CARE FOR KIDS

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Immunization and the Effects of Polio and Rubella in the US from the 20th to the 21st Centuries

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Polio

Poliovirus has been recognized for centuries. Until the mid 1800s, it was an *endemic* disease; that is, it was continually present in the US. Beginning in the late 1800s, it became an epidemic disease with many more cases appearing than were expected. The main reason for the increased numbers of children contracting polio in Europe and the USA was probably the general improvement in public health measures, so that the widespread transmission of poliovirus was interrupted. Very young children no longer contracted mild cases of the disease while still protected by maternal antibodies, and didn't develop early immunity.

Prior to the introduction of a polio vaccine in the US, epidemics occurred every summer. From 90-95% of infected children had no symptoms, while 5-10% had signs ranging from aseptic meningitis to paralysis. The most feared complication, paralysis, probably occurred in only 1-2% of all infected children, especially those between 5-14 years of age. Legs were affected more often than arms. The most severe cases also had paralysis of the respiratory muscles, requiring treatment in the familiar iron lung machine. On average, the decade of the '50s saw about 20,000 cases of paralytic polio each year.

Dr. Jonas Salk produced the first polio vaccine. This inactivated polio vaccine (IPV) was licensed in 1955 and immediately accepted by the general public because of the great fear of paralytic poliomyelitis. Live attenuated polio vaccine, the "oral polio vaccine" (OPV), was produced by Dr. Albert Sabin and licensed in 1961.

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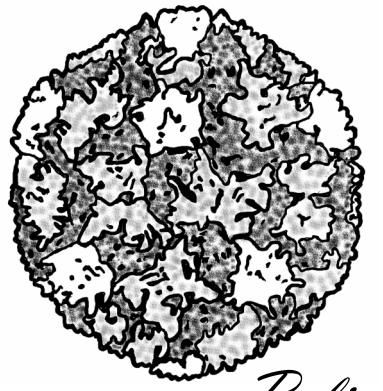
One of the reasons that the Public Health Service switched from the Salk vaccine to the Sabin vaccine in the 1960s had to do with *herd* (or community) *immunity.* Among those in the US who had not received the Salk vaccine, outbreaks of polio continued to occur. In contrast, shortly after the introduction of the Sabin vaccine, there was clear evidence that vaccination of a population with a live attenuated virus also protected children who were not immunized.

Immunization with the Sabin vaccine virtually eliminated wild type poliovirus in the USA. However, one rare but severe adverse effect of the Sabin vaccine became increasingly apparent: A handful



Poliovirus

of paralytic cases occurred in the US each year due to infection with the vaccine virus itself. The medical-legal consequences were increasingly onerous to the pharmaceutical industry, and after much debate, the Public Health Service in the US switched back to the Salk vaccine.

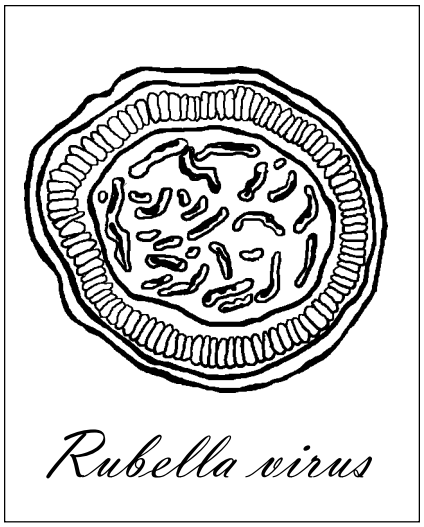
In the meantime, the Sabin vaccine has been successfully used in Mexico, Central America, and South America to eliminate wild type poliovirus. A similar effort to eliminate poliovirus worldwide has been mounted over the last decade.

However, this effort is floundering in Africa because of religious disputes in predominantly Muslim countries. In 2003-2004, a resurgence of poliovirus occurred in Nigeria, which is now exporting poliovirus to many other African nations. It is possible that international travel will re-introduce poliovirus to Europe and the United States, and for that reason immunization against polio continues to be a crucial component of preventive health care.

Rubella

The eradication of rubella – "German measles" or "three-day measles" — is one of the major accomplishments in the history of vaccination in the United States. In the past, rubella epidemics tended to occur on a worldwide basis about every 10 years. The Centers for Disease Control report that during the decade before the introduction of rubella vaccination, the US saw an average of 530,000 cases a year.

The largest rubella epidemic in the United States occurred in 1964-1965, and resulted in the birth of an estimated 30,000 infants with congenital rubella syn-



Rubella virus

drome. As many as 85% of pregnant women with clinical rubella delivered babies with congenital rubella. The highest percentage of congenital rubella occurred when the pregnant mothers had rubella during the first trimester. The percentage fell to 50% during the second trimester, and was virtually nil in the third trimester. Many pregnant women who were unaware of having had rubella during this epidemic also delivered infants with congenital rubella syndrome. Conditions associated with classic congenital rubella include cataracts, deafness, bleeding tendency, hepatosplenomegaly, and growth retardation.

The first rubella vaccine was developed in the 60s. Early studies noted that 10 to 20 days after vaccination, immunized children shed small amounts of rubella vaccine virus. However, unvaccinated siblings did not contract the virus. In other words, unlike live poliovaccine, rubella vaccine virus was not transmissible to susceptible contacts.

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The Unvaccinated Child: Calculating the Risks

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Parents and pediatricians alike struggle with the fallout resulting from news reports that suggest an association between vaccines and neurological or developmental disorders. Parents, trying to make the best decisions for their children, wonder if vaccines are safe. Pediatricians, trying to help parents understand the benefits and risks of vaccines, spend more time explaining side effects, teaching parents to interpret the medical literature as reported to the public, and helping parents make sense of risk-benefit analyses.

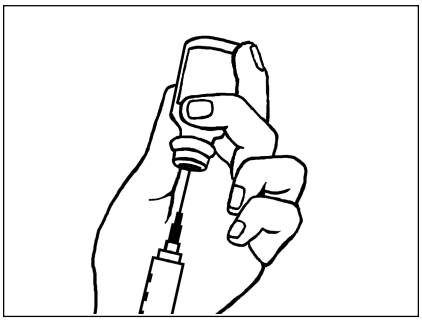
What do you say to the anxious parent?

First, listen to, and validate, parental concerns. Then:

- Provide accurate information
- Refute misinformation
- Inform about possible adverse vaccine events
- Explain the consequences of failing to immunize

What are the consequences if a child isn't vaccinated?

Clearly, the reason we have seen such a dramatic decline in vaccine-preventable diseases in the last century is the high rate of immunization among US children. Prior to this, every year in the US there were nearly 1 million cases of measles, 4 million cases of chickenpox, 20,000 cases of congenital rubella syndrome and more than a quarter of a million cases of pertussis.



The clear relationship between non-vaccination and increased illness continues to be apparent today. For example, in the former Soviet Union from 1989 to 1994, cases of diphtheria rose from 839 to nearly 50,000, and resulted in more than 1,700 deaths. In several European countries, a dramatic decline in MMR vaccination occurred following a controversial 1998 report in *Lancet*, a British medical journal. Subsequently, Ireland experienced a measles epidemic with more than 700 cases, as did the Netherlands, with more than 3,000.

Vaccination programs that result in the immunization of a high proportion of the population can foster "herd immunity," because when disease can't spread easily, this protects even people who aren't vaccinated. However, some diseases require immunization levels as high as 90% to create herd immunity. When the immunization rate dips below this level, the risk increases for disease transmission in the community, even to children who have been vaccinated.

That is because no vaccine produces 100% immunity. Vaccinated people may not be immune due to failure of the vaccine to produce an immune response in the body. Sometimes vaccines are inactivated due to improper handling or storage. With some vaccines, such as that used to prevent tetanus, immunity decreases over time unless a person is revaccinated.

Immunization exemptions

All states allow medical exemptions from immunization for a child with health-related contraindications. In addition, 48 states allow religious exemptions, and 15 allow philosophical exemptions.

It is important for parents to understand that the risks associated with exemptions affect not only their child, but the people with whom their child interacts —

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at home, in school or child care settings, and in the community at large.

These risks are documented in a population-based, retrospective study, published by the Centers for Disease Control in 2000. This study looks at measles and pertussis cases in Colorado, a state that allows religious and philosophical exemptions.

The CDC study found that unvaccinated children were 22 times more likely to develop measles, and 6 times more likely to acquire pertussis. If unvaccinated children were in childcare or elementary school, the rate of infection increased still more: 66 times higher for measles and 16 times higher for pertussis. Every 1% increase in the number of children who weren't vaccinated for pertussis was associated with a 12% increase in pertussis in the schools. In 2000, 476 cases of pertussis occurred in Colorado, resulting in the deaths of two infants too young to receive vaccination. These infants most likely acquired the infection from older siblings who were not vaccinated.

Consequences: An Iowa example

The consequences of immunization exemption can be significant. Earlier this year in Iowa, a group of 28 students from a small private college traveled to India with two professors. A large proportion of students attending this college have non-medical vaccine exemptions. During their stay in India, six of the students contracted measles. As a result, the Iowa Department of Public Health instructed all non-immunized contacts of these infected students to stay in India for 18 days after the last possible exposure. Despite this, one non-immunized student boarded a plane and returned to Cedar Rapids. En route, he developed the symptoms of measles.

When his measles diagnosis was confirmed, the Iowa and Michigan departments of health issued press releases to alert travelers who had passed through the Detroit (where the student had changed planes) and Cedar Rapids airports. They subpoenaed passenger lists from the airline in order to warn other passengers, and issued an alert to all airport visitors and employees in both Detroit and Cedar Rapids, warning them that they had been exposed to this disease. At least three other people contracted measles. The cost has yet to be calculated for this student's choice to refuse measles vaccination and disregard health department instructions.

Documenting immunization

Within your own health care practice, remember to document not only what you do, but also what you don't do.

If parents refuse vaccination for their child, it is important to document in the medical record that you recommended the specific vaccine(s) and that the parent refused. You can find the AAP "Refusal to Vaccinate" form at w.cispimmunize.org/pro/pdf/ RefusalToVaccinate.pdf. Be sure your practice follows "best practice" guidelines for documentation. Lawsuits have occurred for failure to immunize and also for failing to use the most recent version of the Vaccine Information Statement (VIS).

In conclusion, your role as a health care provider is to help parents and young adults make informed decisions about vaccination, and to alert them to its importance in protecting the health not just of their individual child, but also the larger community.

Frequently Asked Questions:

Childhood Immunization

My baby is healthy - why does she need to be immunized?

Immunization is one of the very best ways to keep your baby healthy. Once a baby is ill, it is usually too late to vaccinate.

But aren't most childhood diseases fairly mild?

Not always. Childhood diseases can cause serious, permanent disabilities, like blindness, deafness, and mental retardation.

How well do vaccines work?

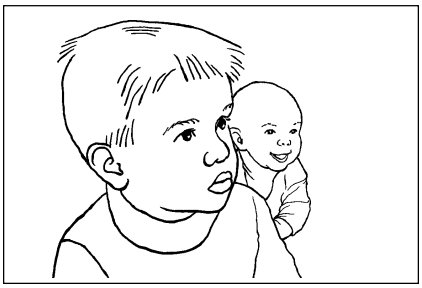
Vaccines work in 85% to 99% of cases. And the 1-15% of immunized children who get a disease anyhow will usually have a much milder illness than an unvaccinated child.

What about side effects?

Typical side effects include a sore arm and mild fever. Depending on the vaccine, side effects that are more serious may occur in from 1:1,000 to 1:1,000,000 children. Often these involve an allergic reaction.

Are the risks really higher if my child isn't immunized?

Yes. That's because the vaccine-preventable diseases of childhood can be very serious indeed. For example, in the US in the 1950s, polio left 20,000 children with paralysis each year. During the 1964 rubella epidemic, 85% of pregnant women with the disease had babies with congenital rubella syndrome. In a 1994 measles epidemic in the former Soviet Union, 50,000 people became ill and one of every 29 died.



Can a vaccine give my child the disease it is supposed to prevent?

Vaccines that use live, weakened (attenuated) virus or bacteria may give a child a very mild case of the disease. Other vaccines cannot cause infection because they use killed virus or bacteria, or only parts or by-products of a virus or bacteria.

Vaccines that . . .

May cause mild illness

- Chicken pox (varicella)
- Flu, live attenuated (nasal spray)
- Measles (rubeola)
- Mumps
- Polio, oral (OPV, no longer used in the US)
- Rubella
- Smallpox

Cannot cause mild illness

- Diphtheria
- Flu, injected
- Haemophilus influenzae type B
- Hepatitis A and B
- Pertussis (whooping cough, given as DTaP)
- Pneumococcal conjugate (pneumonia)
- Polio, injected (IPV)
- Tetanus

What about mercury?

Thimerosal, which contains a type of mercury, is a preservative that prevents bacterial and fungal contamination. The FDA is encouraging its removal from vaccines. Since 2001, all routinely recommended vaccines for children in the US have been either thimerosal free or contain only tiny amounts thimerosal. Ask your physician about obtaining thimerosal-free vaccines for your child.

Can getting several vaccines at a time cause problems?

Sometimes several vaccines are given at once. Careful research shows that this is both safe and effective.

Do breastfed babies need to be immunized?

Yes, they do. If the mother is immune to a disease, the baby may get some antibodies in breast milk. These can give temporary protection. Vaccination, on the other hand, provides long-term protection.

If everyone else is immunized, does my child need to be?

For many diseases, 95% of the population must be immunized in order for "herd immunity" to protect your child. It is very hard to maintain that level of immunization.

Don't immunizations wear off?

Some vaccines, like those for measles and hepatitis B, create lifelong immunity. Others, like tetanus, require booster shots. And some, like pertussis, do wear off, but not until the child is older and less vulnerable to the disease.

An Overview:

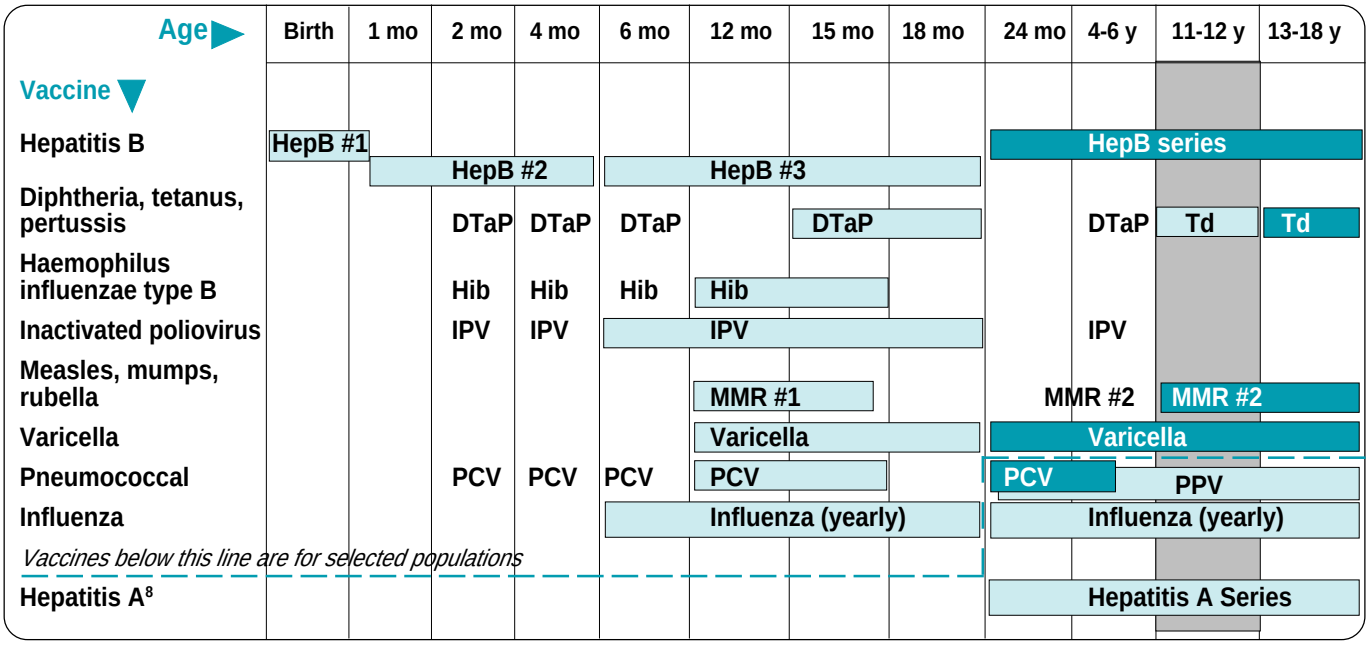
Recommended Child and Adolescent Immunization Schedules • July–December 2004

Below, in simplified form, is the AAP recommended vaccination schedule for routine and catch-up vaccination for children from birth through 18 years. The full AAP vaccination schedule is available at w.cispimmunize.org/IZSchedule.pdf. Special effort should be made to vaccinate children within age groups highlighted for "catch-up immunization."

Range of Recommended Ages

Catch-up Immunization

Preadolescent Assessment



NOTES *[For complete notes, see full AAP vaccination schedule at w.cispimmunize.org/IZSchedule.pdf]*

Measles, mumps, rubella (MMR) vaccine is given to children one year old or older. Second dose: At age 4-6 years, but may be given anytime at least 4 weeks after first dose. Older children should have both doses by age 12 years.

Varicella vaccine is given to children one year old or older who do not have a reliable history of chicken pox. Children older than 13 years should get two doses at least 4 weeks apart.

Pneumococcal vaccine. Pneumococcal conjugate vaccine (PCV) is recommended for all children age 2-23 months, and for certain children age 24-59 months. The final dose in the 4-dose series should be given when the child is more than 12 months old. Pneumococcal polysaccharide vaccine (PPV) is recommended in addition to PCV for certain high-risk groups, including native American children and children older than 2 years with heart or lung disease, sickle cell anemia, diabetes, liver dysfunction, or diseases associated with immune system dysfunction.

Influenza vaccine. Who should be vaccinated: • Healthy children age 6-23 months, due to higher risk of hospitalization due to flu • Close contacts of healthy children age 0-23 months • Children older than six months who are at risk due to conditions like asthma, cardiac disease, sickle cell disease, HIV, diabetes • Household members and health care workers in contact with at-risk children

TIV - Trivalent inactivated influenza vaccine can be given (intramuscular) to any child more than 6 months old. It is given in 2 doses, 4 weeks apart for children younger than 9 years: • 0.25 mL for children 6-35 months old • 0.5 mL if older than 36 months

LAIV - Live attenuated influenza vaccine, intranasally administered, is appropriate for anyone older than 5 years who is not at high risk or in contact with others at high risk. It is given in 2 doses 6 weeks apart for children 5-8 years old. People older than 9 years need only one dose.

Hepatitis A vaccine. Recommended for children in selected states and regions, and for certain high-risk groups. Consult your local public health authority.

Hepatitis B (HepB) vaccine - Should be given to all newborns the first day after birth.

Mother is HBsAg **negative**: • Child's first dose: Monovalent HepB vaccination soon after birth, and before discharge. • Second dose at least 4 weeks after the first except for combination vaccines, which cannot be administered before age 6 weeks. • Third dose at least 16 weeks after the first dose and at least 8 weeks after the second dose. • Last dose in series after age 24 weeks.

Mother is HBsAg **positive**: • Child's first dose: within 12 hours of birth, give HepB and 0.5 mL of hepatitis B immune globulin (HBIG) at separate sites • Second dose at age 1-2 months. • Last dose after age 24 weeks • These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) at age 9-15 months.

Mother's HBsAg status is **unknown** • Child's first dose of HepB within 12 hours of birth. • If later test shows mother is HBsAg positive, give infant HBIG as soon as possible, and no later than age 1 week • Second dose at age 1-2 months • Last dose after age 24 weeks

Diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine. • Fourth dose as early as age 12 months, provided 6 months have elapsed since the third dose and the child is unlikely to return at age 15-18 months. • Final dose when child is older than 4 years. • Tetanus and diphtheria toxoids (Td) at age 11-12 years if at least 5 years have elapsed since the last dose. • Td boosters are recommended every 10 years.

Haemophilus influenzae type b (Hib) conjugate vaccine. Three Hib conjugate vaccines are licensed for infant use. If PRP-OMP (Pedvax HIB or ComVax [Merck]) is given at ages 2 and 4 months, no dose needed at age 6 months. Final dose after age 12 months.

For additional information about vaccines, precautions, contraindications, and vaccine shortages, visit the National Immunization Program, www.cdc.gov/nip/ or call 800-232-2522 (English) or 800-232-0233 (Spanish). *In order to preserve the national vaccine supply in times of shortage so that all children have access to limited vaccine supplies, changes in dosing recommendations may be made by the Advisory Committee on Immunization Practices (ACIP). Physicians should be alert to these time-sensitive changes in the recommended immunization schedule, and comply with recommendations even if they themselves are not experiencing vaccine shortages.*

IMMUNIZATION and the Effects of Polio and Rubella in the US from the 20th to the 21st Centuries

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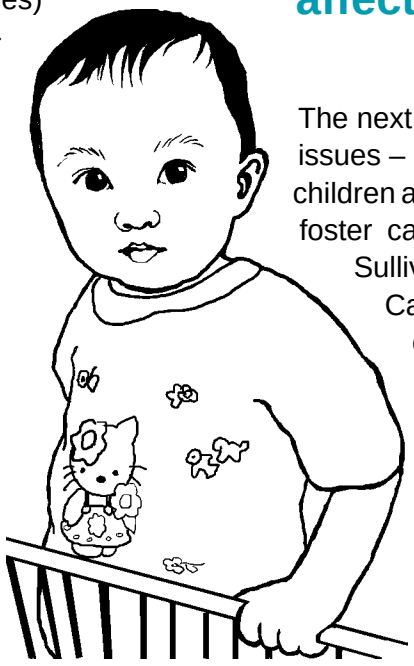
Rubella vaccine was licensed in the United States in 1969. Over the following decade, the number of cases of rubella and congenital rubella syndrome dropped markedly. By 1977, there were only 18 reported cases in the United States, and the number has remained remarkably low over the past 20 years. Today, the rubella vaccination is usually administered as part of the MMR (measles/mumps/rubella) vaccine.

No worldwide effort to eradicate rubella has been mounted. Occasional cases of rubella have been noted recently in the US, mainly in recent immigrants from Mexico and Central America who may not have been immunized as children. In Mexico, for example, immunization for rubeola (measles) is widely available, while rubella (or MMR) vaccination is not as widely administered. For this reason, vaccination against rubella continues to be important.



Getting Ready for Flu Season

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Most health care providers have been planning for months for flu season. To be most successful in preventing influenza infections:

- Start immunizing children October 1 so that you have time to provide the necessary two doses of vaccine, one month apart, for children younger than 9 years who haven't been immunized before.
- Use all clinical encounters, both sick- and well-child visits, to offer vaccine (unless contraindications exist).
- Offer flu vaccine clinics at family-friendly times, such as evenings and Saturday mornings.
- Don't be the source of influenza for your patients. The CDC reports that only 36% of health care workers are vaccinated for influenza! Protect your patients by ensuring that you and all your staff are immunized.

COMING YOUR WAY:

Providing care to children affected by immigration, international adoption, and foster care

The next two issues of this newsletter will discuss developmental issues – physical, emotional, and behavioral – that can arise with children affected by recent immigration, international adoption, and foster care. In the next issue of this newsletter, Dr. Shannon Sullivan, Director of the Adoption Clinic in the UIHC Family Care Center, will discuss the health of internationally adopted children. She will answer frequently asked questions about infectious disease, nutrition, immunizations, and abuse and neglect. In the spring, Dr. Beth Troutman, Assistant Professor of Psychiatry at the UI College of Medicine, will give an overview of emotional and behavioral issues found with children of recent immigrants, children in foster care, and internationally adopted children. Topics will include mental health, attachment disorders, behavior disorders, and abuse and neglect.

What's in this issue

If you have questions about ***billing*** related to EPSDT Care for Kids services, please call Provider Services: **1- 800-338-7909**

If you have questions about ***clinical issues*** and EPSDT Care for Kids services, please call **1 - 800-383-3826**

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