Kindergarten Immunization Coverage Survey

School Year 2014-2015

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List of Figures

List of Tables

Abbreviations

CI	Confidence interval
HP2020	Healthy People 2020
KCI	Kansas Certificate of Immunizations
KDHE	Kansas Department of Health and Environment
KSDE	Kansas State Department of Education
UTD	Up to date

Vaccine Abbreviations

DTaP4	4 doses of diphtheria, tetanus toxoids, and acellular pertussis vaccines including diphtheria and tetanus toxoids (DTaP/DT) vaccine (metric for HP2020)
DTaP5	5 doses of diphtheria, tetanus toxoids and acellular pertussis vaccines including diphtheria and tetanus toxoids (DTaP/DT) vaccine *or* 4 doses of DTaP if the fourth dose is given on or after the fourth birthday
HepA2	2 doses of hepatitis A vaccine
HepB3	3 doses of hepatitis B vaccine
Hib3	3 doses of *Haemophilus influenzae* type b vaccine
MMR2	2 doses of measles, mumps, and rubella vaccine
PCV4	4 doses of pneumococcal conjugate vaccine
Polio3	3 doses of polio vaccine (metric for HP2020)
Polio4	4 doses of polio vaccine
Var2	2 doses of varicella vaccine
5-4-2-2-3	DTaP5 – Polio4 – MMR2 – Var2 – HepB3

Executive Summary

Overview

The Kansas Certificates of Immunizations (KCIs) and other immunization records for children enrolled in a kindergarten class in Kansas public and private schools during the 2014-2015 school year were collected and immunization coverage was evaluated for all required and recommended vaccines. Vaccination coverage levels were calculated for children at the time of school entry (i.e., on the first day of school for the 2014-2015 academic year) and 30 days following school entry. Children who were between the ages of five and seven years on the first day of the school year were included in the study. In total, there were 389 schools, 349 public and 40 private, included in the analysis, which consisted of a representative sample of 9,219 students.

Coverage at Kindergarten Entry

The statewide coverage levels at school entry for all vaccinations required for school entry (DTaP5, Polio4, MMR2, Var2, and HepB3) were above 85%, with HepB3 having the highest coverage at 96.7%. DTaP4 and HepB3 were the only vaccinations to meet the Healthy People 2020 goal of at least 95% coverage for kindergarten immunizations. The complete series for all five required vaccinations (5-4-2-2-3) had a coverage level of 82.7% at school entry. Vaccination coverage levels for most immunizations increased after the first 30 days of school. Children enrolled in private schools had higher coverage levels than children enrolled in public schools throughout Kansas for all required vaccines; the difference was statistically significant for DTaP, Polio, MMR, Hib, and PCV vaccinations.

The 105 Kansas counties were grouped into three categories based on population density, and coverage levels were compared among these groups. Sparsely Populated counties had the highest coverage level for all vaccines (DTaP5, Polio4, MMR2, Var2, HepB3, Hib3, PCV4, and HepA2) as well as the vaccine series (5-4-2-2-3). HepA2 was the only vaccine which showed no significant difference in coverage levels between urban and moderately populated counties at school entry. Twelve counties had ≥95% coverage for all five required vaccinations and eleven were sparsely populated counties (Appendix 2).

Coverage 30 Days after Kindergarten Entry

Measurements of statewide coverage levels at 30 days after the first day of school were significantly higher in four of the five vaccines required for school entry as well as the 5-4-2-2-3 vaccine series. Public schools had higher immunization coverage rates in the 30 days after the first day of school and had significantly higher coverage levels for Var2 and 5-4-2-2-3 compared to immunization coverage rates in private schools 30 days after the first day of school.

School Policy on Immunizations and Exemptions

While a majority of schools (71.6%) had a policy in place to allow children time to get caught up on immunizations, 16.7% of schools did not have any grace period policies in place and 11.6% required children be up-to-date (UTD) on the first day of school. Among public schools, the most common grace period policy was to give children 90 days to become UTD (18.3%), while the most common practice among private schools was to not have a grace period policy in place (19.1%) or to require children to be UTD on the first day of school (18.1%). Schools which excluded children from attendance who were not UTD had significantly higher immunization coverage when compared to schools which did not exclude non-UTD children; significant differences were seen in all five required vaccines and the 5-4-2-2-3 vaccine series both at school entry and 30 days after school entry.

Kindergarten Immunization Coverage Survey School Year 2014-2015

Introduction

Objective

This study was conducted to estimate the immunization coverage levels of children at school entry and 30 days following school entry into kindergarten.

Study Population

The study population included all Kansas kindergarten students who were between the ages of five and seven years on the first day of the 2014-2015 academic year enrolled in either a public or private school. Children who are home schooled or attended other special schools were not included in this analysis.

Study Design

A stratified, simple systematic random sampling design was utilized for this study, with each county and school type representing the strata. The characteristics of interest, or outcome variables, were the percentages of children who were fully immunized against diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *Haemophilus influenzae* type b, hepatitis A virus, hepatitis B virus, varicella, and pneumococcal disease. Vaccination coverage was assessed for these children at school entry into kindergarten and 30 days following school entry.

Vaccination coverage was measured for single vaccines and combinations of vaccines according to the recommended immunization schedule for children by five years of age (Appendix 5).[1] Immunization coverage levels were assessed for all kindergartners of the 2014-2015 academic year which met the inclusion criteria.

Methods

Coverage Assessment Analysis

Sampling Techniques

To ensure an adequate sample size in each county and to maximize the efficiency of the sampling process, a probability sample was selected using a simple systematic random sampling technique. Sampling weights were calculated based on county and school type (public and private). The sampling methodology utilized for immunization coverage in the 2014-2015 school year assessment was different from the sampling methodology used in previous years. The difference in sampling methodology prevents the accurate comparison of data from the 2014-2015 school year to any data published in previous Kindergarten Immunization Coverage Survey reports.

[1] The Recommended Immunization Schedule used as reference for ages and immunizations in this study 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 2012.

Data Collection

All Kansas public and private schools with a kindergarten class received a letter, co-signed by officials representing the Kansas Department of Health and Environment (KDHE) and the Kansas State Department of Education (KSDE), requesting their participation in the survey. The letters sent specified the number of records required to generate estimates of county-specific coverage levels and outlined the process of randomly selecting a probability sample of records. This sample of records did not differentiate between students with an exemption and students without an exemption. The study coordinator at each school (typically the school nurse) was instructed to randomly select kindergarten records based on the calculated sampling ratio for their county. Schools were assigned to one of three groups: schools that send 30 immunization records selected at random, schools that send all of the available immunization records, and schools that do not submit any immunization records. The schools that were assigned to the second group had a total kindergarten enrollment with fewer than 30 students. Therefore, no school was asked to send more than 30 immunization records.

The schools could submit Kansas Certificates of Immunizations (KCIs) or any other form of paper immunization record, including printouts from computerized record keeping programs. The study coordinators were instructed to remove all personal identifiers from paper records, except date of birth, to ensure confidentiality. Copies of the requested immunization records were forwarded to KDHE.

Data Analysis

Consistent with previous studies, children who had a date of birth recorded on the KCI or other data source and were the appropriate age for the analysis were included in the denominator. Point estimates of coverage levels and 95% confidence intervals (95% CI) for DTaP5, Polio4, MMR2, Hib3, HepB3, Var2, HepA2, and PCV4 vaccines were calculated at time of school entry. Additional point estimates of coverage and 95% CI were calculated for DTaP4 and Polio3 to address the Healthy People 2020 (HP2020) objectives. Children were considered up to date for the DTaP5 school requirement if the child had received either five doses of DTaP or four doses of DTaP with the fourth dose administered on or after their fourth birthday.[2] All children who indicated history of varicella disease were included in the denominator, but only those who reported history of varicella vaccination were included in the numerator. This methodology was used because the date of disease was not consistently recorded; it could not be determined if some children had the disease before school entry. The date of school entry was reported by the study coordinators as the first day of school for the 2014-2015 academic year. Immunization coverage levels were also assessed at 30 days following school entry because many school districts maintain a “grace period” policy during which a child may be vaccinated with the appropriate vaccines without being excluded from school. Records submitted from schools reporting exemptions were examined and classified as medical, religious, or non-exempt.

Analyses were performed using weighted data, and the analyses accounted for the complex sample design effect due to the stratification process and differences in sampling ratios between counties.[3] Sample weights were calculated using the number of kindergartners enrolled in a county and the number of records analyzed for that county.

The 105 counties were categorized based on population densities, and for the purpose of this analysis, counties were grouped into “urban” (≥150 persons per square mile), “moderately populated” (20-149.9

[2] Centers for Disease Control and Prevention. Pertussis: Epidemiology and Prevention of Vaccine-Preventable Diseases. Atkinson W, Wolfe S, Hamborsky J, eds. 12th ed., second printing. Washington DC: Public Health Foundation, 2012.
[3] Complex survey design effect was accounted for by using the SAS Procedure PROC SURVEYFREQ.

persons per square mile), and "sparsely populated" (≤19.9 persons per square mile) (Appendix 1). Immunization coverage level estimates were compared among these groups.

Exemption and School Policy Analysis

Sampling Techniques

A census of all children enrolled in Kansas public and private school kindergartens was drawn for exemption and school policy aggregate data collection. This methodology utilized in the 2014-2015 school year assessment was not changed from the sampling methodology used in previous years. This allows the comparison of exemption data from the 2014-2015 school year to any exemption data published in previous Kindergarten Immunization Coverage Survey reports.

Data Collection

All Kansas public and private schools with a kindergarten class received a letter, co-signed by officials representing the Kansas Department of Health and Environment (KDHE) and the Kansas State Department of Education (KSDE), requesting their participation in the survey. Participating schools were asked to complete a form or online survey listing the current total number of kindergarten enrollees and the total number of exemptions. Additionally, the study coordinators were asked to complete a two-question survey assessing policies and procedures at their school regarding grace periods with respect to vaccination requirements and exclusions.

Data Analysis

Exemption data were collected regarding the total number of kindergarten students enrolled who had any type of exemption and were classified by type (religious versus medical). All exemptions were analyzed by school type (public versus private) and county population density group (sparsely populated, moderately populated, and urban).

School policy data were collected regarding the time after the first day of school in which children are allowed to become UTD for the five required immunizations before being excluded from school, commonly called a grace period.
Additional data were collected on enforcement of K.S.A. 72-5211a, which allows schools to exclude children who are not UTD for required immunizations. While there are five immunizations required for school entry (DTaP5, Polio4, MMR2, Var2, and HepB3), it is up to the school board as to whether or not children who are not UTD are excluded until they meet the immunization requirements. Enforcing the statute was stratified by school type (public versus private).

Data regarding school policies regarding the exclusion of non-UTD kindergarten students were linked with immunization records from the corresponding schools utilized in the coverage assessment analysis. Point estimates of coverage levels and 95% CIs at school entry and 30 days after the first day of school calculated for the coverage assessment analysis were stratified by school exclusion policy.

Results

Coverage Assessment Analysis

Data Collection

Letters of invitation to participate in the coverage assessment were sent to 414 Kansas schools; of these, 345 were public schools and 69 were private. These schools were asked to provide immunization records for a specific number of students. Twenty-five schools did not respond or did not respond in time to our data request. The remaining 389 schools (349 public and 40 private) from 102 Kansas counties responded to the data request and were included in the analysis. This corresponds to a school participation of 94%. A total of 9,219 immunization records from the 389 schools were included in the analysis, which is equivalent to one child selected for every 4.3 enrolled.

The 2014-2015 school year enrollment distribution across the state of Kansas was 11.5% in sparsely populated counties, 32.8% in moderately populated counties, and 55.7% in urban counties. The number of records included in the analysis by population density was: 3,008 (32.6% of all records used, representing 12.1% of the population after weighting) in sparsely populated counties, 4,618 (50.1% of all records used, representing 32.9% of the population after weighting) in moderately populated counties, and 1,593 (17.3% of all records used, representing 55.0% of the population after weighting) in urban counties.

Kindergarten Immunization Coverage

Statewide Immunization Coverage

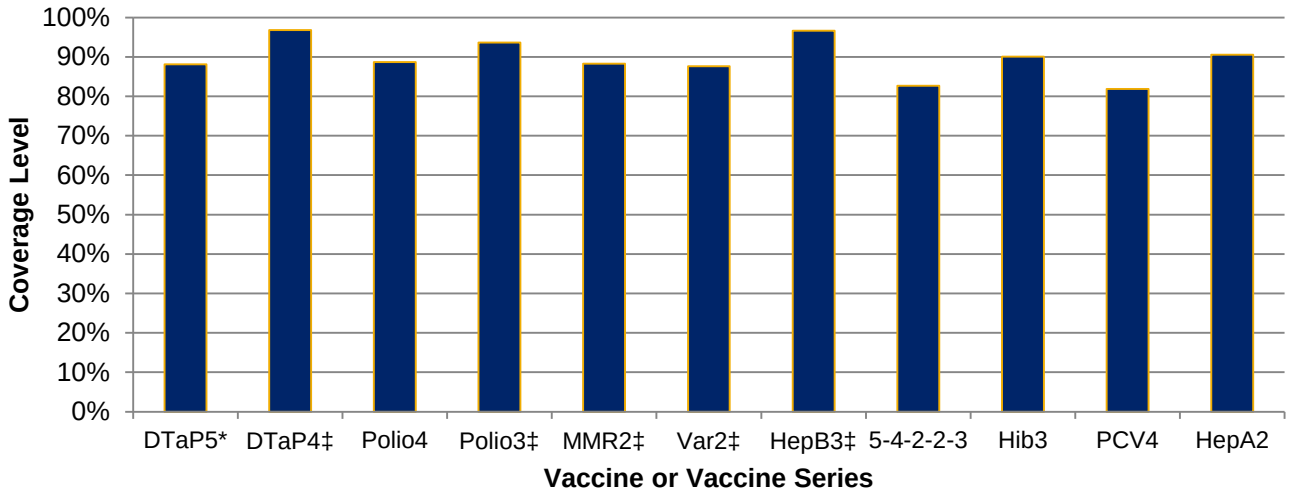
The immunization coverage levels at school entry of all required vaccinations (DTaP5, Polio4, MMR2, Var2, and HepB3) were above 85%, with HepB3 having the highest coverage of any vaccination. The complete series for all five required vaccinations (5-4-2-2-3) had a coverage level of 82.7% at school entry.Var2 had the lowest coverage among required vaccinations with 87.6% of children fully vaccinated at school entry. Of the vaccinations not required for school entry, PCV4 had the lowest coverage with 81.8% of kindergartners fully vaccinated at school entry. HP2020 goals establish a 95% immunization coverage target for DTaP4, Polio3, MMR2, HepB3, and Var2. Statewide coverage for DTaP4 (96.8%) and HepB3 (96.7%) exceeded this HP2020 goal (Figure 1).

The immunization coverage levels of kindergartners were significantly higher for most required vaccinations (DTaP5, Polio4, MMR2, and Var2) as well as the 5-4-2-2-3 vaccine series when comparing coverage levels from school entry to those 30 days following the first day of school (Table 1). The only required vaccination that did not have a significantly increased coverage level was HepB3. Additionally, the coverage levels for the three non-required vaccinations (Hib3, PCV4, and HepA2) did not significantly increase after the first 30 days of school.

Healthy People 2020 goals for kindergarten vaccination coverage levels are ≥95% for all vaccines required by Kansas for school entry (DTaP, Polio, MMR, Varicella, and HepB). The state of Kansas follows different metrics to determine UTD status compared to the HP2020 goals.[4]

[4] Healthy People 2020 (http://www.healthypeople.gov)

Figure 1: Statewide immunization coverage levels of kindergarten students at school entry, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday.*
‡ Healthy People 2020 goal

Table 1: Immunization coverage levels of kindergarten students at school entry and 30 days following school entry, Kansas 2014-2015

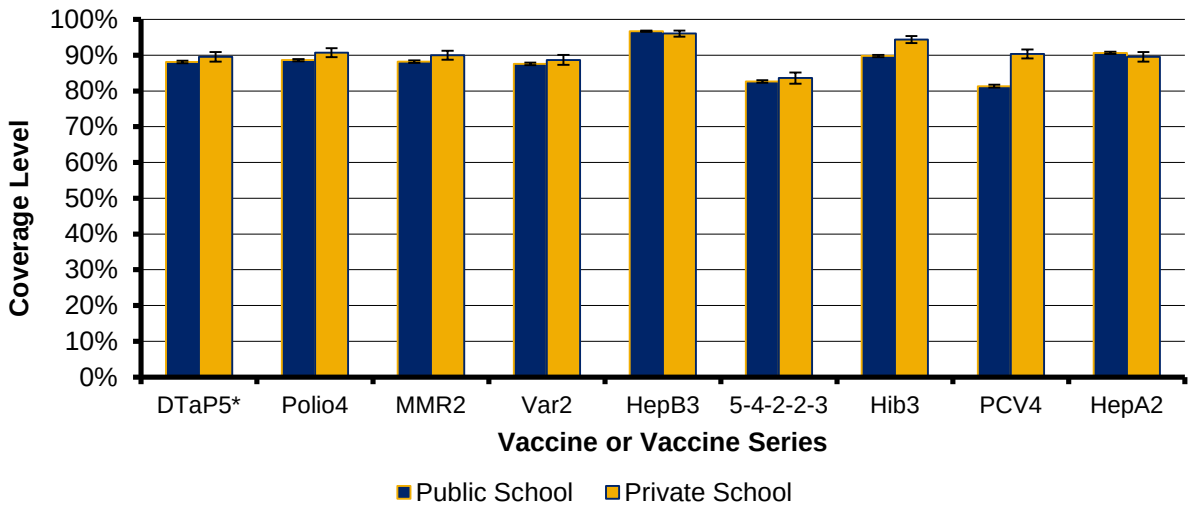
	At School Entry % (95% CI)	30 Days After School Entry % (95% CI)
DTaP5*	88.2 (87.8-88.5)	91.1 (90.8-91.4)
Polio4	88.7 (88.4-89.0)	91.1 (90.8-91.4)
MMR2	88.3 (87.9-88.6)	91.2 (90.9-91.5)
Var2	87.6 (87.3-87.9)	90.6 (90.3-90.9)
HepB3	96.7 (96.5-96.9)	96.8 (96.6-96.9)
5-4-2-2-3	82.7 (82.3-83.1)	85.9 (85.5-86.2)
Hib3	90.0 (89.7-90.3)	90.0 (89.7-90.3)
PCV4	81.8 (81.4-82.2)	82.0 (81.6-82.3)
HepA2	90.6 (90.3-90.9)	90.7 (90.4-91.0)

**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday.*

Immunization Coverage Stratified by School Type (Public vs. Private)

There were differences in the immunization coverage levels for kindergartners enrolled in public and private schools (Figure 2). Children enrolled in private schools had significantly higher immunization coverage at school entry for three of the required vaccines (DTaP5, Polio4, and MMR2) as well as two of the non-required vaccines (Hib3 and PCV4) when compared to children enrolled in public schools at school entry.

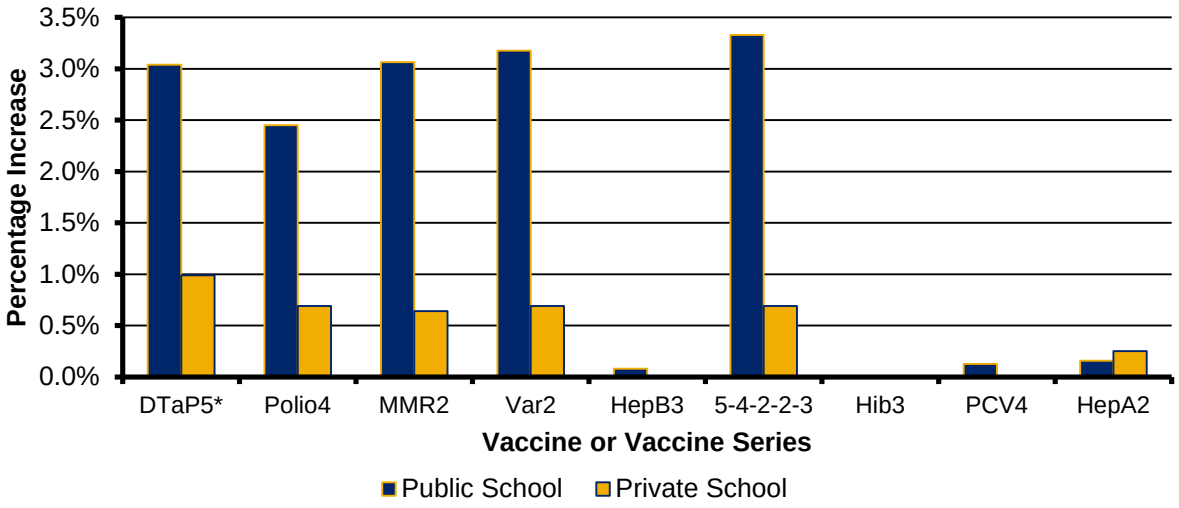
Figure 2: Immunization coverage levels of Kansas kindergartners at school entry, by school type, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday.*

Vaccination coverage was assessed 30 days after the first day of school to determine UTD status of Kansas kindergarten students stratified by school type (public versus private). While private schools had significantly higher immunization coverage for three of the five required immunizations (DTaP5, Polio4, and MMR2), greater increases in immunization coverage were noted among children in public schools in the 30 days after the first day of school (Figure 3).

Figure 3: Percent increase in immunization coverage levels of Kansas kindergarten students 30 days following school entry, by school type, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday.*

The increase in immunization coverage noted in public schools in the 30 days following the first day of school resulted in public schools with significantly higher immunization coverage in one of the required vaccines (Var2) and the 5-4-2-2-3 vaccine series (Table 2).

Table 2: Immunization coverage levels of Kansas kindergarten students 30 days after school entry, by school type, Kansas 2014-2015

	Public School % (95% CI)	Private School % (95% CI)
DTaP5*	91.1 (90.8-91.4)	90.5 (89.3-91.8)
Polio4	91.0 (90.7-91.3)	91.4 (90.2-92.6)
MMR2	91.2 (90.9-91.5)	90.6 (89.4-91.9)
Var2	90.7 (90.4-91.0)	89.4 (88.0-90.7)
HepB3	96.8 (96.6-97.0)	96.0 (95.2-96.9)
5-4-2-2-3	86.0 (85.6-86.3)	84.3 (82.7-85.8)
Hib3	89.8 (89.5-90.1)	94.3 (93.3-95.3)
PCV4	81.5 (81.0-81.9)	90.3 (89.1-91.6)
HepA2	90.8 (90.5-91.1)	89.8 (88.5-91.1)

**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday*

Immunization Coverage Stratified by County Population Density Group

Immunization coverage was also analyzed at the county level. All vaccination coverage levels are listed by county in Appendix 2. Maps of coverage by county are in Appendix 3.

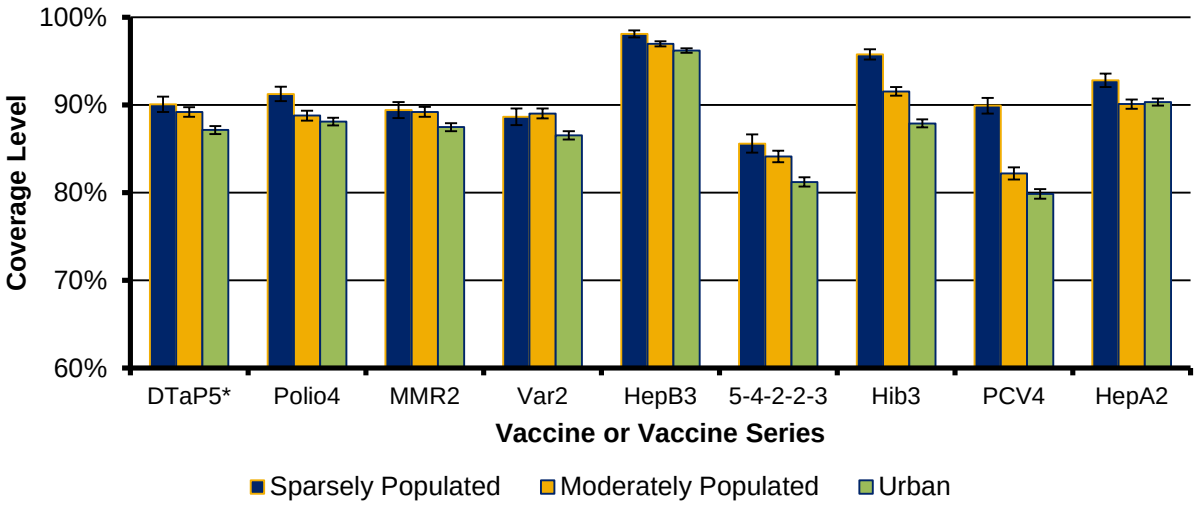
Assessments were completed to determine the number of counties which met vaccine-specific HP2020 goals for kindergarten immunization coverage. Of the 102 counties included in the analysis, 94 obtained the HP2020 goal of ≥95% for HepB3 (Table 3). Hamilton County reached 100% coverage for all five required immunizations for kindergarten entry and an additional eleven counties had ≥95% coverage level for all required vaccinations; all twelve of these counties are sparsely populated.

Table 3: Number of counties and percentage of total statewide kindergarten enrollment reaching Healthy People 2020 goal, by vaccine, Kansas 2014-2015

Vaccine	# of Counties (n=102)	% of 2014-2015 Enrollment
DTaP4	89	91.4%
Polio3	56	43.0%
MMR2	20	9.8%
Var2	20	6.4%
HepB3	94	94.0%

Counties were classified based on their population densities, and coverage levels were compared among the three categories: sparsely populated, moderately populated, and urban. Sparsely populated counties had significantly higher coverage levels at school entry compared to urban counties for all five required vaccines (DTaP5, Polio4, MMR2, Var2, and HepB3), the 5-4-2-2-3 vaccine series, and all three non-required vaccines (Hib3, PCV4, and HepA2). Moderately populated counties had significantly higher coverage levels at school entry compared to urban counties for four of the five required vaccines (DTaP5, MMR2, Var2, and HepB3), the 5-4-2-2-3 vaccine series, and two of the three non-required vaccines (Hib3 and PCV4) (Figure 4).

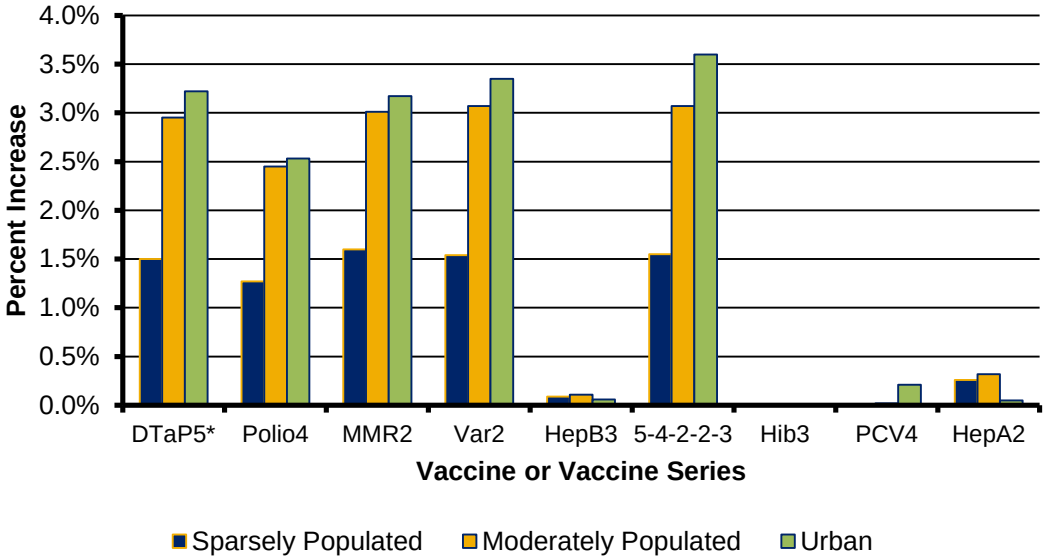
Figure 4: Kansas immunization coverage levels for kindergarten students, by county population density group, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday*

The immunization coverage levels 30 days after school entry for each population density category were significantly higher for most required vaccinations (DTaP5, Polio4, MMR2, and Var2) as well as the 5-4-2-2-3 vaccine series when comparing coverage levels at school entry. The only required vaccination that did not have a significant increase in coverage was HepB3. The greatest increases in immunization coverage levels for required vaccines were in urban counties. Sparsely populated counties had the smallest increase in vaccine coverage in the 30 days after the first day of school (Figure 5).

Figure 5: Percent increase in immunization coverage levels of Kansas kindergarten students 30 days following school entry, by vaccine and county population density group, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday*

While urban counties had the greatest increase in immunization coverage rates in the 30 days after the first day of school, urban counties did not have significantly higher immunization coverage for any vaccines. Moderately populated counties had the highest immunization coverage with significantly higher coverage rates for four of the five vaccines required for school entry (DTaP5, MMR2, Var2, and HepB3) as well as the 5-4-2-2-3 vaccine series when compared to coverage rates in urban counties. Sparsely populated counties had significantly higher coverage rates for Polio4, Hib3, PCV4, and HepA2 when compared to coverage rates in both moderately populated and urban counties (Table 4).

Table 4: Immunization coverage levels of Kansas kindergarten students 30 days after school entry, by vaccine and county population density group, Kansas 2014-2015

	Sparsely Populated (n=3008) % (95% CI)	Moderately Populated (n=4618) % (95% CI)	Urban (n=1593) % (95% CI)
DTaP5*	91.6 (90.7-92.4)	92.1 (91.7-92.6)	90.4 (90.0-90.8)
Polio4	92.5 (91.8-93.3)	91.2 (90.7-91.7)	90.6 (90.2-91.0)
MMR2	91.0 (90.2-91.9)	92.2 (91.7-92.7)	90.6 (90.2-91.0)
Var2	90.2 (89.3-91.1)	92.1 (91.6-92.6)	89.9 (89.5-90.3)
HepB3	98.2 (97.8-98.6)	97.1 (96.8-97.4)	96.2 (96.0-96.5)
5-4-2-2-3	87.2 (86.2-88.1)	87.2 (86.6-87.8)	84.8 (84.3-85.3)
Hib3	95.8 (95.2-96.4)	91.5 (91.0-92.0)	87.9 (87.5-88.3)
PCV4	89.9 (89.0-90.8)	82.2 (81.5-82.9)	80.1 (79.5-80.6)
HepA2	93.1 (92.3-93.8)	90.4 (89.9-90.9)	90.4 (90.0-90.8)

**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday*

Exemption and School Policy Analysis

Data Collection

Letters of invitation to participate in the survey were sent to 816 Kansas schools; of these, 709 were public school and 107 were private. Forty schools did not respond to our data request. Of the 776 responding schools, 12 schools did not respond in time to be included in the analysis. The remaining 764 schools (666 public and 98 private) from 102 Kansas counties responded to the data request and were included in the analysis. This corresponds to a school participation rate of 95%.

Kindergarten Exemptions

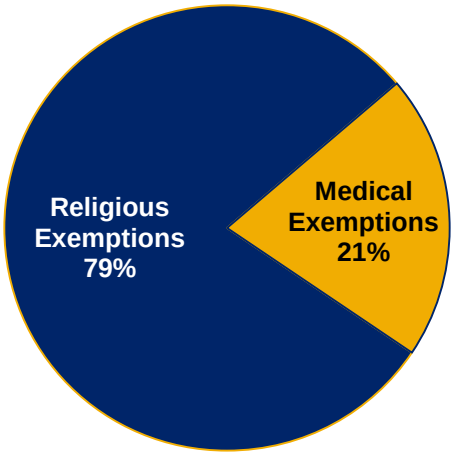
In the state of Kansas, two legal alternatives to vaccination at school entry exist, medical exemption and religious exemption.[5] To receive a medical exemption, a physician must annually sign a form stating the

[5] Statute 72-5209: Same; certification of completion required, alternatives; duties of school boards. (a) In each school year, every pupil enrolling or enrolled in any school for the first time in this state, and each child enrolling or enrolled for the first time in a preschool or day care program operated by a school, and such other pupils as may be designated by the secretary, prior to admission to and attendance at school, shall present to the appropriate school board certification from a physician or local health department that the pupil has received such tests and inoculations as are deemed necessary by the secretary by such means as are approved by the secretary. Pupils who have not completed the required inoculations may enroll or remain enrolled while completing the required inoculations if a physician or local health department certifies that the pupil has received the most recent appropriate inoculations in all required series. Failure to timely complete all required series shall be deemed non-compliance. (b) As an alternative to the certification required under subsection (a), a pupil shall present: (1) An annual written statement signed by a licensed physician stating the physical condition of the child to be such that the tests or inoculations would seriously endanger the life or health of the child, or (2) a written statement signed by one parent or guardian that the child is an adherent of a religious denomination whose religious teachings are opposed to such tests or inoculations. (c) On or before May 15 of each school year, the school board of every school affected by this act shall notify the parents or guardians of all known pupils who are enrolled or who will be enrolling in the school of the provisions this act and any policy regarding the implementation of the provisions of this act adopted by the school board. (d) If a pupil transfers from one

reason for exemption and from which vaccine(s) the child is exempt. To receive a religious exemption, a parent or guardian must write a statement explaining that the child is an adherent of a religious denomination whose religious teachings are opposed to such tests or inoculations. During the 2014-2015 school year, 542 kindergartners from 764 schools were reported as having an exemption, which correlates to 1.5% of the participating enrolled kindergarten population. Of the 542 exemptions reported, 430 (79%) were categorized as religious and 112 (21%) as medical (Figure 6). Exemptions occur throughout the state; however, counties with the greatest percentage of kindergartners with an exemption on file were in the eastern half of the state (Appendix 4). Schools with the greatest percentage of kindergartners with an exemption were clustered in high population areas and in the north-central region of the state.

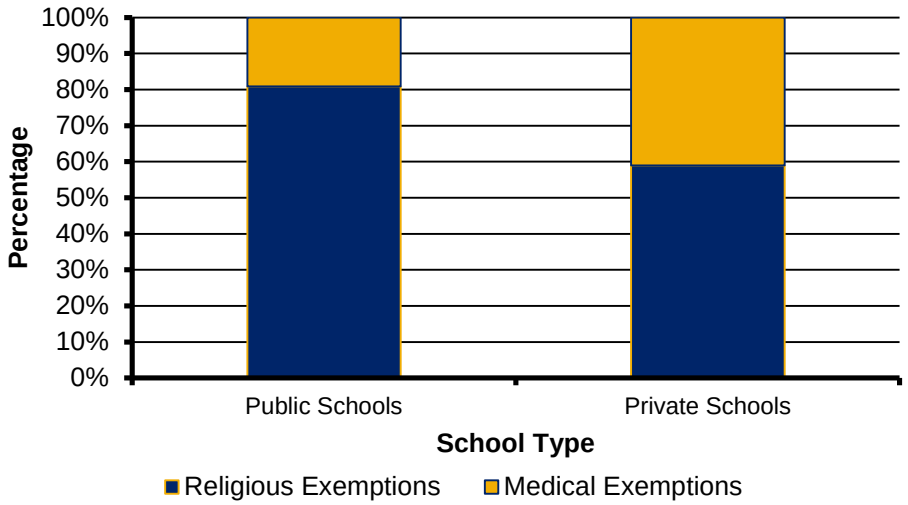
Of the 542 reported exemptions in participating schools, 503 exemptions were reported in public schools while the remaining 39 were reported in private schools. Public schools had the greatest percentage of religious exemptions (81%) compared to private schools (59%) (Figure 7).

Figure 6: Percentage of exemptions reported by schools at kindergarten entry, Kansas 2014-2015



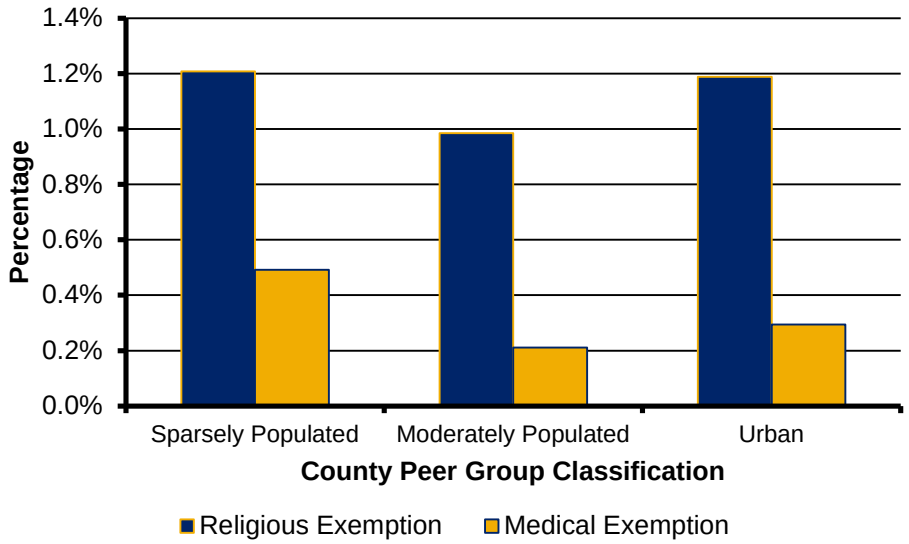
school to another, the school from which the pupil transfers shall forward with the pupil's transcript the certification or statement showing evidence of compliance with the requirements of this act to the school to which the pupil transfers.

Figure 7: Percentage of permissible exemptions reported by schools at kindergarten entry, by school type, Kansas 2014-2015



Vaccine exemptions were compared among the three county population density categories and the percent of total enrollment. The percentage of enrolled kindergarten students with religious exemptions was not significantly different among county population density categories. The highest percentage of kindergartners with religious exemptions were in sparsely populated and urban counties (1.2%) (Figure 8). Maps of exemptions by county are in Appendix 4.

Figure 8: Percentage of total population of kindergarten students with a religious or medical exemption, by county population density group and exemption type, Kansas 2014-2015



Although the percentage of kindergarten students with an exemption has steadily increased from the 2010-2011 school year and the 2013-2014 school year, the percentage of kindergarten students with an exemption decreased by 0.15% in the 2014-2015 school year. However, the decrease was not statistically significant. Changes in the percentage of kindergarten students reported with an exemption

were stratified by exemption type (religious and medical). No statistically significant differences were seen between the two years (Table 6).

Table 5: Religious and medical exemption status among Kansas kindergarten students by year, 2010-2014

School Year	Religious Exemptions Reported % (95% CI)	Medical Exemptions Reported % (95% CI)	All Exemptions Reported % (95% CI)	Total Enrollment
2010-2011	0.75 (0.66-0.83)	0.29 (0.23-0.34)	1.03 (0.93-1.14)	38,496
2011-2012	0.95 (0.85-1.05)	0.34 (0.28-0.40)	1.29 (1.17-1.40)	38,410
2012-2013	1.03 (0.92-1.14)	0.34 (0.27-0.40)	1.37 (1.24-1.49)	35,203
2013-2014	1.34 (1.21-1.47)	0.27 (0.21-0.33)	1.61 (1.46-1.75)	30,339
2014-2015	1.16 (1.05-1.27)	0.30 (0.25-0.36)	1.46 (1.34-1.58)	37,136

School Exclusion Policy

Schools were surveyed about their school policies for grace periods and exclusions. The Kansas statute regarding immunization requirements, KSA 72-5209, states that "every pupil enrolling or enrolled in any school for the first time in this state… shall present to the appropriate school board certification from a physician or local health department that the pupil has received such tests and inoculations as are deemed necessary." Exemptions to inoculations, such as religious or medical exemption, are listed as acceptable alternatives to the required immunizations. It is the decision of the school as to whether or not the school allows a period of time after the first day of school during which a student may become UTD on the required immunizations, referred to as a grace period.

Of the 764 schools that responded to our data request, 754 schools completed the questionnaire about grace period policies. Of the schools completing the questionnaire, 540 (71.6%) reported having a grace period. These grace periods ranged from schools requiring children to be UTD for all required immunizations 30 days after the first day of school to requiring children to be UTD for all required immunizations on the first day of the second semester. While 126 (16.7%) schools did not have a grace period policy and 88 (11.7%) schools required children to be UTD on the first day of school. Grace period policies were stratified by school type to determine the most common grace period among public and private schools. Of the 660 public schools that provided information on grace period policies, 121 (18.3%) reported giving students 90 days to become UTD for the required immunizations. Of the 94 private schools that provided information on grace period policies, 18 (19.1%) did not have a grace period policy (Table 5).

Schools were also asked about policies for excluding children who were not UTD for the five required immunizations. KSA 72-5211a states that "the school board may exclude any pupil until such time as the pupil has complied with the requirements (regarding required immunizations outlined in Kansas statute KSA 72-5209)". Of the 764 schools that responded to our data request, 748 schools responded to the question regarding their exclusion policy. Of the 748 schools that responded, 531 (71%) schools reported that children who are not UTD are excluded until such time that the student has complied with immunization requirements, 170 (23%) responded that they do not exclude children who do not meet

immunization requirements, and 47 (6%) reported that they did not know their school's policy on exclusion of children who were not UTD.

Exclusion policies differed by school type; 490 of 622 (79%) public schools reported that children were excluded if not in compliance with state immunization requirements and 41 of 79 (52%) private schools excluded children not UTD.

Table 6: Immunization grace period policy among kindergartens, by school type, Kansas 2014-2015 (n=754)

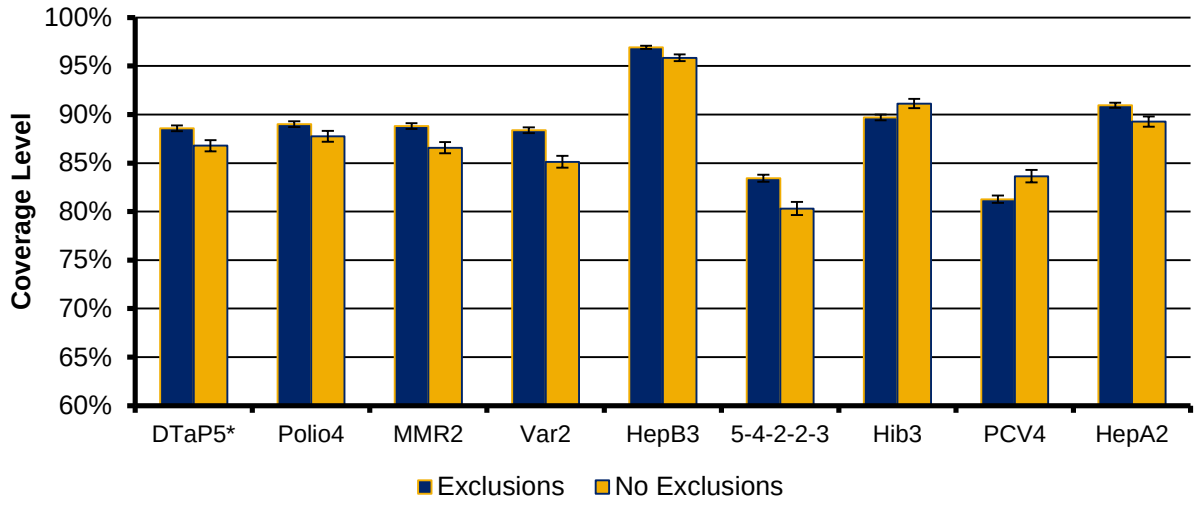
	Public School		Private School		Total	
	#	(%)	#	(%)	#	(%)
1st day of school	71	(11)	17	(18)	88	(12)
30 Days after Start	76	(12)	14	(15)	90	(12)
Sept 22 (Count Day)	12	(2)	2	(2)	14	(2)
60 Days after Start	51	(8)	10	(11)	61	(8)
90 Days after Start	121	(18)	15	(16)	136	(18)
1st day of 2nd Semester	27	(4)	6	(6)	33	(4)
Other Date	119	(18)	1	(1)	120	(16)
Other Policy	75	(11)	11	(12)	86	(11)
No Grace Period Policy	108	(16)	18	(19)	126	(17)

Immunization Coverage Stratified by School Exclusion Policy

Of the 748 schools which provided information regarding exclusion policies, 389 schools also provided immunization records for the immunization coverage assessment. Of these 389 schools, 224 (58%) reported excluding children who were not UTD for the required immunizations. Schools that excluded children that were not UTD had significantly higher immunization coverage rates for all five required vaccines (DTaP5, Polio4, MMR2, Var2, and HepB3), the 5-4-2-2-3 vaccine series, and one of the three non-required vaccines (HepA2) than schools that did not exclude children that were not UTD (Figure 9).

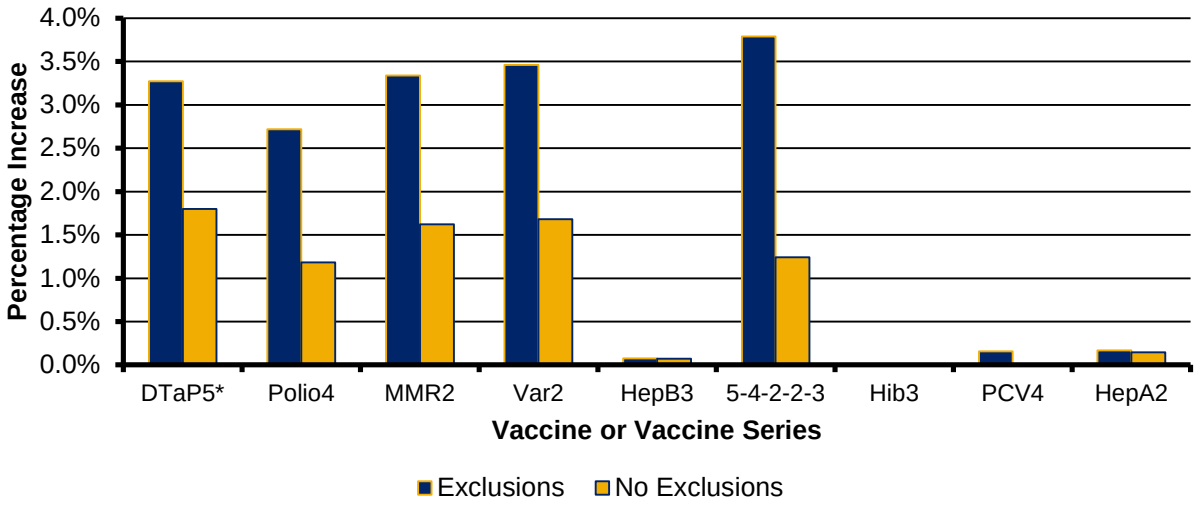
Thirty days after school entry, schools which reported excluding children who were not UTD had significantly larger increases in immunization coverage when compared to schools which reported not excluding children who were not UTD (Figure 10).

Figure 91: Immunization coverage levels of Kansas kindergartners at school entry, by school exclusion policy, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday*

Figure 20: Percent increase in immunization coverage levels of Kansas kindergarten students 30 days following school entry, by school exclusion policy, Kansas 2014-2015



**5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday*

Discussion

All individual vaccinations required for school entry were above 85% coverage at school entry for Kansas kindergartners for the 2014-2015 school year. The vaccinations that met the HP2020 goal of at least 95% coverage were DTaP4 and HepB3. Polio3, MMR2, and Var2 were at most eight percentage points from meeting the HP2020 goal. Four of the five vaccinations required for school entry (DTaP5, Polio4, MMR2, and Var2) as well as the 5-4-2-2-3 vaccine series had significant increases in immunization coverage rates 30 days following the start of the school year when compared to immunization coverage on the first day of school. No increase in vaccination coverage for HepB3, Hib3, HepA2, or PCV4were noted; this is likely because Hib3, HepA2, and PCV4 are not required for school entry and were not always recorded on school immunization records. Therefore immunization coverage levels may be higher than those represented in this report. HepB3 did not increase 30 days following the start of the school year most likely due to the already high immunization coverage rate on the first day of school (96.7%).

Immunization coverage levels for public and private schools were compared. At school entry, children in private schools had significantly higher immunization coverage rates for three of the five required vaccines (DTaP5, Polio4, and MMR2) and two non-required vaccines (Hib3 and PCV4). In the 30 days after the first day of school, public schools had large increases in immunization coverage, with rates surpassing private schools in most required vaccinations and significantly higher coverage rates for Var2 and the 5-4-2-2-3 vaccine series.

The coverage estimates were compared to determine if differences exist among schools in counties of different population densities. Significant differences were detected between urban and non-urban (sparsely populated and moderately populated) counties. All required immunizations (DTaP5, Polio4, MMR2, Var2, and HepB), two non-required immunizations (Hib3 and PCV4) and the 5-4-2-2-3 vaccine series had significantly higher coverage levels in non-urban counties when compared to urban counties.

Immunization coverage rates were compared among schools based on the exemption policies. Coverage rates were found to be significantly higher in schools which reported excluding children for not being up to date for required immunizations. This difference was seen in all five required vaccines (DTaP5, Polio4, MMR2, Var2, and HepB3), the 5-4-2-2-3 vaccine series, and the three non-required vaccines (Hib3, PCV4, and HepA2). These differences in coverage rates were even more pronounced thirty days after the first day of school.

Exemptions were reported for 1.5% of the kindergarten students and the majority of the exemptions were classified as religious (79%). When children are exempt from vaccination or not up to date they are at risk for contracting vaccine preventable diseases (VPDs) and subsequently spreading the disease to other unimmunized or under-immunized individuals (e.g., infants) or other high-risk persons. Therefore, it is important that the numbers of exempt and under-immunized school-aged children remain low. Vaccine coverage is of great public health importance. By having greater vaccination coverage, there is an increase in herd immunity, which leads to lower disease incidence and an ability to limit the size of VPD outbreaks. However, due to unvaccinated and under-vaccinated individuals, the United States has experienced increased incidence in diseases that were previously present at low levels. In 2012 there was an increase in the number of pertussis cases throughout the United States. Kansas experienced a statewide outbreak in 2012 with 887 cases a large increase compared to the 145 cases reported in 2011. Between December 2014 and February 2015, a total of 125 measles cases had been confirmed in United

States connected with an outbreak in California. Among the 110 California residents, 96 (87.3%) were either unvaccinated or had unknown vaccination status.[6]

Limitations

A limitation of this study is Hib3, HepA2, and PCV4 are not required for school entry and may not be consistently reported on the immunization record, thus the coverage estimates for these vaccines may be artificially low. Additionally, school personnel reported the number of exempt students in their school in aggregate. Therefore, KDHE was unable to verify exemptions reported. Finally, no descriptive data are collected about sex, race, or ethnicity.

Strengths

Despite the limitations, the kindergarten immunization survey provides a good estimation of the immunization coverage levels for kindergarten children enrolled in public and private schools in Kansas. It allows state and local officials to identify counties and regions with low vaccine coverage levels in order to focus on these areas and implement enhanced vaccination delivery methods and educational campaigns that can aid in Kansas achieving the HP2020 goal of 95% immunization coverage. The study also had a higher response rate than in previous years. This included high response rates among schools that received requests for immunization records (94%) and schools that received requests for exemption data (95%).

[6] Centers for Disease Control and Prevention. Measles Outbreak – California, December 2014-February 2015. MMWR 2015; 64(06): 153-4

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

Persons per Square Mile in Peer Groups
Sparsely Populated = ≤19.9
Moderately Populated = 20 – 149.9
Urban = ≥ 150.0

Appendix 2: Average school immunization coverage levels for children at school entry for Kansas counties, 2014-2015 (percentages) [§]

COUNTY	DTaP5*	Polio4	MMR2	Var2	HepB3	5-4-2-2-3	Hib3	PCV4	HepA2
STATEWIDE	**88%**	**89%**	**88%**	**88%**	**97%**	**83%**	**90%**	**82%**	**91%**
ALLEN	96%	93%	96%	95%	97%	90%	95%	94%	86%
ANDERSON	90%	91%	91%	91%	96%	88%	95%	88%	88%
ATCHISON	94%	95%	94%	93%	100%	90%	98%	97%	93%
BARBER	98%	100%	94%	94%	98%	94%	98%	92%	94%
BARTON	93%	92%	90%	92%	98%	89%	98%	95%	96%
BOURBON	89%	84%	84%	80%	97%	78%	98%	74%	78%
BROWN	98%	98%	98%	98%	98%	97%	98%	95%	90%
BUTLER	93%	92%	95%	96%	98%	89%	99%	88%	89%
CHASE	67%	71%	67%	67%	79%	67%	79%	71%	71%
CHAUTAUQUA	92%	95%	87%	87%	97%	85%	97%	79%	95%
CHEROKEE	87%	85%	85%	85%	99%	81%	92%	85%	85%
CHEYENNE	93%	89%	89%	89%	100%	86%	96%	100%	96%
CLARK	81%	81%	81%	84%	100%	81%	100%	94%	91%
CLAY	95%	93%	98%	98%	98%	93%	95%	90%	93%
CLOUD	84%	82%	84%	84%	98%	82%	87%	91%	84%
COFFEY	80%	85%	78%	78%	94%	78%	89%	83%	81%
COMANCHE	100%	97%	100%	100%	97%	97%	100%	90%	93%
COWLEY	88%	86%	88%	86%	99%	82%	93%	95%	90%
CRAWFORD	82%	83%	83%	86%	96%	79%	93%	86%	70%
DECATUR	81%	81%	81%	81%	97%	81%	97%	94%	78%
DICKINSON	90%	89%	91%	88%	96%	84%	98%	90%	89%
DONIPHAN	96%	92%	92%	96%	96%	88%	96%	94%	96%
DOUGLAS	84%	84%	85%	83%	94%	80%	86%	77%	73%
EDWARDS	100%	100%	100%	97%	97%	94%	100%	88%	97%
ELK	76%	85%	76%	76%	100%	76%	94%	94%	88%
ELLIS	96%	94%	96%	94%	98%	89%	90%	95%	54%
ELLSWORTH	87%	90%	87%	86%	99%	86%	94%	88%	81%
FINNEY	92%	92%	92%	90%	99%	89%	95%	98%	88%
FORD	89%	90%	88%	88%	99%	86%	95%	92%	89%
FRANKLIN	93%	92%	95%	95%	99%	90%	95%	94%	90%
GEARY	92%	88%	90%	91%	96%	85%	94%	95%	86%
GOVE	87%	90%	87%	85%	97%	82%	95%	85%	87%
GRAHAM	97%	97%	97%	97%	100%	97%	100%	97%	100%
GRANT	97%	87%	93%	93%	97%	87%	97%	97%	93%
GRAY	82%	82%	79%	82%	97%	72%	89%	92%	89%
GREELEY[‡]									
GREENWOOD	90%	85%	85%	85%	100%	83%	100%	95%	88%
HAMILTON	100%	100%	100%	100%	100%	100%	100%	97%	97%
HARPER	86%	91%	88%	85%	98%	82%	88%	86%	86%
HARVEY	76%	76%	90%	90%	86%	71%	78%	92%	71%
HASKELL	90%	92%	92%	90%	98%	88%	96%	96%	90%
HODGEMAN[‡]									
JACKSON	89%	90%	91%	90%	98%	88%	91%	93%	89%

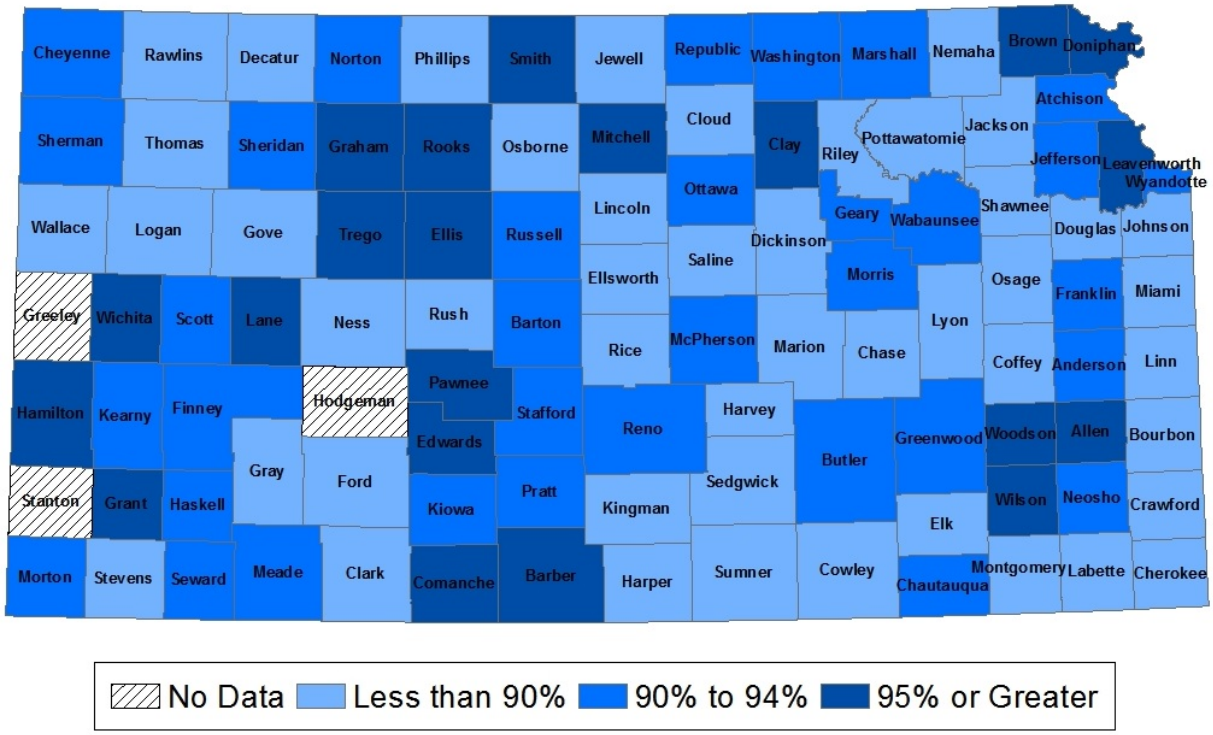
COUNTY	DTaP5*	Polio4	MMR2	Var2	HepB3	5-4-2-2-3	Hib3	PCV4	HepA2
STATEWIDE	**88%**	**89%**	**88%**	**88%**	**97%**	**83%**	**90%**	**82%**	**91%**
JEFFERSON	90%	91%	88%	88%	99%	86%	98%	94%	92%
JEWELL	76%	76%	76%	76%	94%	76%	94%	71%	88%
JOHNSON	86%	86%	88%	86%	95%	81%	82%	89%	75%
KEARNY	91%	87%	93%	93%	98%	87%	93%	93%	83%
KINGMAN	76%	81%	76%	74%	89%	69%	92%	76%	76%
KIOWA	93%	93%	93%	96%	100%	89%	93%	89%	96%
LABETTE	89%	87%	87%	87%	98%	84%	91%	93%	86%
LANE	100%	95%	100%	100%	100%	95%	100%	100%	95%
LEAVENWORTH	95%	94%	95%	94%	97%	89%	94%	94%	86%
LINCOLN	88%	84%	88%	88%	100%	84%	98%	96%	94%
LINN	86%	87%	87%	86%	97%	78%	93%	86%	87%
LOGAN	87%	87%	87%	87%	100%	87%	100%	100%	97%
LYON	84%	91%	80%	82%	98%	79%	97%	91%	88%
MARION	87%	90%	82%	85%	99%	76%	96%	87%	88%
MARSHALL	95%	94%	93%	91%	99%	87%	98%	99%	96%
MCPHERSON	92%	91%	92%	91%	96%	87%	39%	71%	34%
MEADE	95%	97%	95%	95%	100%	95%	100%	100%	95%
MIAMI	87%	85%	87%	89%	95%	80%	71%	92%	68%
MITCHELL	99%	97%	99%	94%	99%	93%	96%	97%	89%
MONTGOMERY	81%	81%	82%	82%	92%	76%	86%	81%	77%
MORRIS	90%	94%	94%	94%	94%	77%	94%	97%	81%
MORTON	92%	95%	93%	90%	100%	88%	100%	100%	90%
NEMAHA	76%	85%	78%	76%	99%	72%	98%	94%	91%
NEOSHO	92%	97%	92%	92%	98%	88%	94%	85%	42%
NESS	86%	86%	86%	86%	100%	71%	100%	100%	100%
NORTON	93%	93%	90%	83%	100%	80%	98%	95%	98%
OSAGE	87%	89%	83%	86%	97%	79%	92%	81%	86%
OSBORNE	88%	100%	81%	88%	100%	81%	100%	88%	100%
OTTAWA	92%	95%	92%	92%	99%	91%	100%	96%	95%
PAWNEE	95%	93%	93%	93%	100%	93%	100%	95%	95%
PHILLIPS	89%	93%	89%	87%	100%	85%	98%	96%	91%
POTTAWATOMIE	86%	84%	84%	82%	95%	81%	92%	86%	88%
PRATT	94%	97%	94%	94%	97%	94%	95%	97%	92%
RAWLINS	88%	84%	92%	92%	96%	84%	92%	96%	92%
RENO	94%	93%	93%	93%	98%	88%	97%	93%	89%
REPUBLIC	94%	94%	94%	91%	96%	91%	96%	89%	91%
RICE	88%	91%	89%	85%	98%	82%	87%	88%	76%
RILEY	88%	88%	88%	86%	96%	82%	93%	82%	84%
ROOKS	97%	97%	100%	97%	98%	95%	97%	100%	97%
RUSH	87%	90%	84%	84%	100%	81%	94%	100%	81%
RUSSELL	93%	90%	95%	95%	98%	88%	95%	95%	85%
SALINE	90%	91%	90%	90%	98%	84%	96%	96%	87%
SCOTT	90%	100%	87%	87%	100%	87%	100%	100%	97%
SEDGWICK	88%	88%	88%	87%	97%	82%	94%	92%	83%
SEWARD	91%	88%	90%	89%	99%	87%	92%	92%	84%
SHAWNEE	85%	89%	80%	83%	97%	76%	95%	91%	90%

COUNTY	DTaP5*	Polio4	MMR2	Var2	HepB3	5-4-2-2-3	Hib3	PCV4	HepA2
STATEWIDE	**88%**	**89%**	**88%**	**88%**	**97%**	**83%**	**90%**	**82%**	**91%**
SHERIDAN	92%	92%	88%	88%	100%	88%	100%	100%	100%
SHERMAN	93%	100%	90%	90%	100%	83%	100%	97%	93%
SMITH	96%	96%	96%	96%	100%	96%	100%	92%	96%
STAFFORD	91%	91%	91%	89%	98%	87%	91%	91%	85%
STANTON‡									
STEVENS	77%	80%	77%	73%	100%	70%	93%	100%	90%
SUMNER	84%	84%	81%	81%	96%	76%	89%	87%	74%
THOMAS	86%	88%	86%	85%	98%	85%	97%	96%	91%
TREGO	97%	97%	93%	97%	100%	93%	100%	97%	90%
WABAUNSEE	90%	90%	90%	90%	99%	90%	96%	96%	90%
WALLACE	63%	63%	63%	63%	100%	63%	100%	63%	100%
WASHINGTON	93%	93%	91%	89%	100%	89%	98%	98%	93%
WICHITA	100%	100%	100%	97%	100%	97%	100%	94%	94%
WILSON	96%	100%	96%	95%	99%	93%	99%	92%	91%
WOODSON	97%	97%	97%	97%	100%	90%	100%	93%	90%
WYANDOTTE	90%	93%	90%	90%	96%	84%	81%	93%	78%

§ Due to Hib3, HepA2, and PCV4 not being required for school entry, these vaccines may not consistently be reported on the immunization record, thus decreasing coverage levels for the individual vaccines. This is evident for several counties that have extremely low levels for the Hib3, HepA2 and PCV4 coverage levels.
*5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday.
‡ No data available

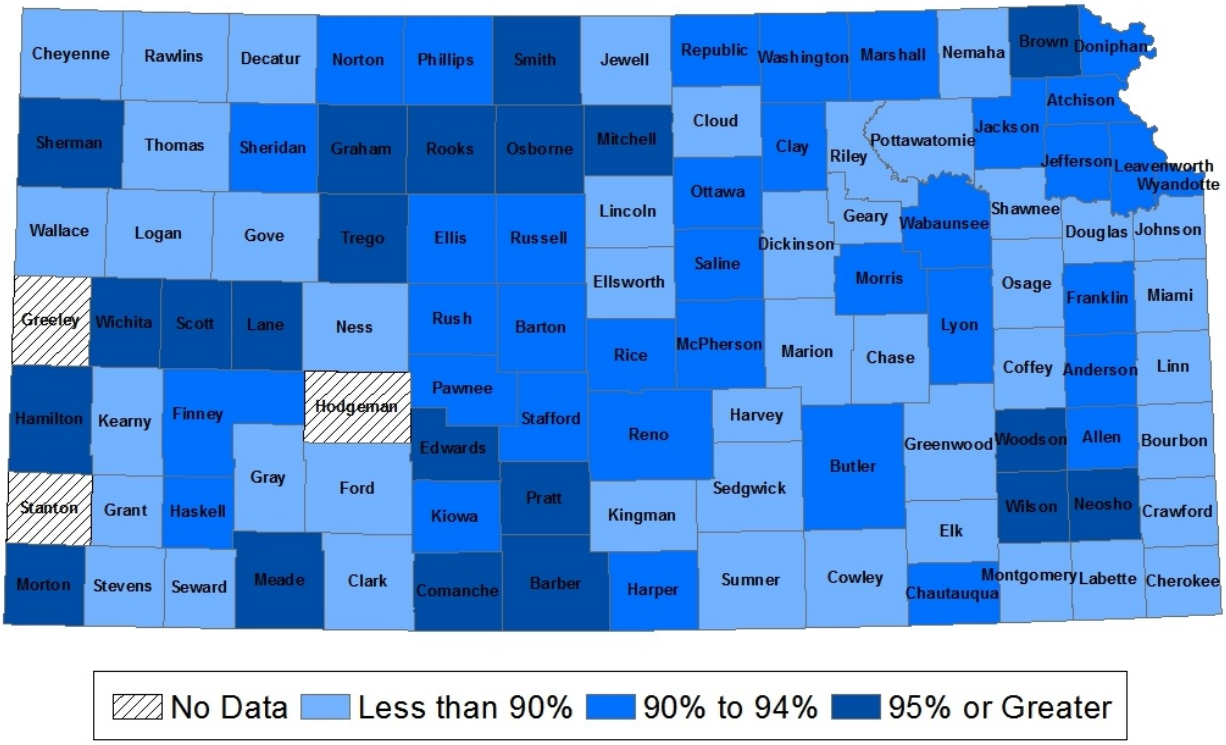
Appendix 3: Maps of immunization levels by county, 2014-2015 Kindergarten Survey

DTaP5 Coverage for Kindergarten Survey, 2014-2015

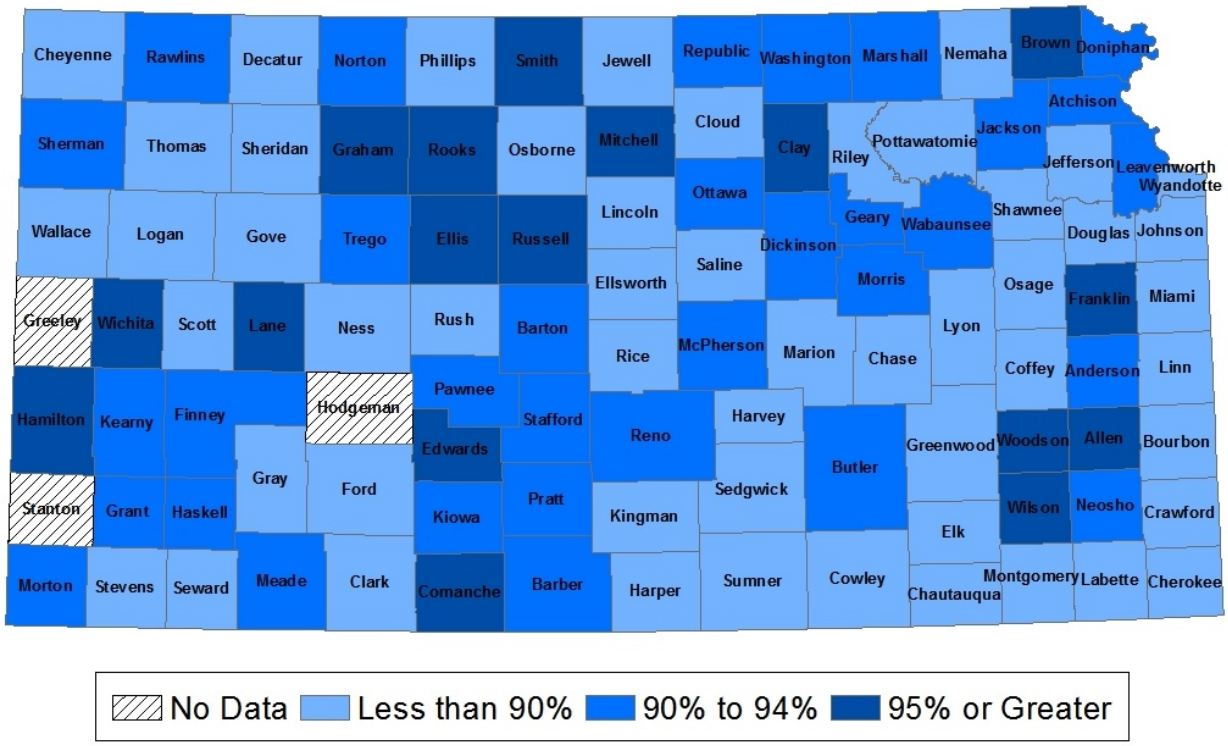


5 doses of DTaP or 4 doses if the fourth is administered on or after the fourth birthday

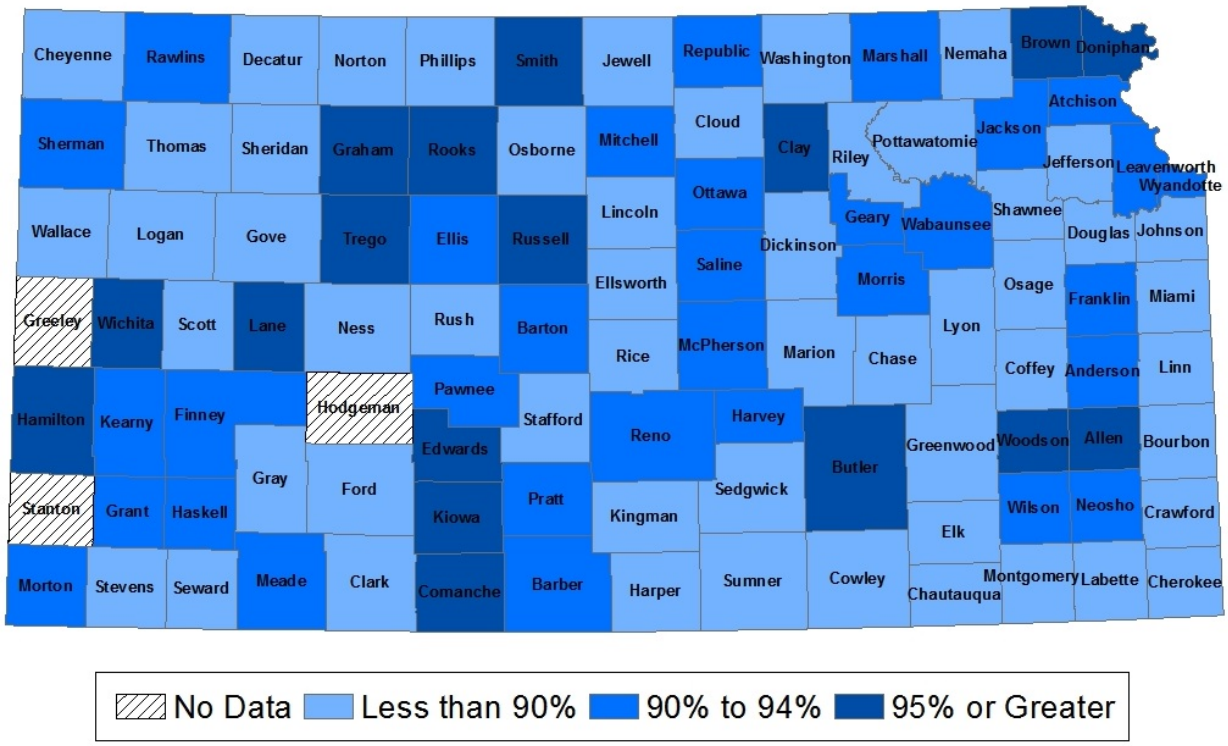
Polio4 Coverage for Kindergarten Survey, 2014-2015



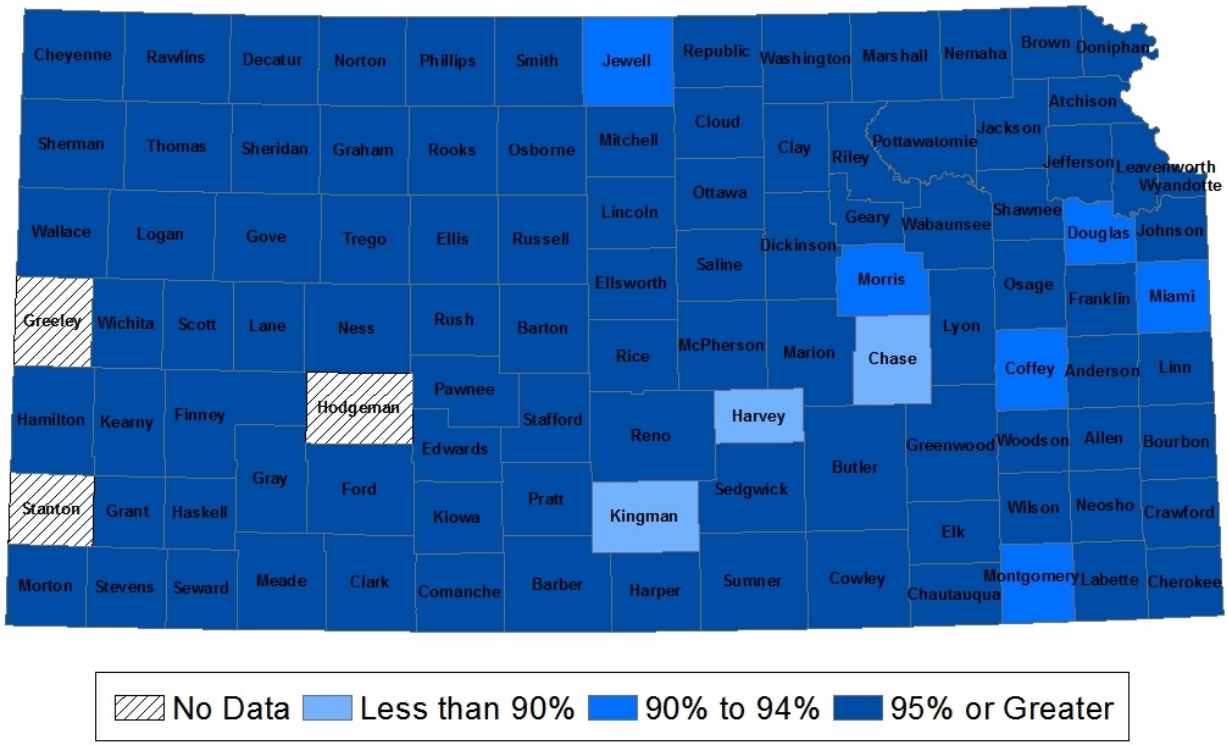
MMR2 Coverage for Kindergarten Survey, 2014-2015



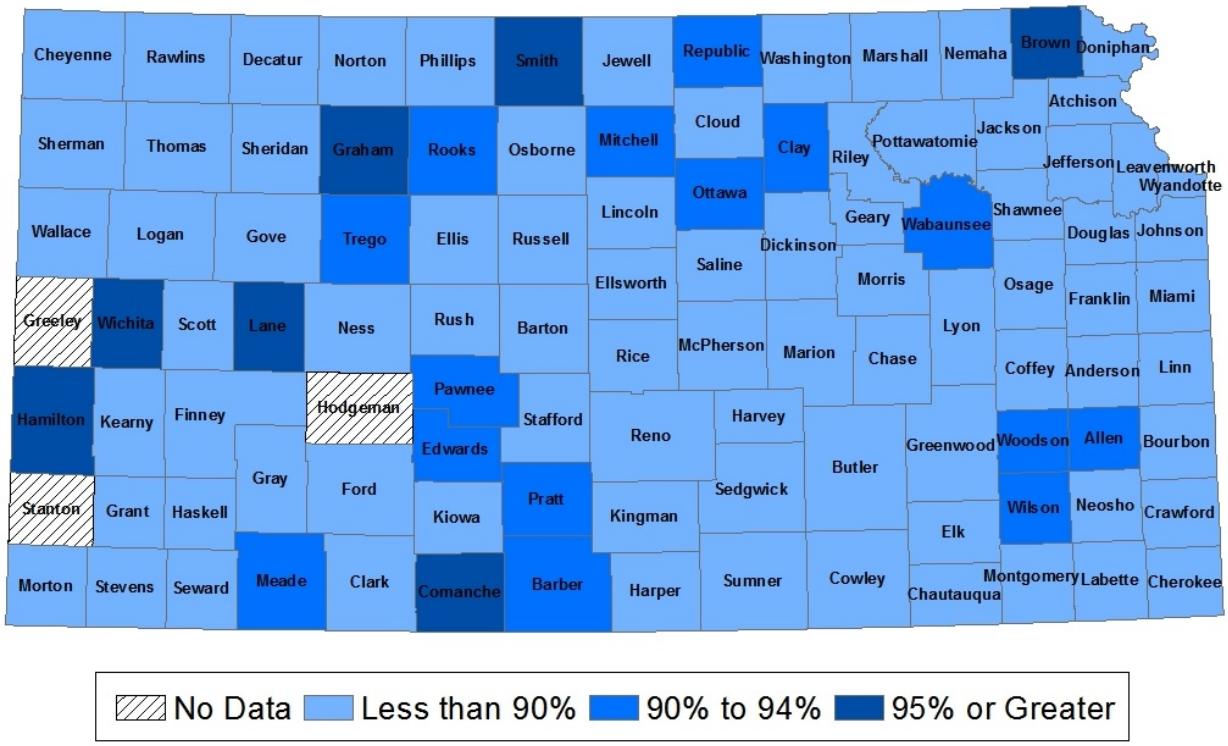
Var2 Coverage for Kindergarten Survey, 2014-2015



HepB3 Coverage for Kindergarten Survey, 2014-2015

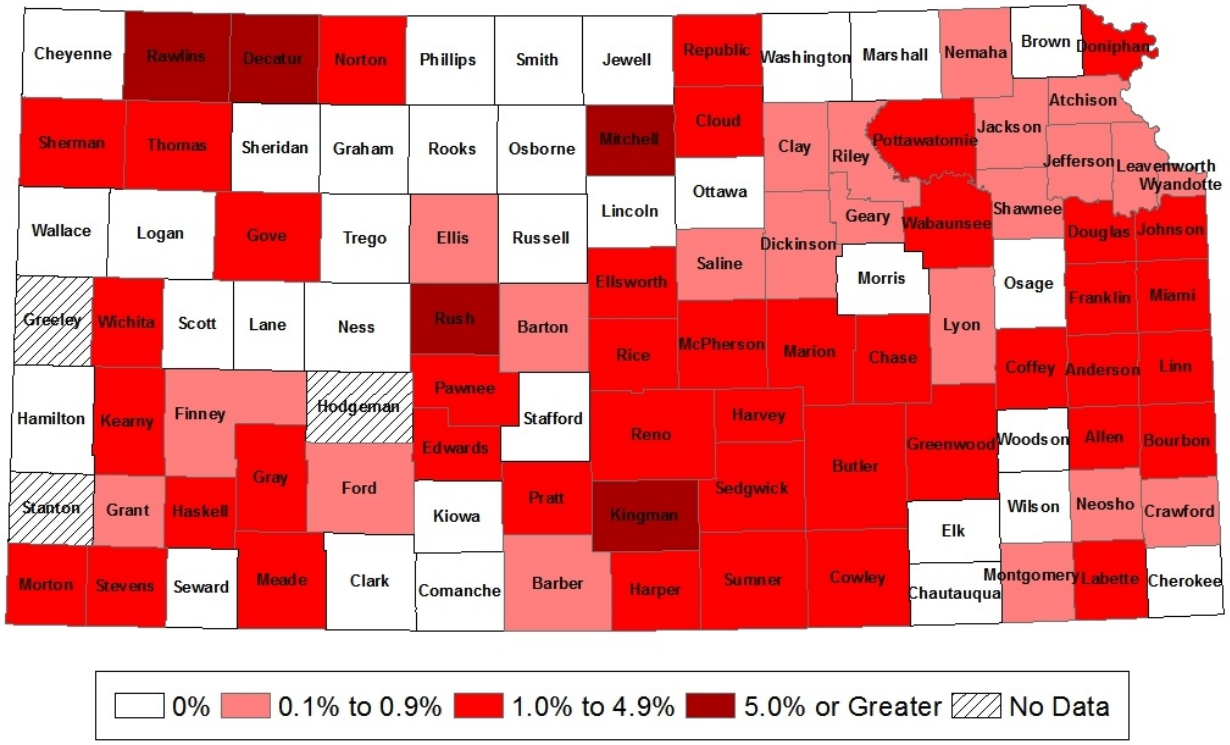


5-4-2-2-3 Coverage for Kindergarten Survey, 2014-2015



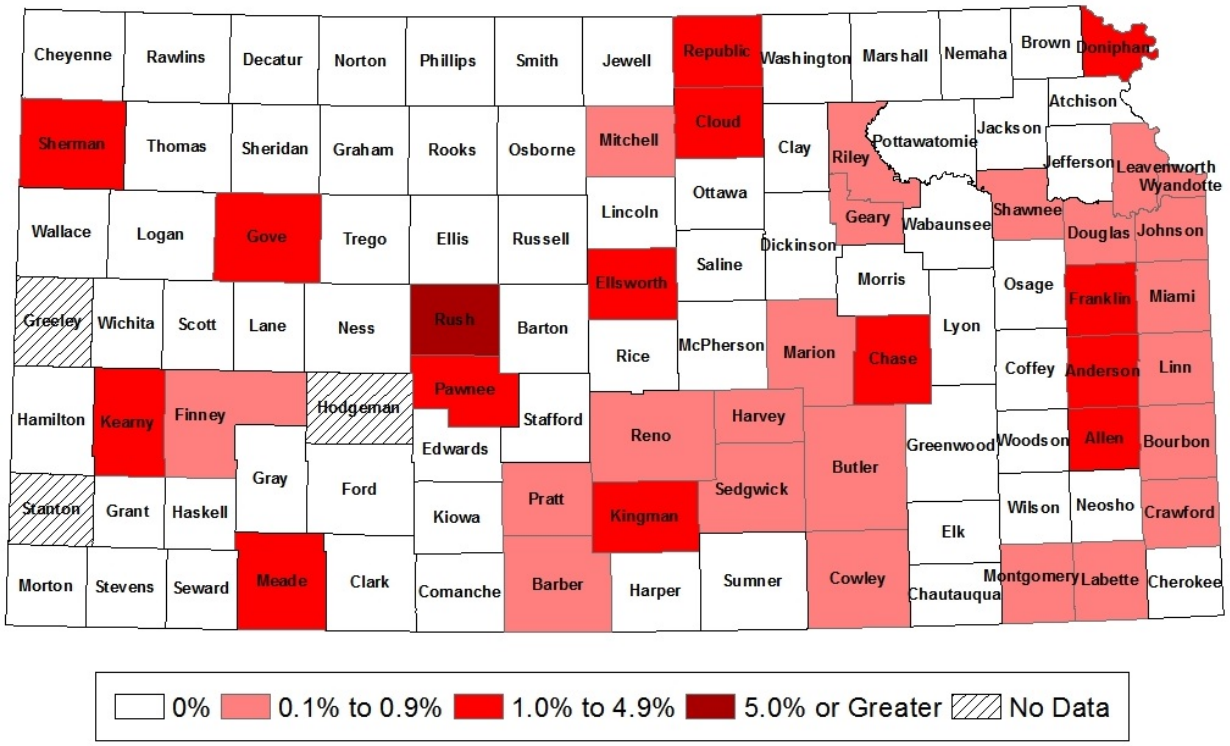
Appendix 4: Maps of exemptions by county, 2014-2015 Kindergarten Survey

Percent of Kindergartners Exempt at Submitting Schools by County, 2014-2015



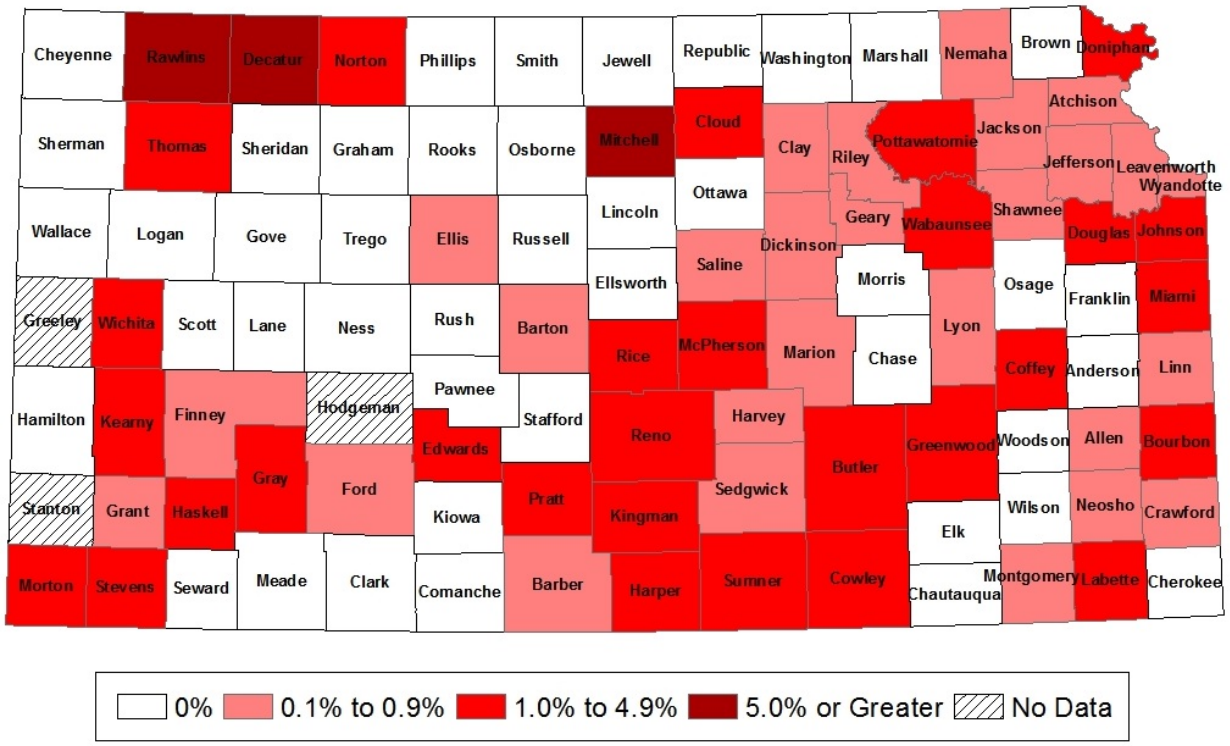
Includes children enrolled at both public and private schools

Percent of Kindergartners with a Medical Exemption at Submitting Schools by County, 2014-2015



Includes children enrolled at both public and private schools

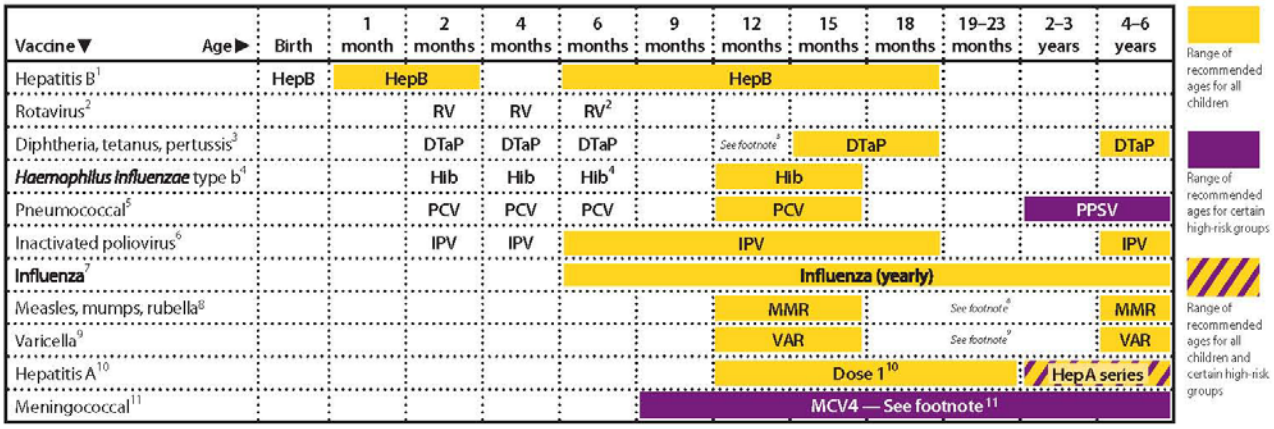
Percent of Kindergartners with a Religious Exemption at Submitting Schools by County, 2014-2015



Includes children enrolled at both public and private schools

Appendix 5: CDC's 2012 Advisory Committee on Immunization Practices (ACIP) Recommendations http://www.cdc.gov/mmwr/preview/mmwrhtml/su6201a2.htm

FIGURE 1. Recommended immunization schedule for persons aged 0 through 6 years — United States, 2012 (for those who fall behind or start late, see the catch-up schedule [Figure 3])



This schedule includes recommendations in effect as of December 23, 2011. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967).

1. **Hepatitis B (HepB) vaccine.** (Minimum age: birth)
   At birth:
   - Administer monovalent HepB vaccine to all newborns before hospital discharge.
   - For infants born to hepatitis B surface antigen (HBsAg)–positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) 1 to 2 months after receiving the last dose of the series.
   - If mother's HBsAg status is unknown, within 12 hours of birth administer HepB vaccine for infants weighing ≥2,000 grams, and HepB vaccine plus HBIG for infants weighing <2,000 grams. Determine mother's HBsAg status as soon as possible and, if she is HBsAg-positive, administer HBIG for infants weighing ≥2,000 grams (no later than age 1 week).

   Doses after the birth dose:
   - The second dose should be administered at age 1 to 2 months. Monovalent HepB vaccine should be used for doses administered before age 6 weeks.
   - Administration of a total of 4 doses of HepB vaccine is permissible when a combination vaccine containing HepB is administered after the birth dose.
   - Infants who did not receive a birth dose should receive 3 doses of a HepB-containing vaccine starting as soon as feasible (Figure 3).
   - The minimum interval between dose 1 and dose 2 is 4 weeks, and between dose 2 and 3 is 8 weeks. The final (third or fourth) dose in the HepB vaccine series should be administered no earlier than age 24 weeks and at least 16 weeks after the first dose.
2. **Rotavirus (RV) vaccines.** (Minimum age: 6 weeks for both RV-1 [Rotarix] and RV-5 [Rota Teq])
   - The maximum age for the first dose in the series is 14 weeks, 6 days; and 8 months, 0 days for the final dose in the series. Vaccination should not be initiated for infants aged 15 weeks, 0 days or older.
   - If RV-1 (Rotarix) is administered at ages 2 and 4 months, a dose at 6 months is not indicated.
3. **Diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine.** (Minimum age: 6 weeks)
   - The fourth dose may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.
4. ***Haemophilus influenzae* type b (Hib) conjugate vaccine.** (Minimum age: 6 weeks)
   - If PRP-OMP (PedvaxHIB or Comvax [HepB-Hib]) is administered at ages 2 and 4 months, a dose at age 6 months is not indicated.
   - Hiberix should only be used for the booster (final) dose in children aged 12 months through 4 years.
5. **Pneumococcal vaccines.** (Minimum age: 6 weeks for pneumococcal conjugate vaccine [PCV]; 2 years for pneumococcal polysaccharide vaccine [PPSV])
   - Administer 1 dose of PCV to all healthy children aged 24 through 59 months who are not completely vaccinated for their age.
   - For children who have received an age-appropriate series of 7-valent PCV (PCV7), a single supplemental dose of 13-valent PCV (PCV13) is recommended for:
     — All children aged 14 through 59 months
     — Children aged 60 through 71 months with underlying medical conditions.
   - Administer PPSV at least 8 weeks after last dose of PCV to children aged 2 years or older with certain underlying medical conditions, including a cochlear implant. See *MMWR* 2010;59(No. RR-11), available at http://www.cdc.gov/mmwr/pdf/rr/rr5911.pdf.
6. **Inactivated poliovirus vaccine (IPV).** (Minimum age: 6 weeks)
   - If 4 or more doses are administered before age 4 years, an additional dose should be administered at age 4 through 6 years.
   - The final dose in the series should be administered on or after the fourth birthday and at least 6 months after the previous dose.
7. **Influenza vaccines.** (Minimum age: 6 months for trivalent inactivated influenza vaccine [TIV]; 2 years for live, attenuated influenza vaccine [LAIV])
   - For most healthy children aged 2 years and older, either LAIV or TIV may be used. However, LAIV should not be administered to some children, including 1) children with asthma, 2) children 2 through 4 years who had wheezing in the past 12 months, or 3) children who have any other underlying medical conditions that predispose them to influenza complications. For all other contraindications to use of LAIV, see *MMWR* 2010;59(No. RR-8), available at http://www.cdc.gov/mmwr/pdf/rr/rr5908.pdf.
   - For children aged 6 months through 8 years:
     — For the 2011–12 season, administer 2 doses (separated by at least 4 weeks) to those who did not receive at least 1 dose of the 2010–11 vaccine. Those who received at least 1 dose of the 2010–11 vaccine require 1 dose for the 2011–12 season.
     — For the 2012–13 season, follow dosing guidelines in the 2012 ACIP influenza vaccine recommendations.
8. **Measles, mumps, and rubella (MMR) vaccine.** (Minimum age: 12 months)
   - The second dose may be administered before age 4 years, provided at least 4 weeks have elapsed since the first dose.
   - Administer MMR vaccine to infants aged 6 through 11 months who are traveling internationally. These children should be revaccinated with 2 doses of MMR vaccine, the first at ages 12 through 15 months and at least 4 weeks after the previous dose, and the second at ages 4 through 6 years.
9. **Varicella (VAR) vaccine.** (Minimum age: 12 months)
   - The second dose may be administered before age 4 years, provided at least 3 months have elapsed since the first dose.
   - For children aged 12 months through 12 years, the recommended minimum interval between doses is 3 months. However, if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.
10. **Hepatitis A (HepA) vaccine.** (Minimum age: 12 months)
    - Administer the second (final) dose 6 to 18 months after the first.
    - Unvaccinated children 24 months and older at high risk should be vaccinated. See *MMWR* 2006;55(No. RR-7), available at http://www.cdc.gov/mmwr/pdf/rr/rr5507.pdf.
    - A 2-dose HepA vaccine series is recommended for anyone aged 24 months and older, previously unvaccinated, for whom immunity against hepatitis A virus infection is desired.
11. **Meningococcal conjugate vaccines, quadrivalent (MCV4).** (Minimum age: 9 months for Menactra [MCV4-D], 2 years for Menveo [MCV4-CRM])
    - For children aged 9 through 23 months 1) with persistent complement component deficiency; 2) who are residents of or travelers to countries with hyperendemic or epidemic disease; or 3) who are present during outbreaks caused by a vaccine serogroup, administer 2 primary doses of MCV4-D, ideally at ages 9 months and 12 months or at least 8 weeks apart.
    - For children aged 24 months and older with 1) persistent complement component deficiency who have not been previously vaccinated; or 2) anatomic/functional asplenia, administer 2 primary doses of either MCV4 at least 8 weeks apart.
    - For children with anatomic/functional asplenia, if MCV4-D (Menactra) is used, administer at a minimum age of 2 years and at least 4 weeks after completion of all PCV doses.
    - See *MMWR* 2011;60:72–6, available at http://www.cdc.gov/mmwr/pdf/wk/mm6003.pdf, and Vaccines for Children Program resolution No. 6/11-1, available at http://www.cdc.gov/vaccines/programs/vfc/downloads/resolutions/06-11mening-mcv.pdf, and *MMWR* 2011;60:1391–2, available at http://www.cdc.gov/mmwr/pdf/wk/mm6040.pdf, for further guidance, including revaccination guidelines.

This schedule is approved by the Advisory Committee on Immunization Practices (http://www.cdc.gov/vaccines/recs/acip), the American Academy of Pediatrics (http://www.aap.org), and the American Academy of Family Physicians (http://www.aafp.org).

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