**Introduction**

Healthcare workers are at an increased risk of contracting certain diseases because of the nature of their occupations. Daily contact with the weakest and most susceptible members of a community predisposes them to being an important potential vector in the transmission of diseases. In this article, recommended vaccines for healthcare workers will be discussed in general, as well those for selected healthcare workers.

**Recommended vaccines for all healthcare workers**

*Hepatitis B*

The hepatitis B virus (HBV) is transmitted by parenteral or mucosal exposure to body fluids from a person with acute or chronic HBV infection. The highest concentrations of the virus are found in blood. Lower titres are present in saliva and semen. There appears to be no transmission of HBV via tears, sweat, urine, faces or droplet nuclei.

It is thought that between 6-30% of individuals who have had a percutaneous injury with a sharp instrument that is contaminated with HBV will become infected with the virus. Transmission rates are lower after mucosal contact or contact through broken skin. Transmission has been reported after ocular exposure. HBV infection has occurred in healthcare workers who have no memory of a percutaneous exposure. In these instances, it was thought that the transmission may have occurred through small breaks in the skin, or inapparent exposure of the mucous membrane.

Therefore, it is recommended that unvaccinated healthcare workers who perform tasks that involve exposure to blood or body fluids should receive a series of hepatitis B vaccines.

In healthy adults, 1 ml is given intramuscularly into the deltoid muscle at the following intervals:
- Heberbiovac-HB* and Euvax B*: 0, 1 and 2 months
- Engerix B*: 0, 1 and 6 months or 0, 1 and 2 months with a fourth dose at 12 months.

More than 90% of healthy adults develop protective antibodies after a series of hepatitis B vaccines. Concentrations of hepatitis B surface antibody (anti-HBs) of at least 10 mIU/ml will protect against acute and chronic infection. Unfortunately, a small percentage of individuals do not respond to a series of hepatitis B vaccines. Therefore, healthcare workers should have their anti-HBs levels checked 1-2 months after completion of the hepatitis B vaccine series to ensure that they are protected. Anti-HBs levels decline over time. Approximately 60% of initial responders will have undetectable levels more than 12 years after vaccination. However, the immune memory remains and the individual is still protected against clinical disease. Booster hepatitis B doses are not routinely recommended.

It is suggested that people who do not respond should receive a second series of hepatitis B vaccines. Anti-HBs levels should then be rechecked 1-2 months after completion of the second hepatitis B vaccine series. Fewer than 5% of individuals do not respond to six doses of hepatitis B vaccines. Individuals who still do not obtain protective anti-HBs levels may already be infected with HBV, or are considered to be primary non-responders. Primary non-responders should be aware of their susceptibility to infection and should they be exposed in the future, will need to receive hepatitis B immunoglobulin.

*Influenza*

The influenza virus is spread from person to person by infected droplets that are generated when the infected person coughs or sneezes. Transmission may also occur through direct or indirect contact with infected respiratory secretions, such as by contaminated hands or fomites.

Adults can transmit influenza from the day before, to approximately five days after, the onset of symptoms, whereas children can transmit influenza for 10 or more days.

Healthcare workers are at risk of occupational exposure to influenza. A healthcare worker with influenza is able to transmit the virus to patients. Of particular concern are...
those patients who are at high risk of severe complications of influenza, such as babies who are less than six months of age, pregnant women and immunocompromised patients. Healthcare workers who are absent from work because of influenza place extra strain on colleagues during the flu season when there is a greater demand for medical treatment.

Therefore, an annual flu vaccine is recommended for healthcare workers who want to protect themselves against influenza. Vaccination is particularly recommended for healthcare workers who are in direct contact with patients.

**Pertussis**

Pertussis is a highly contagious bacterial infection. Secondary attack rates comprise more than 80% in a susceptible household contact. Pertussis is transmitted through contact with infected respiratory secretions and large aerosolised droplets. Individuals with pertussis are most infectious during the catarrhal stage which is characterised by a runny nose, sneezing, low-grade fever, mild occasional coughing, and during the first two weeks after the onset of the cough (approximately 21 days).

Pertussis immunity from childhood vaccination wanes within 5-10 years after the last dose. Usually, pertussis in adulthood is milder than that in infancy or childhood. However, the major concern is that adults can transmit disease to infants before they are old enough to be vaccinated against pertussis. Young infants are at greatest risk of severe pertussis, which may result in hospitalisation and death.

It is recommended that healthcare workers receive a single dose of the adult acellular pertussis-containing vaccine in order to protect them and prevent a spread to susceptible patients. The adult acellular pertussis vaccine is available in combination vaccines: Adacel Quadra® and Boostrix Tetra®. An added benefit of these two vaccines is that they also provide booster doses against diphtheria, tetanus and polio. Polio can be spread to healthcare workers who are in close contact with patients excreting wild-type polio.

**Measles, mumps and rubella**

Measles, mumps and rubella (MMR) are all spread by contaminated aerosolised droplets. Healthcare workers are estimated to be 19 times more likely to contract measles than other adults. They are also considered to be at an increased risk of exposure to mumps and rubella. Complications of mumps in adulthood include symptomatic meningitis, testicular inflammation and oophoritis. Adult women who contract rubella are at increased risk of arthralgias, arthritis and encephalitis. However, the greatest concern regarding rubella is transmission to a pregnant woman and the development of congenital rubella syndrome in the infant.

All healthcare workers should be immune to MMR.

An individual is considered to be immune if he or she has:
- A history of a laboratory-confirmed disease.
- Serological evidence of immunity.
- Documentation of vaccination consisting of two doses of MMR vaccine over the age of 12 months, with a minimum interval of four weeks between doses. One dose of a rubella-containing vaccine is considered to be sufficient to infer rubella immunity.

Two doses of the MMR vaccine are recommended, four weeks apart, for individuals who are not immune.

**Varicella**

Varicella is a highly infectious viral disease. Secondary attack rates approach 90% in susceptible contacts. The varicella-zoster virus is transmitted from person to person by direct contact, aerosolised infected respiratory tract droplets and aerosolised vesicular fluid from skin lesions. Varicella is usually mild and self-limiting in healthy children. However, the risk of complications increases with age. In the USA, adults account for only 5% of reported cases of varicella, but approximately 35% of mortality is caused by varicella.

In a healthcare setting, all susceptible patients are at risk of severe varicella disease and complications, especially pregnant women, premature infants and immunocompromised patients. Therefore, healthcare workers should be immune to varicella.

An individual can be considered to be immune if he or she has had:
- A previous diagnosis of disease by a healthcare provider.
- Serological evidence of immunity.
- Documentation of vaccination with two doses of varicella vaccine, over the age of 12 months, at least four weeks apart.

Two doses of the varicella vaccine are recommended six weeks apart for people who are not immune.

**Recommended vaccines for selected healthcare workers**

**Hepatitis A**

Healthcare workers do not appear to have an increased risk of contracting hepatitis A because of occupational exposure. Therefore, routine immunisation against hepatitis A is not required. The exception is individuals who work with hepatitis A-infected primates or with hepatitis A virus in a laboratory setting. Prevention of hepatitis A in the healthcare setting is achieved primarily by strict infection control. However, outbreaks have been observed
in neonatal intensive care units and in association with adult faecal incontinence. Vaccination could be considered for healthcare workers in institutions where standards of personal hygiene may be expected to be poor, such as care facilities for the mentally handicapped. Vaccination consists of two doses, given 6-12 months apart.

**Meningococcal disease**

Nosocomial transmission of *Neisseria meningitidis* is rare. Vaccination is recommended for laboratory personnel who are routinely exposed to isolates of *N. meningitides*. Routine immunisation of healthcare workers is not required. Generally, measures to avoid contracting meningococcal meningitis consist of reducing exposure to respiratory droplets. If extensive contact with the oropharyngeal secretions of an infected patient occurs, antibiotic post-exposure prophylaxis should be given. Vaccination for healthcare workers may be considered in the event of an outbreak of meningococcal meningitis serotype A, C, W135 or Y.

**Rabies**

People with an increased occupational risk of exposure to rabies infection include veterinary staff, wildlife handlers, laboratory personnel working with the rabies virus and animal welfare staff. These groups should receive pre-exposure prophylaxis of three doses of the rabies vaccine, given on days 0, 7 and 28.

There are no known cases of rabies transmission from a patient to a healthcare worker. However, there is a potential risk of exposure when treating a patient with rabies as the rabies virus may be present in the patient’s saliva, nerve tissue or cerebrospinal fluid. Standard precautions and infection control practices should be upheld. Healthcare workers should wear gowns, goggles, masks and gloves, particularly during intubation and suctioning.

Rabies post-exposure prophylaxis is only recommended for healthcare workers who have been bitten by a patient with rabies or if the healthcare worker’s mucous membranes or nonintact skin was directly exposed to the patient’s saliva, nerve tissue or cerebrospinal fluid.

**Other**

Laboratory staff handling other infectious material may need additional vaccination against vaccine preventable diseases, such as typhoid.

**Conclusion**

It is important for healthcare workers to be vaccinated against hepatitis B, influenza, pertussis, MMR and varicella if they are not already immune. Healthcare workers are at an increased risk of contracting and spreading these diseases. Before vaccination, the healthcare worker should be screened for any potential contraindications to vaccination. Vaccines against hepatitis A, meningococcal meningitis and rabies are only recommended for a select group of healthcare workers or in specific situations. These vaccines may be indicated if other risk factors place the healthcare worker at increased risk of contracting the disease.