

## Six common misconceptions about Immunization

This list of six common misconceptions was originally written by the Centers for Disease Control in the United States primarily for use by practitioners giving vaccinations to children in their practices. But we in WHO think an edited version is useful for all staff giving vaccination as well as concerned parents.

In this modern age of communication, we will encounter patients who have reservations about getting vaccinations for themselves or their children. There can be many reasons for fear of or opposition to vaccination. Some people have religious or philosophic objections. Some see mandatory vaccination as interference by the government into what they believe should be a personal choice. Others are concerned about the safety or efficacy of vaccines, or may believe that vaccine-preventable diseases do not pose a serious health risk.

All health workers giving vaccines have a responsibility to listen to and try to understand a patient's concerns, fears, and beliefs about vaccination and to take them into consideration when offering vaccines. These efforts will not only help to strengthen the bond of trust between staff and the patient but will also help determine which, if any, arguments might be most effective in persuading these patients to accept vaccination.

These pages address six common misconceptions about vaccination that are often cited by concerned parents as reasons to question the wisdom of vaccinating their children. If staff can respond with accurate rebuttals perhaps we can not only ease their minds on these specific issues but discourage them from accepting other anti-vaccine "facts" at face value. Our goal is not to browbeat parents into vaccinating, but to make sure they have accurate information with which to make an informed decision.

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*"Diseases had already begun to disappear before vaccines were introduced, because of better hygiene and sanitation."*
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*"The majority of people who get disease have been vaccinated."*
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*"There are "hot lots" of vaccine that have been associated with more adverse events and deaths than others. Parents should find the numbers of these lots and not allow their children to receive vaccines from them."*
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*"Giving a child multiple vaccinations for different diseases at the same*

*time increases the risk of harmful side effects and can overload the immune system."*

## **Misconception 1**

"Diseases had already begun to disappear before vaccines were introduced, because of better hygiene and sanitation."

Statements like this are very common in anti-vaccine literature, the intent apparently being to suggest that vaccines are not needed. Improved socioeconomic conditions have undoubtedly had an indirect impact on disease. Better nutrition, not to mention the development of antibiotics and other treatments, have increased survival rates among the sick; less crowded living conditions have reduced disease transmission; and lower birth rates have decreased the number of susceptible household contacts. But looking at the actual incidence of disease over the years can leave little doubt of the significant direct impact vaccines have had, even in modern times.

There were periodic peaks and valleys throughout the years, but the real, permanent drop coincided with the licensure and wide use of measles vaccine beginning in 1963. Graphs for other vaccine-preventable diseases show a roughly similar pattern, with all except hepatitis B showing a significant drop in cases corresponding with the advent of vaccine use. Are we expected to believe that better sanitation caused incidence of each disease to drop, just at the time a vaccine for that disease was introduced?

Hib vaccine is another good example, because Hib disease was prevalent until just a few years ago, when conjugate vaccines that can be used for infants were finally developed. (The polysaccharide vaccine previously available could not be used for infants, in whom most of cases of the disease were occurring.) Since sanitation is not better now than it was in 1990, it is hard to attribute the virtual disappearance of Hib disease in children in recent years (from an estimated 20,000 cases a year to 1,419 cases in 1993, and dropping) to anything other than the vaccine.

Finally, we can look at the experiences of several developed countries after they let their immunization levels drop. Three countries — Great Britain, Sweden, and Japan — cut back the use of pertussis (whooping cough) vaccine because of fear about the vaccine. The effect was dramatic and immediate. In Great Britain, a drop in pertussis vaccination in 1974 was followed by an epidemic of more than 100,000 cases of pertussis and 36 deaths by 1978. In Japan, around the same time, a drop in vaccination rates from 70% to 20%-40% led to a jump in pertussis from 393 cases and no deaths in 1974 to 13,000 cases and 41 deaths in 1979. In Sweden, the annual incidence rate of pertussis per 100,000 children 0-6 years of age increased from 700 cases in 1981 to 3,200 in 1985. It seems clear from these experiences that not only would diseases not be disappearing without vaccines, but if we were to stop vaccinating, they would come back.

Of more immediate interest is the major epidemic of diphtheria now occurring in the former Soviet Union, where low primary immunization rates for children and the lack of booster vaccinations for adults have resulted in an increase from 839 cases in 1989 to nearly 50,000 cases and 1,700 deaths in 1994. There have already been at least 20 imported cases in Europe and two cases in U.S. citizens working in the former Soviet Union.

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## Misconception 2

"The majority of people who get disease have been vaccinated."

This is another argument frequently found in anti-vaccine literature — the implication being that this proves vaccines are not effective. In fact it is true that in an outbreak those who have been vaccinated often outnumber those who have not — even with vaccines such as measles, which we know to be about 98% effective when used as recommended.

This apparent paradox is explained by two factors. First, no vaccine is 100% effective. To make vaccines safer than the disease, the bacteria or virus is killed or weakened (attenuated). For reasons related to the individual, not all vaccinated persons develop immunity. Most routine childhood vaccines are effective for 85% to 95% of recipients. Second, in a country such as the United States the people who have been vaccinated vastly outnumber those who have not. How these two factors work together to result in outbreaks in which the majority of cases have been vaccinated can be more easily understood by looking at a hypothetical example:

*"In a high school of 1,000 students, none has ever had measles. All but 5 of the students have had two doses of measles vaccine, and so are fully immunized. The entire student body is exposed to measles, and every susceptible student becomes infected. The 5 unvaccinated students will be infected, of course. But of the 995 who have been vaccinated, we would expect several not to respond to the vaccine. The efficacy rate for two doses of measles vaccine can be as high as >99%. In this class, 7 students do not respond, and they, too, become infected. Therefore 7 of 12, or about 58%, of the cases occur in students who have been fully vaccinated."*

As you can see, this doesn't prove the vaccine didn't work — only that most of the children in the class had been vaccinated, so those who were vaccinated and did not respond outnumbered those who had not been vaccinated. Looking at it another way, 100% of the children who had not been vaccinated got measles, compared with less than 1% of those who had been vaccinated. Measles vaccine protected most of the class; if nobody in the class had been vaccinated, there would probably have been 1,000 cases of measles.

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## Misconception 3

"There are "hot lots" of vaccine that have been associated with more adverse events and deaths than others. Parents should find the numbers of these lots and not allow their children to receive vaccines from them."

This misconception often receives considerable publicity. First of all, the concept of a "hot lot" of vaccine as it is used in this context is wrong. It is based on the presumption that the more reports of adverse events a vaccine lot is associated with, the more dangerous the vaccine in that lot; and that by consulting a list of the number of reports per lot, a parent can identify vaccine lots to avoid.

### **This is misleading for two reasons:**

1. Most surveillance systems report events that are temporally associated with receipt of vaccine; these reports should not be interpreted to imply causality. In other words, an adverse report following vaccination does not mean that the vaccine caused the event. Statistically, a certain number of serious illnesses, even deaths, can be expected to occur by chance alone among children recently vaccinated. Although vaccines are known to cause minor, temporary side effects such as soreness or fever, there is little, if any, evidence linking vaccination with permanent health problems or death. The point is that just because an adverse event has been reported by the surveillance system does not mean it was caused by a vaccine.

2. Vaccine lots are not the same. The sizes of vaccine lots might vary from several hundred thousand doses to several million, and some are in distribution much longer than others. Naturally a larger lot or one that is in distribution longer will be associated with more adverse events, simply by chance. Also, more coincidental deaths are associated with vaccines given in infancy than later in childhood, since the background death rates for children are highest during the first year of life. So knowing that lot A has been associated with x number of adverse events while lot B has been associated with y number would not necessarily say anything about the relative safety of the two lots, even if the vaccine did cause the events.

Reviewing published lists of "hot lots" will not help parents identify the best or worst vaccines for their children. If the number and type of adverse event reports for a particular vaccine lot suggested that it was associated with more serious adverse events or deaths than are expected by chance, most countries have a system which results in the lot being recalled.

All vaccines purchased through the UNICEF vaccine procurement system meet World Health Organization standards for safety and quality of production.

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### **Misconception 4**

"Vaccines cause many harmful side effects, illnesses, and even death — not to mention possible long-term effects we don't even know about."

Vaccines are actually very safe, despite implications to the contrary in many anti-vaccine publications. Most vaccine adverse events are minor and temporary, such as a sore arm or mild fever. These can often be controlled by taking paracetamol after vaccination. More serious adverse events occur rarely (on the order of one per thousands to one per millions of doses), and some are so rare that risk cannot be accurately assessed. As for vaccines causing death, again so few deaths can plausibly be attributed to vaccines that it is hard to assess the risk statistically. Each death reported to ministries of health is generally thoroughly examined to examine whether it is really related to administration of vaccine, and if so, exactly what is the cause. When, after careful investigation, an event is felt to be a genuine vaccine-related event, it is most frequently found to be a programme error, not related to vaccine manufacturer.

### **DTP Vaccine and SIDS**

One myth that won't seem to go away is that DTP vaccine causes sudden infant death syndrome (SIDS). This belief came about because a moderate proportion of children who die of SIDS have recently been vaccinated with DTP; and on the surface, this seems to point toward a causal connection. But this logic is faulty; you might as well say that eating bread causes car crashes, since most drivers who crash their cars could probably be shown to have eaten bread within the past 24 hours.

If you consider that most SIDS deaths occur during the age range when 3 shots of DTP are given, you would expect DTP shots to precede a fair number of SIDS deaths simply by chance. In fact, when a number of well-controlled studies were conducted during the 1980's, the investigators found, nearly unanimously, that the number of SIDS deaths temporally associated with DTP vaccination was within the range expected to occur by chance. In other words, the SIDS deaths would have occurred even if no vaccinations had been given. In fact, in several of the studies children who had recently gotten a DTP shot were less likely to get SIDS. The Institute of Medicine reported that "all controlled studies that have compared immunized versus non-immunized children have found either no association . . . or a decreased risk . . .

of SIDS among immunized children" and concluded that "the evidence does not indicate a causal relation between [DTP] vaccine and SIDS."

But looking at risk alone is not enough — you must always look at both risks and benefits. Even one serious adverse effect in a million doses of vaccine cannot be justified if there is no benefit from the vaccination. If there were no vaccines, there would be many more cases of disease, and along with them, more serious side effects and more deaths. For example, according to an analysis of the benefit and risk of DTP immunization, if we had no immunization program in the United States, pertussis cases could increase 71-fold and deaths due to pertussis could increase 4-fold. Comparing the risk from disease with the risk from the vaccines can give us an idea of the benefits we get from vaccinating our children.

<b>Risk from Disease vs. risk from Vaccines</b>	
<b>DISEASE</b>	<b>VACCINES</b>
<b>MEASLES:</b> Pneumonia: 1 in 20 Encephalitis: 1 in 2,000 Death: 1 in 3,000 in industrialized countries	<b>MMR:</b> Encephalitis or severe allergic reaction: 1 in 1,000,000
<b>MUMPS:</b> Encephalitis: 1 in 300	
<b>RUBELA:</b> Congenital Rubella Syndrome: 1 in 4 if women become infected	

<b>RUBELA:</b> <b>Congenital Rubella Syndrome: 1 in 4</b> <b>(if woman becomes infected early in pregnancy)</b>	
<b>DIPHTHERIA:</b> <b>Death: 1 in 20</b>	<b>DTP:</b> <b>Continuous crying, then full recovery:</b> <b>1 in 100</b>
<b>TETANUS:</b> <b>Death: 3 in 100</b>	<b>Convulsions or shock, then full recovery:</b> <b>1 in 1,750</b>
<b>PERTUSSIS:</b> <b>Pneumonia: 1 in 8</b> <b>Encephalitis: 1 in 20</b> <b>Death: 1 in 200</b>	<b>Acute encephalopathy: 0-10.5 in 1,000,000</b>  <b>Death: None proven</b>

The fact is that a child is far more likely to be seriously injured by one of these diseases than by any vaccine. While any serious injury or death caused by vaccines is too many, it is also clear that the benefits of vaccination greatly outweigh the slight risk, and that many, many more injuries and deaths would occur without vaccinations. In fact, to have a medical intervention as effective as vaccination in preventing disease and not use it would be unconscionable.

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## Misconception 5

"Vaccine-preventable diseases have been virtually eliminated from my country, so there is no need for my child to be vaccinated."

It's true that vaccination has enabled us to reduce most vaccine-preventable diseases to very low levels in many countries. However, some of them are still quite prevalent — even epidemic — in other parts of the world. Travelers can unknowingly bring these diseases into your country, and if you and your family were not protected by vaccinations, these diseases could quickly spread throughout the population, causing epidemics here. At the same time, the cases you currently have could very quickly become tens or hundreds of thousands of cases without the protection you get from vaccines.

We should still be vaccinated, then, for two reasons. The first is to protect ourselves. Even if we think our chances of getting any of these diseases are small, the diseases still exist and can still infect anyone who is not protected. A few years ago a child who had just entered school caught diphtheria and died. He was the only unvaccinated pupil in his class.

The second reason to get vaccinated is to protect those around us. There is a small number of people who cannot be vaccinated (because of severe allergies to vaccine components, for example), and a small percentage of people don't respond to vaccines. These people are susceptible to disease, and their only hope

of protection is that people around them are immune and cannot pass disease along to them. A successful vaccination program, like a successful society, depends on the cooperation of every individual to ensure the good of all. We would think it irresponsible of a driver to ignore all traffic regulations on the presumption that other drivers will watch out for him or her. In the same way we shouldn't rely on people around us to stop the spread of disease; we, too, must do what we can.

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## **Misconception 6**

"Giving a child multiple vaccinations for different diseases at the same time increases the risk of harmful side effects and can overload the immune system."

Children are exposed to many foreign antigens every day. Eating food introduces new bacteria into the body, and numerous bacteria live in the mouth and nose, exposing the immune system to still more antigens. An upper respiratory viral infection exposes a child to 4 - 10 antigens, and a case of "strep throat" to 25 - 50. According to Adverse Events Associated with Childhood Vaccines, a 1994 report from the Institute of Medicine, United States, "In the face of these normal events, it seems unlikely that the number of separate antigens contained in childhood vaccines . . . would represent an appreciable added burden on the immune system that would be immuno-suppressive." And, indeed, available scientific data show that simultaneous vaccination with multiple vaccines has no adverse effect on the normal childhood immune system.

A number of studies have been conducted to examine the effects of giving various combinations of vaccines simultaneously. These studies have shown that the recommended vaccines are as effective in combination as they are individually, and that such combinations carry no greater risk for adverse side effects. Research is under way to find ways to combine more antigens in a single vaccine injection (for example, MMR and chickenpox). This will provide all the advantages of the individual vaccines, but will require fewer shots.

There are two practical factors in favor of giving a child several vaccinations during the same visit. First, we want to immunize children as early as possible to give them protection during the vulnerable early months of their lives. This generally means giving inactivated vaccines beginning at 2 months and live vaccines at 12 months. The various vaccine doses thus tend to fall due at the same time. Second, giving several vaccinations at the same time will mean fewer office visits for vaccinations, which saves parents both time and money and may be less traumatic for the child.

### **Acknowledgments**

**GPV/WHO gratefully acknowledges the permission of CDC Atlanta ,GA., to present an edited version of "Six common misconceptions about immunization" on the World Wide Web**

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