

# RETROSPECTIVE IMMUNIZATION COVERAGE SURVEY

2001- 2002 Results (School Year 2005-06)



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## ACRONYMS

4-3-1 Combination	DTP4-Polio3-MMR1
4-3-1-3-3 Combination	DTP4-Polio3-MMR1-Hib3-HepB3
AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
DTP4	4 doses of diphtheria, tetanus, and pertussis vaccine
HepB3	3 doses of hepatitis B vaccine
Hib3	3 doses of <i>Haemophilus influenzae</i> type b vaccine
KCI	Kansas Certificate of Immunization
KDHE	Kansas Department of Health and Environment
MMR1	1 dose of measles, mumps, and rubella vaccine
MMWR	Morbidity and Mortality Weekly Report
NIS	National Immunization Survey
Polio3	3 doses of polio vaccine
VAR1	1 dose of varicella vaccine

# **RETROSPECTIVE IMMUNIZATION COVERAGE SURVEY 2001-2002 (SCHOOL YEAR 2005-2006)**

## **EXECUTIVE SUMMARY**

The Kansas Certificates Immunization (KCIs) for children five-years of age enrolled in a kindergarten class in a Kansas public school during the 2005-2006 school year were collected and evaluated for immunization coverage rates. The children included in this survey were born between September 2, 1999, and September 1, 2000, and the coverage rates refer to when they were two years old, between September 2, 2001, and September 1, 2002. Immunization coverage rates were also calculated for these children at 5 years of age. The results for this survey are measured against similar previous studies. Seven hundred and eleven schools were included in the analysis. The 9,804 KCIs are a representative sample of the five-year old population enrolled in kindergarten at a public school.

The statewide coverage rate for the 4-3-1-3-3 series (that is, DTP4, Polio3, MMR1, Hib3, HepB3) for children at 2 years of age was 58%. This was below the Healthy People 2010 goal of at least 80%. Vaccination for hepatitis B and varicella have been required for school entry since the 2004-2005 school year. By two years of age, the coverage rate for HepB3 was 88% and for varicella 70%.

Peer groups of counties were regrouped from 5 categories to 3. Mean coverage rate estimates were compared among these groups. Counties that were “sparsely populated” had higher mean coverage rates for the 4-3-1-3-3 series than counties with greater population densities (Moderately populated, Urban).

Twelve counties reached the Healthy People goal of at least 80% coverage for the 4-3-1-3-3 series. These counties were all “sparsely populated” and clustered in the southwest portion of Kansas. At least 75 counties had 90% or greater coverage for Polio3 and MMR1. Those counties that had less than 90% were clustered in the southeast corner of Kansas. For HepB3, the counties with less than 90% coverage were grouped in the southwest corner. No counties achieved 90% for VAR1, but 13 counties had at least 80% coverage.

By 5 years of age, the immunization rates reached at least 95% for DTP4, Polio3, MMR1, and HepB3. For varicella, 83% of the children were vaccinated.

Immunization coverage rates of children by two years of age have increased each year from 1990-91 through 2000-01 and remained elevated for most single vaccines. Significant decreases in rates for DTP4, Hib3, and 4-3-1-3-3 series occurred in 2001-02. Decreases in DTP4 and the 4-3-1-3-3 series were due primarily to a shortage of the DTP vaccine that occurred during 2001-2002. Continued assessment and evaluation of the immunization rates are necessary to monitor progress toward the Healthy Kansas 2010 goal of 90% immunization coverage.

# RETROSPECTIVE IMMUNIZATION COVERAGE SURVEY 2001-2002 (SCHOOL YEAR 2005-2006)

## INTRODUCTION

### **Objective**

Estimate the immunization coverage rates at the age of two years for children in kindergarten enrolled in the Kansas public school system during the 2005-2006 school year.

### **Study Population**

The study population included all children enrolled in kindergarten in the Kansas public school system during the 2005-2006 school year.

### **Study Design**

The study was a stratified, cross-sectional survey, with each county representing a stratum. The characteristics of interest, or outcome variables, are the percentage of children who were fully immunized at two years of age against diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *H. influenzae* type b, hepatitis B virus, and varicella.

Immunization coverage rates were measured for single vaccines and combinations of vaccines according to the recommended immunization schedule for children two years of age.<sup>1</sup> *The results of the survey refer to children who were born between September 2, 1999, and September 1, 2000. The coverage rates refer to the time these children were two-years-old, between September 2, 2001, and September 1, 2002 and coverage rates at five years of age upon first entering school.*

## METHODS

### **Sampling Techniques**

A probability sample of all children enrolled in kindergarten in Kansas public schools was drawn. To ensure an adequate sample size in each county and maximize the efficiency of the sampling process, a different sampling ratio was established for each county, and a probability sample was selected using a systematic sample technique.<sup>2</sup>

### **Data Collection**

All Kansas public schools with a kindergarten class received a letter co-signed by officials representing the Kansas Department of Health and Environment and the Kansas State Department of Education, requesting them to participate in the survey. The letter specified the number of records required to generate estimates of county-specific coverage rates (i.e., sample size) and outlined the process of systematically selecting a probability sample of records. Depending on the calculated sampling ratio for their county, the study coordinator at each school (typically the school

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<sup>1</sup> The Recommended Immunization Schedule used, as reference for ages and immunization in this paper was the schedule approved by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP) and the American Academy of Family Physicians (AAFP) for the year 2000.

<sup>2</sup> The sample ratio is the ratio between the total enrollment in a school and the sample size, and it represents the proportion of enrolled children who are sampled.

nurse) was instructed to select all, every other, every third, every sixth, every fourteenth, or every sixteenth immunization record regardless of the size of the kindergarten class at that school. School administrators and school nurses were also advised to remove all personal identifiers, except date of birth, to ensure confidentiality of children. Copies of the immunization records and the current total number of kindergarten enrollees in each school were forwarded to KDHE.

### **Data Analysis**

Point estimates of coverage rates and 95% confidence intervals (95% CI) for DTP4, Polio3, MMR1, 4-3-1 combination, Hib3, HepB3, and VAR1 vaccines were calculated. A child was considered “up-to-date” for single vaccines if, at age two years, he or she had received at least four doses of DTP, (DTP4), three doses of Polio (Polio3), one dose of MMR (MMR1), three doses of *H. influenzae* type b (HibB3), three doses of Hepatitis B (HepB3), and one dose of the varicella (VAR1) vaccine. A child was considered “up-to-date” for the 4-3-1-3-3 series if he or she was up-to-date for all: DTP4, Polio3, MMR1, Hib3, and HepB3 vaccines. The statewide estimates account for the complex survey design effect due to the stratification process and to the differences in sampling ratios among counties.<sup>3</sup> Sample weights were calculated using the number of kindergartners enrolled in a county and the number of records analyzed for that county. These weights were applied during analysis of statewide estimates.

Population densities were calculated based on population from the 2000 Annual Summary of Vital Statistics to categorize counties.<sup>4</sup> The 2000 vital statistics data corresponds to the data in the current retrospective survey. These categories include Urban, Semi-Urban, Densely-settled Rural, Rural, and Frontier. For the purpose of this analysis, these categories are regrouped into Urban (Urban), Moderately Populated (Semi-Urban, Densely-Populated) and Sparsely-Populated (Rural, Frontier). Mean immunization coverage rate estimates are compared among these groups (Appendix 1).

### **RESULTS**

Letters of invitation to participate in the survey were sent to 769 Kansas public schools. Forty-five schools reported not having a kindergarten class for the 2005-2006 school year and 30 did not respond. Data were received from and analyzed for 694 schools with kindergarten classes, corresponding to a school participation rate of 95.9%.

The number of children enrolled in kindergarten at the participating public schools was 32,689, which is 82% of the 39,654 children in that birth cohort.<sup>5</sup> Those not available to survey include children who attend private school, home school, or other special schools. The number of immunization records received was 12,743. This is equivalent to a sampling ratio of 2.7, meaning that one child was selected for every 2.7 children enrolled. The range of the sample size by county was from 10 to 324 records while the range of student enrollment was from 13 to 6,303.<sup>6</sup>

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<sup>3</sup>Complex survey design effect was accounted for by using the SAS Procedure PROC SURVEYMEANS.

<sup>4</sup> <http://www.kdhe.state.ks.us/hci/as01/as1999.html>

<sup>5</sup>2000 Annual Summary of Kansas Vital Statistics. (<http://www.kdheks.gov/ches/as00/as2000.html>)

<sup>6</sup>Estimates from counties with small sample size (<50) may be unstable and changes over time should be interpreted with caution.

Of the 12,248 immunization records returned and examined, 9,804 (80%) were complete and had usable information regarding immunization history. This includes children who were at least five years of age but less than six years of age on September 1, 2005. Of the 2,444 records excluded, 1,602 (65%) children were not 5 years of age. The remaining excluded records had incomplete or unusable KCIs. The number of records examined by population density includes: 3,202 (33% of all records) Sparsely-populated, 5,198 (53% of all records) Moderately-populated, and 1,404 (14% of all records) Urban categories.

*Statewide Immunization Coverage of Two Year Olds*

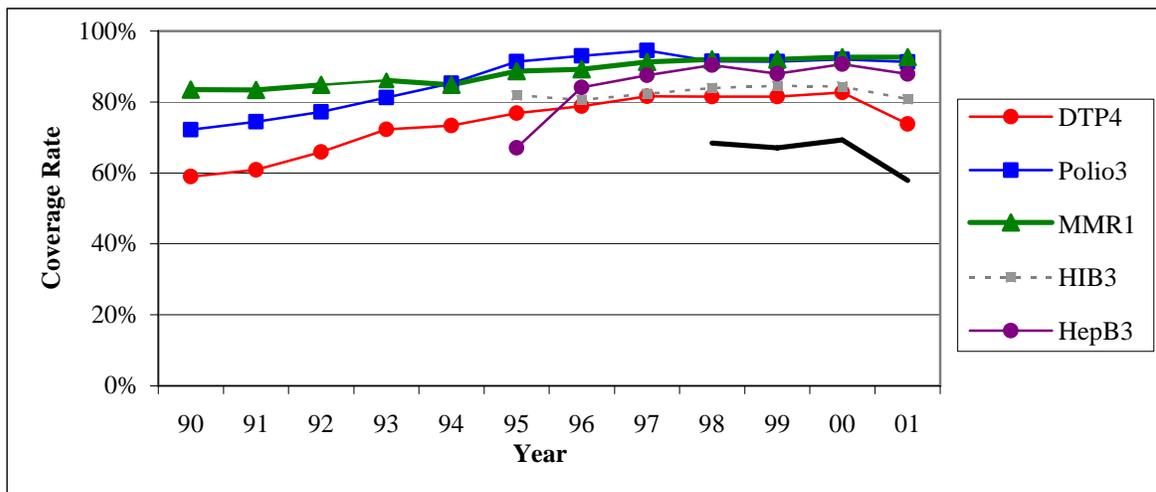
The immunization coverage rates for the single vaccines remained the same or increased compared to the coverage rates of the previous year except for DTP4 and Hib3. Immunization coverage rates have risen each year from 1990-91 through 2000-01 and then decreased significantly in 2001-02 for DTP4, Hib3 and 4-3-1-3-3 as displayed in Figure 1.

**TABLE 1 Kansas immunization coverage rates at the age of 2 years by vaccine for 2001-2002. \*** Percentage up-to-date and 95% confidence interval

	%	95% CI
<b>DTP4</b>	73.8	72.4 - 75.3
<b>Polio3</b>	91.3	90.3 - 92.2
<b>MMR1</b>	92.6	91.8 - 93.4
<b>Hib3</b>	80.8	79.4 - 82.3
<b>HepB3</b>	87.9	86.7 - 89.1
<b>4-3-1-3-3</b>	57.9	56.2 - 59.6
<b>VAR1</b>	70.4	68.9 - 72.0

\*Based on retrospective surveys from school years starting in 2005.

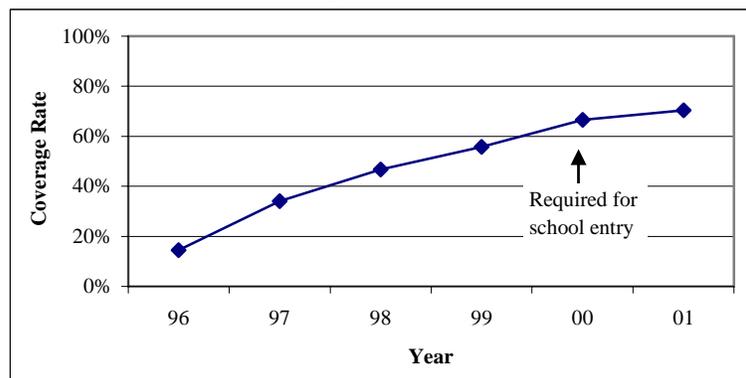
**FIGURE 1 Kansas immunization coverage rates at the age of 2 years by vaccine from 1990-91 through 2001-2002. \***



\* Based on retrospective surveys from school years starting in 1994 through 2005.

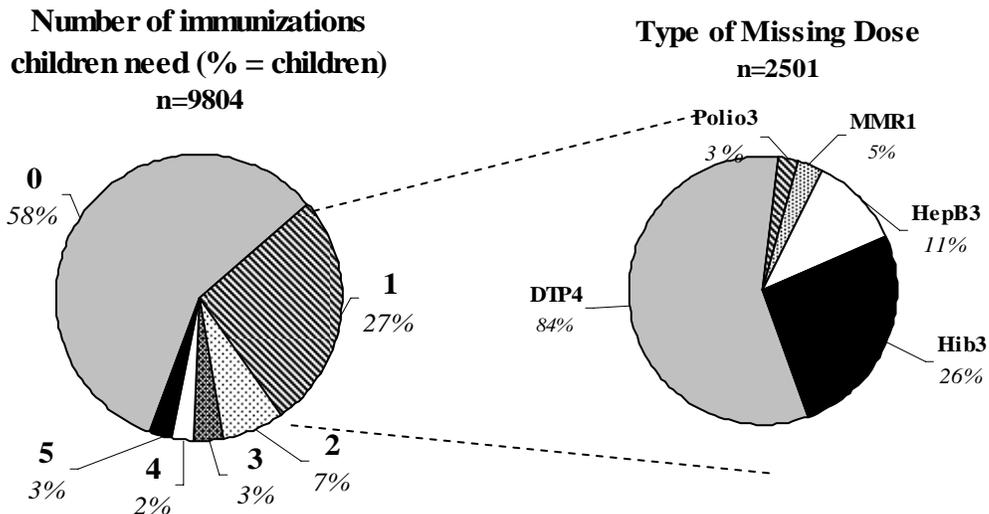
Varicella vaccine was licensed for use in March, 1995 and became a required immunization for kindergartners in 2004. For kindergarten entry, history of varicella disease is accepted in place of VAR1 vaccination. VAR1 coverage rates have increased significantly each year since the analysis began. The coverage rate did not increase when history of varicella disease was included.

**FIGURE 2 Kansas immunization coverage rates at the age of 2 years for one dose of varicella from 1995-96 through 2001-2002. \***



Of children not up-to-date at 24 months of age, 63% (21% of total population studied) needed one additional immunization in order to be up-to-date for the 4-3-1-3-3 series (Figure 3). If these children had received one additional immunization the coverage rates for the 4-3-1-3-3 combination would have increased from 57.9% to 84.5%. Among children needing one additional immunization, 84% needed DTP4. Among children not up-to-date at 24 months of age, 7% (3% of total population) were missing DTP4, Polio3, MMR1, HepB3 and Hib3.

**FIGURE 3: Number and type of immunizations kindergarteners needed to be up-to-date at the age of 24 months, Kansas 2001 - 2002. \***



\*Based on the retrospective survey for the school year starting 2005.

*County-level Immunization Coverage of Two Year Olds*

Immunization coverage was also analyzed at the county level. Immunization coverage by county for all vaccines and the 4-3-1 and 4-3-1-3-3 series is shown in Appendix 2.

Twelve counties reached the Healthy People goal of at least 80% coverage for the 4-3-1-3-3 series. These counties were all “sparsely populated” and clustered in the southwest portion of Kansas (Appendix 3). For DTP4, six counties had at least 90% coverage and zero counties had at least 90% coverage for VAR1. Pockets of need were identified for Polio3, MMR1, and HepB3. Those counties with less than 90% coverage were in the southeast and southwest corners.

Counties were categorized based on their population densities. Estimated mean coverage rates of the counties were compared among three categories (Table 2). Counties that were “sparsely populated” had higher mean coverage rates for the 4-3-1-3-3 series than counties with greater population densities (Moderately populated, Urban).

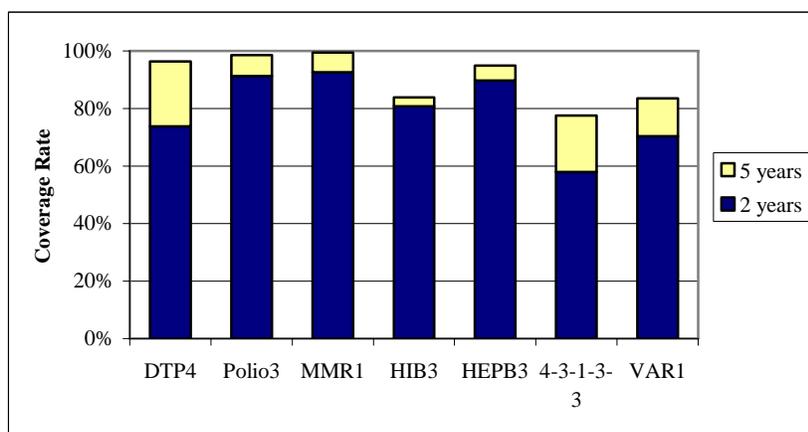
**TABLE 2: Mean Immunization Coverage Rate Estimates (%) Among Categories Based on Population Density.**

Counties by Population Density - Collapsed Groups			
	Sparsley Populated (N=69)	Moderately Populated (N=31)	Urban (N=5)
<b>DTP4</b>	73.7	69.4	74.4
<b>Polio3</b>	93.6	90.9	90.6
<b>MMR1</b>	94.0	91.3	92.3
<b>Hib3</b>	91.0	82.4	79.5
<b>HepB3</b>	91.2	88.5	87.0
<b>4-3-1-3-3 Series</b>	66.7	57.0	57.6
<b>VAR1</b>	72.4	65.3	74.5

*Statewide Immunization Coverage of Five Year Olds*

Immunization rates of kindergarteners when they were five years old were calculated (Figure 4). By age 5, at least 95% of the children were up-to-date for DTP4, Polio3, MMR1, and HepB3. The vaccination coverage rate for VAR1 was 83% and is a statistically significant increase over the previous year. Less than one percent of the children had indicated history of varicella disease. The greatest increases of coverage rates were for DTP4 and 4-3-1-3-3 series, which increased by almost 23 and 20 percentage points, respectively. Coverage rates for all vaccines and 4-3-1-3-3 series show a statistically significant increase including Hib3, which only increased 3 percentage points. These data show those immunization rates are higher when children are about to enter school than at the age of 2 years.

**FIGURE 4 Immunization rates of Kansas kindergartners at ages two and five years, 2005-06. \***



\*Based on the retrospective survey for the school year starting 2005

**DISCUSSION**

Statewide immunization coverage rates remained at stable levels or increased for single vaccines in the current 2005-2006 Retrospective Survey except DTP4 and Hib3 which significantly decreased. Since the children were five years old when this study was carried out, the results of the survey indicate the immunization coverage rates that were effective about three years earlier. Only

immunization coverage rates for Polio3 and MMR1 reached the Healthy People 2010 (HP2010) goal of at least 90% coverage. Coverage rates for Hib3 and HepB3 were less than 10 percentage points from meeting this goal.<sup>7</sup> Immunizations against *H. influenzae* type B (Hib3) were not required for school entry for the 2005-2006 school year and thus not always recorded in the KCI. For this reason the immunization coverage rates might actually be higher than those represented in the data. Despite only 70% coverage for VAR1, rates have significantly increased each year since analysis began.

Twelve counties reached the Healthy People goal of at least 80% coverage for the 4-3-1-3-3 series. These counties were all “sparsely populated” and clustered in the southwest portion of Kansas (Appendix 3). At least 75 counties had 90% or greater coverage for Polio3 and MMR1. Those counties that had less than 90% were clustered in the southeast corner of Kansas. For HepB3, the counties with less than 90% coverage were grouped in the southwest corner. No counties achieved 90% for VAR1, but 13 counties had at least 80% coverage.

County designations are used to create categories by population. The mean coverage rate estimates are compared to determine if differences exist among the counties of different population densities. For the 4-3-1-3-3 series, the mean coverage rate of the “sparsely populated” counties was 10 percentage points higher compared to the other two categories. The “sparsely populated” counties account only for 13% of the population surveyed. Compared to the mean coverage rate estimates of the other two categories (moderately populated, urban), the mean coverage rate estimate for the “sparsely populated” category was highest for the 4-3-1-3-3 series and all vaccines except DTP4 and VAR1. “Urban”, which includes the most densely populated counties and represents 51% of the population surveyed, had a low coverage rate estimate for the 4-3-1-3-3 series. Targeting the population in the 5 “urban” counties in order to increase coverage rate estimates would increase the statewide coverage rate.

The results from this survey were compared with the results from the 2002 National Immunization Survey (NIS), which refers to the same time period in this retrospective survey.<sup>8</sup> The results were compared to confirm the coverage rates in the retrospective survey and to compare coverage rates in Kansas to the rest of the US. Data for the population-based NIS are collected by the Centers for Disease Control and Prevention (CDC) through a telephone survey of randomly selected households. For accuracy, the healthcare providers of the children included in the survey are contacted by mail. The coverage rates for DTP4, Hib3, and 4-3-1-3-3 series were significantly lower in the Retrospective survey when compared to the NIS results for Kansas. Possible reasons for the difference in rates are that Hib3 is not required for school entry and may not be routinely recorded on the KCIs, and differences in sampling methodologies.

From March 2001 through July 2002, the fourth dose of DTP was deferred as a result of vaccine shortage. This was the same time that children in this cohort were to receive their fourth dose of DTP. Only 74% of children were vaccinated with all four doses by age 2 years, but by 5 years of age, 96% of the children had received all recommended doses.

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<sup>7</sup>Healthy People 2010 set goals of 90% coverage for DTP4, Polio3, MMR1, HIB3, HepB3, and VAR1 and 80% coverage for 4-3-1-3-3 series among children aged 19 to 35 months.

<sup>8</sup> *Morbidity and Mortality Weekly Report*; 50 (30); 637-641.

Immunization coverage rates were also examined for kindergarteners when they were five years old. By age 5, immunization coverage rates increased for all single vaccines. At least 95% of the children have received DTP4, Polio3, MMR1, and HepB3. For varicella, 83% of the children had either been immunized or had the disease by 5 years of age. School entry requirements are the most likely reason for this increase, although coverage rates for non-required vaccines increased also.

### **Limitations**

Limitations of this survey include: the survey reports data that refer to immunization coverage rates that occurred three years before the survey. The Retrospective Immunization Survey only includes children who were enrolled in kindergarten in Kansas public schools. Children who attend a private school or are home-schooled are excluded from the survey. However, the records analyzed are representative of 82% of this birth cohort, which is likely to ensure their validity. Also, no descriptive data are collected about race, ethnicity, or religious and medical exemptions.

### **Strengths**

Despite the limitations, the retrospective immunization survey provides a good estimation of the early childhood immunization coverage rates for Kansas. It allows state and local officials to identify and focus on the counties with low coverage rates. Recognition and focus on problem areas such as age and location can aid in Kansas achieving the 90% coverage rate goal. To this purpose, a similar survey is planned for next year.



**APPENDIX 2:**Immunization Coverage Rates of Children 2 Years of Age for Kansas Counties  
2001-2002.\*

<b>COUNTY</b>	<b>DTP4</b>	<b>Polio3</b>	<b>MMR1</b>	<b>Hib3</b>	<b>HepB3</b>	<b>Var1</b>	<b>4-3-1</b>	<b>4-3-1-3-3</b>
ALLEN	58.1	89.9	90.5	86.5	84.5	65.5	57.4	49.3
ANDERSON	69.6	87.3	94.9	92.4	87.3	60.8	64.6	59.5
ATCHISON	72.7	90.9	89.4	81.8	83.3	42.4	68.2	59.1
BARBER	91.9	100.0	94.6	97.3	100.0	67.6	89.2	86.5
BARTON	79.5	90.9	100.0	86.4	90.9	72.7	75.0	65.9
BOURBON	76.2	87.1	93.2	93.2	87.1	66.7	72.1	65.3
BROWN	78.0	88.0	92.0	57.0	87.0	36.0	74.0	47.0
BUTLER	76.0	95.0	92.4	92.0	89.7	67.9	73.7	64.9
CHASE	81.8	100.0	100.0	100.0	100.0	31.8	81.8	81.8
CHAUTAUQUA	80.0	93.3	90.0	90.0	93.3	56.7	73.3	73.3
CHEROKEE	69.2	90.4	92.3	85.3	88.5	67.9	68.6	62.2
CHEYENNE	77.3	95.5	95.5	90.9	95.5	86.4	77.3	77.3
CLARK	78.6	96.4	96.4	96.4	96.4	75.0	78.6	75.0
CLAY	68.1	97.1	94.2	81.2	85.5	73.9	68.1	50.7
CLOUD	74.7	94.3	95.4	93.1	93.1	77.0	73.6	71.3
COFFEY	79.0	92.4	94.3	97.1	91.4	74.3	77.1	71.4
COMANCHE	92.3	96.2	100.0	100.0	88.5	88.5	92.3	84.6
COWLEY	53.0	86.9	89.3	46.4	86.3	55.4	51.8	24.4
CRAWFORD	60.2	88.4	86.1	85.2	86.6	48.6	59.3	53.2
DECATUR	75.0	100.0	100.0	83.3	91.7	33.3	75.0	75.0
DICKINSON	78.7	93.5	89.8	76.9	90.7	70.4	76.9	63.0
DONIPHAN	77.6	89.8	87.8	79.6	83.7	57.1	75.5	67.3
DOUGLAS	75.4	92.8	92.8	89.2	90.5	79.7	72.8	64.3
EDWARDS	43.3	100.0	93.3	100.0	96.7	86.7	40.0	36.7
ELK	81.0	85.7	90.5	95.2	90.5	81.0	81.0	81.0
ELLIS	82.3	96.2	94.9	89.9	85.4	62.0	78.5	67.7
ELLSWORTH	79.5	94.0	96.4	94.0	89.2	74.7	77.1	69.9
FINNEY	76.9	95.0	94.2	90.1	93.4	72.7	76.9	75.2
FORD	65.0	94.6	93.6	93.9	93.6	70.0	63.9	60.4
FRANKLIN	55.4	93.9	93.2	90.5	91.2	79.7	55.4	51.4
GEARY	65.8	84.7	87.6	88.7	85.1	74.2	62.5	58.5
GOVE	63.6	86.4	95.5	90.9	81.8	63.6	63.6	59.1
GRAHAM	50.0	95.0	95.0	95.0	95.0	70.0	50.0	50.0
GRANT	66.1	94.4	93.5	94.4	96.0	75.0	64.5	63.7
GRAY	81.7	91.5	91.5	93.0	90.1	71.8	81.7	80.3

\* Based on the retrospective survey for the school year starting 2005.

<b>COUNTY</b>	<b>DTP4</b>	<b>Polio3</b>	<b>MMR1</b>	<b>Hib3</b>	<b>HepB3</b>	<b>Var1</b>	<b>4-3-1</b>	<b>4-3-1-3-3</b>
GREELEY	53.3	86.7	93.3	86.7	86.7	66.7	53.3	46.7
GREENWOOD	61.0	87.0	90.9	85.7	79.2	55.8	61.0	54.5
HAMILTON	71.4	94.3	94.3	91.4	82.9	85.7	71.4	68.6
HARPER	78.0	98.0	96.0	96.0	94.0	68.0	78.0	78.0
HARVEY	79.5	93.3	91.3	67.7	91.3	64.1	76.4	52.8
HASKELL	74.6	85.9	95.8	93.0	94.4	84.5	73.2	71.8
HODGEMAN	73.7	89.5	94.7	84.2	84.2	78.9	73.7	68.4
JACKSON	84.6	91.5	96.6	78.6	86.3	54.7	82.1	64.1
JEFFERSON	81.9	93.8	91.9	90.0	89.4	68.8	81.3	70.6
JEWELL	70.0	95.0	100.0	80.0	100.0	70.0	70.0	60.0
JOHNSON	81.9	92.4	95.3	65.3	84.1	76.2	80.1	48.7
KEARNEY	80.0	97.5	97.5	95.0	97.5	65.0	80.0	80.0
KINGMAN	79.7	95.7	94.2	100.0	88.4	63.8	75.4	69.6
KIOWA	87.5	93.8	100.0	100.0	93.8	87.5	84.4	81.3
LABETTE	55.9	87.7	89.6	45.5	89.6	68.7	55.5	27.5
LANE	79.2	95.8	83.3	100.0	91.7	70.8	79.2	79.2
LEAVENWORTH	76.0	89.7	89.7	66.5	87.5	75.3	70.3	48.3
LINCOLN	66.7	95.2	100.0	95.2	100.0	71.4	66.7	61.9
LINN	76.8	92.9	91.1	87.5	92.9	57.1	75.0	67.9
LOGAN	87.5	95.8	91.7	91.7	91.7	45.8	83.3	75.0
LYON	58.4	94.6	94.6	92.8	91.6	39.8	57.2	54.2
MARION	82.9	95.1	93.9	82.9	78.0	61.0	80.5	51.2
MARSHALL	72.5	95.7	92.8	91.3	94.2	56.5	71.0	66.7
MCPHERSON	63.2	89.5	90.5	89.5	85.3	64.2	62.1	55.8
MEADE	90.0	100.0	100.0	100.0	90.0	70.0	90.0	80.0
MIAMI	72.0	89.0	91.2	94.0	86.8	59.9	69.2	62.6
MITCHELL	55.0	90.0	87.5	92.5	87.5	47.5	55.0	52.5
MONTGOMERY	65.7	85.9	89.9	89.9	83.8	80.8	63.6	59.6
MORRIS	54.1	88.5	90.2	93.4	95.1	67.2	52.5	50.8
MORTON	91.3	91.3	100.0	87.0	100.0	87.0	87.0	73.9
NEMAHA	90.7	100.0	95.3	86.0	88.4	25.6	90.7	74.4
NEOSHO	61.9	95.2	88.9	90.5	92.1	50.8	61.9	54.0
NESS	73.1	92.3	92.3	96.2	84.6	80.8	73.1	69.2
NORTON	75.0	88.6	93.2	81.8	90.9	70.5	72.7	63.6
OSAGE	75.6	91.5	91.5	67.7	89.6	67.7	72.6	47.0

\*Based on the retrospective survey for the school year starting 2005.

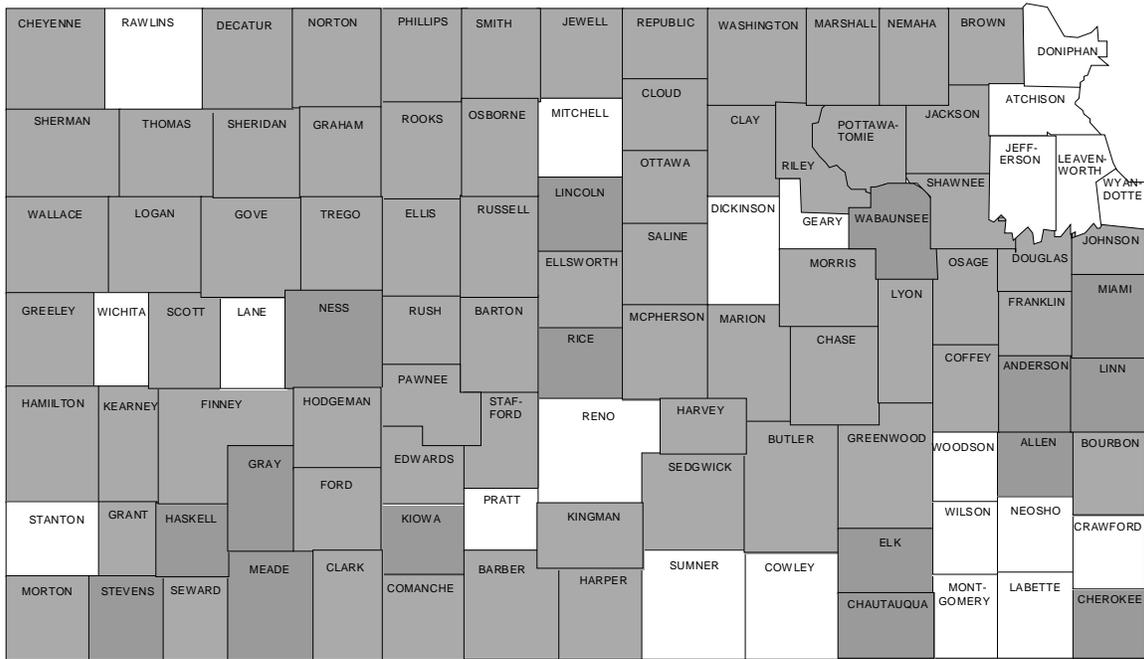
<b>COUNTY</b>	<b>DTP4</b>	<b>Polio3</b>	<b>MMR1</b>	<b>Hib3</b>	<b>HepB3</b>	<b>Var1</b>	<b>4-3-1</b>	<b>4-3-1-3-3</b>
OSBORNE	75.0	92.9	92.9	89.3	82.1	64.3	75.0	71.4
OTTAWA	64.8	93.0	94.4	77.5	93.0	74.6	64.8	46.5
PAWNEE	81.4	98.3	94.9	93.2	94.9	81.4	79.7	72.9
PHILLIPS	78.2	96.4	96.4	98.2	94.5	63.6	78.2	76.4
POTTAWATOMIE	80.2	91.1	95.3	93.8	92.2	70.3	79.7	76.0
PRATT	74.6	94.0	89.6	95.5	91.0	70.1	68.7	65.7
RAWLINS	47.1	82.4	88.2	88.2	88.2	29.4	47.1	47.1
RENO	76.9	88.0	85.2	88.0	88.9	74.4	72.8	69.8
REPUBLIC	81.0	95.2	100.0	90.5	90.5	85.7	81.0	71.4
RICE	75.0	92.5	91.3	80.0	90.0	71.3	71.3	55.0
RILEY	72.8	86.7	92.2	58.9	86.1	75.6	69.4	41.7
ROOKS	88.5	100.0	100.0	96.2	96.2	75.0	88.5	82.7
RUSH	82.9	97.1	94.3	97.1	85.7	45.7	82.9	74.3
RUSSELL	70.9	90.9	90.9	89.1	83.6	60.0	70.9	61.8
SALINE	66.4	90.4	93.9	82.5	90.0	79.3	65.0	53.9
SCOTT	88.6	100.0	100.0	100.0	97.1	77.1	88.6	88.6
SEDGWICK	75.2	90.2	92.9	89.1	88.7	71.8	72.6	64.3
SEWARD	66.0	96.8	93.6	89.4	92.6	74.5	63.8	58.5
SHAWNEE	83.0	93.5	93.5	94.6	90.8	74.8	80.6	75.5
SHERIDAN	68.2	95.5	90.9	90.9	90.9	59.1	63.6	54.5
SHERMAN	53.6	92.8	91.3	82.6	91.3	62.3	50.7	43.5
SMITH	44.0	96.0	100.0	88.0	92.0	68.0	44.0	44.0
STAFFORD	76.2	95.2	90.5	78.6	88.1	73.8	76.2	66.7
STANTON	74.1	96.3	88.9	92.6	92.6	74.1	70.4	66.7
STEVENS	66.7	93.0	91.2	77.2	80.7	68.4	66.7	59.6
SUMNER	52.7	88.6	87.5	83.2	87.5	37.0	51.6	46.2
THOMAS	64.4	97.8	95.6	93.3	95.6	64.4	64.4	64.4
TREGO	87.1	93.5	93.5	96.8	93.5	83.9	87.1	87.1
WABAUNSEE	93.3	100.0	100.0	100.0	93.3	73.3	93.3	86.7
WALLACE	76.9	92.3	92.3	92.3	92.3	76.9	76.9	76.9
WASHINGTON	72.0	94.0	96.0	92.0	92.0	68.0	72.0	72.0
WICHITA	72.2	91.7	86.1	97.2	88.9	72.2	69.4	63.9
WILSON	54.6	88.7	87.6	86.6	90.7	54.6	53.6	50.5
WOODSON	51.9	77.8	85.2	100.0	100.0	51.9	48.1	48.1
WYANDOTTE	56.5	84.0	87.0	59.5	80.9	69.8	54.6	35.5

\*Based on the retrospective survey for the school year starting 2005.

**Appendix 3:** Kansas maps of counties with at least 90% or better immunization coverage by age 2 years for the 4-3-1-series and individual vaccines and 80% for 4-3-1-3-3 Series, 2005-06 Retrospective Survey.

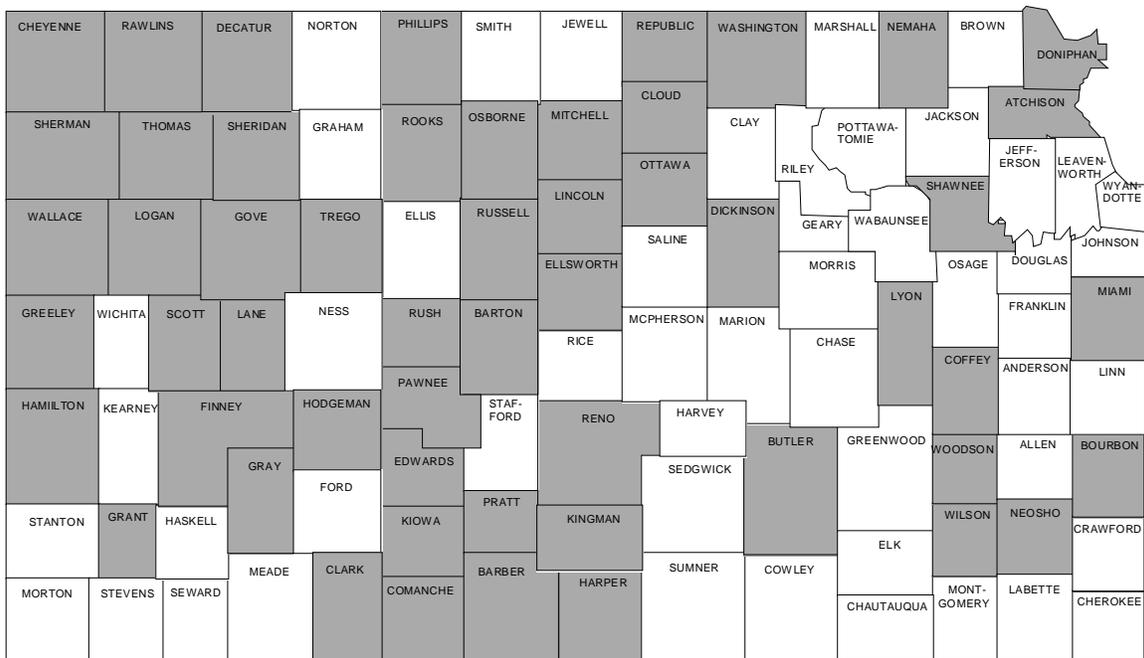


## MMR1 for Retrospective Survey 2005-06



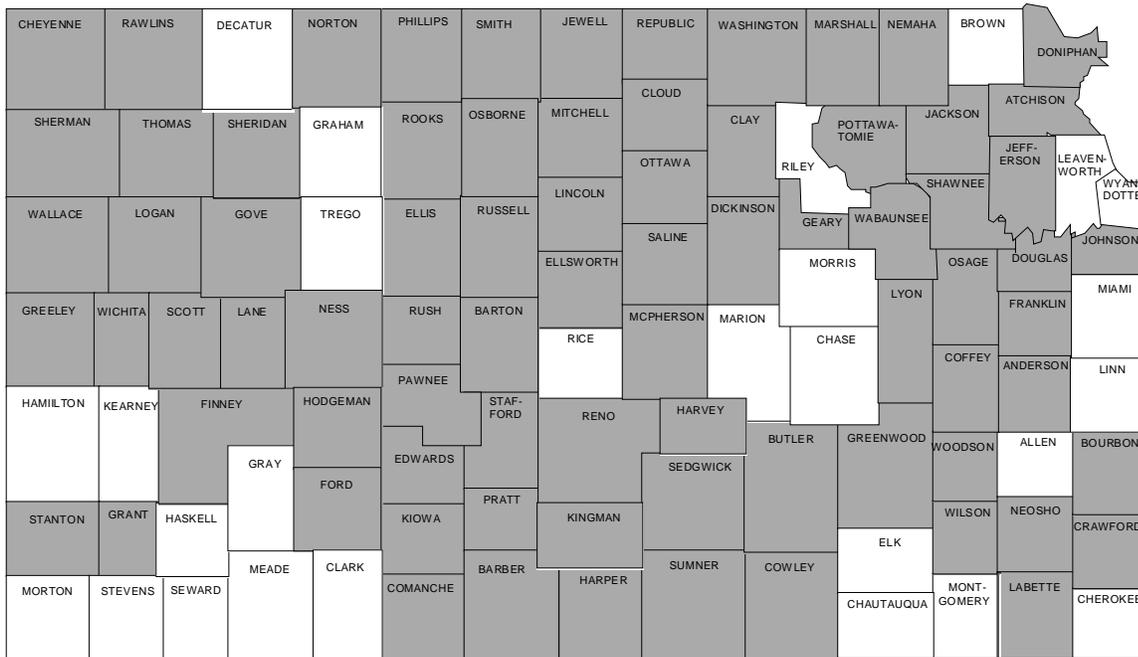
■ 90% or better coverage

## HIB3 for Retrospective Survey 2004-05



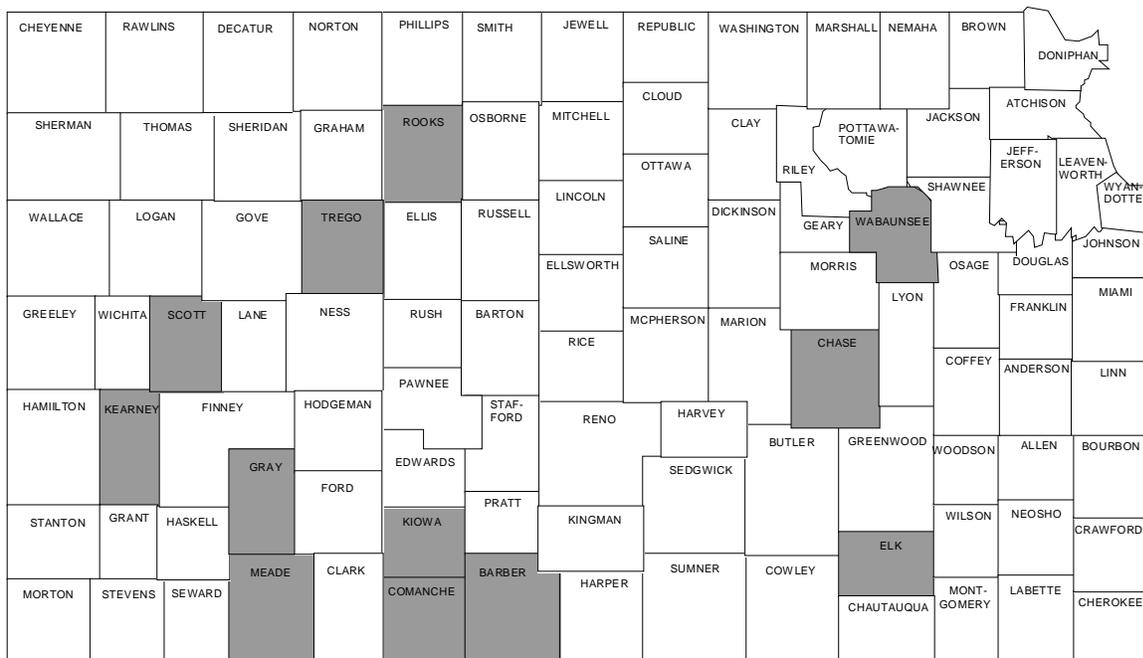
■ 90% or better coverage

## HEPB3 for Retrospective Survey 2004-05



■ 90% or better coverage

## 4-3-1-3-3 Series for Retrospective Survey 2005-06



■ 80% or better coverage