

Retrospective Vaccination Coverage Survey

2012-2013 Results (School Year 2016-2017)



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Background

The Kansas Kindergarten Immunization Coverage Assessment is an annual study conducted by the Kansas Department of Health and Environment (KDHE) to assess vaccination coverage among kindergarten students. The population for this study includes kindergarten students between the ages of five and seven years on the first day of the academic year and enrolled in either a public or private school in Kansas. This retrospective study utilized data from the 2016-2017 Kindergarten Immunization Coverage Assessment to calculate vaccination coverage levels among those children when they were 24 and 35 months of age.

The Advisory Committee for Immunization Practices (ACIP) recommends children by 24 months of age receive (Table 1)¹:

Table 1: ACIP Birth to 6 Years Immunization Recommendations

	Vaccine For	Number of Doses	Healthy People 2020 Coverage Goals
DTaP4	Diphtheria, Tetanus, Pertussis	4	90%
HepB3	Hepatitis B	3	
Hib3	<i>Haemophilus influenzae</i> type b	3	
MMR1	Measles, Mumps, Rubella	1	
PCV4	Pneumococcal	4	
Polio3	Polio	3	
Var1	Varicella	1	
HepA2	Hepatitis A	2	85%
4-3-1-3-3-1-4	DTaP4, Polio3, MMR1, Hib3, HepB3, Var1, PCV4	N/A	80%

Methods

Data collection

Each Kansas public and private school with a kindergarten class received a letter requesting participation in this study which were co-signed by the Secretary of KDHE and the Commissioner of the Kansas State Department of Education. These letters specified the number of records requested, based upon a simple random sample and kindergarten enrollment population which was used to ensure adequate sample size from each Kansas County. Sampling weights were calculated based on county size and school type (public or private). Schools were assigned to one of three groups:

- Schools that sent 30 vaccination records selected at random

¹ Child and Adolescent Schedule from Centers for Disease Control and Prevention

- Schools that sent all vaccination records
 - For schools with less than 30 kindergarten students enrolled
- Schools that sent no vaccination records

Records could include exemption records based on how records were requested to be selected.

Participating schools could submit Kansas Certificates of Immunizations (KCIs) or any other form of paper vaccination record, including printouts from computerized record keeping programs, to KDHE. All personal identifiers were removed from records, except date of birth, to ensure confidentiality. The sampling methodology changed with the 2014-2015 assessment so reports from prior years cannot be compared. To be included in analysis, data had to be received by a set cut-off date, as indicated on the participation letter; additionally, data could not be utilized if date of birth was missing or date of vaccine was illegible.

Data Analysis

Consistent with previous studies, sample population comprised of children with date of birth on records that met the age requirement for inclusion. Point estimates of coverage levels and 95% confidence intervals (95% CI) were analyzed for:

- DTaP4, Polio3, MMR1, Hib3, HepB3, Var1, PCV4, HepA2, and the 4-3-1-3-3 series
 - Coverage at 24 months of age
 - Coverage at 35 months of age

A child was considered up-to-date (UTD) for the 4-3-1-3-3-1-4 series if he or she was UTD for DTaP4, Polio3, MMR1, Hib3, HepB3, Var1, and PCV4 vaccinations. Results were compared to results from the National Immunization Survey (NIS); a population-based, random, telephone survey conducted by the Centers for Disease Control and Prevention (CDC).

Sample weights were calculated using the number of kindergarteners enrolled in a county by school type and the number of records included in analysis for that county. Furthermore, counties were categorized by population density ([Appendix 1](#)), and grouped into “urban” (≥ 150 persons per square mile), “moderately populated” (20-149.9 persons per square mile), and “rural” (≤ 19.9 persons per square mile) with vaccination coverage compared among these groups.

Results:

There were 297 schools that provided 6,748 records for this study (Table 2). Schools not included were either part of the group of schools not selected to submit records, did not respond to the request for records, or did not respond in time. Demographic information was not collected so study population

demographics such as gender, race, and ethnicity were not able to be reported. All 105 Kansas counties were represented in analysis.

Table 2: Study population, Kansas, by academic year

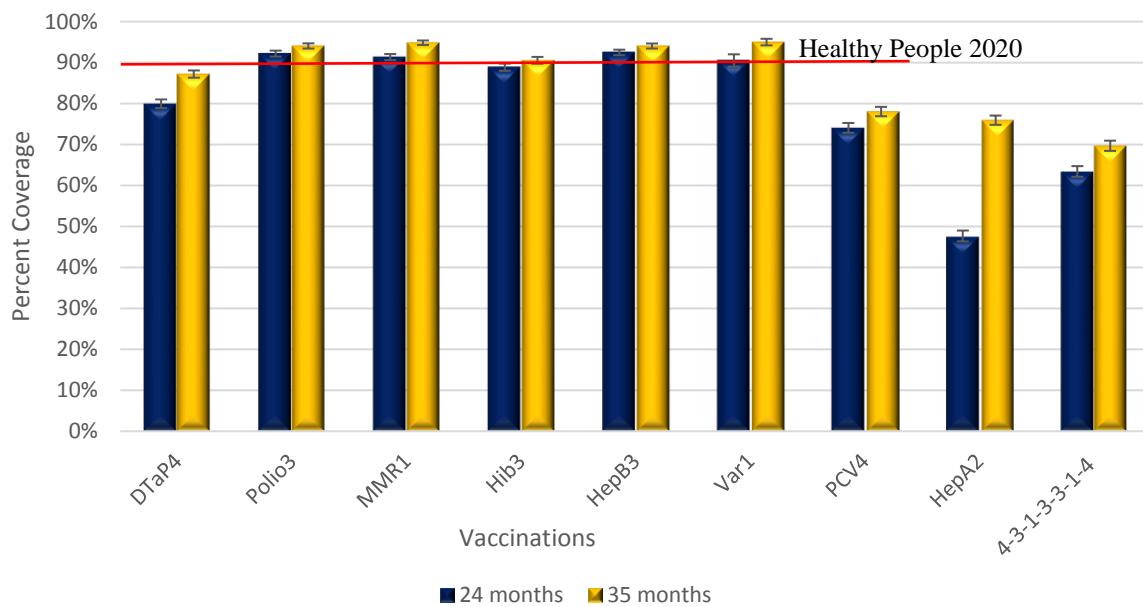
Study Year	School Year	Response Rate	Public Schools	Private Schools	Total Records	Counties Represented (out of 105)
2010-2011	2014-2015	94%	349	40	9,219	102
2011-2012	2015-2016	94%	302	54	8,304	105
2012-2013	2016-2017	80%	260	37	6,748	105

Statewide Vaccination Coverage

At 24 months of age, all vaccinations required for entry into kindergarten (DTaP4, Polio3, MMR1, Var1 and HepB3) were at or above 80%, HepB3 had the highest coverage at 92.5% and HepA2 had the lowest coverage at 47.7% (Figure 1). Polio3, MMR1, HepB3, and Var1 met Healthy People 2020 (HP2020) goals of 90% coverage.

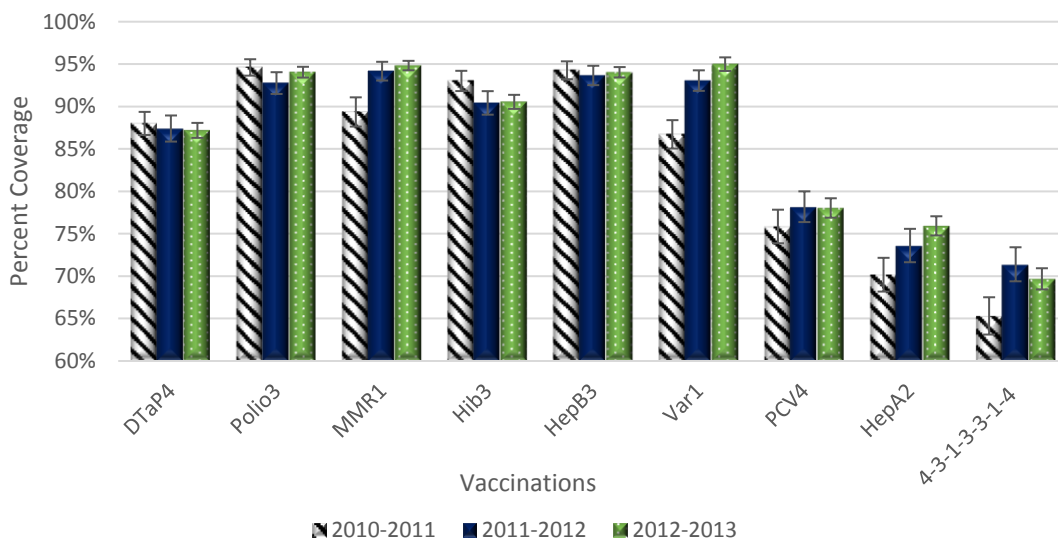
Coverage rates significantly increased among 35-month-old children for all vaccinations compared to 24 months of age. HepA2 coverage experienced the greatest increase at 28.2%; Hib3 increased 1.6% and now met HP2020 goal of 90% coverage. However, DTaP4, PCV4, HepA2 and 4-3-1-3-3-1-4 series were still below national metrics.

Figure 1: Statewide vaccination coverage at 24 and 35 months of age, Kansas, 2012-2013



Comparison of vaccination coverage at 35 months of age to the previous year’s retrospective study revealed significant changes in coverage. Significant decrease in Hib3 coverage was observed in 2012-2013 cohort compared to 2010-2011; conversely, MMR1, Var1, HepA2, and the 4-3-1-3-3-1-4 series rates significantly increased (Figure 2). When comparing all three cohort years Var1 coverage experienced the greatest increase (8.3%), while Hib3 experienced the greatest decrease (-2.5%) among Kansas children 35 months old. There were no significant differences comparing 2011-2012 and 2012-2013 years. DTaP4, HepB3, PCV4, and HepA2 coverage did not experience a significant change between cohort years.

Figure 2: Vaccination coverage at 35 months of age by year, Kansas, 2010-2011 to 2012-2013



National Immunization Survey (NIS) Coverage at 19-35 Months of Age

Coverage for DTaP4, Polio3, MMR1, HepB3, Var1, and HepA2 series were significantly higher in the current retrospective study of children 35 months of age when compared to National NIS vaccination coverage among 19-35 month old children (Table 3). Alternatively, Hib3, PCV4, and 4-3-1-3-3-1-4 series rates were significantly lower compared to National NIS respondents.

Table 3: Vaccination coverage level by study type

	Kansas Retrospective 35-month-olds	United States NIS [§] 19-35-month-olds
DTaP4	87.2% *	83.1%
Polio3	94.0% *	92.7%
MMR1	94.8% *	91.9%
Hib3	90.5% *	92.8%
HepB3	94.0% *	90.8%

Var1	95.0%*	91.2%
PCV4	78.0%*	82.0%
HepA2	75.9%*	54.7%
4-3-1-3-3-1-4 series	69.7%*	72.6%

§Based on 2013 NIS, children aged 19-35 months of age
 *Significantly different from national NIS

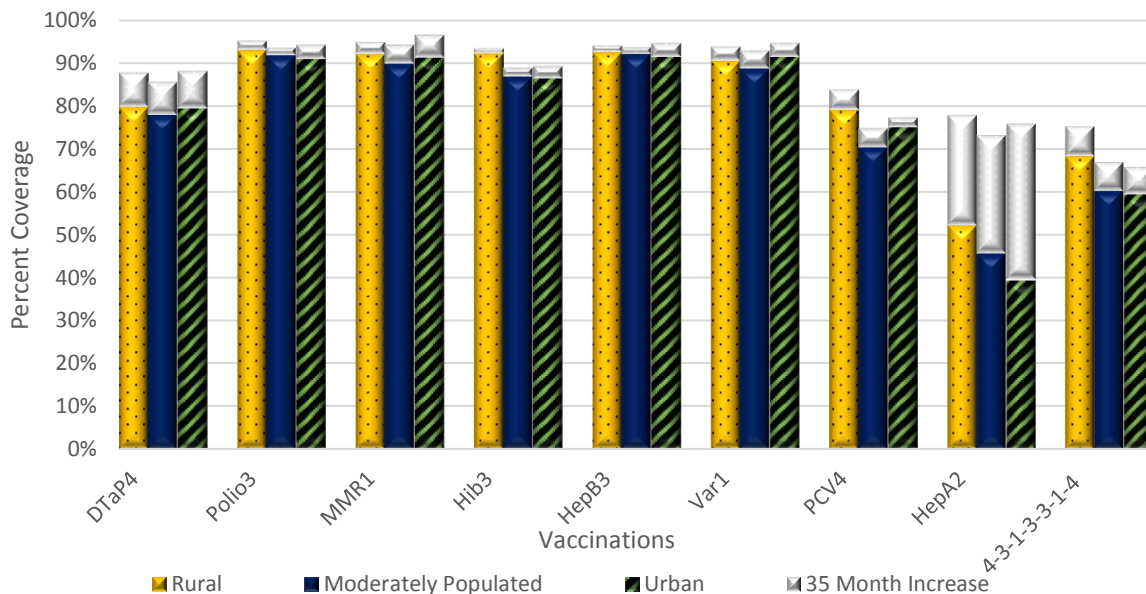
Vaccination Coverage by County Type

Counties were classified based on population densities and vaccination was compared. Among 24 month old children, urban counties were observed to have the highest coverage for Var1, while rural counties had the highest coverage for all other vaccinations compared to counties of greater population densities (Figure 3). HepB3 had the highest coverage among all counties. Rural and urban counties met HP2020 goals for MMR1 and Var1; all counties met HP2020 national metrics for Polio3, HepB3, and Var1. Conversely, all counties were below the HP2020 goals for DTaP4, PCV4, HepA2, and 4-3-1-3-3-1-4 series.

An increase in coverage was observed for all vaccinations among 35 month old children, regardless of county population density. The greatest increase was seen in HepA2 among children in urban counties, with a 36.5% increase in coverage. Vaccine coverage that met the HP2020 goals now included MMR1 and Var1 with the increase in coverage at 35 months of age.

Vaccination coverage by county is in [Appendix 2](#).

Figure 3: Vaccination coverage of Kansas children at 24 and 35 months of age by county type, 2012-2013



Discussion:

All vaccinations required for entry into kindergarten were at or above 80% at 24 months of age. Coverage rates for the 4-3-1-3-3-1-4 series was lower than individual vaccination rates due to the lower number of children who are UTD for all seven of the vaccines in this series. Between 24 and 35 months of age all vaccinations increased in coverage, HepA2 coverage had the greatest increase. This drastic increase may be explained by ACIP recommendations for initial dose to be given between 12 and 23 months with the second dose to be given 6 to 18 months later. Compared to National NIS results, participants in this retrospective study had significantly higher coverage for all vaccines except for Hib3 and PCV4; the lower coverage for these vaccines that are not required to enter kindergarten in Kansas may reflect a lack of recording of these vaccines on submitted records, the data source for this study.

Vaccination coverage variance by county population density groups (rural vs. moderately populated vs. urban) was observed. Children in rural counties had higher coverage rates for nearly all vaccinations at 24 and 35 months compared to counties with greater population densities. This result was unexpected as urban counties have a greater number of providers compared to rural counties where access to care is more limited. Factors not assessed in this study may be contributing to this finding, including insurance status of child, socioeconomic status, and vaccine hesitancy among parents.

Vaccination coverage is of great public health importance. By having greater vaccination coverage this provides protection for persons who are not able to be vaccinated by disrupting chains of infection and slowing the spread of vaccine preventable diseases (VPDs). Unvaccinated or non-UTD children are at an increased risk for not only contracting VPDs but also spreading disease to other unimmunized or under-immunized individuals (e.g., infants) or other high-risk persons. Therefore, it is important that the number of fully vaccinated children remain high. Yet, due to increasing number of unvaccinated or under-immunized individuals, the United States has experienced increased incidence of VPDs; including pertussis. In 2015 Kansas experienced a large pertussis outbreak that lasted nine months and included 95 cases among school-aged children. It was observed that 73.4% of the cases were UTD; well below the estimated percentage of 92% - 94% needed for herd immunity to prevent pertussis infection.

Limitation:

A limitation of this study is Hib3, HepA2, and PCV4 are not required for school entry and may not be consistently reported on the vaccination record, thus the coverage estimates for these vaccines as well as the 4-3-1-3-3-1-4 vaccine series may be artificially low. Additionally, no data was collected about sex, race, or ethnicity; preventing analysis for improved targeting, effective messaging, and the role these factors play in likelihood of immunization.

For children with history of varicella disease marked on the vaccination record, date of disease was rarely given. Without knowing the date of disease, it could not be definitively determined that the disease took place before the first scheduled dose of varicella containing vaccine. Thus children with marked history of disease, regardless of the number of varicella vaccinations were not included in analysis for varicella coverage. This amounted to 36 (0.5%) records being removed from varicella coverage analysis.

Strengths

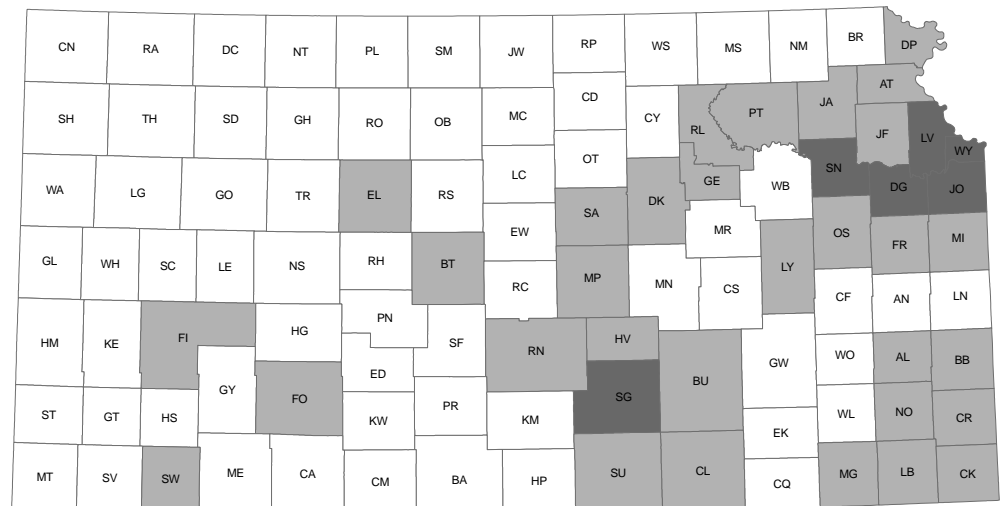
Despite the limitations, this retrospective study provides a good estimate of vaccination coverage levels among 24 and 35 month old children in Kansas. This document allows state and local officials to identify counties and regions with low vaccine coverage levels in order to focus implementation of enhanced vaccination delivery methods, and provide educational campaigns that can aid in Kansas achieving national vaccination coverage metrics. Additionally, this study had a high response rate in terms of survey participation; 80% of schools that received requests for information sent in vaccinations records. This enabled results to accurately be generalized to all Kansas children in this age group.

Appendix 1: Kansas counties categorized based on population density, 2010

Sparsely Populated	
Anderson	Marshall
Barber	Meade
Brown	Mitchell
Chase	Morris
Chautauqua	Morton
Cheyenne	Nemaha
Clark	Ness
Clay	Norton
Cloud	Osborne
Coffey	Ottawa
Comanche	Pawnee
Decatur	Phillips
Edwards	Pratt
Elk	Rawlins
Ellsworth	Republic
Gove	Rice
Graham	Rooks
Grant	Rush
Gray	Russell
Greeley	Scott
Greenwood	Sheridan
Hamilton	Sherman
Harper	Smith
Haskell	Stafford
Hodgeman	Stanton
Jewell	Stevens
Kearny	Thomas
Kingman	Trego
Kiowa	Wabaunsee
Lane	Wallace
Lincoln	Washington
Linn	Wichita
Logan	Wilson
Marion	Woodson

Moderately Populated	
Allen	Jackson
Atchison	Jefferson
Barton	Labette
Bourbon	Lyon
Butler	McPherson
Cherokee	Miami
Cowley	Montgomery
Crawford	Neosho
Dickinson	Osage
Doniphan	Pottawatomie
Ellis	Reno
Finney	Riley
Ford	Saline
Franklin	Seward
Geary	Sumner
Harvey	

Urban
Douglas
Johnson
Leavenworth
Sedgwick
Shawnee
Wyandotte



Sparsely Populated
 Moderately Populated
 Urban

Persons per Square Mile in Peer Groups

Sparsely Populated = ≤ 19.9

Moderately Populated = 20 – 149.9

Urban = ≥ 150.0

**Appendix 2: Vaccination coverage levels of children 35 months of age for
Kansas counties 2012-2013*§**

COUNTY	DTaP4	Polio3	MMR1	Hib3	HepB3	Var1	PCV4	HepA2	4-3-1-3-3-1-4
STATEWIDE	87%	94%	95%	91%	94%	95%	78%	76%	70%
ALLEN	93%	95%	99%	99%	95%	99%	90%	88%	84%
ANDERSON	84%	90%	88%	86%	90%	86%	81%	67%	79%
ATCHISON	84%	91%	94%	91%	94%	93%	84%	58%	80%
BARBER	76%	91%	94%	94%	94%	94%	71%	59%	68%
BARTON	85%	96%	94%	96%	97%	92%	84%	79%	81%
BOURBON	74%	82%	93%	91%	95%	92%	67%	59%	53%
BROWN	83%	96%	96%	94%	96%	95%	76%	62%	63%
BUTLER	83%	93%	96%	95%	93%	93%	80%	76%	70%
CHASE	87%	91%	91%	83%	91%	91%	83%	65%	78%
CHAUTAUQUA	88%	91%	91%	85%	94%	91%	88%	76%	76%
CHEROKEE	84%	93%	93%	92%	90%	96%	79%	72%	73%
CHEYENNE	71%	86%	100%	86%	86%	100%	86%	71%	71%
CLARK	89%	100%	100%	97%	100%	97%	89%	95%	84%
CLAY	93%	94%	90%	91%	91%	90%	90%	84%	83%
CLOUD	86%	94%	91%	90%	96%	89%	79%	90%	72%
COFFEY	85%	96%	98%	93%	87%	93%	80%	67%	65%
COMANCHE	87%	97%	100%	97%	97%	90%	77%	73%	70%
COWLEY	76%	91%	86%	87%	93%	87%	73%	66%	63%
CRAWFORD	81%	89%	87%	82%	87%	88%	49%	60%	41%
DECATUR	76%	97%	93%	83%	97%	90%	76%	83%	69%
DICKINSON	86%	96%	90%	94%	95%	96%	81%	81%	65%
DONIPHAN	95%	99%	98%	97%	99%	98%	93%	81%	90%
DOUGLAS	88%	90%	94%	84%	92%	87%	71%	73%	65%
EDWARDS	87%	95%	92%	97%	100%	90%	82%	77%	74%
ELK	86%	91%	97%	94%	89%	97%	77%	71%	74%
ELLIS	94%	98%	98%	94%	98%	97%	73%	92%	67%
ELLSWORTH	81%	92%	94%	88%	96%	96%	81%	83%	73%
FINNEY	88%	96%	98%	95%	97%	94%	81%	77%	77%
FORD	90%	97%	96%	93%	95%	93%	85%	71%	79%
FRANKLIN	79%	93%	93%	89%	94%	92%	72%	73%	69%
GEARY	88%	91%	95%	91%	92%	94%	84%	80%	72%
GOVE	69%	94%	81%	88%	88%	94%	81%	63%	56%
GRAHAM	92%	100%	96%	100%	96%	96%	92%	84%	92%
GRANT	100%	97%	93%	97%	100%	90%	83%	70%	73%
GRAY	81%	97%	97%	97%	95%	97%	87%	78%	76%
GREELEY	86%	86%	90%	95%	100%	90%	81%	81%	76%
GREENWOOD	77%	94%	92%	89%	95%	92%	77%	76%	71%
HAMILTON	90%	97%	93%	93%	90%	87%	80%	83%	77%
HARPER	94%	97%	99%	98%	97%	99%	87%	76%	81%
HARVEY	86%	92%	93%	94%	93%	89%	83%	75%	69%
HASKELL	83%	94%	91%	92%	92%	92%	78%	80%	75%
HODGEMAN	100%	100%	100%	100%	100%	100%	96%	88%	96%
JACKSON	96%	99%	98%	97%	97%	98%	87%	86%	84%
JEFFERSON	87%	93%	93%	94%	92%	92%	81%	83%	72%

COUNTY	DTaP4	Polio3	MMR1	Hib3	HepB3	Var1	PCV4	HepA2	4-3-1-3-3-1-4
STATEWIDE	87%	94%	95%	91%	94%	95%	78%	76%	70%
JEWELL	86%	100%	95%	90%	95%	95%	90%	57%	81%
JOHNSON	91%	97%	96%	89%	95%	97%	78%	77%	68%
KEARNY	82%	97%	97%	90%	97%	96%	79%	76%	74%
KINGMAN	81%	91%	93%	90%	86%	91%	80%	69%	70%
KIOWA	91%	95%	88%	91%	93%	93%	88%	79%	77%
LABETTE	84%	95%	95%	89%	89%	100%	78%	60%	57%
LANE	100%	100%	95%	100%	95%	95%	95%	95%	84%
LEAVENWORTH	90%	92%	96%	92%	94%	95%	80%	75%	68%
LINCOLN	100%	100%	100%	100%	100%	100%	100%	82%	100%
LINN	84%	94%	92%	93%	90%	86%	78%	60%	68%
LOGAN	97%	100%	100%	100%	100%	98%	100%	92%	95%
LYON	90%	99%	95%	99%	94%	95%	90%	80%	82%
MARION	86%	91%	93%	91%	92%	94%	84%	76%	71%
MARSHALL	95%	98%	98%	93%	95%	95%	91%	88%	84%
MCPHERSON	85%	91%	94%	49%	91%	94%	46%	61%	44%
MEADE	94%	100%	100%	100%	100%	100%	81%	84%	78%
MIAMI	83%	91%	96%	43%	90%	95%	36%	70%	33%
MITCHELL	98%	99%	99%	98%	99%	96%	89%	98%	88%
MONTGOMERY	82%	93%	90%	93%	90%	89%	71%	68%	64%
MORRIS	82%	94%	88%	94%	94%	88%	82%	71%	82%
MORTON	81%	93%	87%	87%	75%	78%	67%	67%	43%
NEMAHA	89%	94%	93%	94%	91%	93%	82%	78%	73%
NEOSHO	89%	97%	98%	99%	97%	98%	6%	72%	6%
NESS	86%	93%	93%	93%	93%	84%	61%	68%	46%
NORTON	97%	97%	100%	97%	100%	100%	94%	89%	94%
OSAGE	83%	83%	97%	90%	93%	97%	80%	73%	73%
OSBORNE	90%	97%	90%	93%	90%	90%	87%	67%	77%
OTTAWA	80%	93%	97%	87%	87%	93%	73%	87%	57%
PAWNEE	91%	97%	100%	94%	97%	97%	94%	85%	85%
PHILLIPS	97%	97%	97%	100%	100%	100%	100%	90%	90%
POTTAWATOMIE	86%	95%	96%	87%	94%	92%	87%	79%	71%
PRATT	87%	98%	99%	92%	99%	99%	78%	76%	72%
RAWLINS	87%	100%	100%	91%	100%	100%	78%	70%	70%
RENO	81%	95%	93%	91%	97%	89%	76%	65%	70%
REPUBLIC	82%	93%	86%	93%	93%	86%	86%	75%	82%
RICE	95%	98%	100%	91%	96%	96%	74%	85%	69%
RILEY	94%	95%	97%	83%	92%	94%	73%	73%	63%
ROOKS	100%	100%	93%	100%	100%	100%	100%	93%	93%
RUSH	100%	100%	100%	100%	100%	100%	100%	90%	100%
RUSSELL	89%	95%	99%	95%	98%	98%	88%	76%	81%
SALINE	90%	95%	94%	93%	98%	92%	82%	77%	76%
SCOTT	87%	100%	93%	100%	97%	97%	87%	87%	73%
SEDGWICK	89%	95%	99%	92%	98%	99%	79%	76%	67%
SEWARD	83%	92%	96%	92%	93%	94%	76%	75%	67%
SHAWNEE	87%	95%	95%	89%	92%	92%	81%	80%	68%
SHERIDAN	100%	100%	95%	100%	100%	100%	95%	95%	95%

COUNTY	DTaP4	Polio3	MMR1	Hib3	HepB3	Var1	PCV4	HepA2	4-3-1-3-3-1-4
STATEWIDE	87%	94%	95%	91%	94%	95%	78%	76%	70%
SHERMAN	90%	97%	93%	97%	97%	93%	90%	67%	87%
SMITH	80%	80%	100%	80%	80%	100%	80%	80%	80%
STAFFORD	88%	94%	94%	91%	88%	94%	88%	91%	76%
STANTON	89%	93%	96%	89%	86%	89%	82%	75%	61%
STEVENS	82%	94%	94%	94%	97%	91%	86%	76%	74%
SUMNER	77%	92%	87%	88%	90%	85%	76%	70%	70%
THOMAS	90%	89%	91%	93%	92%	90%	90%	89%	86%
TREGO	97%	100%	97%	93%	100%	93%	90%	90%	77%
WABAUNSEE	74%	91%	91%	91%	80%	88%	82%	63%	54%
WALLACE	84%	87%	97%	90%	94%	97%	81%	65%	68%
WASHINGTON	95%	100%	100%	95%	90%	100%	90%	86%	86%
WICHITA	97%	97%	97%	97%	100%	93%	87%	87%	87%
WILSON	80%	90%	92%	94%	89%	95%	73%	67%	58%
WOODSON	90%	93%	97%	97%	97%	93%	80%	83%	73%
WYANDOTTE	77%	89%	93%	83%	91%	94%	69%	69%	56%

* Based on the retrospective survey for the school year starting 2016.

§ Due to Hib3 and PCV4 not being required for school entry, these vaccines may not consistently be reported on the vaccination record, thus decreasing coverage levels for the individual vaccines, as well as the 4-3-1-3-3-1-4 series. This is evident for several counties that have low coverage levels for the 4-3-1-3-3-1-4 series as well as low Hib3 and PCV4 coverage levels.