

KINDERGARTEN IMMUNIZATION COVERAGE SURVEY

School Year 2009-10



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ACRONYMS

CI	Confidence interval
HP2010	Healthy People 2010
KCI	Kansas Certificate of Immunizations
KDHE	Kansas Department of Health
KSDE	Kansas State Department of Education

VACCINE ACRONYMS*

*Vaccine acronym followed by a number indicates the number of doses.

DTaP	Diphtheria and tetanus toxoids and acellular pertussis vaccines including diphtheria and tetanus toxoids (DTaP/DT) vaccine
HepA	Hepatitis A vaccine
HepB	Hepatitis B vaccine
Hib	<i>Haemophilus influenzae</i> type b vaccine
MMR	Measles, mumps, and rubella vaccine
PCV	Pneumococcal conjugate vaccine
Polio	Polio vaccine
Var	Varicella vaccine
5-4-2-2-3	DTaP5 – Polio4 – MMR2 – Var2 – HepB3

EXECUTIVE SUMMARY

Overview

The Kansas Certificates of Immunizations (KCIs) and other immunization data for children enrolled in a kindergarten class in Kansas public and private schools during the 2009-2010 school year were collected and evaluated for immunization coverage rates. Immunization coverage rates were calculated for children at the time of school entry. Children who were between the ages of five and seven on September 1, 2009 were included. The results for this survey were measured against similar previous studies. In total, there were 797 schools, 695 public and 102 private, included in the analysis. A representative sample of 15,330 children from both public and private schools with complete and usable KCIs, or other sources of immunization data, were included in the analysis.

Coverage at Kindergarten Entry

The statewide coverage rates for all vaccines required for school entry (DTaP5, Polio4, MMR2, Var2, HepB3) were above 80%, with HepB3 having the highest coverage at 96%. HepB3 was the only vaccine to meet the Healthy People 2010 goal of at least 95% coverage rates of immunizations for kindergartners. Vaccine coverage rates of most vaccines increased within the first 30 days of school. There is minimal variation between coverage rates of children enrolled in private school and public schools throughout Kansas for required vaccines. HepB3 is the exception, with coverage rates being significantly higher for kindergartners in public schools.

The 105 counties were grouped into 3 categories based on population density, and coverage rates were compared among these groups. Counties that were “sparsely populated” (<20 persons per square mile) had higher coverage rates for HepB3 and HIB3 than “moderately populated” (20 – 149.9 persons per square mile) and “urban” (≥ 150 persons per square mile) counties. Var2 and HepA2 coverage rates were lowest in “sparsely populated” counties compared to counties with greater population density; while DTaP5 and Polio4 showed no significant variation in coverage rates between population density groups. No counties had 100% coverage rates for all 5 required vaccines; however, of the 4 counties that had 100% coverage rates for 4 of the 5 required vaccines, all were sparsely populated (Appendix 2). Ninety-seven counties had 95% coverage or better for HepB3.

KINDERGARTEN IMMUNIZATION COVERAGE SURVEY SCHOOL YEAR 2009-2010

INTRODUCTION

Objective

This study was conducted to estimate the immunization coverage rates of children at school entry.

Study Population

The study population included all kindergarten students enrolled in both public and private schools in the 2009-10 school year.

Study Design

A stratified, cross-sectional design was utilized for this study, with each county representing a stratum. The characteristics of interest, or outcome variables, were the percentages of children who were fully immunized against diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *H. influenzae* type b, hepatitis A virus, hepatitis B virus, varicella, and pneumococcal disease. Coverage rates were assessed for these children at school entry into kindergarten.

Immunization coverage rates were measured for single vaccines and combinations of vaccines according to the recommended immunization schedule for children by 5 years of age.¹ The schedule for 2009 is in Appendix 4. *Immunization coverage rates were assessed at time of school entry for all kindergartners who were between the ages of five and seven upon entering kindergarten on September 1, 2009.*

METHODS

Sampling Techniques

A probability sample of all children enrolled in Kansas public school kindergartens was drawn. To ensure an adequate sample size in each county and to 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.² Due to the small size of the private school population in Kansas, all records from private schools were solicited.

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 to public schools 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

¹ 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 2009.

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

(typically the school nurse) was instructed to select all, every other, every third, every sixth, every eighteenth, or every nineteenth immunization record regardless of the size of the kindergarten class at that school. The private schools were instructed to select all immunization records. The schools were informed they could submit KCIs or any other form of immunization record, including printouts from computerized record keeping programs. The study coordinators were also advised to remove all personal identifiers, except date of birth, to ensure confidentiality. Copies of the immunization records and the current total number of kindergarten enrollees in each school were forwarded to KDHE.

Data Analysis

Starting in the 2006-07 Retrospective Survey and continuing through the 2009-10 survey, the data analysis methods were changed from previous years. In the current study, all children who had a date of birth recorded on the Kansas Certificate of Immunizations (KCI) or other data source and were the appropriate age for the analysis were included in the denominator. Point estimates of coverage rates and 95% confidence intervals (95% CI) for DTaP5, Polio4, MMR2, Hib3, HepB3, Var2, HepA2 and PCV3 vaccines were calculated at time of school entry. For public schools, the date of school entry was based on school district data from KSDE. This data is not available for private schools; therefore, September 1, 2009 was used as the school start date. All children who indicated history of varicella were included in the denominator, but only those who reported history of vaccination were included in the numerator. This methodology was performed because the date of disease was frequently not recorded, thus it could not be determined if the child had the disease before school entry.

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 calculated from the 2004 Annual Summary of Vital Statistics.⁴ The 2004 Annual Summary of Vital Statistics data correspond to the data in the current kindergarten survey. For the purpose of this analysis, counties were grouped by population density into “urban,” “moderately populated,” and “sparsely populated” (Appendix 1). Immunization coverage rate estimates were compared among these groups.

RESULTS

Data Collection

Letters of invitation to participate in the survey were sent to 864 Kansas schools; of these, 747 were public schools and 117 were private. Fourteen schools reported not having a kindergarten class for the 2009-2010 school year and 51 did not respond. Data were received from 799 schools (697 public schools and 102 private schools) with kindergarten classes, corresponding to a school participation rate of 94%.⁵

³ Complex survey design effect was accounted for by using the SAS Procedure PROC SURVEYFREQ.

⁴ 2004 Annual Summary of Kansas Vital Statistics (<http://www.kdheks.gov/ches>)

⁵ In total, there were 797 schools, 695 public and 102 private, included in the analysis; KCIs from 2 public schools could not be included in the analysis as the dates of birth were removed

The number of children enrolled in kindergarten at the participating public and private schools was 37,882, which is 95.8% of the 39,553 children in that birth cohort.⁶ The children in the birth cohort that did not participate in the study include children who attend home school or other special schools as well as those enrolled in schools that did not participate in the study. The number of immunization records received was 15,645. This is equivalent to a sampling ratio of 2.4, meaning that one child was selected for every 2.4 children enrolled. The range of the sample size by county was from 14 to 1,102 records while the range of student enrollment was from 14 to 7,836.⁷

Of the 15,645 immunization records returned and examined, 15,330 (98%) were complete and had usable information regarding birth dates and immunization history. The majority of the immunization records submitted by schools were KCIs; however, some schools submitted printouts from computerized record keeping programs. For the kindergarten analysis, 15,290 (99.7%) children were included in the analysis because they were between the ages of 5 and 7 on September 1, 2009. In the weighted analysis, 0.1% of the study population did not have vaccinations because of a medical exemption and 1% did not have vaccinations because of a religious exemption.

The number of records examined by population density includes: 4,343 (28.4% of all records used, representing 11.8% of the population after weighting) in sparsely populated, 7,075 (46.3% of all records used, representing 32.2% of the population after weighting) in moderately populated, and 3,872 (25.3% of all records used, representing 55.9% of the population after weighting) in urban counties. The birth cohort across the state of Kansas is 10.7% sparsely populated, 34.6% moderately populated and 54.6% urban.⁸

Statewide Immunization Coverage of Kindergartners at School Entry

The immunization coverage rates of all the vaccines required for school entry (DTaP5, Polio4, MMR2, Var2, and HepB3) were above 80%, with HepB3 having the highest coverage rates of any vaccine (Figure 1). Healthy People 2010 goals for kindergarten immunization coverage rates are $\geq 95\%$ for all vaccines required by Kansas for school entry.⁹ The only vaccine that reached this goal was the hepatitis B vaccine. Of the vaccines not required for school entry, HepA2 had the lowest coverage rate, with 36% of kindergartners documented as having been vaccinated.

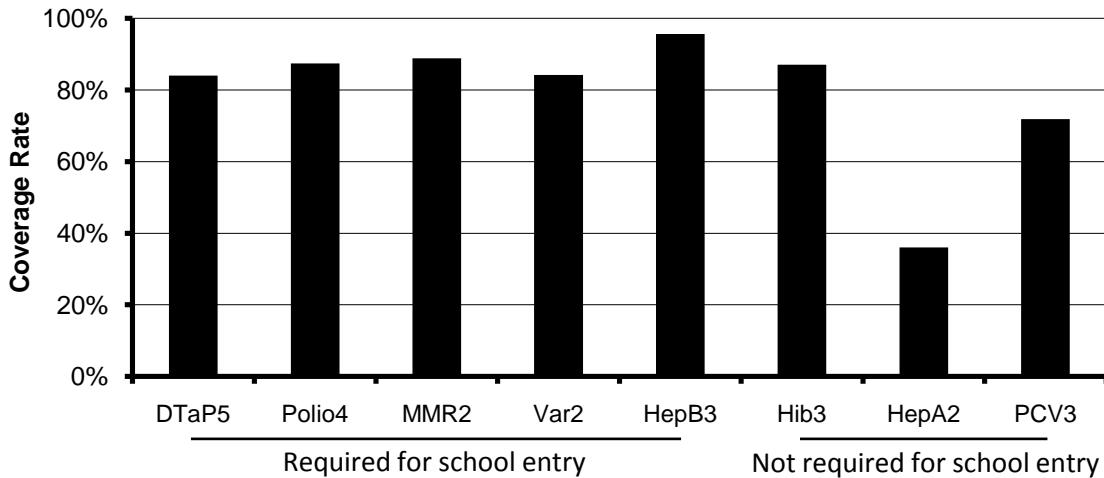
⁶2004 Annual Summary of Kansas Vital Statistics (<http://www.kdheks.gov/ches>)

⁷ Estimates from counties with small sample size (<50) may be unstable and changes over time should be interpreted with caution

⁸ Numbers are rounded

⁹ Healthy People 2010 (<http://www.healthypeople.gov>.)

Figure 1 Immunization coverage rates of kindergarten students at school entry, Kansas 2009-2010.



* Based on kindergarten survey from school year starting in 2009.

Many school districts maintain a policy of a “grace period” during which a child may be vaccinated with the appropriate vaccines without being excluded from school. The immunization rates of kindergartners are significantly greater for most required vaccines (DTaP5, Polio4, MMR2, Var2) when comparing coverage rates from school entry to 30 days following the first day of school (Table 1). The percentage of kindergartners up-to-date for all required vaccines [DTaP5, Polio4, MMR2, Var2, HepB3 (5-4-2-2-3)] was significantly higher 30 days after school entry than they were at the first day of school. The only required vaccine that did not have a significantly increased coverage rate was HepB3. Additionally, none of the three non-required vaccinations assessed significantly increased during the first 30 days of school.

Table 1 Immunization coverage rates of kindergarten students at school entry and 30 days following school entry, Kansas 2009-2010.

*Percentage up-to-date and 95% confidence interval

	At School Entry % (95% CI)	30 Days After School Entry % (95% CI)
DTaP5	84.1 (83 - 85.1)	86.4 (85.4 - 87.3)
Polio4	87.5 (86.5 - 88.4)	89.9 (89 - 90.7)
MMR2	88.9 (88 - 89.8)	91.5 (90.7 - 92.3)
Var2	84.2 (83.2 - 85.2)	87 (86 - 87.9)
HepB3	95.7 (95 - 96.3)	95.7 (95.1 - 96.4)
5-4-2-2-3	75.6 (74.3 - 76.8)	78.2 (77.0 - 79.4)
Hib3	87.1 (86.1 - 88.1)	87.1 (86.1 - 88.1)
HepA2	36 (34.7 - 37.4)	36.9 (35.5 - 38.3)
PCV3	71.8 (70.6 - 73.1)	71.8 (70.6 - 73.1)

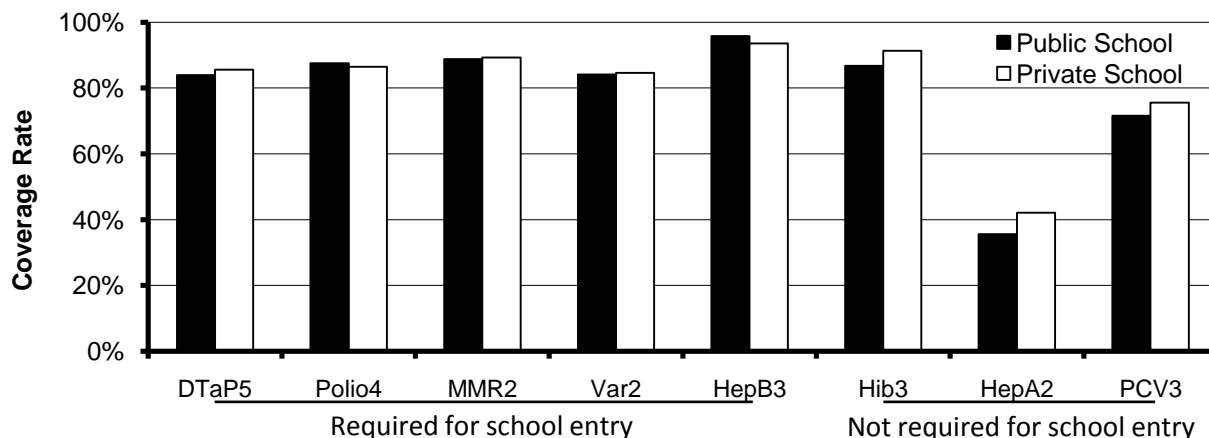
In the state of Kansas, two legal alternatives to vaccination exist: medical exemption and religious exemption. To receive a medical exemption, a physician must sign a form stating the reason for exemption and from which vaccine(s) the child is exempt. A parent or guardian must write a statement explaining that the child is an adherent of a religious denomination whose religious teachings are opposed to such tests or inoculations to receive a religious exemption. During the 2009-10 retrospective study, 0.1% of the study population indicated a medical exemption, while 1% indicated a religious exemption to one or more vaccines. When all children who had a stated exemption to any vaccine were excluded from the analysis, there was no significant difference between immunization rates for any vaccine (Table 2).

TABLE 2 Kansas immunization coverage rates of all and non-exempt children at kindergarten entry, Kansas 2009 - 2010.

	All Kindergartners n=15,290	Non-Exempt Kindergartners n=15,136
	% (95% CI)	% (95% CI)
DTaP5	84.1 (83 - 85.1)	84.9 (83.9 - 85.9)
Polio4	87.5 (86.5 - 88.4)	88.3 (87.4 - 89.2)
MMR2	88.9 (88 - 89.8)	89.7 (88.9 - 90.6)
Var2	84.2 (83.2 - 85.2)	85.1 (84.1 - 86.1)
HepB3	95.7 (95 - 96.3)	96.5 (95.9 - 97.1)
Hib3	87.1 (86.1 - 88.1)	87.8 (86.9 - 88.8)
HepA2	36 (34.7 - 37.4)	36.4 (35 - 37.8)
PCV3	71.8 (70.6 - 73.1)	72.5 (71.3 - 73.8)

There was little variation in the immunization coverage rates for kindergartners enrolled in public and private schools for the required vaccines (Figure 2). HepB3 was the only vaccine that had significantly different immunization coverage rates, with children enrolled in public school having greater immunization coverage than those enrolled in private schools. Additionally, the immunization rates were significantly greater for all three non-required vaccinations for children in private schools.

FIGURE 2 Immunization coverage rates of public and private school kindergartners at school entry, Kansas 2009-2010.



County-level Immunization Coverage of Kindergartners at School Entry

Immunization coverage was also analyzed at the county level. All vaccine coverage rates are displayed by county in Appendix 2.

Of the 105 counties, 97 reached the Healthy People goal of $\geq 95\%$ for HepB3. However, less than 16 counties reached the HP2010 for the remaining required vaccines (DTaP5, Polio4, MMR2, and Var2). Four counties reached 100% coverage rates for 4 of the 5 required immunizations for kindergarten. All 4 of these counties are sparsely populated.

Counties were classified based on their population densities, and coverage rates were compared among the three categories (Table 3). Urban counties had significantly lower coverage rates for HepB3 than the counties with lower population densities (sparsely populated, moderately populated). Conversely, counties that were sparsely populated had significantly lower coverage rates for the Var2 series than counties with greater population densities (moderately populated, urban).

TABLE 3 Kansas immunization coverage rates by peer group for kindergartners, 2009-10.*

Counties by Population Density – Condensed Groups n=15,290			
	Sparsely Populated (n=4343)	Moderately Populated (n=6361)	Urban (n=3481)
DTaP5	84.2 (83.1 - 85.3)	83.7 (82.8 - 84.6)	84.2 (82.5 - 86)
Polio4	86.5 (85.4 - 87.5)	88.1 (87.3 - 88.9)	87.3 (85.7 - 88.9)
MMR2	87.6 (86.6 - 88.6)	90.2 (89.5 - 91)	88.3 (86.8 - 89.9)
Var2	80.7 (79.5 - 81.9)	84.4 (83.5 - 85.3)	84.8 (83.1 - 86.6)
HepB3	98.1 (97.6 - 98.5)	97.2 (96.8 - 97.6)	94.3 (93.2 - 95.5)
Hib3	93.8 (93.1 - 94.6)	88.3 (87.5 - 89.1)	84.9 (83.2 - 86.7)
HepA2	26.9 (25.6 - 28.2)	28.9 (27.8 - 30)	42.1 (39.7 - 44.5)
PCV3	73.7 (72.4 - 75)	70.3 (69.2 - 71.4)	72.3 (70.2 - 74.5)

* Based on retrospective surveys from school years starting in 2009

DISCUSSION

All vaccines required for school entry in Kansas were above 80% coverage for kindergartners enrolled in private and public schools. The only vaccine that met the Healthy People 2010 goal of at least 95% coverage was HepB3. DTaP5, Polio4, MMR2, and Var2 were less than 11 percentage points away from meeting the goal. For required vaccines that did not meet the HP2010 goal, immunization rates 30 days following the start of the school year were significantly higher when compared to the first day of school. However, these rates are still below the HP2010 goals. Immunization against *H. influenzae* type B, hepatitis A, and pneumococcal disease, was not required for school entry for the 2009-2010 school year, and thus not always recorded in school immunization records. For this reason, the immunization coverage rates might actually be higher than those represented in the data.

Sixteen counties (representing 7.5% of the birth cohort) reached the Healthy People goal of at least 95% coverage for the MMR2 vaccine series. Fourteen of these counties were sparsely populated, while the remaining 2 counties were moderately populated (Appendix 3). For DTaP5, 5 counties (representing 3.3% of the birth cohort) had at least 95% coverage, while 11 counties (representing 5.9% of the birth

cohort) 95% coverage or better for Polio4. Ninety-seven counties (representing 92% of the birth cohort) had a minimum of 95% coverage for HepB3. Five counties (representing 2.2% of the birth cohort) had 95% or greater coverage for Var2.

Geographic regions where immunization rates were high (90% or greater) for DTaP5 and Var2 were in the western part of the state.

County designations were used to create categories by population. The coverage rate estimates were compared to determine if differences exist among the counties of different population densities. For HepB3 and Hib3, the coverage rate of sparsely populated counties was statistically higher compared to moderately populated and urban counties, and the moderately populated rates were statistically greater than the urban rates. Conversely, the coverage rates for HepA2 were statistically greater in urban counties when compared to less populated counties. Hepatitis A vaccination is required for school-run daycares and preschools; because there are more of these programs in urban counties, this may account for the greater vaccination coverage rates for Var2 and HepA2. The moderately populated category, which is comprised of 32% of the population surveyed, had the lowest coverage estimates for DTaP5 and PCV3. The moderately populated counties had the highest coverage rate for MMR2 and Polio4. Urban counties, which includes the most densely populated counties and represents 56% of the population surveyed, had the lowest coverage rate estimates for Hib3 and HepB3. Var2 and HepA2 were the only vaccines for which the urban category had the highest rate. Due to the large percentage of the population living in the 5 urban counties (57%), targeting this population to improve vaccination coverage would increase the statewide immunization rates.

Vaccine coverage is of great public health importance. By having greater vaccine coverage rates, there is an increase in herd immunity, which leads to lower incidence rates and an ability to limit the size of disease outbreaks. In 2006, a widespread outbreak of mumps occurred in Kansas and across the United States. Prior to the outbreak, the incidence rate of mumps was at a historical low, and even with the outbreak, the rates were still lower than pre-vaccination era. Due to high vaccine coverage rates, tens or hundreds of thousands of cases were possibly prevented.

Limitations

One limitation of this study is Hib3, HepA2 and PCV3 are not required for school entry and may not consistently be reported on the immunization record, thus decreasing coverage rates for the individual vaccines. This is evident in Appendix 2 for several counties that have extremely low rates for Hib3, HepA2, and PCV3. Also, no descriptive data are collected about sex, race, or ethnicity. Additionally, it is possible the exemption data is not an accurate representation of exemptions among children due to the sampling method.

Strengths

Despite the limitations, the retrospective immunization survey provides a good estimation of the immunization coverage rates for kindergarten children enrolled in private and public schools in Kansas. It allows state and local officials to identify counties and regions with low vaccine coverage rates. Focus on these areas and implementation of enhanced vaccination delivery methods and educational campaigns can aid in Kansas achieving the 95% coverage rate goal. To aid in this goal, a similar survey is planned for next year.

Appendix 1: Kansas counties categorized based on population density, 2000.

Sparsely Populated

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

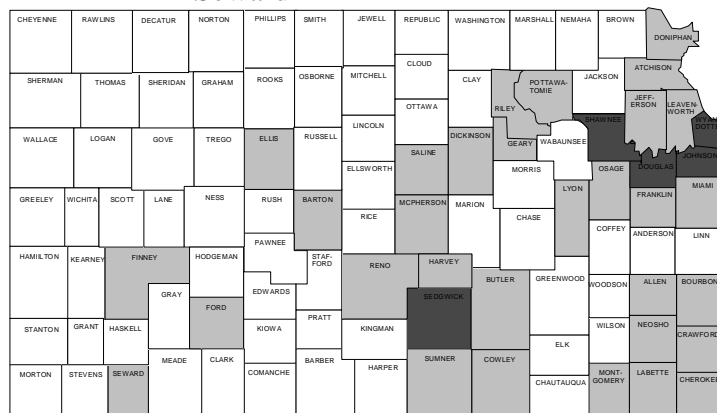
Moderately Populated

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

Urban

- Douglas
- Johnson
- Sedgwick
- Shawnee
- Wyandotte

Persons per Square Mile in Peer Groups
 Sparsely Populated = <6 – 19.9
 Moderately Populated = 20 – 149.9
 Urban = ≥ 150.0



□ Sparsely Populated ■ Moderately Populated ■ Urban

APPENDIX 2: Immunization Coverage Rates of Children at School Entry for Kansas Counties
2009-2010 (percentages).*§

COUNTY	DTaP5	Polio4	MMR2	Var2	HepB3	5-4-2-2-3	Hib3	HepA2	PCV3
STATEWIDE	84	88	89	84	96	76	87	36	72
ALLEN	84	85	90	84	99	74	90	16	69
ANDERSON	85	92	92	80	98	74	89	24	79
ATCHISON	81	87	90	75	98	66	97	15	31
BARBER	78	83	83	83	100	78	89	20	63
BARTON	89	93	94	92	98	86	82	43	67
BOURBON	74	78	77	70	80	75	79	7	69
BROWN	85	90	89	72	99	61	97	36	72
BUTLER	88	89	91	83	97	75	95	26	74
CHASE	70	74	93	48	100	41	89	11	0
CHAUTAUQUA	80	83	85	80	96	72	93	17	80
CHEROKEE	82	90	91	87	98	76	91	30	87
CHEYENNE	93	100	100	96	100	89	100	29	89
CLARK	90	84	87	81	100	77	100	32	97
CLAY	86	90	94	88	98	79	96	50	90
CLOUD	83	84	88	86	98	79	94	23	88
COFFEY	82	82	86	76	98	71	93	6	76
COMANCHE	100	100	100	94	100	94	100	18	71
COWLEY	82	87	87	79	99	73	96	16	68
CRAWFORD	82	89	89	82	98	73	94	22	60
DECATUR	90	90	90	90	95	90	95	5	67
DICKINSON	85	85	86	79	97	74	98	27	89
DONIPHAN	84	85	85	84	98	75	91	22	71
DOUGLAS	81	84	86	82	89	70	87	23	68
EDWARDS	80	83	83	78	100	75	100	20	95
ELK	67	72	67	69	100	56	94	22	72
ELLIS	91	94	96	91	99	86	82	20	71
ELLSWORTH	81	82	85	79	99	72	99	37	84
FINNEY	83	86	89	86	97	76	92	45	86
FORD	81	86	87	80	98	73	95	51	84
FRANKLIN	83	83	92	92	97	77	94	30	86
GEARY	85	87	89	84	98	77	86	30	70
GOVE	88	91	91	84	97	78	78	3	59
GRAHAM	79	92	83	83	100	71	92	0	42
GRANT	90	92	97	91	98	83	96	22	72
GRAY	76	77	77	73	100	70	93	40	86
GREELEY	93	100	100	100	100	93	100	79	100
GREENWOOD	86	91	90	85	97	77	92	21	72
HAMILTON	100	100	100	98	100	98	92	60	77
HARPER	83	84	87	79	97	73	92	18	68
HARVEY	90	92	94	88	99	81	71	34	58
HASKELL	87	90	93	90	98	82	97	55	77
HODGEMAN	85	95	90	90	100	85	90	70	85
JACKSON	90	92	94	80	96	75	85	22	64
JEFFERSON	89	93	92	87	98	81	94	20	88

COUNTY	DTaP5	Polio4	MMR2	Var2	HepB3	5-4-2-2-3	Hib3	HepA2	PCV3
STATEWIDE	84	88	89	84	96	76	87	36	72
JEWELL	90	95	90	85	100	85	90	20	70
JOHNSON	86	88	89	86	91	74	81	55	70
KEARNY	89	93	96	93	98	84	95	38	85
KINGMAN	88	88	88	73	94	70	88	29	64
KIOWA	78	78	78	78	96	70	91	13	57
LABETTE	79	84	85	82	97	75	88	31	77
LANE	87	87	90	94	100	84	94	58	84
LEAVENWORTH	89	93	92	88	98	80	84	46	76
LINCOLN	92	92	97	95	97	87	95	11	58
LINN	77	82	86	67	98	57	96	18	65
LOGAN	70	70	70	52	96	44	96	4	85
LYON	86	89	90	85	98	80	96	30	42
MARION	72	76	75	69	94	63	92	17	67
MARSHALL	90	91	91	84	98	83	98	30	80
MCPHERSON	83	83	87	82	95	76	10	18	8
MEADE	90	90	93	90	100	85	88	29	83
MIAMI	84	87	89	84	95	78	89	28	75
MITCHELL	90	95	94	86	99	83	97	26	78
MONTGOMERY	82	88	94	82	98	72	89	37	49
MORRIS	77	84	87	81	96	73	90	23	51
MORTON	85	89	92	92	100	79	85	23	58
NEMAHA	82	84	82	72	98	69	95	32	64
NEOSHO	14	89	90	84	98	11	97	2	15
NESS	36	36	36	36	100	29	100	29	100
NORTON	85	87	87	85	98	83	93	19	61
OSAGE	88	90	90	82	97	78	94	20	86
OSBORNE	86	86	86	86	90	86	81	10	62
OTTAWA	88	89	87	84	100	78	94	37	88
PAWNEE	81	82	82	78	99	74	96	30	85
PHILLIPS	85	84	84	78	98	76	96	24	82
POTTAWATOMIE	89	92	92	87	97	82	92	14	85
PRATT	83	82	86	83	96	78	95	27	52
RAWLINS	85	90	90	90	100	85	90	20	95
RENO	88	91	94	89	97	83	95	23	91
REPUBLIC	89	100	100	94	100	85	94	24	91
RICE	63	66	66	57	97	53	96	11	71
RILEY	84	86	88	84	91	82	80	14	76
ROOKS	95	95	97	92	100	90	98	47	83
RUSH	81	89	81	74	100	67	96	11	81
RUSSELL	87	86	88	77	95	73	91	27	92
SALINE	83	89	90	84	100	76	92	50	90
SCOTT	97	100	98	95	100	92	97	79	87
SEDGWICK	84	87	88	83	96	77	91	33	74
SEWARD	87	92	97	92	100	83	95	45	77
SHAWNEE	85	87	89	88	97	79	93	33	87
SHERIDAN	81	72	81	78	94	69	94	3	66

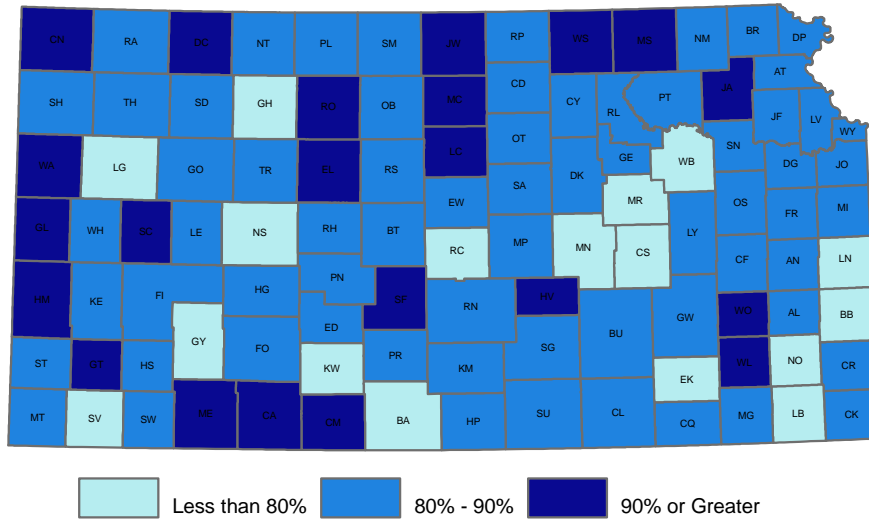
COUNTY	DTaP5	Polio4	MMR2	Var2	HepB3	5-4-2-2-3	Hib3	HepA2	PCV3
STATEWIDE	84	88	89	84	96	76	87	36	72
SHERMAN	89	89	88	82	99	79	97	14	85
SMITH	88	85	91	85	100	76	97	32	88
STAFFORD	92	94	92	91	98	87	87	45	60
STANTON	88	93	95	88	100	80	95	49	76
STEVENS	79	79	83	78	99	73	92	42	49
SUMNER	83	87	89	70	98	65	90	8	29
THOMAS	83	83	86	78	100	74	98	19	83
TREGO	88	88	88	80	96	72	96	16	76
WABAUNSEE	79	82	80	77	97	70	92	10	85
WALLACE	90	90	90	90	100	81	95	33	90
WASHINGTON	93	93	96	94	99	89	96	21	76
WICHITA	88	88	88	81	100	81	100	28	97
WILSON	91	93	95	87	99	79	98	32	49
WOODSON	100	100	100	87	100	87	97	7	67
WYANDOTTE	80	84	85	81	97	70	70	41	61

* Based on the Kindergarten survey for the school year starting 2009.

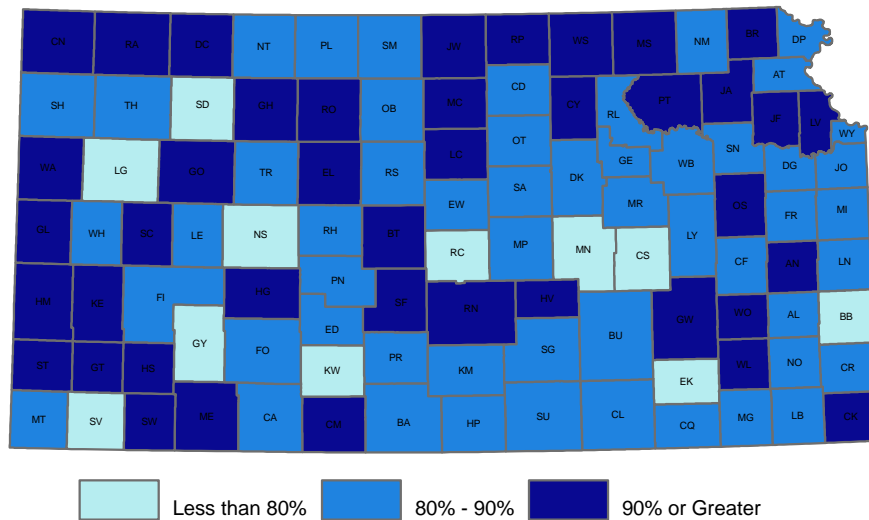
§ Due to Hib3, HepA2, and PCV3 not being required for school entry, these vaccines may not consistently be reported on the immunization record, thus decreasing coverage rates for the individual vaccines. This is evident for several counties that have extremely low rates for the Hib3, HepA2 and PCV3 coverage rates.

Appendix 3: Maps of immunization rates by county, 2009-10 Kindergarten Survey.

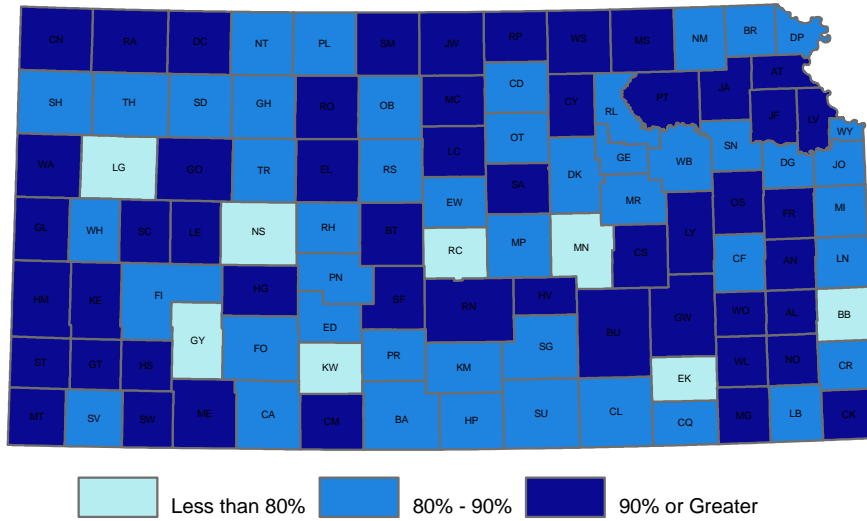
DTaP5 Series for Kindergarten Survey 2009-2010



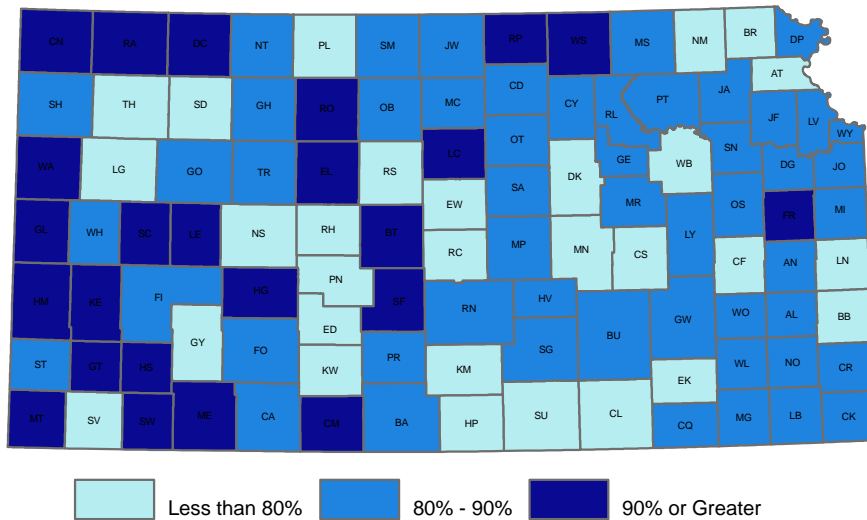
Polio4 Series for Kindergarten Survey 2009-2010



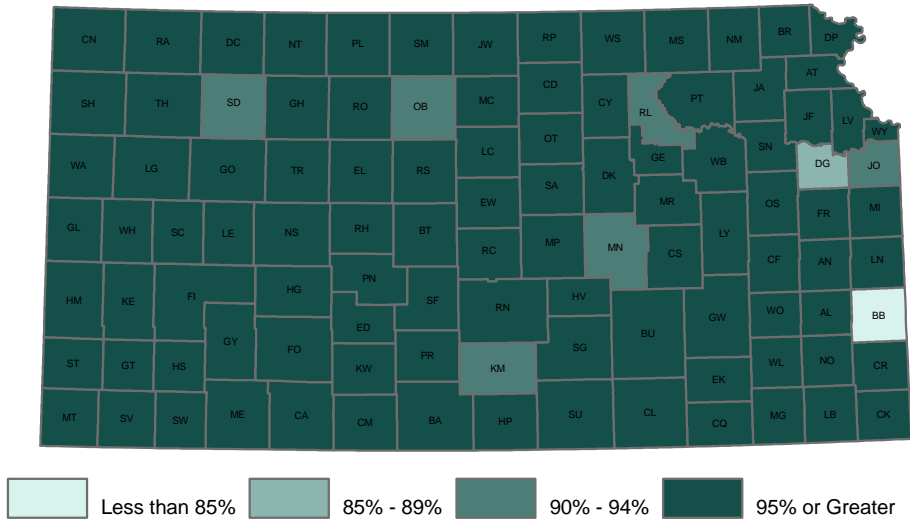
MMR2 Series for Kindergarten Survey 2009-2010



Var2 Series for Kindergarten Survey 2009-2010

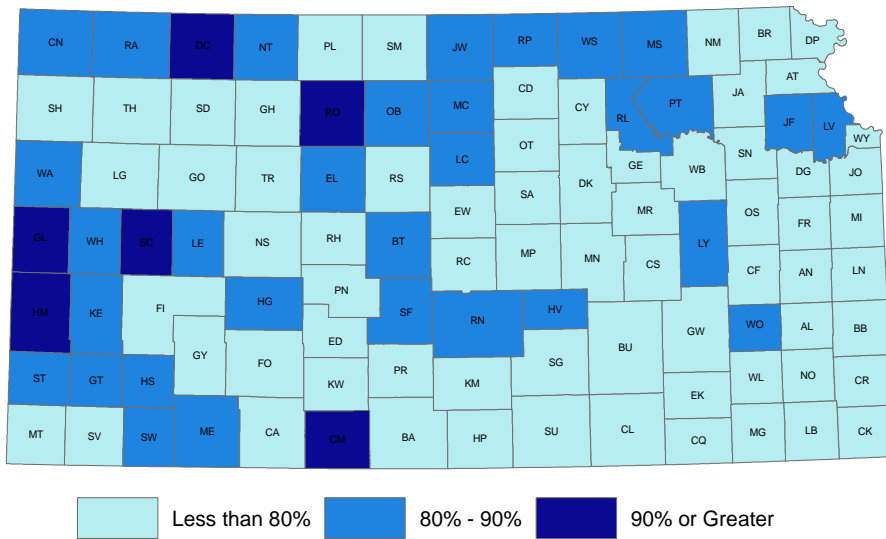


HepB3 Series for Kindergarten Survey 2009-2010



Note: Intervals used are different from the other maps

5-4-2-2-3 Series for Kindergarten Survey 2009-2010



Appendix 4: CDC's 2009 Advisory Committee on Immunization Practices (ACIP) Recommendations http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5751a5.htm?s_cid=mm5751a5_e

Recommended Immunization Schedule for Persons Aged 0 Through 6 Years—United States • 2009
For those who fall behind or start late, see the catch-up schedule

Vaccine ▼	Age ►	Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	19–23 months	2–3 years	4–6 years
Hepatitis B ¹		HepB	HepB		^{see footnote 1}	HepB						
Rotavirus ²			RV	RV	RV ³							
Diphtheria, Tetanus, Pertussis ³			DTaP	DTaP	DTaP	^{see footnote 2}	DTaP					DTaP
Haemophilus influenzae type b ⁴			Hib	Hib	Hib ⁵	Hib						
Pneumococcal ⁶			PCV	PCV	PCV	PCV					PPSV	
Inactivated Poliovirus			IPV	IPV		IPV						IPV
Influenza ⁸						Influenza (Yearly)						
Measles, Mumps, Rubella ⁷						MMR				^{see footnote 7}		MMR
Varicella ⁸						Varicella				^{see footnote 8}		Varicella
Hepatitis A ⁹							HepA (2 doses)				HepA Series	
Meningococcal ¹⁰											MCV	

Range of recommended ages
 Certain high-risk groups

This schedule indicates the recommended ages for routine administration of currently licensed vaccines, as of December 1, 2008, for children aged 0 through 6 years. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. Licensed combination vaccines may be used whenever any component of the combination is indicated and other components are not contraindicated and if approved by the Food and Drug Administration for that dose of

the series. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations, including high-risk conditions: <http://www.cdc.gov/vaccines/pubs/acip-list.htm>. Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS). Guidance about how to obtain and complete a VAERS form is available at <http://www.vaers.hhs.gov> or by telephone, 800-822-7967.

1. Hepatitis B vaccine (HepB). (Minimum age: birth)

At birth:

- Administer monovalent HepB to all newborns before hospital discharge.
- If mother is hepatitis B surface antigen (HBsAg)-positive, administer HepB and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth.
- If mother's HBsAg status is unknown, administer HepB within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if HBsAg-positive, administer HBIG (no later than age 1 week).

After the birth dose:

- The HepB series should be completed with either monovalent HepB or a combination vaccine containing HepB. The second dose should be administered at age 1 or 2 months. The final dose should be administered no earlier than age 24 weeks.
- Infants born to HBsAg-positive mothers should be tested for HBsAg and antibody to HBsAg (anti-HBs) after completion of at least 3 doses of the HepB series, at age 9 through 18 months (generally at the next well-child visit).

4-month dose:

- Administration of 4 doses of HepB to infants is permissible when combination vaccines containing HepB are administered after the birth dose.

2. Rotavirus vaccine (RV). (Minimum age: 6 weeks)

- Administer the first dose at age 6 through 14 weeks (maximum age: 14 weeks 6 days). Vaccination should not be initiated for infants aged 15 weeks or older (i.e., 15 weeks 0 days or older).
- Administer the final dose in the series by age 8 months 0 days.
- If 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 vaccine (DTaP). (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.
- Administer the final dose in the series at age 4 through 6 years.

4. Haemophilus influenzae type b conjugate vaccine (Hib). (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.
- TriHibit[®] (DTaP/Hib) should not be used for doses at ages 2, 4, or 6 months but can be used as the final dose in children aged 12 months or older.

5. Pneumococcal vaccine. (Minimum age: 6 weeks for pneumococcal conjugate vaccine [PCV]; 2 years for pneumococcal polysaccharide vaccine [PPSV])

- PCV is recommended for all children aged younger than 5 years. Administer 1 dose of PCV to all healthy children aged 24 through 59 months who are not completely vaccinated for their age.

- Administer PPSV to children aged 2 years or older with certain underlying medical conditions (see *MMWR* 2000;49[No. RR-5]), including a cochlear implant.

6. Influenza vaccine. (Minimum age: 6 months for trivalent inactivated influenza vaccine [TIV]; 2 years for live, attenuated influenza vaccine [LAIV])

- Administer annually to children aged 6 months through 18 years.
- For healthy nonpregnant persons (i.e., those who do not have underlying medical conditions that predispose them to influenza complications) aged 2 through 49 years, either LAIV or TIV may be used.
- Children receiving TIV should receive 0.25 mL if aged 6 through 35 months or 0.5 mL if aged 3 years or older.
- Administer 2 doses (separated by at least 4 weeks) to children aged younger than 9 years who are receiving influenza vaccine for the first time or who were vaccinated for the first time during the previous influenza season but only received 1 dose.

7. Measles, mumps, and rubella vaccine (MMR). (Minimum age: 12 months)

- Administer the second dose at age 4 through 6 years. However, the second dose may be administered before age 4, provided at least 28 days have elapsed since the first dose.

8. Varicella vaccine. (Minimum age: 12 months)

- Administer the second dose at age 4 through 6 years. However, the second dose may be administered before age 4, provided at least 3 months have elapsed since the first dose.
- For children aged 12 months through 12 years the minimum interval between doses is 3 months. However, if the second dose was administered at least 28 days after the first dose, it can be accepted as valid.

9. Hepatitis A vaccine (HepA). (Minimum age: 12 months)

- Administer to all children aged 1 year (i.e., aged 12 through 23 months). Administer 2 doses at least 6 months apart.
- Children not fully vaccinated by age 2 years can be vaccinated at subsequent visits.
- HepA also is recommended for children older than 1 year who live in areas where vaccination programs target older children or who are at increased risk of infection. See *MMWR* 2006;55[No. RR-7].

10. Meningococcal vaccine. (Minimum age: 2 years for meningococcal conjugate vaccine [MCV] and for meningococcal polysaccharide vaccine [MPSV])

- Administer MCV to children aged 2 through 10 years with terminal complement component deficiency, anatomic or functional asplenia, and certain other high-risk groups. See *MMWR* 2005;54[No. RR-7].
- Persons who received MPSV 3 or more years previously and who remain at increased risk for meningococcal disease should be revaccinated with MCV.

The Recommended Immunization Schedules for Persons Aged 0 Through 18 Years are approved by the Advisory Committee on Immunization Practices (www.cdc.gov/vaccines/imz/acip/), the American Academy of Pediatrics (<http://www.aap.org>), and the American Academy of Family Physicians (<http://www.aafp.org>).
 DEPARTMENT OF HEALTH AND HUMAN SERVICES • CENTERS FOR DISEASE CONTROL AND PREVENTION

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