Understanding Immunization Toolkit

How Well Do Vaccines Work?
Vaccine Effectiveness

June 2010
Vaccine effectiveness (or efficacy) refers to how well the vaccine protects a person from getting the disease it is intended to prevent. Effectiveness is reported by measuring antibody levels in the blood after immunization. It may also be reported by the number of people in the population who get sick after being vaccinated.

A vaccine is considered effective if people who get the vaccine develop antibodies and if fewer people get sick with the disease (Qin et. al., 2007, p.1309-1310). For example (see Table 1), 96% to 99% of people who get the chickenpox vaccine develop antibodies to chickenpox (PHAC, 2006, p. 329), but studies have found that the vaccine is 70% to 90% effective in preventing chickenpox infection (Denniehy, 2001, p. 877). So, almost all people develop antibodies after vaccination but up to three in ten people may still get sick even though they had the vaccine.

No vaccine is able to prevent disease in all people who get vaccinated.

Some vaccines are effective at making the symptoms or complications related to the disease less severe. For example, the chickenpox vaccine is more than 95% effective in preventing severe chickenpox, so while you still might get chickenpox if you have had the vaccine, almost all people who get it after
being vaccinated will not get as sick as they would have without it (Dennehy, 2001, p. 877).

A clinical effectiveness of 50% means that your chances of getting sick are half of what they would be if you did not get vaccinated. These numbers tell us the chances that someone might get sick, but they do not tell us specifically who will get it and who will not. The chickenpox vaccine is 70% to 90% effective, but we never know if we are going to be one of the 10% or 30% who will get the chickenpox or one of the 70% to 90% who will not get it.

How well the vaccine works depends on:

• How new the vaccine is and how well it has been studied: Researchers study and monitor vaccines and make changes to improve them. Effectiveness is sometimes lower when vaccines are new and gets better with more research and monitoring (Dennehy, 2001, p. 873).

• The type of vaccine (Dennehy, 2001, p.880): For example, Canada bought two kinds of H1N1 vaccine from one company.
• The manufacturer. There are a number of pharmaceutical or drug companies that make vaccines and effectiveness may not be the same for each. The United States is using H1N1 vaccine developed by five different companies.

• Whether the vaccine matches the type of disease the strain - (i.e. the flu) that people are getting: For example, the flu vaccine has been found to be 80% effective at preventing the flu when the strains in the vaccine match the strains in circulation. (Demicheli et al., 2007, p. 7)

• Overall health: Underlying health conditions may lower the effectiveness of some vaccines.

• Age: Vaccines may have different levels of effectiveness depending on the age of the person being vaccinated.

• Living setting: for example, in a long-term care facility, versus in the community.
In general, vaccines produce antibodies in most people who receive them. The immune response from vaccines is different for each vaccine, but for children, most vaccines are between 70% and 100% effective at producing an antibody response (PHAC, 2006, p. 168, 175, 192, 212, 230, 239, 252, 260, 329). It is important to note that other factors, such as good sanitation, hand washing and clean water can prevent diseases.
Vaccine | Clinical effectiveness of the vaccine
--- | ---
Diphtheria | 95% effective at preventing diphtheria (National Network for Immunization Information, 2008). Immunity lasts about 10 years so booster shots are recommended.
Haemophilus influenzae type b (Hib) | After introduction of Hib vaccines in the United States, the number of cases reduced by about 95% compared to the number of cases before routine immunization (Dennehy, 2001, p. 881)
Hepatitis B | Over 90% effective in preventing spread of hepatitis B through sexual contact and 95% effective at preventing the spread from infected mothers to newborns (Gold, 2006, p. 239).
Influenza | Effective at preventing the flu in 82% of those vaccinated and preventing 33% of flu-like illness (not caused by the flu virus) (Jefferson et al., 2008, p. 99).
<table>
<thead>
<tr>
<th>Disease</th>
<th>Effectiveness Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>The number of cases of measles in Canada has decreased by 99% (Gold, 2006, p. 157).</td>
</tr>
<tr>
<td>Meningococcal</td>
<td>97% effective at preventing illness in adolescents, and 92% in children (Ramsey et al., 2001, p. 195-196).</td>
</tr>
<tr>
<td>Mumps</td>
<td>64% effective for protection from mumps after one dose of the vaccine and 88% after two doses (Harling et al., 2005, p. 4072)</td>
</tr>
</tbody>
</table>
| Pertussis    | The DTaP (diphtheria, tetanus, acellular pertussis) vaccine has been found to be at least 88% effective but protection decreases over time (Wilson, 2006, p. 233).  
<p>|              | The effectiveness of the acellular pertussis vaccine ranges from 58% to 93% (Dennehy, 2001, p. 881).                                                   |
| Pneumococcal | 83% effective at preventing systemic pneumococcal infections caused by types included in the vaccine and 73% caused by all types (vaccine and non-vaccine types) (Hutchinson et al., 1999, p. 2391). |</p>
<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polio</td>
<td>90% protection after 2 doses of the vaccine and about 100% protection after 5 doses (Gold, 2006, p. 95).</td>
</tr>
<tr>
<td>Rubella</td>
<td>There have been big decreases in the number of cases of rubella and congenital rubella syndrome (Gold, 2006, p. 203). The number of cases of congenital rubella syndrome has decreased by over 99%.</td>
</tr>
<tr>
<td>Tetanus</td>
<td>The vaccine is almost 100% effective at preventing tetanus however, immunity only lasts for 10 years so a booster shot is recommended every 10 years (National Network for Immunization Information, 2009)</td>
</tr>
<tr>
<td>Tuberculosis (BCG)</td>
<td>The vaccine is 51% effective at preventing tuberculosis (TB). In newborns the protective effect of BCG vaccine against TB is estimated at 74% (PHAC)</td>
</tr>
<tr>
<td>Varicella (Chickenpox)</td>
<td>70% to 90% effective in preventing chickenpox infection and 95% effective in preventing severe disease (Dennehy, 2001, p. 877).</td>
</tr>
</tbody>
</table>
References


