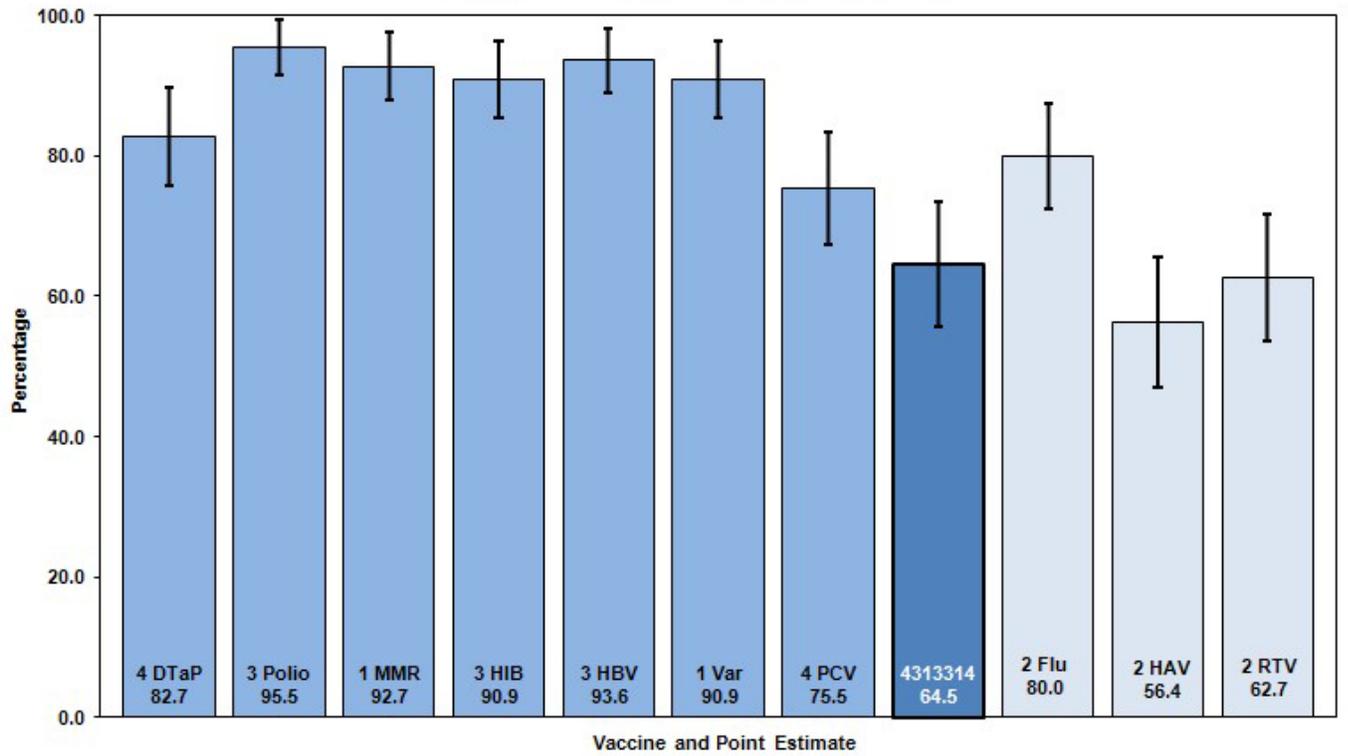
**2010 Immunization Status Survey of 24-Month-Old Children in Tennessee:  
Percentage of children complete in Knoxville-Knox Region (KKR) by vaccine  
(point estimates and 95% confidence intervals)**



**2010 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)**



**2010 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)**

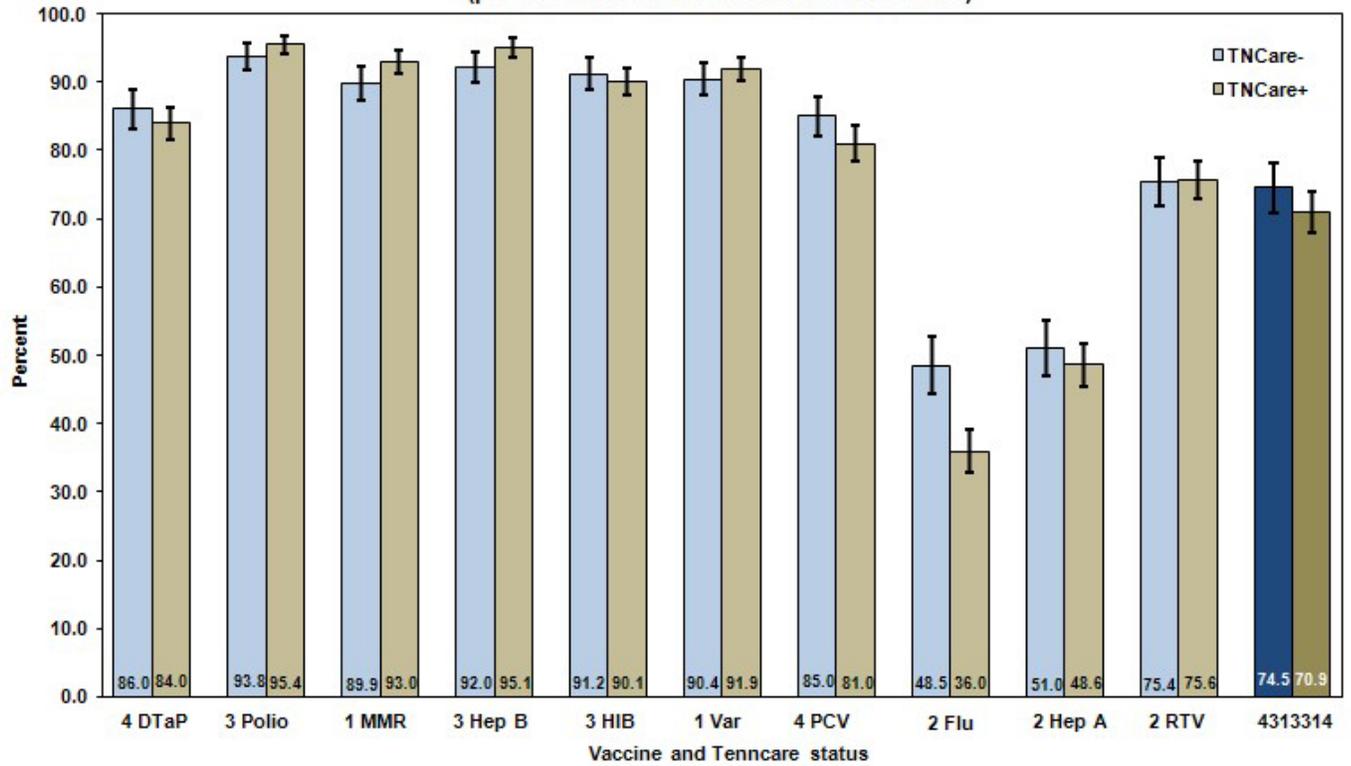


**Appendix 3**  
**2010 Immunization Status Survey**  
**Of 24-Month-Old Children in Tennessee**

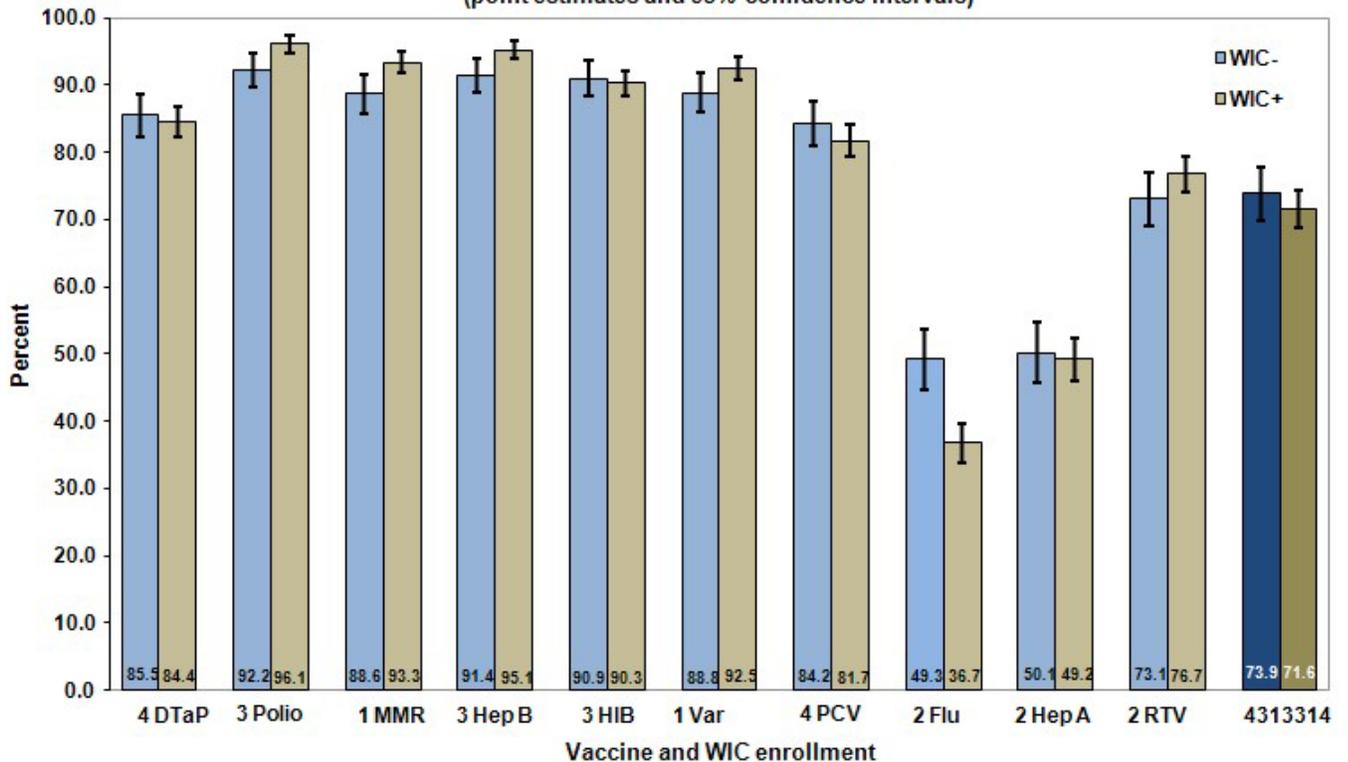
**Additional Statewide Charts for Specific Groups**

	Page
Immunization levels by vaccine and TennCare enrollment status	... 33
Immunization levels by vaccine and WIC enrollment status	... 33

**2010 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)**



**2010 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)**



# **Appendix 4**

## **2010 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)	... 35
Series Complete (4:3:1:3:3:1:4) by Provider Type	... 35
Series Complete (4:3:1:3:3:1:4) by Race	... 36
Series Complete (4:3:1:3:3:1:4) by Number of Older Siblings	... 36
Series Complete (4:3:1:3:3:1:4) by TennCare Enrollment	... 37

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

Region	Yes		No		Total
	n=	%	n=	%	n=
Northeast TN	89	77.4%	26	22.6%	115
East TN	91	79.8%	23	20.2%	114
Southeast TN	85	73.3%	31	26.7%	116
Upper Cumberland	79	71.8%	31	28.2%	110
Mid-Cumberland	76	67.3%	37	32.7%	113
South Central	84	75.0%	28	25.0%	112
West TN	84	75.0%	28	25.0%	112
Shelby County	72	65.5%	38	34.5%	110
Davidson County	82	72.6%	31	27.4%	113
Knox County	84	73.7%	30	26.3%	114
Hamilton County	80	75.5%	26	24.5%	106
Madison County	81	68.6%	37	31.4%	118
Sullivan County	71	64.5%	39	35.5%	110
Total	1058	72.3%	405	27.7%	1463

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

Region	Public			Private			Both		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	3	4	75.0%	69	90	76.7%	17	21	81.0%
East TN	3	3	100.0%	69	86	80.2%	19	23	82.6%
Southeast TN	10	15	66.7%	52	69	75.4%	23	28	82.1%
Upper Cumberland	2	5	40.0%	59	78	75.6%	18	25	72.0%
Mid-Cumberland	2	6	33.3%	58	93	62.4%	6	12	50.0%
South Central	10	11	90.9%	40	55	72.7%	34	43	79.1%
West TN	23	30	76.7%	45	57	78.9%	16	24	66.7%
Shelby County	7	12	58.3%	44	60	73.3%	21	37	56.8%
Davidson County	1	1	100.0%	66	90	73.3%	15	21	71.4%
Knox County	2	4	50.0%	66	90	73.3%	16	20	75.0%
Hamilton County	4	4	100.0%	64	86	74.4%	12	14	85.7%
Madison County	20	33	60.6%	37	52	71.1%	24	32	75.0%
Sullivan County	3	4	75.0%	53	79	67.1%	15	24	62.5%
Total	90	132	68.2%	732	985	74.3%	236	324	72.8%

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

Region	White			Black			Other		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	84	107	78.5%	4	7	57.1%	1	1	100.0%
East TN	90	113	79.6%	1	3	33.3%	1	1	100.0%
Southeast TN	83	111	74.8%	2	4	50.0%	2	3	66.7%
Upper Cumberland	75	105	71.4%	4	4	100.0%	0	1	0.0%
Mid-Cumberland	68	98	69.4%	6	11	54.5%	2	4	50.0%
South Central	77	102	75.5%	7	10	70.0%	0	0	0.0%
West TN	66	90	73.3%	20	23	87.0%	0	1	0.0%
Shelby County	32	41	78.0%	40	69	58.0%	0	0	0.0%
Davidson County	50	70	71.4%	27	37	73.0%	5	6	83.3%
Knox County	73	101	72.3%	12	14	85.7%	2	3	66.7%
Hamilton County	63	83	75.9%	19	26	73.1%	2	2	100.0%
Madison County	35	52	67.3%	46	66	69.7%	0	0	0.0%
Sullivan County	65	104	62.5%	3	4	75.0%	3	3	100.0%
Total	861	1177	73.2%	191	278	68.7%	18	25	72.0%

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

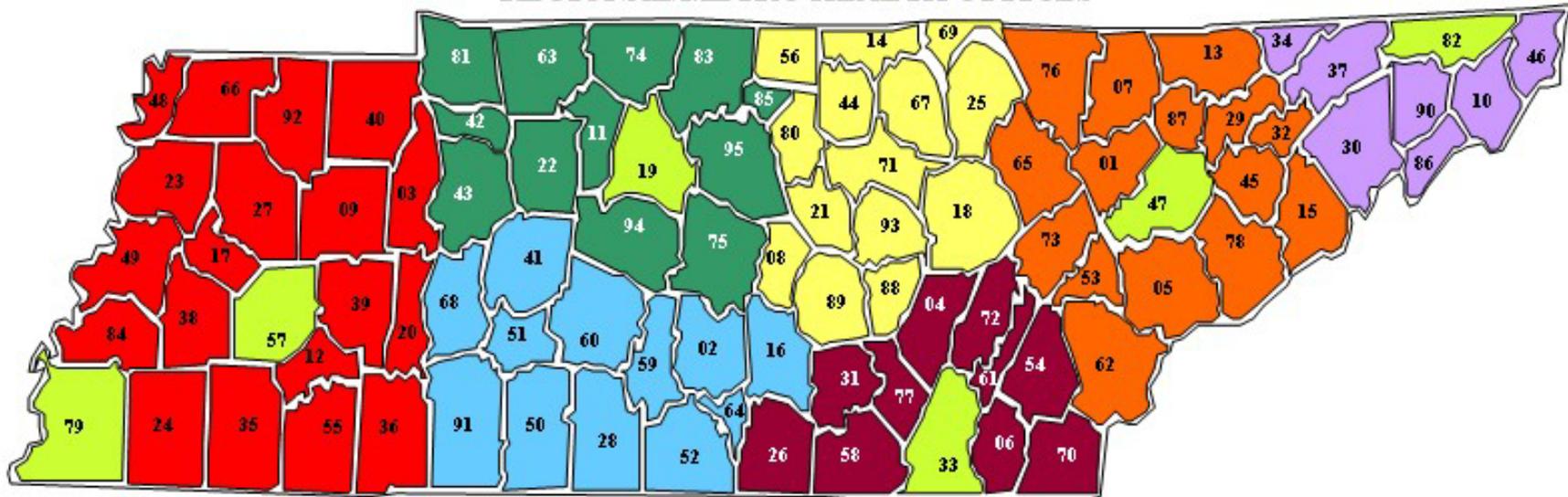
Region	0 Siblings			1 Siblings			2+Siblings		
	Yes	Total	%	Yes	Total	%	Yes	Total	%
Northeast TN	47	55	85.5%	32	42	76.2%	10	18	55.6%
East TN	44	52	84.6%	23	30	76.7%	23	31	74.2%
Southeast TN	34	45	75.6%	33	41	80.5%	18	30	60.0%
Upper Cumberland	34	41	82.9%	27	43	62.8%	18	26	69.2%
Mid-Cumberland	32	44	72.7%	23	35	65.7%	19	32	59.4%
South Central	36	44	81.8%	34	46	73.9%	14	22	63.6%
West TN	34	44	77.3%	34	43	79.1%	16	25	64.0%
Shelby County	32	43	74.4%	20	35	57.1%	20	32	62.5%
Davidson County	41	50	82.0%	20	32	62.5%	21	31	67.7%
Knox County	37	45	82.2%	30	44	68.2%	17	25	68.0%
Hamilton County	30	43	69.8%	34	39	87.2%	16	24	66.7%
Madison County	35	52	67.3%	28	42	66.7%	18	24	75.0%
Sullivan County	38	54	70.4%	19	33	57.6%	14	23	60.9%
Total	474	612	77.5%	357	505	70.7%	224	343	65.3%

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

Region	Enrolled			Not Enrolled		
	Yes	Total	%	Yes	Total	%
Northeast TN	52	67	77.6%	37	48	77.1%
East TN	54	70	77.1%	37	44	84.1%
Southeast TN	53	73	72.6%	32	43	74.4%
Upper Cumberland	55	75	73.3%	24	35	68.6%
Mid-Cumberland	41	70	58.6%	35	43	81.4%
South Central	66	84	78.6%	18	28	64.3%
West TN	55	69	79.7%	29	43	67.4%
Shelby County	46	73	63.0%	26	37	70.3%
Davidson County	47	66	71.2%	35	47	74.5%
Knox County	32	49	65.3%	52	65	80%
Hamilton County	38	51	74.5%	42	55	76.4%
Madison County	61	92	66.3%	20	26	76.9%
Sullivan County	37	59	62.7%	34	51	66.7%
<b>Total</b>	<b>637</b>	<b>898</b>	<b>70.9%</b>	<b>421</b>	<b>565</b>	<b>74.5%</b>

# 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	Mauvy	72	Rhea	69	Pickett	53	Loudon		
36	Hardin	85	Trousdale	64	Moore	77	Sequatchie	71	Putnam	62	Monroe		METROS
38	Haywood	94	Williamson	68	Perry			80	Smith	65	Morgan	#	County
39	Henderson	95	Wilson	91	Wayne			88	Van Buren	73	Roane	19	Davidson
40	Henry							89	Warren	76	Scott	33	Hamilton
48	Lake							93	White	78	Sevier	47	Knox
49	Lauderdale									87	Union	57	Madison
55	McNairy											79	Shelby
66	Obion											82	Sullivan
84	Tipton												
92	Weakley												