

Childhood Immunization Rates in Louisiana Trends from 1995- 2004

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Immunization is an invaluable tool in preventing the morbidity and mortality associated with many infectious diseases. The CDC currently recommends that children obtain immunizations against 11 diseases. We examined immunization rates in Louisiana children aged 19- 35 months from 1995- 2003 and compared these rates with the rates in neighboring states and the national coverage rate. Coverage rates were affected by the number of vaccinations in a series and the year of life at which the vaccines are received. We also found discrepancies in coverage rates of immunizations that should be given simultaneously. While Louisiana coverage rates have improved after a dip in 2001, we suggest steps to help physicians further improve coverage rates.

Immunization is invaluable in the prevention of the morbidity and mortality associated with many infectious diseases. Following the widespread use of vaccines in the United States, case numbers of preventable childhood illnesses decreased by over 90%. Polio paralyzed 21,000 people in 1952, but the United States has not had a single case since 1979. Rubella cases have plummeted from a high of 1.8 million during a 1964 outbreak to a scant 9 cases in 2004. Prior to the introduction of the measles immunization, there were over 3 million cases and 500 deaths per year, while in 2002 only 44 cases of measles were reported to the Centers for Disease Control and Prevention.¹ Pertussis reached an all time low of 1,010 cases in 1976 after widespread spread use of whole-cell pertussis vaccine combined with diphtheria and tetanus toxoids.² Every dollar spent for vaccinating children is repaid many times, reducing hospital costs and sparing individuals from debilitating illnesses and death.

Recognizing that immunization is a powerful tool to prevent death and disease, the CDC's Recommended Childhood Immunization Schedule currently recommends that all children in the United States obtain immunizations against 11 diseases. By the age of two, a child should have received vaccinations against Hepatitis B, diphtheria, tetanus, pertussis, Haemophilus

influenzae b, poliomyelitis, measles, mumps, rubella, varicella, and pneumococcal disease.

The CDC lists vaccination practices among the top ten public health achievements of the 20th century. The Louisiana Office of Public Health has made immunization of every child in Louisiana a high priority. The Louisiana Legislature supported this philosophy by requiring immunizations for all children in schools and child-care facilities statewide. Currently, the Louisiana Immunization Program is the largest vaccine distributor in the state, dispensing over 1.25 million vaccines to over 50,000 children across the state each year.

METHODS

The CDC completes an annual survey measuring immunization coverage. The survey data comes from 5 major sources:

1. The National Immunization Survey (NIS)
2. Retrospective school entry surveys
3. Special area and population surveys
4. Clinical Assessment Software Application (CASA) surveys of clinics and private practices
5. Reports from managed-care plans on coverage for children in their care³.

The NIS survey has been conducted since 1994 via 30,000 randomized telephone surveys canvassing 78 Immunization Action Plan areas that are comprised of all 50 states, the District of Columbia, and 27 other large metropolitan areas. The NIS is the primary source of both national and statewide estimates of coverage levels for children 19- 35 months old. Retrospective studies involve the review of school records and are the most common form of assessing local-level coverage. Specialized surveys are used to determine local coverage rates in small, specific populations that are more sensitive to changes. The CDC developed the Clinical Assessment Software Application (CASA) software to assess coverage levels in a medical clinic or private practice.

Louisiana establishes its own annual statewide coverage estimates, relying on the NIS, CASA data, and retrospective school studies to supply data.

This report was prepared using the results of national and state immunization coverage surveys, all of which are available on the Internet.⁴ National and Louisiana state coverage rates for every recommended childhood vaccination were compared, and results from 1995 to 2003 were charted to identify trends.

The CDC and Louisiana Office of Public Health currently recommend immunizations for eleven pathogens. In summary, the immunization schedule from 19 to 35 months of age consists of:

1. A series of 3 Diphtheria/ Pertussis/ Tetanus vaccines administered during the first year of life, preferably at 2, 4, and 6 months of age. In this article 3DTP refers to three or more doses of this vaccine.
2. A DTP booster administered after the first year of life, preferably between 15 and 18 months of age. 4 DTP refers to four or more doses of this vaccine.
3. A series of 3 injectable polio vaccines administered preferably at 2 and 4 months and between 6 and 18 months of age. In this article 3Pol refers to three or more doses of poliovirus vaccine.
4. A series of 3 *Haemophilus influenzae b* vaccines administered at 2, 4, 6 months of age. This vaccine is abbreviated 3Hib in this article.
5. One initial dose of Measles, Mumps, Rubella vaccine given between 12 and 15 months of age, to be followed by two additional vaccinations later in life. In this article, one or more doses of MMR vaccine are abbreviated 1MMR.
6. A series of three Hepatitis B vaccines administered at birth, from 1 to 4 months of age, and from 6 to 18 months of age. In this article, 3HBV refers to three or more doses of Hepatitis B vaccine.
7. One vaccination against Varicella, administered between 12 and 18 months of age, unadjusted for history of varicella illness. One or more doses of Varicella vaccine are abbreviated 1Var in this article.
8. Three or more doses of pneumococcal conjugate vaccine, administered at 2, 4, and 6 months of age, with a booster given between 12 and 18 months of age. In

this article, three or more doses of pneumococcal conjugate vaccine are abbreviated 3PCV.

Other abbreviations in this article:

- 3DTP/P/M refers to three or more doses of Diphtheria/ Tetanus/ Pertussis vaccine, three or more doses of Poliovirus vaccine, and 1 or more doses of Measles vaccine.
- 4DTP/P/M refers to four or more doses of Diphtheria/ Tetanus/ Pertussis vaccine, three or more doses of Poliovirus vaccine, and 1 or more doses of Measles vaccine.
- 4DTP/P/M/Hib refers to four or more doses of Diphtheria/ Tetanus/ Pertussis vaccine, three or more doses of Poliovirus vaccine, 1 or more doses of Measles vaccine, and 3 or more doses of *Haemophilus influenzae b* vaccine.
- 4DTP/P/M/Hib/HBV refers to four or more doses of Diphtheria/ Tetanus, Pertussis vaccine, three or more doses of Poliovirus vaccine, 1 or more doses of Measles vaccine, 3 or more doses of *Haemophilus influenzae b* vaccine, and 3 or more doses of Hepatitis B vaccine. This combination of vaccinations is recommended for all children by the age of 18 months.
- 4DTP/P/M/Hib/HBV/Var refers to four or more doses of Diphtheria/ Tetanus, Pertussis vaccine, three or more doses of Poliovirus vaccine, 1 or more doses of Measles vaccine, 3 or more doses of *Haemophilus influenzae b* vaccine, 3 or more doses of Hepatitis B vaccine, and at least one dose of Varicella vaccine. This combination of vaccinations is recommended for all children by the age of 18 months and is considered the gold standard for immunization of children under age 3 years.

RESULTS

First Year Vaccines

Figure 1 compares the immunization rates for 3DTP and 3Hib in Louisiana. Yearly trends of the two vaccinations are similar and coverage rates range from 89.9%

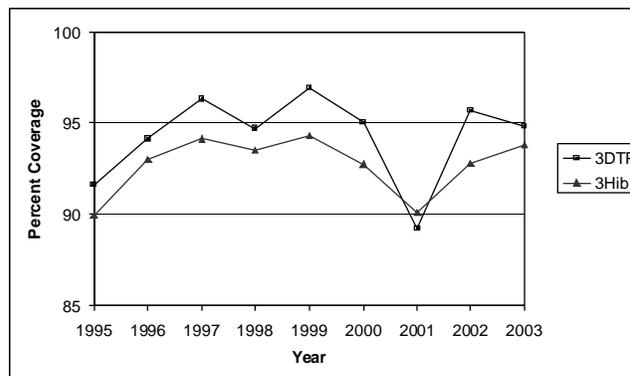


Figure 1. Louisiana immunization rates of 3DTP and 3Hib for children aged 19-35 months.

(3Hib, 1995) to 96.9% (3DTP, 1999). Hib vaccination rates are generally around 2% lower than 3DTP rates. Coverage rates for both showed a steep decline in 2001. The 3DTP and 3Hib immunization series are both given during the first year of life, preferably at 2, 4, and 6 months of age. These vaccines can and should be administered simultaneously.

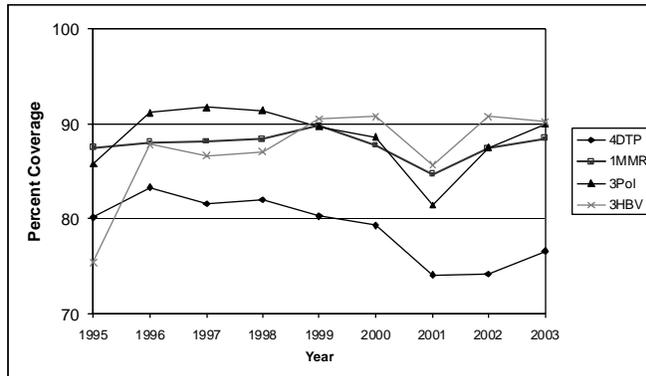


Figure 2. Louisiana immunization rates for 4DTP, 3Pol, 1MMR, and 3HBV for children aged 19-35 months. See Methods for abbreviations.

Second Year Vaccines (Figure 2)

Immunization rates for 4DTP range from 74 to 80%, about 10% lower than those for 3DTP. The 4DTP series requires one additional injection beyond 3DTP given between 15 and 18 months of age. 4DTP rates exhibit the same yearly trends and dip in 2001.

The poliovaccine series consists of three injections, two given during the first year of life and the final injection given from 6 to 18 months of age. It shows similar yearly trends and coverage rates as other second year vaccines. Poliovaccine coverage rates range from 80 to 92%, consistently 5 to 7% higher than 4DTP and lower than the first year vaccines.

Only one immunization is recommended for MMR during the first 35 months of life. The CDC recommends administering this vaccine during the second year of life between 12 and 15 months of age. This immunization also shows slightly lower coverage rates compared to first year vaccines (3DTP), similar to poliovaccine.

The hepatitis B vaccine series is comprised of a series of three injections, the last one given between 6 and 18 months of age. Coverage rates of HBV vaccine are similar to that of other second year vaccines, including 4DTP, MMR and 3 Pol.

In summary, rates for immunizations that include a dose during the second year are lower than those of the first year. It appears that 4DTP coverage rates are lower than that of other series vaccines like polio, MMR and 3HBV.

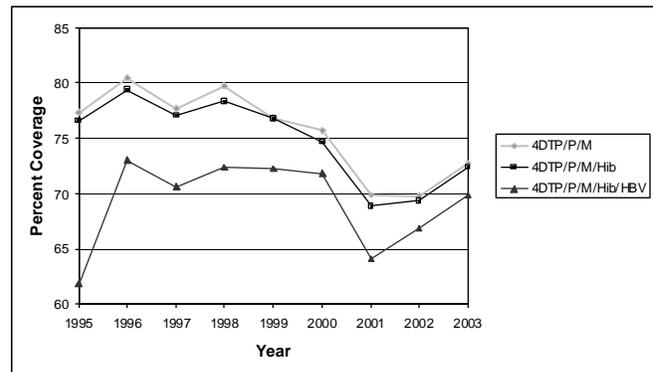


Figure 3. Louisiana coverage rates for 4DTP/P/M, 4DTP/P/M/Hib and 4DTP/P/M/Hib/HBV for children aged 19-35 months. See Methods for abbreviations.

Number of Injections

The complete series of vaccinations for DTP, Poliovirus, MMR, Haemophilus b, and Hepatitis B, shown in Figure 3, should be given at birth plus four visits. The CDC and Louisiana Office of Public Health recommend these vaccines be administered at the same times, achieving complete coverage with four visits to a physician.

The series 4 DTP/P/M/Hib/HBV requires the most vaccines and also consistently shows the lowest coverage rates. As the number of vaccinations examined increases, rates of coverage decrease.

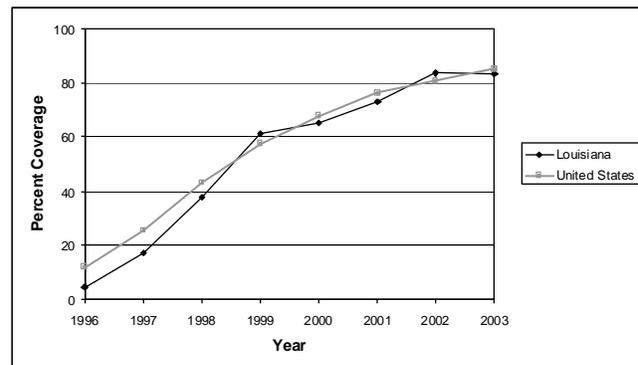


Figure 4. Louisiana and national coverage rates for Varicella for children aged 19-35 months.

Varicella

Rates of Varicella coverage do not follow the same pattern as coverage rates of other vaccines (Figure 4). The Varicella vaccine is relatively new and was only added to the CDC's Recommended Schedule in 1995. The vaccination coverage rate for Varicella is still in the growth phase, although this trend may be slowing in Louisiana; the rate of coverage remained constant from 2002 to 2003 at 83.3%.

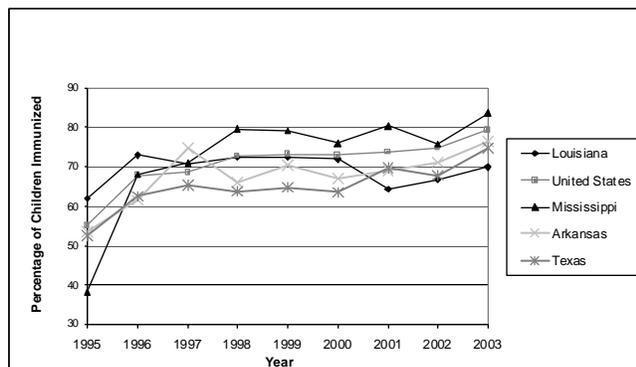


Figure 5. 4DTP/P/M/Hib/HBV Immunization rates for children 19-35 months old in Louisiana and surrounding states from 1995-2003. See Methods for abbreviations.

Comparison of Louisiana and National Coverage Rates (Table 1, Figure 5)

Similar immunization trends are observed in Louisiana and the United States. First year immunizations show higher coverage rates than second year immunizations. Rates for 3DTP are higher than Hib vaccination rates

both nationally and in Louisiana. Immunizations given during the second year of life, including Hepatitis B, 4DTP, Poliovirus and MMR, have continually lower coverage rates than DTP and 3Hib. Nationally, the trend of decreasing immunization coverage as number of immunizations increases is also seen.

From 1996 to 2000, immunization rates in Louisiana and the United States as a whole remained fairly stable. The national average of all immunization rates increased 8.8% over this time period, but this number is inflated by the large percentage change (33%) in HBV immunization rates. If HBV containing vaccines are excluded, overall increases in national immunization rates were 2.5% over this time period. In 1996, Louisiana immunization rates were higher than the national average for all vaccines except 3DTP and MMR. By 2000, national rates had caught up to Louisiana rates for all vaccines except 3DTP.

Immunization rates in Louisiana declined steeply between 2000 and 2001, showing an average decrease of 7.0%. Overall rates declined for every vaccination, ranging from a 2.8 to 11.1% decline from 2000 rates. National rates remained stable, showing a modest increase of 0.4% for the year.

Table 1. Comparison of Louisiana and National Immunization Coverage Rates from 1995- 2003 In Children 19-35 Months of Age.

LOUISIANA	1995	1996	% Change 1995- 1996	2000	% Change 1996- 2000	2001	% Change 2000- 2001	2003	% Change 2001- 2003
3 DTP	91.6	94.1	2.7	95	1	89.2	-6.1	94.8	6.3
4 DTP	80.1	83.3	4	79.3	-4.8	74.1	-6.6	76.6	3.4
3 Pol	85.8	91.2	6.3	88.6	-2.9	81.4	-8.1	90	10.6
MMR	87.5	88	0.6	87.7	-0.3	84.7	-3.4	88.4	4.4
3Hib	89.9	93	3.4	92.7	-0.3	90.1	-2.8	93.8	4.1
3HBV	75.4	87.8	16.4	90.7	3.3	85.6	-5.6	90.2	5.4
3DTP/P/M	NA	NA	NA	83.5	NA	74.2	-11.1	NA	NA
4DTP/P/M	77.3	80.5	4.1	75.7	-6	69.9	-7.7	72.4	3.6
4DTP/P/M/Hib	76.6	79.4	3.7	74.7	-5.9	68.9	-7.8	69.9	1.5
4DTP/P/M/Hib/HBV	61.8	73	18.1	71.8	-1.6	64.1	-10.7	64.7	0.9
			Range: 0.6 to 18.1% Average: 5.9		Range: -6.0 to 1.0 Average: -1.9		Range: -11.1 to -2.8 Average: -7.0		Range: 0.9 to 10.6 Average: 4.5
UNITED STATES	1995	1996	% Change 1995- 1996	2000	% Change 1996- 2000	2001	% Change 2000- 2001	2003	% Change 2001- 2003
3 DTP	94.5	94.9	0.4	94.1	-0.4	94.3	0.2	96	1.8
4 DTP	78.4	81.1	3.4	81.7	4.2	82.1	0.5	84.8	3.3
3 Pol	87.8	91	3.6	89.5	1.9	89.4	-0.1	91.6	2.5
MMR	89.8	90.6	0.9	90.5	0.8	91.4	1	93	1.8
3Hib	91.2	91.4	0.2	93.4	2.4	93	-0.4	93.9	1
3HBV	67.9	81.8	20.5	90.3	33	88.9	-1.6	92.4	3.9
3DTP/P/M	NA	NA	NA	83.6	NA	84.4	1	NA	NA
4DTP/P/M	76	78.4	3.2	77.6	2.1	78.6	1.3	81.3	3.4
4DTP/P/M/Hib	73.7	76.4	3.7	76.2	3.4	77.2	1.3	79.4	2.8
4DTP/P/M/Hib/HBV	55.1	67.7	22.9	72.8	32.1	73.7	1.2	72.5	-1.6
			Range: 0.2 to 22.9 Average: 6.5		Range: -0.4 to 33.0 Average: 8.8		Range: -1.6 to 1.3 Average: 0.4		Range: -1.6 to 3.9 Average: -1.9

Vaccination rates in Louisiana are recovering from the nadir of 2001. From 2001 to 2003, Louisiana increased an average of 4.5% (ranging from 0.9 to 10.6%). Over the two-year period, net gains were made for every vaccination. However, vaccinations given during the second year of life recovered more slowly than vaccinations given during the first year of life. While state immunization coverage remains below the United States average for all vaccinations, Louisiana rates are climbing back up towards national average rates.

DISCUSSION

In 2001, Louisiana coverage rates declined dramatically for all recommended vaccinations except Varicella. A Task Force was convened in 2002 to examine the causes of the decline. They looked at number of possible and probable causes including local public health unit closures, the effect of the thimerosal and autism/MMR controversies, patient migration from public to private providers, private sector vaccine practices, simultaneous administration of vaccines, and Medicaid vaccine reimbursement rates.⁵ The Task Force found that the reduction in public health units and personnel and the practices of private providers had the greatest effect on coverage rates.

In early 2000, the Louisiana Office of Public Health had a major layoff that resulted in the net loss of 206 employees, or 11.1% of the total workforce. Most of the staff reductions occurred in direct patient services and field operations. The Louisiana Office of Public Health also closed 25 Public Health clinics around the state and ended the Shots for Tots ambulatory outreach effort. During the 1980's in Louisiana, public health units provided over 70% of vaccinations. Recently vaccine administration has shifted from the public to the private sector, with over 60% of children now receiving immunizations from a private provider. The Vaccines for Children program and a vigorous push by a Medicaid-Managed Care Initiative advocating that all children receive comprehensive health care in a medical home have contributed to this shift.⁵

Vaccines for Children was created by the United States Congress in 1993 to provide free vaccines to providers serving eligible children. Louisiana implemented this program in October 1995. Louisiana provides free immunizations to children 18 years of age and younger who are uninsured and/ or American Indian or Alaskan Native. In 1995, there were 265 provider sites participating. Today, there are over 1032 participating sites. This increase in provider sites over time played a part in the recent increases in vaccination coverage and also in the shift from public to private providers.

Commendably, Louisiana immunization rates have improved since 2001. However, even with the recent improvements in coverage rates, Louisiana currently ranks

46 out of 50 states with 74.9% of children fully immunized at 35 months versus the national average of 80.9% coverage.

While immunization rates in Louisiana are over 80% for all first year vaccines, rates fall for vaccines administered in the second year of life. Low vaccine coverage can be the result of low community demand for vaccines, lack of access to vaccination services, or system- or provider- related factors.⁶ Many of these factors would require complex, multifaceted solutions and are not easily rectified. However, there are some easy steps providers can take to increase vaccination rates in their practices.

Barriers to achieving complete immunization can include a failure of patients to return, a lack of patient tracking, a lack of understanding of vaccine importance, a lack of knowledge of contraindications by the provider and the client, and a lack of provider follow-up and recall with clients.⁷ Also, providers often miss opportunities to vaccinate children.⁸ Differences in coverage in the different series are testimony to missed opportunities: the rates for 3DTP and 3Hib should be very close, but 3Hib is consistently lower (Figure 1) and rates for 4DTP should be closer to the other 2nd year vaccination rates (Figure 2).

To combat these barriers, the Louisiana Office of Public Health, Community Preventative Services and the Every Child By Two program strongly recommend that providers take the following actions (based on a systematic review of over 17 published services showing that these actions increased vaccination coverage rates):

1. **Provider Based Strategies**

- a. *Utilize all clinical encounters to screen, and when indicated, immunize children.*

Providers can use medical records, tracking systems (including LINKS, the Louisiana state immunization registry), or provider reminder/ recall systems to check a client's immunization status. Providers should immunize every child when indicated.

- b. *Administer simultaneously all vaccine doses for which a child is eligible at the time of each visit.*

By following this recommendation, providers ensure that children are not slipping through the cracks unvaccinated. Combined vaccines allow providers to immunize a child against more than one disease at the same time, reducing the number of necessary injections. The Pediatrx vaccine immunizes against HepB, DTaP, and IPV with one injection that can be administered at 2, 4, and 6 months of age. The TriHIBit vaccine immunizes against DTaP and Hib and can be administered at 12 months of age to finish the DTaP and Hib series of vaccinations. Combined vaccinations have the advantage of protecting against multiple diseases with one, easy injection. As we have seen, immunization rates decrease as the number of injections required increase; combined vaccines are a wonderfully simple solution to this problem.

Table 2. Comparison of Louisiana, Surrounding States, and United States Immunization Coverage Rates in Children Entering Kindergarten, 2003- 04 School Year.

	% Surveyed	3Pol	4DTP	Measles	Mumps	Rubella	3HBV	Var
Louisiana	100.0%	97.1%	95.3%	99.6%	99.6%	99.5%	91.6%	90.4%
Arkansas	100.0%	91.4%	91.3%	91.3%	92.7%	92.7%	93.2%	93.4%
Mississippi	100.0%	99.8%	99.8%	99.8%	99.8%	99.8%	99.8%	99.8%
Texas	0.5%	95.4%	95.7%	95.5%	98.8%	98.8%	97.2%	95.9%
United States	na	95.6%	95.5%	95.4%	96.0%	95.9%	95.7%	99.3%

c. *Implement reminder/ recall systems.*

This reminder or recall system is meant to inform the provider when certain clients are due or overdue for specific vaccinations. The content and form of these reminders can vary and include flagging charts or reminders via computer or mail. A review of the literature showed that implementing a reminder/recall system for providers increased vaccination rates by an average of 15.5 percentage points within a practice.

d. *Be aware of contraindications and follow only true contraindications.*

Providers and parents are often unaware of true contraindications for vaccines. This lack of knowledge can lead to missed opportunities for vaccinations. A concise overview of contraindications for parents and providers can be found at http://www.cdc.gov/nip/publications/pink/Appendices/A/cont_prec.pdf. A more comprehensive review for providers of contraindications for specific vaccines can be found at <http://www.cdc.gov/nip/home-hcp.htm#Patient-educ> and also at <http://www.cdc.gov/nip/publications/acip-list.htm#Vaccine>. Providers should be aware of true contraindications and relate this information to parents in order to ensure that all eligible children are vaccinated at every opportunity.

e. *Use accurate and complete reporting procedures.*

The Louisiana Immunization Network for Kids Statewide (LINKS) is the Louisiana state immunization registry. LINKS helps providers use accurate and complete reporting procedures, serves as a provider tracking system of immunizations, and guarantees that a child's immunization records are accessible at other providers' practices. All of these practices can improve immunization rates. Providers who are interested in LINKS should contact the program manager, at (504) 483-1900 for more information.

2. **Client based Strategies**

a. *Client reminder/ recall systems to increase vaccination coverage.*

This involves reminding members of a target population that vaccinations are due (reminders) or late (recall). Delivery of reminders can be done with postcards, letters or

telephone calls. The messages given may be specific or general. This technique has been shown to increase vaccination coverage rates by 8 to 16 percentage points in studies.

b. *Educate parents about immunizations in general terms.*

Providers should educate their clients about the benefits and risks of immunizations. The CDC provides informational brochures and posters at the following link: <http://www.cdc.gov/nip/home-hcp.htm#Patient-educ>.

c. *Question parents about contraindications, and before immunizing a child, inform them in specific terms about the risks and benefits of the immunization their child is about to receive.*

Well informed parents are more likely to appreciate the benefit of the immunizations their child is receiving. Also, by opening a dialogue with parents, providers will be able to address any specific concerns or questions the parent has about the vaccinations.

National and state immunization rates equalize at school entry, due to immunization entry requirements (Table 2).⁹ However, from the age of one year to five years, many children are under-immunized. Because babies are more likely to have complications or die from vaccine-preventable diseases than older children, ensuring they are fully vaccinated is of extreme public health importance.

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