Adult and Childhood Immunisation

2013 Revised Edition

Adult and Childhood Immunisation

International Council of Nurses

ISBN: 978-92-95099-08-1

Table of Contents

Acknowledgements

This publication was made possible through unrestricted educational grant from Merck and Co. The expert contribution of the following is acknowledged: Laura Craig, Lora Shimp and Mark Kane.

The current document was revised and updated by Teresa Thornton, RN, NPP, Immunisation Nurse Consultant.

Preface

Immunisation is one of the most successful and cost-effective public health interventions. Thanks to modern vaccines crippling childhood diseases have been brought under control and some like smallpox have been eradicated saving the lives of millions. Immunisation is key to the achievement of Millennium Development Goal 4 to reduce under-five mortality by two thirds by 2015. Many of these deaths occur from diseases that can be prevented with vaccines. Immunisation is also a key strategy to ensure global health security and to respond to the threat of emerging infections. Despite the success of immunisation, parents sometimes fail to have their children fully vaccinated due to misinformation and unfounded rumours about possible adverse events. Failure to protect children through vaccination far outweighs any likelihood of adverse events following immunisation.

Nurses have possibly the most important role to play of any health care professional in the immunisation process. As the largest professional group that has presence in all health settings, nurses are most likely to advise and inform parents on vaccination, as well as actually administer vaccines. Nurses are also well placed to act as role models to achieve national goals and targets for immunisation coverage.

This publication aims to provide up-to-date information to nurses and other health professionals. It is divided into three topic areas. The first describes how vaccines work and the value, safety and cost-effectiveness of vaccination. It focuses on the role of immunisation throughout life and the role of nurses in vaccination. In addition, it explores the underuse of vaccines and the development of new vaccines. The second section covers adverse events following immunisation, exploring common errors which can lead to AEFI and how to report and minimise AEFI. The final section of this paper is on safe immunisation practices, covering auto-disable syringes; counterfeits, cold chain management and waste management.

Chapter 1: Vaccines

How vaccines work

Vaccination is one of the most important and successful public health measures ever implemented and about 80% of the world's children are routinely vaccinated. Due to the success of immunisation, crippling childhood diseases such as poliomyelitis are nearing eradication and some like smallpox have been completely eradicated.

Vaccines are preventive medicines that protect against disease by inducing immunity. Vaccines achieve immunity by introducing to the immune system substances (termed antigens) derived from the disease-causing agents, such as viruses or bacteria. The antigens consist of parts of the bacterium or virus, such as components of its surface, the whole organism in a weakened or killed state, or sometimes a non-toxic form of a toxin produced by a bacterium. The immune system recognises these antigens as foreign substances, and reacts to them by developing an immune response that includes the production of antibodies. These antibodies are designed to attach precisely to the antigen.

Following vaccination, if the true infectious agent is encountered, antibodies are produced rapidly, which block the virus or bacteria. In addition, the antibodies make it easier for other parts of the immune system to recognise and attack the invading agent, thereby preventing the development of one or more associated diseases.

With the constant advance of science, the scope of vaccines has expanded. Initially, vaccines were targeted at preventing infectious diseases. Now, there are a number of vaccines in development that aim to treat rather than prevent diseases, such as cancer. While these vaccines are not yet available for use, they aim to harness the power of the immune system, and focus it on attacking established disease rather than protecting against future infection.

Vaccination against diseases is essential to reaching the Millennium Development Goal 4 to reduce under-five mortality by two thirds by 2015. Many of these deaths are caused by diseases that can be prevented with vaccines. Immunisation is also a key strategy to ensure global health security and for responding to the threat of emerging infections (WHO 2008a).

The value, safety and cost-effectiveness of vaccination

Vaccination is widely regarded as one of the most successful and cost-effective health interventions available. The World Health Organization (WHO) states the lives of well over two million children are saved annually through immunisation, and with sustained effort and sufficient financial resources that figure could reach four to five million by 2015 (WHO 2008a).

Vaccines used in routine immunisation are highly effective at preventing disease, although, as with most medicines, they do not achieve 100% effectiveness and may have

some side-effects. However, vaccines are generally safe, and most side-effects are minor, with only the rare occurrence of serious complications. In addition to the direct protection offered to individuals by vaccines, widespread immunisation can further reduce the spread of infection even to those who are not vaccinated, through 'herd protection'.[1] Herd protection occurs when the proportion of the population protected by vaccination is sufficient to block transmission of an infection, thereby extending protection to the unvaccinated.

Vaccines are also one of the most cost-effective health investments available, with many health economic studies demonstrating direct net health savings for many vaccines, as well as benefits to wider society. As a consequence, immunisation is not only an important public health tool, but can also promote economic development.

The role of immunisation throughout life

While many vaccines are traditionally given to infants and young children (such as those against tuberculosis, polio, diphtheria, tetanus, pertussis, hepatitis A and B, *Haemophilus influenzae type b* (Hib), measles, mumps, rubella, rotavirus, and varicella), it is important to recognise that immunisation has a role to play throughout life. Booster doses of some vaccines are needed for protection throughout the life cycle. In addition, influenza and pneumococcal immunisations, for example, are offered not only to children who are the traditional target group for vaccines, but also to the elderly to protect against these potentially fatal illnesses. Hepatitis B vaccine is also important for those at increased risk due to their occupation, such as health care workers, or their lifestyle, and rabies vaccine is essential for those potentially exposed to infection in their work or to rabid animals.

While immunisation rates in children are as high as 80%, vaccines for adolescents and adults remain underused because of lack of infrastructure to deliver the vaccines, lack of programmes to pay for immunisation in these populations and lack of a culture of vaccination in adults. As new vaccines are developed, for instance to protect against cervical cancer caused by human papillomavirus, immunisation throughout a lifetime, going beyond the traditional vaccination during childhood, is likely to become increasingly necessary, common and the standard of care.

The role of nurses in vaccination

Nurses have possibly the most important role to play of any health care professional in the immunisation process. As the largest professional group that has a presence in all health settings, nurses are most likely to advise and inform individuals on vaccination, as well as

[1] "Herd protection", also known as "herd immunity" or "community immunity": When a critical portion of a community is immunized against a contagious disease, most members of the community are protected against that disease because there is little opportunity for an outbreak. Even those who are not eligible for certain vaccines—such as infants, pregnant women, or immunocompromised individuals—get some protection because the spread of contagious disease is contained. This is known as "community immunity." Natioanl Institute for Allergy and Infectious Diseases, Available at: www.niaid.nih.gov/topics/pages/communityimmunity.aspx

actually administer vaccines. Nurses are also well positioned to act as role models to achieve national goals and targets for immunisation coverage.

According to a North American study (Pitman 2012) when flu and pneumonia vaccinations are coordinated and given by nurses instead of doctors, more elderly and at-risk adults get their shots. The researchers found that changing who performs the vaccinations, especially putting them in the hands of trained nurses, was one of the most successful vaccination-promoting strategies, along with calls and texts to patients reminding them about the shots.

Several factors can influence parents' and caregivers' decision when considering vaccination of their children. The most important factor is a strong recommendation from a trusted health care provider, such as nurses. In 2012, for the 11th year in a row, nurses ranked the highest in the annual Gallup "Honesty and Ethics in Professions" survey in the USA and were considered by the public to have either 'high' or 'very high' honesty and ethical standards (Gallup 2012). Research shows that trust in health professionals is fundamental. Consequently, nurses have an important role to play in addressing parents' and caregivers' wider concerns as well as providing evidence-based health advice.

In addition to science-based evidence, emotional and societal pressures also affect the decision-making process about immunisation. Ironically decisions can also be influenced by the success of immunisation, namely a decline in vaccine-preventable diseases. This can lead to complacency as parents and caregivers are less likely to appreciate the consequences of infectious and vaccine-preventable diseases. Vaccines are so effective at preventing disease that diseases which used to be common in childhood are now hardly ever seen. Many parents have never seen or heard of a child having Hib disease, but parents hear about adverse events following immunisation and now fear that more than the actual disease it is given to prevent.

In addition to their role as trusted advisors, nurses can assist the efficient up-take of vaccines by using health visits as an opportunity to promote vaccination. Research shows that effective record keeping, such as the use of flow sheets, can prompt professionals to discuss vaccines with parents, caregivers or patients and accurately record their administration, thereby reducing missed vaccination opportunities. In addition, a clear understanding of absolute, relative and inappropriate contraindications for vaccination can also ensure that vaccines are given safely and in a timely fashion.

Nurses and other health care providers need to be at the forefront to assure immunisation safety and to dispel myths about rumours and allegations. They should also be prepared to prevent and address adverse events following immunisations (AEFI) (ICN 2009a).

In short, nurses are an invaluable part of the immunisation process, which is one of the world's most important public health interventions.

Underused vaccines

Vaccine coverage has grown substantially since the introduction of WHO's Expanded Programme on Immunization in 1974. Routine vaccination against measles, polio, diphtheria, tetanus, pertussis, and tuberculosis (BCG) is available in all developing countries. Together, these vaccines prevent close to 2.5 million deaths every year (WHO 2010).

Recent years have seen a dramatic increase in the implementation of new and under-utilised vaccines providing additional prevention of untimely deaths and disabilities. These include vaccines against Hepatitis B, *Haemophilus influenzae* type b (Hib), *Streptococcus pneumoniae*(pneumococcus), rotavirus and rubella.

Other vaccines against a number of important public health problems have now been developed or improved. Vaccines against human papillomavirus (HPV) provide an opportunity to impact global cervical cancer morbidity and mortality through immunisation activities in older age groups. Widespread use of vaccines of regional importance, such as those against Japanese Encephalitis, epidemic meningococcal meningitis, yellow fever, and typhoid could further decrease disease burden in some of the poorest countries of the world.

Building on the successes of the routine immunisation programmes of countries, the wide-spread use of new and under-utilised vaccines has the potential to contribute significantly to the Millennium Development Goal 4 to reduce global childhood mortality by two-thirds by 2015. To ensure that countries can make rational, evidence-based decisions about the choice of new vaccines and technologies, current gaps in knowledge related to disease burden, vaccine product characteristics, delivery systems, advocacy and communication, the cost-effectiveness of various strategies as well as regulatory issues will have to be filled.

While these vaccines offer important public health benefits in the regions impacted by the diseases that they prevent, in some countries there may be misconceptions about their value or difficulties in accessing these vaccines due to cost or weak health systems that are not strong enough to sustain their use. To provide a solution to these barriers, several organisations, such as the GAVI Alliance (www.gavialliance.org) and PATH (www.path.org), are focusing on increasing vaccine use and access around the world.

In 2002, an estimated 1.4 million children under the age of five, 14% of the 10 million who die each year, died of diseases that are preventable with widely available vaccines, namely diphtheria, Hib, measles, pertussis, poliomyelitis, tetanus and yellow fever (WHO 2008a).

Many of the existing under-utilised vaccines represent diseases of regional importance, or for which the use of vaccine in population-based programmes has not yet been broadly experienced. The revised Global New Vaccines Plan of Action focuses on two vaccines that are now rapidly progressing towards global utilisation (Hepatitis B and Hib); three vaccines at early stages of implementation (HPV, pneumococcal and rotavirus); and two with regional and country importance (epidemic meningitis and Japanese Encephalitis).

Further diseases for which vaccines have important implications will be added as the vaccines reach the implementation stage (WHO 2010).

New and under-utilised vaccines

The following information is from the World Health Organization's website section on New and Under-utilized Vaccines available at www.who.int/nuvi/diseases/en:

- ***Haemophilus influenzae* type b (Hib)** is estimated to cause at least 8.13 million cases of serious disease worldwide in 2000 (uncertainty range 7.33-13.2 million cases) and approximately 371 000 (247 000 - 527 000)[2] deaths each year among young children. The main clinical manifestations of invasive Hib infections are severe pneumonia and meningitis. Hib also causes potentially severe inflammatory infections of the face, mouth, blood, epiglottis, joints, heart, bones, peritoneum and trachea. Although this problem occurs worldwide the burden of Hib disease is most significant in resource-poor countries.

  Vaccines are the only public health tool capable of preventing the majority of serious Hib disease. Hib vaccines are safe and efficacious even when administered in early infancy. By October 2011, 171 of the 193 Member States (89%) had adopted the vaccine in their routine immunization programmes. As a consequence, invasive Hib disease is practically eliminated in many industrialized countries and its incidence dramatically reduced also in many parts of the developing world. So far, however, access to immunization against this disease has been limited for many children living in low-income countries.
  In view of their demonstrated safety and efficacy, WHO recommends that Hib conjugate vaccines to be included in all routine infant immunization programmes.

- **Japanese encephalitis (JE)** is the main cause of viral encephalitis in many countries of Asia. The infection is mosquito-borne and caused by the JE virus, a flavivirus related to dengue, yellow fever and West Nile viruses. The virus exists in a transmission cycle between mosquitoes and pigs and/or water birds (enzootic cycle). Humans become infected only incidentally when bitten by an infected mosquito and the disease is predominantly found in rural and periurban settings.

  The disease is endemic with seasonal distribution in parts of China, the Russian Federation's south-east, and South and South-East Asia. All year transmission is observed in tropical climate zones. Currently, JE is considered hyperendemic in northern India and southern Nepal as well as in parts of central and southern India, and authorities have responded with immunization campaigns. The spread of JE in new areas has been correlated with agricultural development and intensive rice cultivation supported by irrigation programmes.

[2] Burden of disease caused by haemophilus influenzae type b in children younger than 5 years: global estimates: The Lancet, vol. 374, September 12 2009.

JE vaccines have been available since decades and have proven their potential to control the disease. Other control measures such as mosquito control or amplifying pig control have shown to be less reliable. WHO recommends JE immunization in all regions where the disease is a recognized public health problem (WER2006; 81:325).

Surveillance of the disease is mostly syndromic for acute encephalitis syndrome, while case confirmation and distinction from other causes of encephalitis requires a laboratory diagnosis on serum or, preferentially, cerebro spinal fluid (CSF). Laboratory testing is often conducted in dedicated sentinel sites, and efforts are undertaken to expand laboratory-based surveillance. Case-based surveillance is established in countries that effectively control JE through vaccination.

Overall, the disease is considered under-reported, and annual mortality is estimated to range from 10-15,000 deaths. A recent literature review estimates a total number of 68,000 clinical cases of JE (Bulletin of WHO, October 2011). Of these cases, 30 % or more result in permanent neuropsychiatric sequelae.

The portfolio of licensed JE vaccine is evolving rapidly. Traditionally, the most widely used vaccine was a purified inactivated product made from either Nakayama or Beijing strains propagated in mouse-brain tissue. It is still produced and used in several South-East Asian countries. Over the past years, the live attenuated SA14-14-2 vaccine manufactured in China has become the most widely used vaccine in endemic countries, which requires only one dose for primary immunization.

Recently, two cell-culture based vaccine inactivated vaccine have been licensed; one as traveler's vaccine and the other for paediatric use in Japan. In addition, a live, recombinant product based on the yellow fever vaccine strain has been licensed in two JE-endemic countries.

- **Human papillomavirus (HPV)** causes cervical cancer which is the second most common cancer in women worldwide. In 2008, there were an estimated 529,000 new cases and 274,000 deaths due to cervical cancer. More than 85 % of cervical cancer deaths are in developing countries, where it accounts for 13% of all female cancers.

  Human papillomaviruses are common throughout the world. Although most infections with HPV cause no symptoms, persistent genital HPV infection can cause cervical cancer in women. Virtually all cervical cancer cases (99%) are linked to genital infection with HPV which is the most common viral infection of the reproductive tract. HPV can also cause other types of anogenital cancer, head and neck cancers, and genital warts in both men and women. HPV infections are transmitted through sexual contact.

  Two HPV vaccines are now being marketed in many countries throughout the world. Both vaccines are highly efficacious in preventing infection with virus types 16 and 18, which are together responsible for approximately 70% of cervical cancer cases globally. They are also highly efficacious in preventing precancerous

cervical lesions caused by these types. One vaccine is also highly efficacious in preventing anogenital warts, a common genital disease which is virtually always caused by infection with HPV types 6 and 11. The primary target group in most of the countries recommending HPV vaccination is young adolescent girls. Data from clinical trials and initial post-marketing surveillance conducted in several continents show both vaccines to be safe.

- **Rotavirus** is the most common cause of severe diarrhoeal disease in infants and young children globally. Rotaviruses are estimated to be responsible for approximately 527,000[3] deaths each year, with more than 85% of these deaths occurring in low-income countries in Africa and Asia, and over two million are hospitalized each year with pronounced dehydration. Among 43 countries participating in the Global Surveillance Network for rotavirus in 2009, 36% of hospitalizations for diarrhea among children aged <5 years were caused by rotavirus infection (WER 29 April 2011). Children under five years of age, especially those between 6 months and two years are most vulnerable to the disease. Vaccines against rotavirus gastroenteritis are available and are the single prevention and control measure with the most significant impact on reducing severe disease incidence. Currently, two oral vaccines in four presentations compatible with traditional EPI immunization schedules are available, licensed in most countries, and introduced in national immunization programmes of several American, European and Eastern Mediterranean countries. Several other live oral rotavirus vaccines are in various stages of development in conjunction with vaccine manufacturers in developing countries.

  Recent data from clinical trials, which evaluated vaccine efficacy in countries with high child mortality, has led the WHO Strategic Advisory Committee on Immunization (SAGE) to provide a recommendation for inclusion of rotavirus vaccination of infants into all national immunization programmes. Furthermore, in countries where diarrhoeal deaths account for ≥10% of under-5 mortality the introduction of the vaccine is strongly recommended.

- Diseases caused by ***Streptococcus pneumoniae*** **(pneumococcus)** constitute a major global public health problem. In 2000, about 14·5 million episodes of serious pneumococcal disease (uncertainty range 11·1–18·0 million) were estimated to occur, resulting in about 826 000 deaths (uncertainty range: 582 000–926 000) in children aged 1–59 months, of which an estimated 91 000 (uncertainty range: 63 000–102 000) were in HIV-positive and 735 000 (uncertainty range:519 000–825 000) in HIV-negative children. Of the deaths in HIV-negative children, over 61% (uncertainty range:449 000 [316 000–501 000]) occurred in ten African and Asian countries.

  Streptococcus pneumoniae is a major cause of diseases such as pneumonia, meningitis and sepsis, though each of these diseases are also caused by other organisms. In the developed world, serious disease occurs mainly in children below two years of age and in the elderly. In developing countries, the disease is

[3] Figures taken from Parashar UD et al. Global mortality associated with rotavirus disease among children in 2004. *Journal of Infectious Diseases*, 2009, 200:9-15

common in children under two years, including newborn infants; rates of the disease in the elderly population are largely unknown. Growing resistance of pneumococcus to conventional antibiotics emphasises the urgent need for vaccines to control pneumococcal disease.

There are close to 90 known serotypes of pneumococcus, though relatively few of these are responsible for most serious disease due to this organism. Antibody to the capsular polysaccharide confers protection against disease, but this protection is serotype specific. In 2007, WHO recommended the use of pneumococcal vaccines in all countries, urging that the highest priority for introduction be given to countries with high pneumonia and under five mortality rates. This recommendation was based on the high levels of disease burden in developing countries and proven efficacy and safety of the pneumococcal conjugate vaccines. A conjugated vaccine containing 7 serotypes of pneumococcus (7-valent conjugated vaccine or PCV 7) has been available since 2000. In 2009, a vaccine containing 10 serotypes, including types 1 and 5 that are important in developing countries, was WHO prequalified for use. In August 2010, a vaccine containing 13 serotypes (4, 6B, 9V, 14, 18C, 19F, 23F, 1, 5, 7F, 3, 6A and 19A) was WHO prequalified.

- **Bacterial meningitis** remains a serious threat to global health, accounting for an estimated annual 170 000 deaths worldwide.

  Three species, *Haemophilias' influenzae*, *Streptococcus pneumoniae* and *Neisseria meningitidis*, are responsible for most cases of bacterial meningitis occurring beyond the neonatal period. Since the introduction of *H. influenzae* type b (Hib) conjugate vaccines, *N. meningitidis* and *S. pneumoniae* have become the commonest causes of bacterial meningitis in the world. With the progressive implementation of the conjugated polysaccharide vaccines against pneumococcus, it is likely that *N. meningitidis* will remain a major agent of meningitis worldwide.

  Moreover, *N meningitidis* is the only bacteria able to generate epidemics of meningitis. Meningococcus serogroups that are responsible for severe meningitis belong to only 6 groups: Nm A, B, C, X, Y and W135. Group A meningococci are characterized by their propensity to cause large scale epidemics in developing countries, specifically in the countries of the African 'meningitis belt'. Group B meningococcus (Nm B) is the most important cause of endemic meningitis in industrialized countries, accounting for 30% to 40% of the cases in North America and for up to 80% in some European countries.NmB also can cause severe, persistent epidemics, which begin slowly but may persist for 10 years or longer, as seen in the past in Norway; in Cuba, Brazil and areas of Chile; and currently in New Zealand. Vaccines against groups A, C, Y and W135 include bivalent or plurivalent polysaccharide (PS) and conjugate vaccines, some of which have already been combined with routinely administered vaccines to fit within the EPI regimen. Thus, the introduction of the NmC conjugate vaccines as an addition to routine infant immunization in the UK has had a tremendous impact on the incidence of the disease, resulting in a more than 90% decrease in the number of deaths and clinical cases and a 66% decrease in asymptomatic carriage.

Because epidemic group A meningococcal meningitis continues to be a major problem in countries of the sub-Saharan meningitis belt, the Meningitis Vaccine Project (MVP), a partnership between the WHO and PATH, has developed a NmA conjugate vaccine. The vaccine has successfully been tested in Phase I, II and II/III clinical trials in India and African countries of the meningitis belt: Mali, the Gambia and Senegal. In December 2009, the vaccine was licensed in India for vaccination of individuals 1-29 years old and prequalified by WHO in June 2010. At the end of 2010, around 20 million population from Burkina Faso, Mali, and Niger were immunized with the vaccine and these countries reported the lowest number of confirmed meningitis A cases ever recorded during the 2011 epidemic season. At the end of 2011, Cameroon, Chad and Nigeria have vaccinated more than 22 million individuals. Continuing surveillance for cases of meningitis and monitoring of vaccination coverage will be crucial to confirm the effects of the vaccine as it is introduced across the meningitis belt.

Group B *N. meningitidis*, is the only serogroup against which capsular PS vaccines cannot be developed, due to antigenic mimicry with PS in human neurologic tissues. Efforts to find novel vaccine antigens to protect against serogroup B disease have identified several sub-capsular proteins, including factor H binding protein, Neisserial adhesin A, and Neisseria-heparin binding antigen. As the proteins used in these vaccines can also be found across all meningococcal serogroups, such vaccines have the potential to protect against both serogroup B and additional serogroups. Among the several candidate vaccines that are currently under investigation in clinical trials, the vaccine known as 4CMenB has induced, in a pivotal phase IIb study, robust immune response when given alone or with other routine vaccines. Although preliminary data are promising, the role these vaccines could play in controlling meningococcal disease remains to be determined.

Chapter 2: Adverse events following immunisation (AEFI)

Vaccine safety is a concern for everyone the vaccine manufacturer, the provider, and the patient receiving the vaccine. No vaccine is 100 percent safe or effective as with other pharmaceuticals. Continuous monitoring of vaccines even after licensure and quick assessment of adverse events following immunisation can help differentiate between coincidental events and true vaccine reactions. Maintaining high standards for vaccine safety and quick assessment of safety concerns promotes public confidence in vaccines ensuring continued high vaccination rates.

Vaccines, like other pharmaceutical products, undergo extensive safety and efficacy evaluations in the laboratory, in animals, and in sequentially phased human clinical trials prior to licensure.

However, while rates of common vaccine reactions, such as injection-site reactions and fever, can be estimated before licensure, the comparatively small number of patients enrolled in these trials generally limits detection of rare side effects or side effects that may occur many months after the vaccine is given. Even the largest prelicensure trials (more than 10,000 persons) are inadequate to assess the vaccine's potential to induce possible rare side effects. Therefore, it is essential to monitor reports of vaccine-associated adverse events once the vaccine has been licensed and released for public use (CDC 2012a).

What are AEFI?

Vaccines are designed to stimulate the immune system, consequently initiating an immune response within the body. Medical events that occur after vaccination have been termed adverse events following immunisation (AEFI), and include true vaccine reactions as well as events that are temporally, but not necessarily causally, related to the vaccine or vaccination.

AEFI can happen for various reasons and are divided into five major categories: vaccine reactions; programmatic errors; coincidental; injection reactions; and unknown (WHO 2009).

1. *Vaccine reactions*
   True vaccine reactions are caused by some component of the vaccine and the individual response of the vaccinee. This event would not have occurred without vaccination (e.g. vaccine-associated paralytic poliomyelitis after oral polio vaccine).

2. *Programmatic errors (see box)*
   These are the result of errors made in the storage, handling, reconstitution (or other preparation) and administration of the vaccine.

3. *Coincidental*
   Event that happens after vaccination but is not caused by the vaccine - a chance association.

4. *Injection reactions*
   These are events arising from anxiety about, or pain from, the injection itself rather than the vaccine.

5. *Unknown*
   The cause of the AEFI cannot be identified.

Vaccine reactions are usually mild (e.g. injection-site swelling, fever, rash, malaise) and rarely cause serious illnesses (e.g. anaphlaxsis, seizures, thrombocytopenia). In extremely rare cases, they can be potentially life-threatening. However, the majority of AEFIs are minor and self-limiting.

Programmatic errors that can lead to AEFI (WHO 2009a)

- Too much vaccine given in one dose.
- Improper immunization site or route.
- Syringes and needles improperly sterilized.
- Vaccine reconstituted with incorrect diluent.
- Wrong amount of diluent used.
- Drug inadvertently substituted for vaccine or diluent (can result from inattention when reading labels on vials resulting in mistaken content).
- Vaccine prepared incorrectly for use, e.g. an adsorbed vaccine not being shaken properly before use.
- Vaccine or diluent contaminated.
- Vaccine stored incorrectly.
- Contraindications ignored, e.g. a child who experienced a severe reaction after a previous dose of a vaccine is immunized with the same vaccine.
- Reconstituted vaccine used beyond six hours after reconstitution or not thrown out at the end of an immunization session and used at a subsequent one.

Immunisation providers play a key role in keeping vaccines safe and efficacious. They do this through:

- Proper vaccine storage
- Following the guidelines for administration, timing and spacing of vaccine doses
- Following the guidelines for precautions and contraindications
- Reporting of adverse events following immunisation
- Communication with patients about the benefits and risks of vaccination

Communicating potential mild side-effects and AEFI to parents and caregivers

AEFI can impact the effectiveness of immunisation programmes and must be addressed effectively. Nurses play an important role in addressing AEFI for parents and caregivers. By explaining what AEFI are, nurses can help parents and caregivers to better understand the process of vaccination, be equipped to monitor AEFI and to seek appropriate help as needed. For instance, common AEFI can include pain or swelling at the injection site, fever and rashes.

Reporting AEFI

Many countries have national surveillance systems for reporting AEFI to local and national health authorities. Reporting is very important as it allows national regulatory authorities and governments to identify the probable causes of AEFI and to recognise and respond to any changes in their rates of occurrence (e.g. increased reporting rates of AEFI due to programmatic errors may indicate a need for corrective action, and increased reporting of vaccine reactions may in some cases indicate a potential vaccine quality problem) (WHO 2009a).

Minimising AEFI

AEFI can be prevented or reduced through several strategies:

- Reconstitute appropriate vaccines only with the diluent supplied by the manufacturer.
- Discard reconstituted vaccines at the end of each immunisation session, as well as vaccines stored out of refrigeration.
- No other drugs and substances should be stored in the refrigerator of the immunisation centre beside vaccines.
- Train and provide close supervision of immunisation workers to ensure that proper procedures are being followed, to prevent deaths or injury following immunisation.
- Participate in investigation of AEFIs to pinpoint the cause of the incident and to correct it.
- Report AEFIs to manufacturer and/or regulatory agency

Ensuring immunisations and related safety is a powerful public health tool in disease control and eradication, and in maintaining public confidence in vaccine benefit. Working with their national immunisation programmes and others, nurses are key stakeholders in immunisation efforts and in safety promotion, monitoring and reporting AEFI (WHO 2009a).

Chapter 3: Safe immunisation practices

Vaccine administration

In order for a vaccine programme to be successful appropriate vaccine administration must be followed. Professional standards of medication administration and directives in vaccine package inserts should be utilised.

"The "Rights of Medication Administration" should be applied to each encounter when vaccines are administered. These rights include:

- the right patient
- the right vaccine or diluent
- the right time*
- the right dosage
- the right route, needle length, and technique
- the right site, and
- the right documentation.

*(includes administering at the correct age, the appropriate interval, and before vaccine or diluent expires) (CDC 2012a)

Training and education

All personnel who will administer vaccines should receive training and education on vaccine administration. Training should be provided on an on-going basis as new vaccines are introduced and the immunisation schedule guidelines change.

Before vaccination, patients should be prepared for vaccination which will include:

- **Screening:** Patients should be screened for contraindications and precautions at each vaccine visit. This may be as simple as asking, "Have you ever had a problem after vaccination in the past" or "Do you have any allergies?" National standards for contraindications and precautions are also included with each vaccine in the package insert.

- **Benefit risk communication:** Before vaccination the patient should be provided with information about the disease and the benefits of vaccination in terms they understand. Parents, guardians and patients are increasingly exposed to information through the media or internet regarding vaccines which may or may not be accurate. Health care providers, specifically nurses, are seen as a trusted source of information and, within this environment, patients should be given information about the benefits and risks of vaccination. After care instruction should also be provided, e.g. low grade fever, local injection site redness and swelling. Comfort measures such as cool compress and antipyretic teaching can be provided.

- **Standard medication preparation:** Each vaccine and diluent vial should be inspected for damage or contamination. The expiration date printed on the vial or box should be checked. Vaccines that require reconstitution should follow manufacture guidelines utilising the specific diluent for each vaccine. Filling Syringes - Agitate (shake) the vial to mix the vaccine thoroughly and obtain a uniform suspension prior to withdrawing each dose. Vaccine should not be drawn into the syringe until it is to be administered. Multiple vaccines should never be combined in a single syringe except when specifically approved by the FDA and packaged for that specific purpose. Vaccine should never be transferred from one syringe to another. Partial doses from separate vials should not be combined into a single dose.

- **Managing acute vaccine reactions:** Severe reactions following vaccination are rare. Staff administering vaccines must be educated on signs and symptoms of vaccine reactions as well procedures should be in place in the event of a reaction. Standing orders including medications and equipment should be in the exam room in the event of a reaction staff are prepared to follow the protocol for stabilisation of the patient.

- **Documentation:** All vaccines administered should be documented in the patient's permanent medical record or immunisation registry if available.

Burden of disease associated with unsafe injection practices

"Injectable medicines are commonly used for the prevention, diagnosis, and treatment of various medical conditions. Unsafe injection practices put patients and healthcare providers at risk of infectious and non-infectious adverse events." (CDC 2012a). This harm is preventable. As defined by the World Health Organization, "a safe injection does not harm the recipient, does not expose the provider to any avoidable risks and does not result in waste that is dangerous for the community." (WHO n.d.a)

WHO estimates each year at least 16 billion injections are administered in developing and transitional countries. The vast majority, around 95%, are given in curative care. Immunisation accounts for around 3% of all injections (WHO 2006a). Worldwide, up to 40% of injections are given with syringes and needles reused without sterilisation and in some countries this proportion is as high as 70% (WHO 2006a).

According to the WHO Fact Sheet on Injection Safety (WHO 2006a), "The most recent study* indicates that each year unsafe injections cause an estimated 1.3 million early deaths, a loss of 26 million years of life, and an annual burden of USD 535 million in direct medical costs.

"Unsafe injection practices are a powerful engine to transmit blood-borne pathogens, including hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). Because infection with these viruses initially presents no symptoms, it is a silent epidemic. However, the consequences of this are increasingly recognized.

- **Hepatitis B virus**: HBV is highly infectious and causes the highest number of infections: in developing and transitional countries 21.7 million people become infected each year, representing 33% of new HBV infections worldwide
- **Hepatitis C virus**: Unsafe injections are the most common cause of HCV infection in developing and transitional countries, causing two million new infections each year and accounting for 42% of cases.
- **Human immunodeficiency virus**: Globally nearly 2% of all new HIV infections are caused by unsafe injections. In South Asia up to 9% of new cases may be caused in this way. Such proportions can no longer be ignored."

**The cost of unsafe injections by M.A. Miller & E. Pisani: Bulletin of the World Health Organization, Vol. 77, no 10, 808-811.*

Recognition of the risks associated with unsafe injections has led to improvements in infection-control practices, sufficient supplies and appropriate waste disposal strategies. In some countries, however, the introduction of disposable equipment without adequate education, supplies and waste management has caused a widespread re-use of injection equipment without sterilisation. Unauthorised repackaging of needles and syringes for re-sale is also common. While the purpose of all vaccination programmes is to prevent disease, re-use of needles and syringes is the cause of most immunisation-related infections and diseases. The use of auto-disable syringes during routine immunisation is an effective way of preventing injury, infection and the spread of disease.

Safe immunisation practices are those that do not result in injury or harm to the person being vaccinated, nor to the health care worker administering the vaccine, nor to the community. These best practices help create an effective and safe vaccination programme.

- *Auto-disable syringes*
  Unsafe injection practices cause and estimated 1.3 million premature deaths, associated predominantly with therapeutic injections. Use of Auto-Disable (AD) syringes can help to lower the risk of infection and disease. AD syringes are single use with a mechanism that disables or locks the plunger immediately after use. The locked plunger prohibits the syringe from being reused to administer additional vaccine.

- *Recognising counterfeits*
  Counterfeit medicines and vaccines are described as those without any or with decreased amounts of the active ingredient. Counterfeiting is a global threat to health and can result in serious harm. It is estimated by the Federal Service for Health Sphere Supervision (FSHSS) that 10% of the medicines on the market in Russia are counterfeits (WHO n.d.b). The United States of America also credits internet sales as being a major source of counterfeit medicines.

  The ability to recognise a counterfeit vaccine or medicine is very important. Noticing differences in packaging, recognising the manufacturer and increasing health care workers' and parents' and caregivers' awareness are just some of the ways in which counterfeits can be identified. Any suspected counterfeit medicine or vaccine should be reported immediately to the appropriate local health authority.

More information on counterfeit medicines, including the ICN IND Toolkit and the WHPA campaign, can be found on www.icn.ch/projects/Counterfeit-Medecines/

- *Cold chain management*
  Cold chain management is the process of transporting and storing vaccines and diluents within the manufacturer-recommended correct temperature range from the time of manufacture until administration to patient. This process includes equipment and procedures used to deliver vaccines to health clinics, and once there, storing them until administered. Vaccines exposed to temperatures outside the recommended ranges can have reduced potency and protection.

  Both heat and freezing can impair the active components of a vaccine, thereby reducing its effectiveness, and potentially rendering it ineffective. Vaccines damaged by out of range temperatures will have the same appearance as vaccines stored under proper temperature conditions. Consequently, recommendations for storage are listed on the vial label or packaging for each vaccine. Most vaccines are recommended to be stored between 2 to 8°C.

  Many vaccines now have Vaccine Vial Monitors (VVM) on their labels to indicate cumulative over-exposure to heat. The VVM is made of heat-sensitive material and is comprised of a circle with a square on the inside. The square changes irreversibly from light to dark when the vaccine has been over-exposed to heat. Once this inner square is as dark as the outer reference circle, the vaccine's efficacy is likely to have been reduced and it must be discarded without being used.

  The temperature of storage refrigerators and freezers should be checked and recorded twice daily. If out of range temperatures are noted, immediate action should be taken to correct the situation. If there is any break in the cold chain, the affected vaccines may need to be discarded, depending on the severity and length of improper temperature exposure and VVM status.

- *Waste management*
  Proper waste management is a concern for all nurses and health care workers. Improper disposal of medical waste can result in the spread of infectious material, the inappropriate reuse of needles and syringes and increased risk of needlestick injuries.

  According to WHO, 10-25% of the health care waste generated is considered to be infectious waste (WHO n.d.c). Needles should not be recapped and AD syringes and needles should be properly disposed of in safety boxes and/or according to country policy. Sorting sharps (needles, etc.), infectious waste and general waste into three separate bins or containers is an effective first step in reducing the risk to nurses, parents, caregivers and the environment.
  Some countries have health care waste management services that collect and properly destroy the waste at dedicated facilities while others lack this. National guidelines and policies guide local health facilities and authorities regarding appropriate waste management and disposal methods (see ICN monograph on *Health Care Waste Management*).

Immunisation schedules

High vaccination rates will result in reduction of vaccine preventable diseases. Each patient encounter should be used as an opportunity to review and update as necessary the patients' vaccination status (CDC 2011a).

With many vaccines available against a range of diseases, following the recommended immunisation schedule is an effective method of optimising protection. Many countries publish recommendations on vaccination schedules for infants, children and adults. These are compiled based on local epidemiological features, available vaccines and often on the recommendations of national technical advisory committees on immunisation. In addition, WHO collates schedules categorised by region, country and antigen, and also provides a useful online reference tool on its website: http://apps.who.int/immunization_monitoring/en/globalsummary/scheduleselect.cfm

WHO's recommendations on specific vaccines, including recommended schedules, are contained in vaccine position papers available online: www.who.int/immunization/documents/positionpapers/en/index.html

Nurses and other health care workers should refer to their national or local health authority for information on relevant schedules. Compliance with the specific recommended vaccination schedule is important. However, some flexibility must be allowed for the management of missed appointments and interruptions to a series of immunisations.

It is important that nurses and other health care workers also provide appropriate information and counselling during vaccination sessions. Parents and caregivers of infants and children being vaccinated, as well as adults being vaccinated, should be informed on several key points:

- The benefits of vaccinations
- Where and when to come for the next vaccination
- Potential side effects and how to deal with them
- The importance of keeping and referring to the vaccination card
- Which disease(s) can be prevented by the vaccination(s) being given.

Vaccination information should be promptly entered onto the vaccination card and into the appropriate recording system for tracking the child. The vaccination registries should also be updated during or immediately following the vaccination session.

References

Centers for Disease Control and Prevention (2011). General Recommendations on Immunization. Recommendations of the Advisory Committee on Immunization Practices (ACIP). Vol 60, No. 2, January 28, 2011. Available at: www.cdc.gov/mmwr/pdf/rr/rr6002.pdf. Accessed 11 January 2013.

Centers for Disease Control and Prevention (2012). Vaccine safety. Epidemiology and Prevention of Vaccine-Preventable Diseases, The Pink Book: Course Textbook – 12th Edition Second printing (May 2012). Available at: www.cdc.gov/vaccines/pubs/pinkbook/safety.html. Accessed 17 December 2012

Gallup (2012). Honesty/Ethics in Professions. Available at: www.gallup.com/poll/1654/honesty-ethics-professions.aspx. Accessed 17 December 2012.

International Council of Nurses (2009). Adverse Events Following Immunization (AEFI), ICN Nursing Matters Fact Sheet. Available at: www.icn.ch/images/stories/documents/publications/fact_sheets/19a_FS-Adverse_Events_Immunisation.pdf. Accessed 11 January 2013.

Pitman G (2012). *Nurses can help improve vaccination rates: study*. Reuter 25 November 2012. Available at: www.reuters.com/article/2012/11/26/us-flu-vaccinations-idUSBRE8AP00820121126. Accessed 17 December 2012.

World Health Organization (n.d.a). The SIGN Alliance. Injection Safety. Available at: www.who.int/injection_safety/sign/en/ . Accessed 11 January 2013.

World Health Organization (n.d.b). Counterfeit medicines. Medicines. Available at: www.who.int/medicines/services/counterfeit/impact/ImpactF_S/en/index1.html. Accessed 11 January 2013.

World Health Organization (n.d.c). Reducing HCW risks. HealthCare Waste Management. Available at: www.healthcarewaste.org/basics/risk-reduction/. Accessed 11 January 2013.

World Health Organization (2008a). WHO immunization work: 2006-07 highlights. Available at: www.who.int/immunization/newsroom/Highlights_06_07.pdf. Accessed 17 December 2012.

World Health Organization (2009a). Information for health-care workers - managing adverse events. Immunization safety. Available at: www.who.int/immunization_safety/aefi/managing_AEFIs/en/. Accessed 11 January 2013.

World Health Organization (2010). WHO best practices for injections and related procedures toolkit. Available at: http://whqlibdoc.who.int/publications/2010/9789241599252_eng.pdf. Accessed 11 January 2013.

Bibliography

Australian Government (2008). Department of Health and Ageing, The Australian Immunisation Handbook 9th Edition 2008. Available at: www.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook-home. Accessed 11 January 2013.

Bednarczyk R, Davis R, Ault K, Orenstein W & Omer SB (2012). "Sexual activity-related outcomes after human papillomavirus vaccination" *Pediatrics* 2012; DOI: 10.1542/peds.2012-1516. Available at: http://pediatrics.aappublications.org/content/early/2012/10/10/peds.2012-1516.abstract. Accessed 11 January 2013.

Centers for Disease Control and Prevention (2011). Shingles (Herpes Zoster). Available at: www.cdc.gov/shingles/about/overview.html. Accessed 11 January 2013.

Centers for Disease Control and Prevention (2012). Injection Safety. Available at: http://www.cdc.gov/injectionsafety/. Accessed 11 January 2012.

Dineley Johnson T (n.d.). *Online-only: Study urges health workers to fight vaccine fears with effective messages*. The Nation's Health. Available at: http://thenationshealth.aphapublications.org/content/40/7/E32.full. Accessed 17 December 2012).

GAVI Alliance (n.d.). About the Alliance. Available at: www.gavialliance.org/about/ Accesssed 11 January 2013.

International Council of Nurses (2009). Immunisation Safety: An Essential Nursing Function. ICN Nursing Matters Fact Sheet. Available at: www.icn.ch/images/stories/documents/publications/fact_sheets/19e_FS-Immunisation_Safety_Essential_Nsg_Function.pdf. Accessed 17 December 2012.

International Council of Nurses (2009). Influenza (the "flu", or the "grippe"), ICN Nursing Matters Fact Sheet. Available at: , www.icn.ch/images/stories/documents/publications/fact_sheets/4f_FS-Influenza.pdf. Accessed 11 January 2013.

International Council of Nurses (2009). First Do No Harm: Auto-Disable Syringes for Immunization Safety. ICN Nursing Matters Fact Sheet. Available at: www.icn.ch/images/stories/documents/publications/fact_sheets/19d_FS-Auto_Disable_Syringes.pdf. Accessed 11 January 2013.

International Council of Nurses (2009). Immunisation Safety: Safe Waste Disposal Practices Save Lives. ICN Nursing Matters Fact Sheet. Available at: www.icn.ch/images/stories/documents/publications/fact_sheets/19f_FS-Immunisation_Safety_Waste_Disposal.pdf. Accessed 11 January 2013.

International Federation of Pharmaceutical Manufacturers and Associations (2009), Counterfeit Drugs, a Global Health Risk, Issue Brief. Available at: www.ifpma.org/fileadmin/content/Global%20Health/Counterfeits/IFPMA_Issue_Brief_Counterfeiting_9_October_2009.pdf. Accessed 11 January 2013.

Immunization Action Coalition (n.d.). www.immunize.org.

One and Only campaign: www.oneandonlycampaign.org/

PATH Malaria Vaccine Initiative (MVI) (n.d.). Malaria vaccines. Available at: , www.malariavaccine.org/malvac-overview.php. Accessed 11 January 2013.

PATH (n.d.). Vaccine vial monitor: World's smartest sticker. Available at: www.path.org/projects/vaccine_vial_monitor.php. Accessed 11 January 2013.
PATH (2013). Vaccine Resource Library. Available at: www.path.org/vaccineresources. Accessed 11 January 2013.

Public Health Agency of Canada (2004). Report of a Vaccine-Associated Adverse Event, Available at: www.phac-aspc.gc.ca/im/pdf/hc4229e.pdf. Accessed 11 January 2013.

Roll Back Malaria (n.d.). What is Malaria? Available at: www.rbm.who.int/cmc_upload/0/000/015/372/RBMInfosheet_1.htm. Accessed 11 January 2013.

USAID (2009). Immunization Programs for Healthy Children. *Available at:* www.immunizationbasics.jsi.com/. Accessed 11 January 2013.

Watt JP, Wolfson LJ, O'Brien KL, Deloria-Knoll M, McCall N, Lee E, Levine OS, Hajjek R, Mulholland K, Cherian T, for the Hib and Pneumococcal Golbal Burden of Disease Study Team (2009). "Burden of disease caused by *Haemophilus influenzae* type b in children younger than 5 years: global estimates". *The Lancet*, vol 374, September 12 2009. Available at www.who.int/nuvi/hib/GBD_Hib.pdf. Accessed 11 January 2013.

World Health Organization (n.d.). Estimated rotavirus deaths for children under 5 years of age: 2008, 453 000. Immunization surveillance, assessment and monitoring. Available at: www.who.int/immunization_monitoring/burden/rotavirus_estimates/en/index.html. Accessed 11 January 2013.

World Health Organization (n.d.). Estimates of disease burden and cost-effectiveness Immunization surveillance, assessment and monitoring. Available at: www.who.int/immunization_monitoring/burden/estimates_burden/en/index.html. Accessed 11 January 2013.

World Health Organization (n.d.). Guidance for healthcare waste management in LICs. HealthCare Waste Management. Available at: ,www.healthcarewaste.org/. Accessed 11 January 2013.

World Health Organization (n.d.). The 8 steps along the waste stream. HealthCare Waste Management. Available at:, www.healthcarewaste.org/basics/waste-steps/. Accessed 11 January 2013.

World Health Organization (n.d.). Information for health-care workers - managing adverse events. Global vaccine safety. Available at: www.who.int/vaccine_safety/initiative/detection/managing_AEFIs/en/index1.html. Accessed 11 January 2013.

World Health Organization (n.d.). WHO-UNAIDS HIV Vaccine Initiative. Initiative for Vaccine Research (IVR). Available at: www.who.int/vaccine_research/diseases/hiv/en/. Accessed 11 January 2013.

World Health Organization (n.d.). Japanese encephalitis. Initiative for Vaccine Research (IVR). Available at: www.who.int/vaccine_research/diseases/vector/en/index1.html. Accessed 11 January 2013.

World Health Organization (2003). Varicella vaccine. Immunization, Vaccines and Biologicals, Available at: http://archives.who.int/vaccines/en/varicella.shtml#position. Accessed 11 January 2013.

World Health Organization (2003). Yellow Fever vaccine. Immunization, Vaccines and Biologicals. Available at: www.who.int/vaccines/en/yellowfever.shtml. Accessed 11 January 2013.

World Health Organization (2006a). Injection Safety. Fact Sheet No. 231. Media Centre. Available at: www.who.int/mediacentre/factsheets/fs231/en/. Accessed 11 January 2013.

World Health Organization (2006). Weekly Epidemiological Record. 25 August 2006, No. 34/35, 2006, 81 325-340. Available at: www.who.int/immunization/wer8134/japanese%20encephalitis_Aug06_position%20paper.pdf. Accessed 17 December 2012.

World Health Organization (2007). Weekly epidemiological record, 23 March 2007, 82nd Year, No. 12, 2007, 82, 93–104. Available at: www.who.int/immunization/wer8212pneumococcus_child_Mar07_position_paper.pdf. Accessed 11 January 2013.

World Health Organization (2007). WHO: working to ensure global quality, safety and standards in immunization. Available at: www.who.int/immunization/newsroom/QSS_BR.pdf. Accessed 11 January 2013.

World Health Organization (2008). Influenza. Immunization, Vaccines and Biologicals. Available at: , www.who.int/immunization/topics/influenza/en/index.html. Accessed 11 January 2013.

World Health Organization (2008). Mumps - The Disease. Immunization, Vaccines and Biologicals. Available at: www.who.int/immunization/topics/mumps/en/index1.html. Accessed 11 January 2013.

World Health Organization (2008). Rubella - the Disease. Immunization, Vaccines and Biologicals. Available at: www.who.int/immunization/topics/rubella/en/index1.html. Accessed 11 January 2013.

World Health Organization (2009). Acute respiratory infections: Streptococcus pneumoniae. Initiative for Vaccine Research (IVR). Available at: , www.who.int/vaccine_research/diseases/ari/en/index3.html. Accessed 11 January 2013.

World Health Organization (2009). Hib - The Disease. Immunization, Vaccines and Biologicals. Available at: www.who.int/immunization/topics/hib/en/index1.html. Accessed 11 January 2013.

World Health Organization (2010). New and Under-utilized Vaccines Implementation (NUVI). Available at: www.who.int/nuvi/en/index.html. Accessed 17 December 2012.

World Health Organization (2011). Estimated global incidence of Japanese encephalitis; a systematic review. Campbell GL, Hills SL, Fischer M, Jacobsen JA, Hoke CH, Hornbach JM, Martin AA, Solomon Tm Tasi TF, Tsu VD and Ginsburg AS. Bulletin of the World health organization, October 2011. Available at: www.who.int/bulletin/volumes/89/10/10-085233/en/index.html. Accessed 17 December 2012.

World Health Organization (2011). Human papillomavirus. New and Under-utilized Vaccines Implementation (NUVI). Available at: www.who.int/nuvi/hpv/en/**.** Accessed 17 December 2012.

World Health Organization (2012). "WHO recommends seasonal influenza vaccination to pregnant women as the highest priority" Immunization, Vaccines and Biologicals. Available at: www.who.int/immunization/en/. Accessed 11 January 2013.

World Health Organization (2012). Rabies. Fact Sheet N°99, Media Centre. Available at: www.who.int/mediacentre/factsheets/fs099/en/index.html. Accessed 11 January 2013.

World Health Organization (2012). Dengue and severe dengue. Fact Sheet N°117, Media Centre. Available at: www.who.int/mediacentre/factsheets/fs117/en/**.** Accessed 11 January 2013.

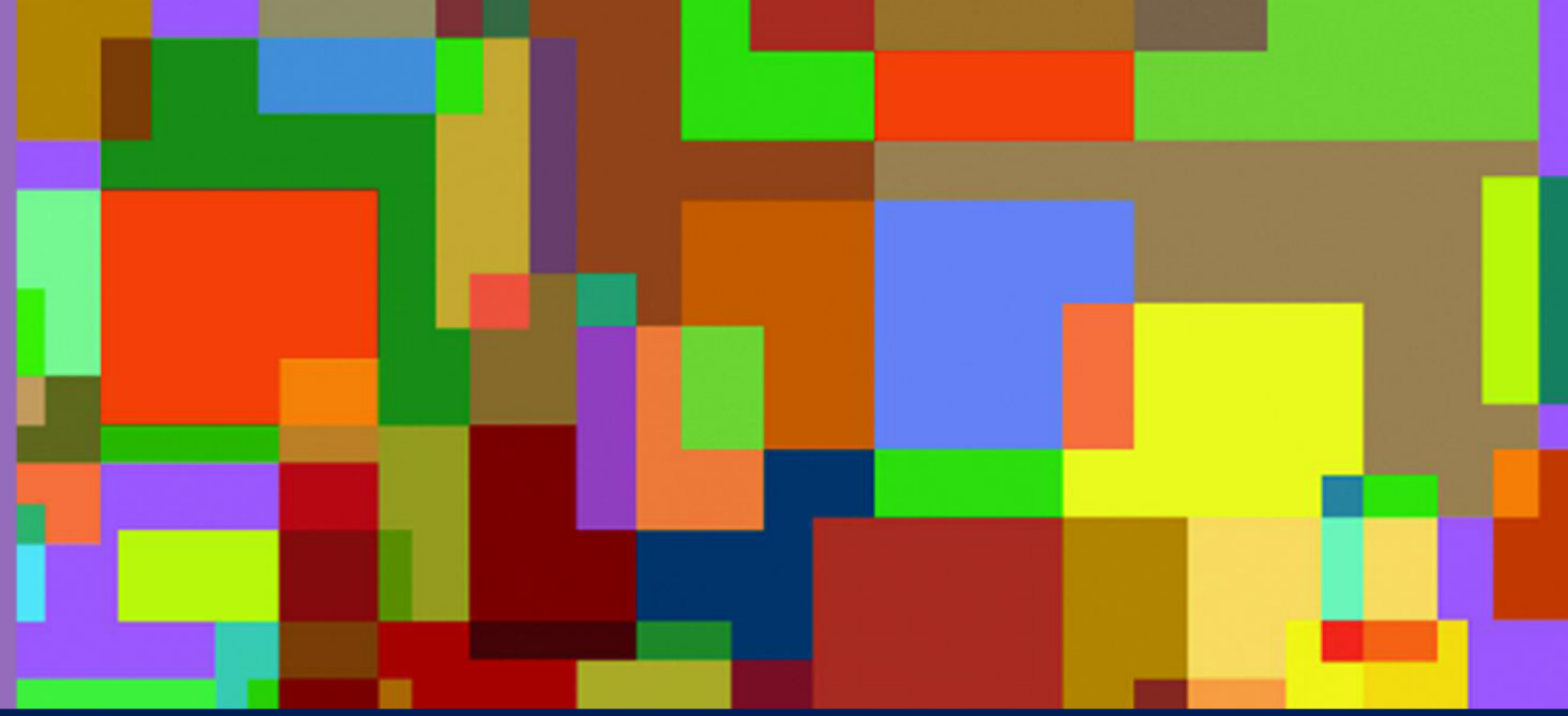
World Health Organization (2012). Hepatitis B. Fact Sheet N°204 Media Centre. Available at: www.who.int/mediacentre/factsheets/fs204/en/. Accessed 11 January 2013.

World Health Organization (2012). Medicines: spurious/falsely-labelled/ falsified/counterfeit (SFFC) medicines. Fact sheet N°275. Media Centre. Available at: www.who.int/mediacentre/factsheets/fs275/en/. Accessed 11 January 2013.

World Health Organization (2012). Malaria. Initiative for Vaccine Research (IVR). Available at: www.who.int/vaccine_research/Malaria/en/. Accessed 11 January 2013.

World Health Organization (2012). Cholera. Fact sheet N°107. Media Centre. Available at: www.who.int/mediacentre/factsheets/fs107/en/. Accessed 11 January 2013.

World Health Organization (2013). Potential use of oral cholera vaccines. Available at: , www.who.int/topics/cholera/vaccines/use/en/index.html. Accessed 11 January 2013.



International Council of Nurses

3, place Jean-Marteau, 1201 Geneva, Switzerland

Tel: + 41 22 908 0100 Fax: + 41 22 908 0101 Email: icn@icn.ch

www.icn.ch