Arizona Health Care Cost Containment System

Quality Management Medical Study

A Report on the Immunization Status of AHCCCS Members 2 Years of Age for Contract Year 2001

(October 1, 2000, through September 30, 2001)

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AHCCCS ANNUAL IMMUNIZATION ASSESSMENT
CONTRACT YEAR 2001

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AHCCCS ANNUAL IMMUNIZATION ASSESSMENT
CONTRACT YEAR 2001
(October 1, 2000, to September 30, 2001)

EXECUTIVE SUMMARY

This is the ninth annual assessment of immunization completion rates among selected 2-year-old children enrolled in the Arizona Health Care Cost Containment System (AHCCCS). This study evaluated the immunization status of children eligible under Medicaid (Title XIX of the Social Security Act) and KidsCare (Title XXI, the State Child Health Insurance Program) during the contract year from October 1, 2000, to September 30, 2001.

Monitoring of immunization rates is critical to identifying undervaccinated populations and increasing coverage levels, in order to prevent circulation of viruses and bacteria that cause many childhood diseases.

The Centers for Disease Control and Prevention (CDC) recommends immunizing children for 12 preventable diseases. Ten of the 12 immunizations are discussed in this report. They include diphtheria, tetanus, and acellular pertussis (DTaP) vaccine, inactivated poliovirus (IPV) vaccine, measles, mumps and rubella (MMR) vaccine, Haemophilus influenza type b (Hib) vaccine, hepatitis B virus (HBV) vaccine, and varicella zoster virus (VZV) vaccine. Pneumococcal conjugate vaccine (PCV) was not included in this study because of its recent introduction, and because manufacturing delays limited availability of the vacine during the study period. Hepatitis A immunization also was not studied because it is not recommended as a routine vaccination in all areas of the state.

Methodology

AHCCCS identified a representative random sample of children within each contracted Health Plan (Contractor), stratified by county. The final sample size included 5,480 children (Medicaid and KidsCare combined) whose second birthdays occurred during the study period. Data initially was obtained from the Arizona State Immunization Information System (ASIIS), an automated registry. When an incomplete record or no record was found in ASIIS, that case was sent to the appropriate Contractor for further data collection. An external quality review organization (EQRO) was utilized for data entry, and to aggregate and validate results.

Overall Findings

For all but one individual vaccination, rates of completed immunizations for the combined Medicaid and KidsCare samples improved from the previous contract year. The only rate for the combined population that did not increase in the most recent year, DTaP, was only 0.2 percent below last year's level. Combined rates of completion for two series of vaccinations also improved. The five-antigen series that includes DTaP, IPV, MMR, Hib and HBV showed the greatest improvement from the previous year, increasing from 63.4 percent to 66.1 percent. It should be noted that the antigen-series rates are not an average of the individual antigens, but a measurement of the number of children who had all of the required immunizations.

AHCCCS goals for immunization completion rates in four categories (including the DTaP immunization rate, which was within 0.2 percent of the AHCCCS goal) were met by the combined population during contract year (CY) 2001. The following is a comparison of individual and antigen-series rates for all children included in the study in CYs 2000 and 2001 with AHCCCS goals.

COMBINED TWO-YEAR-OLD IMMUNIZATION RATES
(Medicaid and KidsCare Populations)

Immunization (Doses)	DTaP (4)	IPV (3)	MMR (1)	Hib (2)	HBV (3)	VZV (1)	4:3:1 Series	4:3:1:2:3 Series
All children, CYE 2000	82.0%	87.9%	87.3%	82.8%	77.7%	71.9%	78.0%	63.4%
All children, CYE 2001	81.8%	88.5%	90.0%	83.4%	80.4%	78.5%	79.1%	66.1%
AHCCCS Goals*	**82.0%**	**88.0%**	**90.0%**	**90.0%**	**87.0%**	**67.0%**	**82.0%**	**73.0%**

Notes: The 4:3:1 Series is four doses of DTaP, three doses of IPV, and one MMR dose.
The 4:3:1:2:3 Series is four doses of DTaP, three doses of IPV, one dose of MMR, two doses of Hib, and three doses of HBV.
* AHCCCS goals are for Contract Year 2001.

The KidsCare Program has made great strides in reaching AHCCCS goals, even though it is relatively new (the program was implemented November 1, 1998). Below is a comparison of immunization completion rates between the KidsCare and Medicaid children included in the CY 2001 study.

COMPARISON OF KIDSCARE AND MEDICAID TWO-YEAR-OLD IMMUNIZATION RATES

Immunization (Doses)	DTaP (4)	IPV (3)	MMR (1)	HIB (2)	HBV (3)	VZV (1)	4:3:1 Series	4:3:1:2:3 Series
KidsCare	82.5%	89.3%	90.2%	83.0%	79.9%	79.9%	80.1%	67.0%
Medicaid	81.0%	87.7%	89.7%	83.8%	80.8%	77.1%	78.1%	65.1%

Conclusion

Much of the improvement in immunization rates is due to the partnership among AHCCCS, Contractor and providers. AHCCCS Contractors' outreach efforts have been successful in encouraging families to complete immunizations for their children. Other activities that facilitate access to services, such as providing transportation and assistance with scheduling appointments, have contributed to the steady increase in AHCCCS immunization rates. In addition, collaboration with the Arizona Department of Health Services (ADHS) Immunization Program Office, which administers the state's Vaccines for Children (VFC) program and the ASIIS registry, has contributed to improvement in immunization rates. Further efforts through The Arizona Partnership for Immunization (TAPI), of which AHCCCS is a key member, have raised public awareness of the importance of immunizations and provided a forum for many organizations to collaborate toward a common goal.

Additionally, AHCCCS Contractors and community based organizations have been successful in enrolling children into the KidsCare program. These outreach efforts are aimed at linking children to health services, and likely contributed to immunization rates for KidsCare members that generally were somewhat higher than rates for children enrolled under Medicaid.

AHCCCS Contractors have maintained or improved immunization rates despite a significant increase in AHCCCS membership. Combined enrollment in the AHCCCS acute Medicaid and KidsCare programs increased by 21 percent during CY 2001. Accordingly, the total sample for this study increased 18.3 percent from the previous year.

AHCCCS has made substantial progress toward meeting the immunization goals of *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. These goals include a 90-percent rate of immunization for all individual antigens and for the 4:3:1 combination. Goals established for *Healthy People 2010* are the same as the 2000 goals for individual antigens. *Healthy People 2010* also includes a goal of 80 percent for children ages 19-35 months who receive the 4:3:1:3:3 series of vaccines (four DTaP, three IPV, one MMR, three Hib and three HBV doses). AHCCCS will continue to strive to meet these goals.

As AHCCCS immunization rates come closer to meeting *Healthy People* goals, it will become more difficult to achieve significant improvement. Moreover, the study sample draws upon a new population of 2-year-olds each year, rather than building on the successful efforts focused on the previous group. This makes the task of improvement difficult and challenging each year.

Limited supplies of some vaccines also may affect the level of improvement in AHCCCS immunization rates in the future. During this study period, manufacturing delays of DTaP vaccine resulted in limited supplies and may have contributed to the lack of improvement in the completion rate for this antigen. Shortages of certain vaccines are expected to continue into mid-2002 and may affect future studies.

AHCCCS will continue to work with Contractors to achieve established AHCCCS goals and to meet the immunization goals of *Healthy People 2010.* Contractors that do not show demonstrable and sustained improvement may be required to submit to AHCCCS corrective action plans to improve immunization rates.

A REPORT ON THE IMMUNIZATION STATUS OF AHCCCS MEMBERS 2 YEARS OF AGE
Contract Year 2001 (October 1, 2000, to September 30, 2001)

I. INTRODUCTION

Background

Prevention of disease is the most cost-effective approach to health care. Once a disease process begins, the economic impact on the health care system begins to mount. There are a number of ways to prevent disease. One way is isolation from infectious disease or elimination of the disease. But as people become increasingly mobile, it is almost impossible to isolate them from infectious disease. Despite attempts to eradicate several vaccine preventable infectious diseases, many continue to exist. Thus, vaccination is the most effective way of preventing disease.

Vaccination coverage levels of 90 percent are, in general, sufficient to prevent circulation of viruses and bacteria that cause many diseases.[1] Monitoring of immunization rates is critical to identifying undervaccinated populations and increasing coverage levels.

The Arizona Health Care Cost Containment System (AHCCCS) ensures that vaccinations are provided to children and adolescents as part of the Early and Periodic Screening, Diagnosis and Treatment (EPSDT) package of services. Vaccines are distributed at no charge to providers who are enrolled in the federal Vaccines for Children (VFC) program which are provided then to AHCCCS members younger than 19 years.

AHCCCS requires that children and adolescents are vaccinated according to the most current Recommended Childhood Immunization Schedule, which is approved by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP) and the American Academy of Family Physicians (AAFP). The schedule recommends vaccines that are intended to immunize children against these diseases: diphtheria, tetanus, pertussis (also known as whopping cough), poliomyelitis, hepatitis B, Haemophilus influenza type b, measles, mumps, rubella, pneumococcal disease and varicella (also known as chicken pox). Vaccination for hepatitis A also is recommended in selected high-risk areas, including Maricopa County, Arizona.

In recent years, several new vaccines and combinations of vaccines have been introduced. The newest of these is pneumococcal conjugate vaccine (PCV), which is recommended as a routine immunization for children up 2 years old and for certain high-risk children younger than 5 years old. Assessment of PCV immunization was not included in this study because of its recent introduction, and because manufacturing delays limited availability of the vaccine during the AHCCCS contract year being reported (October 1, 2000 to September 30, 2001). Hepatitis A immunization also was not studied because it is not recommended as a routine vaccination in all areas of the state.

Continued vigilance of immunization levels is important, as decreased immunization rates will likely result in outbreaks of disease. The following table includes the number of reported cases of vaccine-preventable diseases that have occurred in the state of Arizona since 1998. The number of cases are for the total population and are not age-specific.

Reported cases of vaccine-preventable diseases in Arizona

	1998	1999	2000	2001
Diphtheria	0	0	0	0*
Polio	0	0	0	0 *
Hib < 5 years	8	3	353**	74
Hepatitis A	1841	700	467	411
Hepatitis B	185	138	215**	161
Measles	11	1	0	1
Mumps	6	1	6	1
Meningococcal	48	44	33	19
Pertussis	245	75	112	637
Rubella	2	13	1	0
Tetanus	1	0	0	0*
Congenital Rubella Syndrome	0	2	0	0*

Sources: Arizona Department of Health Services [4] and MMWR February 1, 2002 [5]

NOTES: * Data are from January 1, 2001, through June 19, 2001.

** Data from the Arizona Department of Health Services and MMWR were compared. Where differences were noted, the higher number was used.

Data for varicella were not reported.

As seen above, pertussis has increased dramatically in 2001. The increase in pertussis cases originally was thought to be associated with the use of acellular (or purified and inactivated) pertussis vaccine instead of the whole-cell pertussis vaccine introduced in the 1940s. A recent study indicates that this is not the case and that further investigation is needed to determine cause(s) for the rise in pertussis.[6]

Hepatitis A and B viruses also continue to be a problem in Arizona. Although there have been no reported cases of some diseases, including diphtheria and polio, continued monitoring and immunization is necessary to prevent a resurgence of these diseases.

All vaccines carry some risk of adverse effects, and it is expected that the risks associated with vaccines will decrease with improvements in the manufacturing process. However, this risk is usually minimal, compared with the serious health risks and possibility of death posed by different diseases.

In 1996, the most recent year for which complete mortality information is available, tetanus, pertussis, measles, mumps and Haemophilus influenza type b accounted for 14 deaths nationally. Varicella accounted for 81 deaths that year, 121 deaths were attributed to hepatitis A and 1,082 deaths were attributed to hepatitis B.[1] Appendix C explains the different diseases discussed in this study, along with their complications.

AHCCCS and Healthy People 2000 and 2010 Goals

AHCCCS has established goals for Contractors to achieve in immunizing 2-year-old members. Contract year 2001 goals for individual vaccinations include:

- Diphtheria, Tetanus and acellular Pertussis (DTaP) (four doses) - 82 percent
- Inactivated poliovirus vaccine (IPV) (three doses) - 88 percent

- Measles, mumps, rubella (MMR) (one dose) - 90 percent
- Haemophilus influenza type b (Hib) (two doses) - 90 percent
- Hepatitis B (HBV) (three doses) - 87 percent
- Varizella (VZV) – (one dose) - 67 percent

The AHCCCS goals for series of immunizations include:
- DTaP, IPV, MMR (4:3:1 series) - 82 percent
- DTaP, IPV, MMR, Hib, and HBV (4:3:1:2:3 series) - 73 percent

In establishing immunization goals, AHCCCS used as a guideline the U.S. Department of Health and Human Services (DHHS) immunizations goals, as published in *Healthy People 2000: National Health Promotion and Disease Prevention Objectives* and *Healthy People 2010.* The 2000 objectives include a 90-percent rate for individual immunizations and the 4:3:1 series that includes DTaP, IPV and MMR vaccinations. The 4:3:1 series will be measured as part of *Healthy People 2010*; however, the focus in future years will be completion of the five-antigen series of recommended vaccines.[9] A goal of *Healthy People 2010* is that 80 percent of children 19-35 months old receive the 4:3:1:2:3 series.

In order to target progress toward these long-range goals, or benchmarks, AHCCCS has set interim goals for Contractors to meet each year. For example, the AHCCCS five-antigen series goal for CY 2001 is 73 percent, which is the 1998 baseline measurement for this series published in the *Healthy People 2010* objectives.

Strategies that have Improved Immunization Rates

In the last decade, immunization coverage levels have increased nationwide.[1] For example, in calendar year 2000, 77.6 percent of American children 19 to 35 months old were fully immunized with the 4:3:1 series, according to the National Immunization Survey conducted by the Centers for Disease Control and Prevention (CDC).[6] This rate was 55 percent in 1991.[1]

Strategies that have helped increase the number of children vaccinated, both nationally and in Arizona, include:
- implementation of Standards for Pediatric Immunization Practices, a set of recommendations for all health care providers to ensure progress toward achieving *Healthy People 2000* immunization objectives. These standards were designed to help eliminate barriers and missed opportunities that impede vaccine delivery.[1]
- education of families/caregivers and providers regarding appropriate record keeping, storage and tracking of immunizations.
- implementation of the Arizona State Immunization Information System (ASIIS), a centralized database of vaccinations reported by all types of providers. This database has information available at no charge for providers when there is a question about whether a child's immunizations are current. This is particularly helpful for children who are transient and/or are seen by multiple providers throughout the state, since providers may be reluctant to vaccinate patients who do not have immunization records with them. Use of ASIIS to check patients' immunization status should prevent the need for patients to return for vaccinations.
- requirements by states, including Arizona, that children have certain immunizations prior to starting school or attending a licensed day-care facility.
- patient reminders and recall, which have been found to be effective in improving vaccination rates.

Mail and telephone reminders to both patients' homes and to providers are equally effective.[1]

- provider and member education. Practice-based assessment of immunization rates and feedback to staff involved has also been found to be effective. This is accomplished through outreach by the Arizona Immunization Program Office (AIPO), The Arizona Partnership for Immunization (TAPI) and AHCCCS Contractors.
- the use of incentives. Several AHCCCS Contractors offer incentives; for example, a gift certificate when a parent provides proof that a child is fully immunized by 2 years old.

II. PURPOSE OF THE STUDY

Arizona places a high priority on childhood immunizations to prevent disease and death. AHCCCS and its Contractors have been very active with efforts to improve immunization rates. In 1993, the Arizona Legislature enacted House Bill 2044, which requires that an assessment and a written report describing the immunization status of two-year-olds enrolled in the AHCCCS program be submitted annually to the Governor.

This study was the ninth annual assessment on the immunization status of AHCCCS members, two years of age. It covered the AHCCCS contract year from October 1, 2000, to September 30, 2001 and analyzed immunization completion rates among children enrolled in AHCCCS under Medicaid (Title XIX of the Social Security Act) and KidsCare (Title XXI, the State Child Health Insurance Program, or SCHIP). Results of this immunization assessment were compared with results of previous years' results to provide a base against which improvement can be measured. The study also identified potential areas for improvement.

III. IMMUNIZATION RECOMMENDATIONS AND QUALITY INDICATORS

During the time frame of this study, the Centers for Disease Control and Prevention (CDC) recommended immunizing children for 12 preventable diseases. Specific recommended immunizations discussed in this report are: diphtheria, tetanus, and acellular pertussis (DTaP) vaccine, inactivated poliovirus (IPV) vaccine, measles, mumps and rubella (MMR) vaccine, Haemophilus influenza type b (Hib) vaccine, hepatitis B virus (HBV) vaccine, and varicella zoster virus (VZV) vaccine. In addition, single doses of combined antigens were separated into the appropriate primary vaccines for reporting purposes. These combination vaccines include Tetra-immune (TETRA), which combines DTaP and Hib in a single immunization, and COMVAX, which combines Hib and HBV. Derivatives of the primary vaccines, such as oral poliovirus vaccine (OPV) and diphtheria, tetanus toxoids and pertussis (DTP) also were included in the results.

This study used the Health Plan Employer Data and Information Set (HEDIS®) 2001 methodology, which was developed by the National Committee for Quality Assurance (NCQA) and includes immunizations recommended by the CDC is 2001. In order to measure improvement and establish trends, results based on both the current and past years' HEDIS® criteria are presented. All quality indicators are based on identical criteria for the denominator (i.e., children eligible for the study).

The denominator in the study sample consisted of children:

- whose second birthdays occurred on or between October 1, 2000, and September 30, 2001, and
- who had at least 12 months of continuous enrollment prior to, and including, their second birthdays (one disenrollment period of 30 days or less in the 12-month period was allowed).

Definitions of the current quality indicators follow:

Primary Quality Indicators

1. DTaP Immunization Rate

Numerator: The number of children in the denominator who received at least four DTaP doses by their second birthdays

2. IPV Immunization Rate

Numerator: The number of children in the denominator who received at least three IPV doses by the their second birthdays (OPV used only in selected cases)

3. MMR Immunization Rate

Numerator: The number of children in the denominator who received at least one MMR dose between their first and second birthdays

4. Hib Immunization Rate

Numerator: The number of children in the denominator who received at least two Haemophilus influenza type b doses by their second birthdays, with at least one of them falling on or between the first and second birthdays

5. HBV Immunization Rate

Numerator: The number of children in the denominator who received at least three HBV doses by the their second birthdays, with at least one of them falling on or between the sixth-month of life and second birthdays

6. VZV Immunization Rate

Numerator: The number of children in the denominator who received at least one varicella vaccine with a date of service falling on or between their first and second birthdays

7. HEDIS® 2001 Combination #1 (4:3:1:2:3)

Numerator: The number of children in the denominator who received the appropriate doses of DTaP, IPV, MMR, Hib and HBV by their second birthdays

8. HEDIS® 2001 Combination #2 (4:3:1:2:3:1)

Numerator: The number of children in the denominator who received the appropriate doses of DTaP, IPV, MMR, Hib, HBV and VZV by their second birthdays

In addition to the primary quality indicators listed above, two HEDIS® indicators from prior years were reported. This provides Contractors with more information for assessing their immunization rates.

Additional Quality Indicators

1. Three-Antigen Combined Immunization Rate (4:3:1)

Numerator: The number of children in the denominator who received the appropriate doses of DTaP, IPV and MMR by their second birthdays

2. HEDIS® 3.0/1999 Five-Antigen Combined Rate (4:3:1:2:2)

Numerator: The number of children in the denominator who received the appropriate doses of DTaP, IPV, MMR, Hib and 2 doses of HBV by their second birthdays

Any antigens administered after 24 months of age were not included in the numerator. HEDIS® restricts the timing of doses of MMR, Hib, HBV and VZV, according to CDC recommendations. Children who received their last dose of MMR, HIB or VZV vaccine before 12 months of age were not included in the numerator. At least one dose of HBV must have been administered after six months of age for the immunization to be included in the numerator.

IV. METHODOLOGY

The primary immunizations included in this assessment were DTaP, IPV, MMR, Hib, HBV and VZV. The primary vaccines that comprise the combined antigens (i.e., Tetra-immune, which includes DTaP and Hib in a single immunization, and COMVAX, which consists of Hib and HBV together) were reported separately in the appropriate categories. Derivatives of primary vaccines, such as oral polio vaccine (OPV), and diphtheria, tetanus and whole-cell pertussis vaccine (DTP), also were included in the results. Thus, all of the immunizations that a child might have received, relative to the primary vaccines, were accounted for in the study.

Assessment Tool

AHCCCS contracted with Health Services Advisory Group Inc. (HSAG), an external quality review organization, to assist with the annual immunization assessment. The state's ASIIS database also was used to extract immunization data.

The assessment tool used for the AHCCCS immunization assessment in previous years was updated for this study (see Appendix D). The assessment tool was designed in a scannable format that could be recognized by *Teleform* (V5.4) software. This software package uses the latest technology in object character recognition (OCR), which both improves data validity and reduces data processing time. Scanning eliminates data entry, and the errors and clean up associated with keypunching.

Study Sample

AHCCCS identified the study group by defining a representative, stratified random sample of children enrolled with each AHCCCS Contractor using a finite sampling factor and accounting for distribution of members by county. Sample selection was calculated for each Contractor to provide a 99 percent confidence level. The sample consisted of children whose second birthdays occurred between October 1, 2000, and September 30, 2001, and who had at least 12 months of continuous enrollment prior to, and including, their second birthdays. One disenrollment period of 30 days or less in the 12-month period was allowed.

Data Collection

The data collection process for this study generally followed the same methodology as in the previous two years, except that ASIIS, the statewide immunization registry operated by the Arizona Department of Health Services (ADHS), also was used to collect immunization data. AHCCCS provided ASIIS with two database files containing the sample cases of Medicaid and KidsCare children. AHCCCS requested ASIIS to query and cross-match the members that AHCCCS provided against data in the registry. AHCCCS also requested immunization data for those members where matches existed in the ASIIS registry.

ADHS reformatted data received from AHCCCS to import the files into the batch query function of PC-Immunize. PC-Immunize is an immunization software product used by ASIIS staff and providers statewide. Using this batch query function, ASIIS staff searched the statewide immunization registry by first name, last name, and date of birth.

Medicaid Members

Out of the AHCCCS sample size of 5,480 children enrolled under Medicaid, a total of 4,895 had a single match in the registry and immunization data for these children was provided to HSAG and to AHCCCS. A "single match" occurred when one matching record was found in the registry. In addition, 265 children had multiple matches in the registry. "Multiple matches" were those instances when more than one record for each child existed in the ASIIS registry. The remaining 320 children had no matching record in the registry. HSAG was given two files: the demographic information of the entire sample of 5,480 children and the vaccine data of 4,895 children with a single match.

KidsCare Members

AHCCCS provided 978 names to ASIIS. Of these, 873 had a single match in the registry and immunization data for these children was provided to HSAG and to AHCCCS. Thirty-six children had multiple matches in ASIIS and the remaining 69 children had no matching records in ASIIS.

Excluded Cases

From the Medicaid sample of 5,480 cases, 117 members were excluded, for a final sample of 5,363. Eighty three of the 117 members were excluded because they were enrolled with Arizona Health Concepts, which no longer has an acute-care contract with AHCCCS. Another four cases were excluded from the study when it became clear the children were older than 24 months prior to the start of the study period. An additional 30 cases were excluded after their records indicated a parental refusal or contraindication to immunization. Final sample sizes by individual Contractor ranged from 43 to 1,728 children.

From the KidsCare sample of 978 cases, 12 members were excluded, for a final sample of 966. Three of the 12 members were excluded because they were enrolled with Arizona Health Concepts. Seven cases were excluded after their records indicated a parental refusal or contraindication to immunization. One case was determined to be invalid and was excluded from the study when it became clear the child was older than 24 months prior to the start of the study period. Additionally, one case was excluded after it was determined that child had two separate member identification numbers. Final sample sizes by individual Contractor ranged from two to 335 children.

HSAG merged and analyzed files received from ASIIS to determine whether those immunization records were complete or incomplete, according to HEDIS® specifications. Overall, 24 percent of records in ASIIS were found to be complete; that is, the registry showed that those children had all the vaccinations expected by two years of age. A list of children who had incomplete immunization records were sent to each Contractor with an appropriate number of assessment tools. Contractors were responsible for obtaining and abstracting immunization records for the remaining children onto scannable tools. As an alternative method to a full medical record assessment, AHCCCS allowed Contractors to use two sources of data: medical records and administrative (claims) information. In accordance with NCQA hybrid methodology, administrative data were combined with medical record data only if there were at least two weeks between the administrative dates of service and the medical record dates. This methodology allowed data from different sources to be combined, while reducing the possibility of counting immunizations twice. Four of the 11 Contractors submitted data using this hybrid methodology.

After immunization records were abstracted by the Contractors, the scannable tools were sent to HSAG for entry into the database. HSAG validated all logical field-to-field comparisons that existed in the data set (e.g., checked for immunizations prior to birth). This "clean" data was then merged with the ASIIS data and the original sample file. Following HEDIS® specifications, immunizations found in the medical record that were within 14 days of the ASIIS data (for the same immunization) were considered to be the same immunization and were not counted twice.

Data Validation

In order to ensure the accuracy of data collected, a sample of 320 cases (five percent of the total sample), stratified by Contractor, was chosen from those cases that had recorded immunization information. The Medicaid sample consisted of 269 cases, while the KidsCare program had 51 cases. Contractors' validation samples ranged from three to 103 cases. Following selection of the validation sample, trained nurse abstractors from HSAG went to provider offices and abstracted the immunization information onto the immunization tool. This tool was then scanned into a database and compared with the original immunization information sent in by Contractors.

The validation of immunizations was conducted on several levels and is presented in a table on the following page. First, the total number of immunizations given was compared across antigens (Columns 2, 3 and 4). For example, Contractors showed 262 doses of MMR provided for the sample cases, while HSAG only found 249, or a difference of 13 shots. The second level of analysis was based on critical errors (Columns 5 and 6). Critical errors occur when the counts are different and the result could have made a difference to the overall rate. Using IPV as an example, if a Contractor reported one dose and HSAG found two doses, the results would not have affected the IPV rate, which requires three doses by 24 months of age. However, if the Contractor had reported three doses and HSAG found only two doses, this would be a critical error. VZV had 13 over-reported critical errors and eight that were under-reported. This means that Contractors reported children who received the VZV immunization 13 times that could not be verified, yet missed reporting eight children who received the VZV immunization. The largest critical differences were under-reporting of HBV (12 times) and over-reporting Hib (29 times).

DATA VALIDATION SUMMARY
(Contract Year 2001)

	Original Abstraction	HSAG Results	Difference	Critical Errors		% Kappa Agreement
				Over	Under	
DTaP	234	214	20	23	3	91.9%
IPV	264	249	15	17	2	94.1%
MMR	262	249	13	19	6	92.2%
HIB (2 Doses)	243	219	24	29	5	89.4%
HBV (3 Doses)	231	223	8	20	12	90.0%
VZV	222	217	5	13	8	93.4%
Total	**1,456**	**1,371**	**85**	**121**	**36**	**91.8%**

The percent Kappa Agreement (last column) is calculated using the Kappa statistic. When computing the agreement rate of DTaP, for example, the Kappa statistic takes into account the agreement in both hits and misses (e.g., if the Contractor did not find a shot for DTaP and HSAG did not find a shot for DTaP, then both are in agreement). Data validation included both medical records and data from administrative databases. Antigen-specific results from this validation sample indicated better than a 90 percent agreement with the data that was previously submitted from the Contractors for five of the six antigens. All of the antigens have some over- and under-reporting. Only one antigen fell below the 90 percent agreement level (Hib, at 89.4 percent). Although there did appear to be minimal over-reporting, none appeared to come from any one particular Contractor. The few errors that were observed appeared to occur strictly by chance. Contractors were just as likely to under-report as they were to over-report. Consequently, comparative results of the antigen rates were not significantly different between the original cases and the re-abstracted validation cases.

Data Analysis

Once data collection and validation was finalized, HSAG managed the database and conducted the analysis using *Stata* (V5.0) statistical software. *Stata* statistical code was first developed to generate antigen-specific and combined immunization rates for the initial Arizona immunization status report. The computer code has been updated annually to address changes in recommended immunization schedules and newly recommended antigens. In determining if a child is age-appropriately immunized for a particular antigen, HSAG computer algorithms followed HEDIS® 2001 definitions.

The primary analysis provided results on the percentage of 2-year-old members that were age-appropriately immunized for each of HEDIS® 2001 quality indicators (DTaP, IPV, MMR, Hib, HBV, VZV and the combined series rates). The HBV immunization rate also was calculated for two doses, following the HEDIS®3.0 1999 criteria. This provides Contractors with additional information for comparison to prior reports and other comparative study results. Additional analysis was conducted to identify missed opportunities for DTaP vaccination and the degree of partially immunized children, both by Contractor and by county.

V. RESULTS

Combined Results (Medicaid and KidsCare Populations)

For all but one individual vaccination, rates of completed immunizations for the combined sample of Medicaid and KidsCare members improved from the previous contract year. The only vaccination that did not increase in the most recent year, DTaP, was only 0.2 percent below last year's level. This decrease in DTaP immunization rates is consistent with national findings. The National Immunization survey conducted by the CDC found that the four-dose rate for DTaP declined from 83.3 percent in 1999 to 81.7 percent in 2000 (these rates include commercially insured children, as well as those covered under Medicaid and SCHIP programs).[10]

Rates of completion for two series of vaccinations among the combined sample also improved. The 4:3:1:2:3 series showed the greatest improvement, increasing 2.7 percentage points, from 63.4 percent to 66.1 percent. This represents a relative improvement of 4.3 percent. The 4:3:1 series increased by 1.1 percentage points, from 78.0 percent to 79.1 percent. This represents a relative improvement of 1.4 percent. It should be noted that the combined rates are not an average of the individual antigens, but a measurement of the number of children who had all of the required immunizations.

AHCCCS has established long-range goals for immunization completion rates for individual antigens and antigen series. These goals are based on *Healthy People 2000: National Health Promotion and Disease Prevention Objectives* published by the U.S. Department of Health and Human Services, as well as revised objectives contained in *Healthy People 2010*. AHCCCS also has set interim goals based on the statewide average of all Contractors' performance for previous years. AHCCCS goals for immunization completion rates in four categories (including the DTaP immunization, which was within 0.2 percent of the AHCCCS goal) were met by the combined population during contract year (CY) 2001 (October 1, 2000, through September 30, 20001). The following is a comparison of rates of individual immunizations and antigen-series rates for all children included in the study in CYs 2000 and 2001 with AHCCCS goals. These results also are compared with *Healthy People* goals.

COMBINED TWO-YEAR-OLD IMMUNIZATION RATES
(Medicaid and KidsCare Populations)

Immunizations (doses)	DtaP (4)	IPV (3)	MMR (1)	Hib (2)	HBV (3)	VZV (1)	4:3:1 Series	4:3:1:2:3 Series
All children, CYE 2000	82.0%	87.9%	87.3%	82.8%	77.7%	71.9%	78.0%	63.4%
All children, CYE 2001	81.8%	88.5%	90.0%	83.4%	80.4%	78.5%	79.1%	66.1%
AHCCCS Goals*	**82.0%**	**88.0%**	**90.0%**	**90.0%**	**87.0%**	**67.0%**	**82.0%**	**73.0%**
Healthy People 2010 Goals	**90.0%**	**90.0%**	**90.0%**	**90.0%**	**90.0%**	**N/A****	**90.0%**	**80.0%**

Notes: * AHCCCS goals are for CY 2001
** No Healthy People goals established for this antigen

AHCCCS Contractors have maintained immunization rates despite a significant increase in AHCCCS membership. Combined enrollment in the AHCCCS acute Medicaid and KidsCare programs increased by 21 percent during CY 2001. Accordingly, the total sample size for this study increased by 18.3 percent from the previous year.

It should be noted that, unlike previous years, virtually all records in the sample selected by AHCCCS were found, either through ASIIS or by locating the medical chart. In past years, the percent of missing records in this study has decreased dramatically, from more than 12 percent in 1993 to 1.2 percent in 2000. The use of ASIIS as an additional data source has further improved the ability to collect immunization records for this study. Of the final combined sample of 6,329 Medicaid and KidsCare members, medical charts for two members could not be located. AHCCCS was unable to confirm whether records for these two children were contained in ASIIS because there were not exact matches of demographic information (name, birth date, etc.).

Medicaid Program Results

All of the individual immunization rates were at or above 80 percent, except VZV (77 percent). The 4:3:1 and 4:3:1:2:3 series rates maintained their trend of small, but continuous increases. The 4:3:1 series completion rate for Medicaid-eligible children reached its highest level in CY 2001, at 78.1 percent. While this series only includes a few of the vaccinations required, it continues to be measured as an indicator of long-term trends. The 4:3:1:2:3 series completion rate for Medicaid-eligible children also was at its highest, 65.1 percent, in this reporting period. AHCCCS also measured the 4:3:1:2:3:1 series, which includes varicella vaccine; that rate improved from 53.4 percent in the previous measurement year to 56.5 percent.

Results for Medicaid-eligible children from 1998 through 2001 are summarized in the following table. Rates for all individual vaccines and immunization series have increased during that time. The smallest increase was for hepatitis B vaccine, which increased 1.1 percentage point from 1998 to 2001. The largest increase was for varicella, which improved by 33.4 percentage points, or a relative improvement of 76 percent. (Varicella zoster vaccine, or VZV, was licensed for use in healthy children and adults in March 1995 and first included in the AHCCCS annual immunization assessment for the 1997 contract year.)

IMMUNIZATION RATES
(Medicaid-eligible Children)

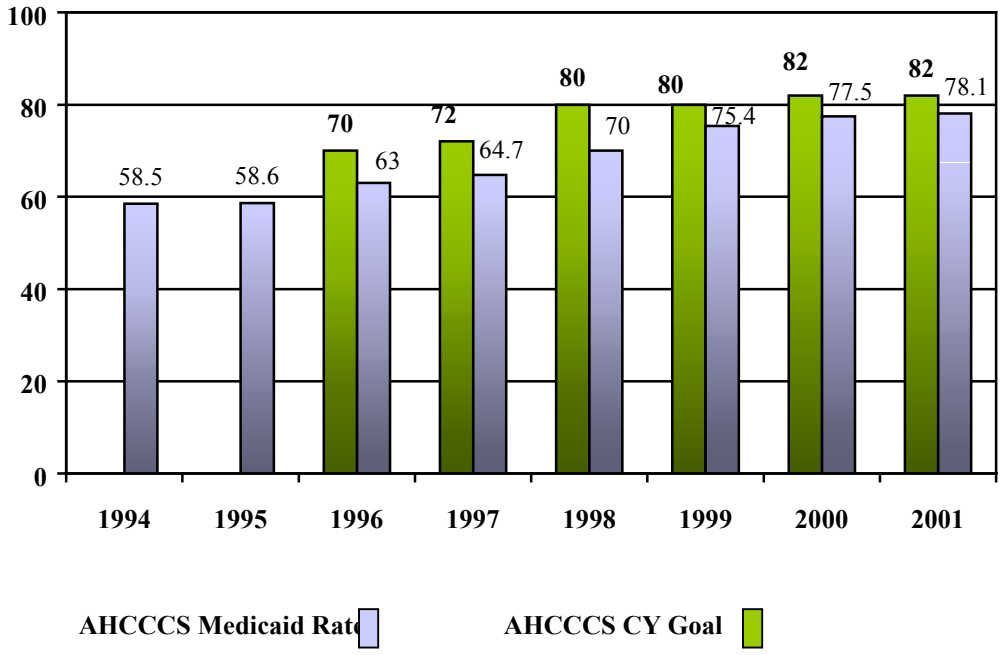
CONTRACT YEAR	DTaP (4)	IPV/OPV (3)	MMR (1)	Hib (2)	HBV (3)	VZV (1)	4:3:1 Series	4:3:1:2:3 Series
1998	75.0%	84.8%	83.0%	80.8%	79.7%	43.7%	70.0%	60.7%
1999	79.9%	87.2%	86.8%	82.2%	79.5%	62.8%	75.4%	61.9%
2000	81.4%	88.3%	87.6%	84.3%	80.0%	71.1%	77.5%	64.7%
2001	**81.0%**	**87.7%**	**89.7%**	**83.8%**	**80.8%**	**77.1%**	**78.1%**	**65.1%**
AHCCCS Goals	**82%**	**88%**	**90%**	**90%**	**87%**	**67%**	**82%**	**73%**

Notes: Numbers in parentheses below the antigen represents the number of doses.
IPV is the preferred vaccine over OPV. DTaP is the preferred vaccine over DTP.
* AHCCCS goals are for CY 2001

AHCCCS has made significant progress toward meeting goals for immunization completion rates among Medicaid-eligible children. Rates for IPV and MMR are within 0.3 of a percent of the AHCCCS goals, and DTaP is only one percentage point below the goal for that antigen. The rate for VZV exceeded the AHCCCS goal by 10.1 percent.

The following graph displays the annual trend in the combined DTaP, IPV and MMR rate from 1994 to present.

ANNUAL TREND IN DTAP, IPV AND MMR COMBINED SERIES
(Percentage Rates from Contract Years 1994 through 2001)



Note: AHCCCS goals were not established for CYs 1994 and 1995

The other antigen series for which AHCCCS has a goal is the 4:3:1:2:3 series. The AHCCCS rate for this series has increased by 4.4 percentage points, from 60.7 percent in 1998 (when this combination was first measured) to 65.1 percent in 2001.

KidsCare Program Results

This is the second year of reporting immunization rates for children enrolled in AHCCCS under KidsCare, Arizona Child Health Insurance Program (Title XXI of the Social Security Act). The KidsCare program was implemented November 1, 1998, and is designed to decrease the number of children in Arizona who are without health care coverage. This study includes nine Contractors that provide KidsCare coverage, but results are presented in aggregate because individual sample sizes are too small to yield meaningful results.

Immunization rates for KidsCare children were nearly identical to the Medicaid immunization rates, as seen in the table below. Rates for KidsCare members were slightly higher than rates for Medicaid children in six of the eight antigen categories.

COMPARISON OF KIDSCARE AND MEDICAID TWO-YEAR-OLD IMMUNIZATION RATES

Immunizations (doses)	DTaP (4)	IPV (3)	MMR (1)	HIB (2)	HBV (3)	VZV (1)	4:3:1 Series	4:3:1:2:3 Series
KidsCare	82.5%	89.3%	90.2%	83.0%	79.9%	79.9%	80.1%	67.0%
Medicaid	81.0%	87.7%	89.7%	83.8%	80.8%	77.1%	78.1%	65.1%

AHCCCS goals were achieved for four antigens: DTaP, IPV, MMR and VZV. KidsCare rates for two immunization series (4:3:1 and 4:3:1:2:3), were 2 percentage points higher than rates for the Medicaid sample. As seen in the following summary of KidsCare immunization rates, improvement was made in all but one antigen, the DTaP vaccine.

IMMUNIZATION SUMMARY
(KidsCare-eligible Children)

CONTRACT YEAR	DTaP (4)	IPV (3)	MMR (1)	Hib (2)	HBV (3)	VZV (1)	4:3:1 Series	4:3:1:2:3 Series
2000	82.6%	87.4%	87.0%	81.2%	75.4%	72.7%	78.5%	62.1%
2001	82.5%	89.3%	90.2%	83.0%	79.9%	79.9%	80.1%	67.0%
AHCCCS Goals	**82%**	**88%**	**90%**	**90%**	**87%**	**67%**	**82%**	**73%**

VI. ANALYSIS

AHCCCS overall rates compare favorably with the Medicaid national average, as well as with commercial health plans' rates. The NCQA national Medicaid and commercial averages for childhood immunizations are presented in the table below for comparative purposes. The 2001 AHCCCS immunization rate for the 4:3:1:2:3 series (DTaP, IPV, MMR, Hib and HBV) compares favorably to the 2000 NCQA national average for Medicaid plans and, as expected, is below the average for commercial health plans. However, the AHCCCS 2001 rate for the 4:3:1:2:3:1 series, which includes varicella vaccine, is above 2000 NCQA national averages for both Medicaid and commercial health plans.

COMPARISON OF AHCCCS MEDICAID RATES WITH NATIONAL AVERAGES

	AHCCCS Medicaid	2000 NCQA National Averages	
		Medicaid	Commercial
4:3:1:2:3 Series	65.1	66.8	69.8
4:3:1:2:3:1 Series	56.5	53.5	55.7

Source: National Committee for Quality Assurance

Several AHCCCS Contractors included in this study exceeded AHCCCS CY 2001 goals for individual antigens or for immunization series, and some achieved or surpassed *Healthy People 2000* objectives. Ten of 11 Contractors exceeded the AHCCCS goal for varicella vaccine, seven Contractors exceeded the AHCCCS goals for both DTaP and MMR, and six Contractors surpassed the AHCCCS goal for IPV. Four Contractors met or exceeded the AHCCCS goal of 82 percent for the 4:3:1 series and two surpassed the AHCCCS goal of 73 percent for the 4:3:1:2:3 series.

The antigen-series rates were impacted most by the DTaP antigen, which had the lowest rate among those antigens included in the combined rate. DTaP is the only antigen that requires four doses by two years of age. Sixty percent of children in the Medicaid group who were not fully immunized for DTaP had received three of the four recommended doses. Although the DTaP rate reached a high of 81 percent in 2001, The DTaP rate could have been 92.5 percent had those children who had three doses of DTaP received one more dose.

In previous years, these combination rates also were impacted by HBV. In 1998, only two doses of HBV were required to be age-appropriately immunized. This was to allow for Contractors that could not adequately capture the first dose of HBV which was typically administered in the hospital. This requirement was changed back to three doses in 1999 to monitor HEDIS® 2001 specifications. The third dose of HBV affected the five-antigen combination series. The rate for the series that included three doses of HBV was 2 percentage points lower than the rate with only two doses of the vaccine. This gap, however was narrower in 2001 than in previous years.

Limited supplies of vaccine and delays in shipping may have resulted in some missed opportunities for vaccination during the study period. In mid-2000, Wyeth Lederle Inc. and Baxter Healthcare Corp. stopped producing diphtheria, tetanus and acellular pertussis (DTaP) vaccine. Providers who participate in the VFC Program have been asked to keep no more than a one-month supply of some vaccines. This situation may have posed a barrier to improvement in the DTaP rate for CY 2001.

The only single antigen rate that was less than 80 percent was varicella, or VZV, with a rate of 77 percent. This rate has improved from 43.78 percent in 1998 to 77.1 percent in 2001. This increase indicates a high demand for VZV, as parents hope to spare their children (and themselves) the effects of this highly contagious disease. Only one Contractor had a VZV rate for 2001 below 70 percent, at 41.9 percent.

VII. CONCLUSIONS AND RECOMMENDATIONS

The annual AHCCCS immunization assessment documents the rate of two year old Medicaid- and KidsCare-eligible children who obtained complete antigen-specific and antigen-series immunizations. As the 2001 study demonstrated, rates of completed immunizations for all but one antigen improved from the previous contract year. In general, immunization rates for KidsCare members proved to be nearly identical to rates for those children covered under Medicaid.

Certain vaccinations pose greater challenges for completion of all doses. In the past, DTaP has been the primary antigen limiting AHCCCS overall immunization rates for combined antigens. This is not surprising since DTaP is the only antigen that requires four doses by 2 years of age. A combined-antigen rate can equal, but never exceed, the lowest individual-antigen included in the combined rate. Efforts to improve the DTaP rate have been somewhat successful, as reflected in an increase in the overall Medicaid rate for this antigen over the last few years.

In addition to DTaP, Contractors must now focus on ensuring that members receive two doses of Hib and three doses of HBV. Despite steady increases in the rates for these antigens, overall rates for Hib and HBV both are more than 6 percentage points below the AHCCCS goals for those antigens. To continue the upward movement and achieve *Healthy People 2010* immunization goals, a concerted effort to increase rates for Hib and HBV (which can be given together in a single COMVAX shot), as well as maintain rates for other antigens, is needed.

In late 2001, the CDC recommended deferral of the fourth dose of DTaP (usually given at 15 to 18 months) to help ensure that younger children are able to receive the first three doses. The Arizona Department of Health Services did not implement this recommendation until early 2002. The shortage of DTaP is expected to continue well into 2002, and also may affect results of next year's AHCCCS immunization assessment.[7]

This year's total study sample, including Medicaid and KidsCare members, represented an increase of 18.3 percent over last year's sample. This growth is due to a similar increase in the AHCCCS total population. Overall, Contractors maintained or improved immunization rates from last year's assessment despite a significant increase in enrollment.

Much of the improvement in immunization rates over the past several years is due to the partnership among AHCCCS, Contractors and providers. To achieve this AHCCCS, Contractors and providers created and implemented the use of tracking forms for Early and Periodic Screening, Diagnosis and Treatment (EPSDT) services. EPSDT benefits include all age appropriate immunizations and these tracking forms provide a convenient way for primary care practitioners to document all immunizations given, along with other well-child services, during an office visit. Contractors require provides to use these forms and to submit copies to them for monitoring and follow-up. In addition, Contractor outreach efforts have also been successful in encouraging families to complete immunizations for their children. Other Contractor activities that facilitate access to services, such as providing transportation and assistance with scheduling appointments, have contributed to the steady increase in AHCCCS immunization rates.

Collaboration with the Arizona Department of Health Services (ADHS) Immunization Program Office, which administers the state's Vaccines for Children (VFC) program and the ASIIS registry, has contributed to improvement in immunization rates. Further efforts through The Arizona Partnership for Immunization (TAPI), of which AHCCCS is a key member, have raised public awareness of the importance of immunizations and provided a forum for many organizations to collaborate toward a common goal.

As anticipated, the ASIIS automated registry relieved some of the Contractors' burden for locating immunization information. ASIIS was created in 1996 as a statewide immunization registry and currently supports PC-Immunize and PCI2000 software. As of January 1998, Arizona state law requires providers to report immunizations to ASIIS. In this study, 24 percent of completed records were found in the ASIIS database. This is an increase from the 18 percent of complete records found in ASIIS last year, when AHCCCS validated use of this system to collect data for its annual assessment. More efforts need to be done to improve communication by all providers. As more ASIIS records are found to be complete, Contractors will spend less time collecting immunization records each year and can devote staff resources to ensuring that more children are fully immunized.

In addition, the following strategies should help support continued progress toward achieving AHCCCS goals and *Healthy People 2010* objectives:

- Ensure that the CDC's *Standards for Immunization Practices* are implemented to the greatest extent possible at the Contractor and provider levels. These standards, which are included in Appendix E, were developed in 1992 by the National Vaccine Advisory Committee and have been endorsed by more than a dozen professional health care and advocacy organizations.

- Utilize patient reminder and recall strategies. These may be automated, such as computer-generated lists or phone calls to patients with a recorded message, or may include more "low-tech" approaches, such as mailed reminders to patients or an "Immunization Due" stamp or clip to flag charts for providers.

- Vaccinate at every opportunity and administer multiple vaccinations when indicated. Providers may miss opportunities to vaccinate because of concerns about administering several vaccines simultaneously. These concerns include reduced immune response and increased potential for adverse events, but neither is supported by scientific data.[1] Health care providers need to educate parents/caregivers about the safety and efficacy of administering multiple vaccines. The licensing of additional combination vaccines is expected in the near future and may help to alleviate parental objections about administering several shots at once.

- Continue utilizing the ASIIS registry, claims data and EPSDT tracking forms to determine the immunization status of members. Contractors can use these resources to specifically target individuals due for vaccinations. This could potentially impact overall immunization rates, especially those antigens that require only one dose (MMR and VZV), or to ensure that children who have three doses of DTaP receive the fourth dose before their second birthdays.

- Consider developing targeted outreach activities to certain groups or geographic areas. NIS data indicate that Native Americans, African Americans and Hispanics are likely to have lower immunization coverage levels.[10] Monitoring coverage in specific geographic areas, such as at the county level, may help Contractors target interventions to increase immunization and prevent outbreaks of disease.

Immunization awareness in Arizona has increased and many organizations have made a concerted effort to improve the immunization status of children by 2 years of age. However, as AHCCCS immunization rates come closer to meeting *Healthy People* goals, it will become more difficult to target improvement and reach those members who are most at-risk for not receiving complete immunizations.

AHCCCS will continue to work with Contractors to achieve established AHCCCS goals and to meet the immunization goals of *Healthy People 2010.* Contractors that do not show demonstrable and sustained improvement may be required to submit to AHCCCS corrective action plans to improve immunization rates.

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APPENDIX A

LIST OF IMMUNIZATIONS AND COMBINED ANTIGENS

DTaP	Diphtheria, tetanus toxoids and acellular pertussis (other derivatives are DTP, Td and TD)
IPV	Inactivated poliovirus vaccine (oral poliovirus vaccine, or OPV, used in selective cases)
MMR	Measles, mumps and rubella
Hib	Haemophilus influenza type b
HBV	Hepatitis B vaccine
VZV	Varicella zoster vaccine
TETRA	DTaP and Hib in a single immunization
COMVAX	Hib and HBV in a single immunization

APPENDIX B

DISEASE	CLINICAL MANIFESTATIONS	RESEVOIR	TRANSMISSION
Hepatitis B (HBV)	Occur more frequently in adults than in children however symptoms may include jaundice, anorexia, nausea, vomiting, right upper quadrant abdominal pain, fever, headache, myalgias, skin rashes, arthralgias, arthritis and dark urine	Human carrier	Parenteral or mucosal exposures from others who have HBV or carriers
Diphtheria	Cold like symptoms, such as sore throat, anorexia, and low-grade fever. Respiratory obstruction may occur. Eventually the tonsils and soft palate will be covered with a bluish-white membrane. Widespread use of vaccines began in the late 1940s	Human carrier	Respiratory tract, and rarely from skin lesions or from contaminated articles
Tetanus	Lockjaw, stiffness of the neck, difficulty swallowing, rigid abdominal muscles, fever, hypertension, and tachycardia. Complete recovery can take months. Neonatal tetanus is rare in the United States however there are over 270,000 estimated annual cases worldwide. Vaccines were started in the 1940s. Since the 1970s there have been between 50-100 cases reported annually. Prior to the 1970s there were 500-600 cases reported per year	Organisms from the soil and intestinal tracts of animals and humans	Contaminated wounds. Tetanus can also occur with an ear infection, dental infection, animal bite, abortion or pregnancy
Pertussis	Cold-like symptoms (first stage), coughing spells that end in a high-pitched whoop. Cyanosis can occur at the second stage, with gradual recovery in 2-3 weeks (convalescent stage). The most common complication is secondary bacterial pneumonia, which is the cause for most of the deaths. Overall case-fatality rate 0.2% (84% are children under the age of six months). Prior to the 1940s there were 200,000 cases annually in the United States. Since 1980 there are approximately 3700 cases annually	Human carrier	Respiratory droplet, at times by airborne droplets of respiratory secretions or freshly contaminated articles
Haemophilus influenza type b (Hib)	Meningitis, epiglottitis, pneumonia, arthritis, cellulitis, osteomyelitis and bacteremia. Others experience hearing impairment or neurologic sequelae. Over-all case fatality rate is 2-5%. This disease is rare after five years of age	Human carrier	Most likely by respiratory droplet

Measles	Maculopapular rash, fever, cough, Koplik's spots (blue-white spots on the buccal mucosa), cold-like symptoms, anorexia, diarrhea, generalized lymphadenopathy and conjunctivitis	Human carrier	Large respiratory droplets and aerosolized droplet nuclei, which can be present in a room for up to two hours, after a person with measles has occupied the area
Mumps	Parotitis, myalgia, anorexia, malaise, headache and low-grade fever	Human carrier	Airborne or through direct contact with infected droplet nuclei
Rubella	Low-grade fever, malaise, swollen glands and upper respiratory infection (URI) prior to a rash. In 1964 there was a rubella epidemic with 12.5 million people contracting rubella and 20,000 with congenital rubella syndrome (CRS). One infant with CRS has an estimated $200,000 cost for medical care over their lifetime. The cost of the 1964 epidemic was $840 million; this does not include the emotional aspects incurred from this epidemic	Human carrier Infants with congenital rubella may shed the virus for up to one year	Airborne transmission or droplets from respiratory secretions of people with rubella or with subclinical cases of (30-50%)
Varicella (VZV - also known as Chicken Pox)	Fever, and malaise prior to a rash in adults. Children usually present with a rash initially. Pruritus is common. Herpes Zoster (shingles) occur when the VZV reactivates	Human carrier	Respiratory tract, direct contact or inhalation of aerosols from skin lesions of a person that has VZV
Poliomyelitis (polio)	Nonparalytic aseptic meningitis, flaccid paralysis and death. There are cases of subclinical polio. These cases are considered contagious and can transmit the disease to others. From 1980-1999 there have been an average of eight cases annually. 95% were vaccine associated paralytic polio caused by the live oral polio vaccine, thus most people are now given Inactivated Polio Vaccine (IPV)	Human carrier	Fecal-oral route and at times the oral-oral route

Below is a list of complications of these diseases.

Disease	**Complications**
HBV	Chronic infection and malaise/fatigue for weeks and /or months. There are over 200 million carriers worldwide. Overall case-fatality rate of 1,000-1500 per year in the United States which is due to HBV related liver carcinoma. 200-300 fatalities a year from fulminant disease and 250,000 fatalities a year worldwide are due to HBV liver disease. The cause of 80 percent of hepatocellular carcinomas and is second only to tobacco use regarding known human carcinogens.

Diphtheria	Usually due to the effects of the toxin, and include myocarditis, neuritis, otitis media, respiratory insufficiency and death. Overall case-fatality rate is 5-10 percent and up to 20 percent in children under five years of age.
Tetanus	Laryngospasm, fractures of the spine or long bones, hyperactivity of the autonomic nervous system, nosocomial infection especially pulmonary embolism, aspiration pneumonia and death.
Pertussis	Seizures and encephalopathy. In unimmunized populations the case fatality rate are more than 300,000 deaths annually.
Hib	Meningitis, epiglottitis, pneumonia, arthritis, cellulitis, osteomyelitis and bacteremia. Others experience hearing impairment or neurologic sequelae and death can occur. Over-all case fatality rate is 2-5 percent.
Measles	Diarrhea, otitis media, pneumonia, subacute sclerosing panencephalitis (SSPE) and encephalitis. When a woman has measles and is pregnant, complications can result in premature labor, spontaneous abortion and low birth weight infants. Pneumonia accounts for 60 percent of the deaths. Death is greater in children under five years of age and adults over 20 years of age.
Mumps	CNS involvement; orchitis, oophoritis, myocarditis, pancreatitis, and deafness and death. Over-all case fatality rate 1-10 per 10,000 cases.
Rubella	Over-all case fatality rate in 1964 included 2,100 neonatal deaths and 11,250 abortions (both surgical and spontaneous). Other complications included 2,000 cases of encephalitis. The infants with CRS were noted to be deaf, blind and mentally retarded.
Varicella	Secondary bacterial infections, pneumonia, central nervous system symptoms and Reye's syndrome. If a woman is pregnant and develops maternal Varicella between five days before and two days after delivery the neonate has a 30 percent fatality rate. Prior to five days before delivery the neonate will usually not have any complications. Over-all case fatality rate is 1 per 60,000 cases. Adults have a 35 percent mortality rate however; this represents only 5 percent of the cases. People that are immunocompromised have a 36 percent mortality rate.
Polio	Case fatality rate is 2-5 percent in children, 15-30 percent in adults. In 1952 there were more than 21,000 paralytic cases reported.

Risk of Complications from Disease vs. Risk of Adverse Reactions from Vaccines

No vaccine is perfectly safe or effective. Approximately 10,000 cases of adverse health effects are reported to the CDC through the Vaccine Adverse Event Reporting System (VAERS) each year. Research is under way by the U. S. Public Health Service to better understand which vaccine adverse events are truly caused by vaccines (or are coincidental to their administration) and how to reduce the already low risk of serious vaccine-related injury.

Children are far more likely to be injured by a vaccine-preventable disease than by the vaccine. Still, some parents refuse to have their children immunized because of the possiblity of adverse reaction to a vaccine. Of the 6,329 cases in the final total sample for the 2001 AHCCCS immunization assessment, 27 (0.4 percent) parent refusals were documented and these cases were excluded from the total sample size.

Below is a comparison of risks from disease and risks from vaccines.

Disease	Vaccine
Measles Pneumonia = 1 in 20 Encephalitis 1 in 2,000 Death = 1 in 3,000 **Mumps** Encephalitis = 1 in 300 **Rubella** Congenital Rubella Syndrome = 1 in 4 (if a woman becomes infected early in pregnancy)	**MMR** Encephalitis or severe allergic reaction = 1 in 100,000
Diphtheria Death = 1 in 20 **Tetanus** Death = 3 in 100 **Pertussis** Pneumonia = 1 in 8 Encephalitis = 1 in 20 Death = 1 in 200	**DTP** Continuous crying, then full recovery = 1 in 100 Convulsions or shock, then full recovery = 1 in 1,750 Acute encephalopathy = 0-10.5 in 1,000,000 Death = none proven

Source: Centers for Disease Control and Prevention, Epidemiology and Prevention of Vaccine-Preventable Diseases, sixth edition (second printing), January 2001