+HOW TO TREAT

# Adult vaccination

**Adult vaccination receives less attention than the childhood vaccination schedule, and its importance may be overlooked at times. The purpose of this article is to summarise the vaccines recommended for use in adults. It is structured to answer the question "What vaccines should I consider for this patient in front of me?"**


## There is no comprehensive adult vaccination schedule

Adult vaccination is the poor cousin of childhood vaccination. Over the last 30 years, considerable efforts have gone into refining the childhood vaccination schedule, resulting in:

- a reduction in the number of visits in the 1990s
- the greater use of combination vaccines since 2000
- the introduction of new antigens
- the introduction of pneumococcal conjugate vaccine, human papillomavirus (HPV) vaccine and rotavirus vaccine.

Also, considerable improvements in coverage have been made with the help of the National Immunisation Register, a legacy of the meningococcal group B vaccination programme (MeNZB).

There is no comprehensive adult vaccination schedule. The only vaccination visits being recommended are the visits at age 45 and 65 years for tetanus-diphtheria (Td) vaccine and the annual influenza vaccine from age 65 years (also for those with specific medical indications). No effort is made to measure adult immunisation coverage except for an approximation

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of the uptake of the annual influenza vaccine.

Vaccination of adults – particularly as patients age and immune senescence intervenes – is less effective in disease prevention than is the case with childhood vaccination. Nevertheless, adult vaccination remains of considerable potential benefit, as it provides a reduction in disease incidence and an amelioration of disease severity. Adults suffer from significant morbidity and mortality from vaccine-preventable diseases (VPDs).

### Vaccine-preventable diseases in adults

HPV-related diseases result in death from various cancers: cervical, anal and oropharyngeal. For example, in 2010, there were 180 reported cases of cervical cancer and 52 deaths.[1]

On average, up to two cases of tetanus occur each year, predominately in adults. Of the 21 cases between 2001 and 2012, 17 were in adults, the vast majority of whom were either unvaccinated or had unknown vaccination status.[1]

Pertussis remains a significant problem in adults with almost half of the reported cases occurring in adults aged more than 30 years.[1] The importance of pertussis in adults, however, is in the potential transmission of the infection to infants too young to be vaccinated.

Influenza causes deaths in adults; attempts in recent years to improve the coverage of influenza vaccine in those aged over 65 years have likely reduced influenza-related deaths. Nevertheless, more than half of the reported influenza deaths between 2000 and 2011 occurred in those aged 65 years and older.[1] The 126 reported deaths probably significantly underestimates the true number caused by influenza – see later, "Adults aged 65 and older".

Shingles causes significant morbidity in older age groups in New Zealand, and a recent publication indicates that the incidence in New Zealand is similar to that reported internationally.[2] The lifetime risk of shingles is one in three, and half of those who live to age 85 years will be affected.

Perhaps the largest burden of VPDs in the elderly is that due to pneumococcal disease, although the burden has been reduced in recent years by the implementation of universal childhood pneumococcal vaccination resulting in reduced exposure of the elderly to the pneumococcal types included in the vaccine. Nevertheless, the rate of invasive pneumococcal disease (IPD) remains highest in those aged 65 years and older: a reported rate of 30.8 cases per 100,000 population.[1]

The purpose of this article is to summarise the vaccines recommended for use in adults. It is structured to answer the question "What vaccines should I consider for this patient in front of me?"

The article discusses healthy adults aged 18 to 20 years, 20 to 65 years and 65 years and older; pregnant patients; individuals at risk because of occupation; and those who are travelling. Outside the scope of this article are those with impaired immunity; this group, in any case, is well covered in the *Immunisation Handbook 2014*. And while travel vaccines are covered here, remember vaccination is only part (at times a very small part) of the travel-related consultation.

Panel 1 provides a summary list of the vaccines that may be recommended to those in the various age groups, in pregnancy, at occupational risk and prior to travel.

**Adults suffer from significant morbidity and mortality from vaccine-preventable diseases (VPDs)**

## CASE VIGNETTE 1

**Varicella vaccination in an adult who has been exposed?**

A 42-year-old father asks to have the chickenpox vaccine because he has no history of chickenpox and his daughter has just been diagnosed with it. He is advised he is probably immune, as 70 to 90 per cent of adults with no history are immune, and he should have a blood test to check for susceptibility.

However, he does not have the blood test and suffers a quite severe chickenpox illness, probably ameliorated by his taking aciclovir 800mg five times daily.

Two doses of varicella vaccine are required for this age group. I would suggest the optimum approach, where household exposure has occurred, is to vaccinate and draw blood for testing simultaneously, and if varicella IgG is positive, omit the second dose.

## Panel 1 Routine adult vaccinations; and funding

**School leaver to age 20 years**
- Catch-up of childhood immunisations: MMR, hepatitis B, tetanus (Td); **funded**
- HPV; **funded for females to age 20**
- Meningococcal, varicella

**Adults aged 20 to 65 years**
- Tdap, influenza, HPV, hepatitis A, shingles, varicella; **influenza vaccine funded for those at high risk**

**Adults aged 65 years and older**
- Pneumococcal, Tdap, influenza, shingles; **influenza vaccine funded**

**Pregnancy**
- Tdap, influenza; **funded**

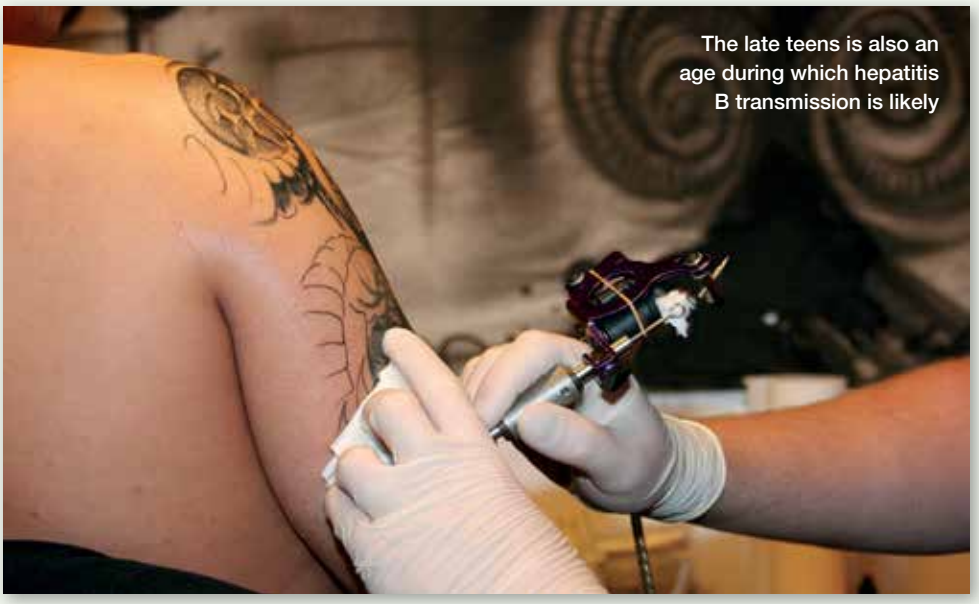
**Occupational risk**
- MMR, hepatitis B, varicella, Tdap, influenza, hepatitis A, meningococcal, polio, BCG; **employer funded**

**Travellers**
- Catch-up of childhood immunisations plus diphtheria-tetanus ADT booster, hepatitis A, hepatitis B, typhoid, yellow fever, rabies, Japanese encephalitis, meningococcal ACYW135, polio; **not funded**

# School leaver to age 20 years: Time to catch up on missed vaccines

## Currently funded

**Catch-up childhood vaccines are funded, and the HPV vaccine is funded for females up to age 20 years**



The late teens is also an age during which hepatitis B transmission is likely

The first concern with the school leaver to 20 years age group is to ensure all childhood vaccines have been received, and to offer any catch-up doses that may be required.

Two doses of measles-mumps-rubella (MMR) vaccine should have been administered, and if not documented, a catch-up dose should be offered. This is particularly important for women, who should be immune to rubella prior to pregnancy. If not immune, women should receive two doses of rubella-containing vaccine as an adult, after which no further dose is required.[3]

Check also that the age-11-year dose of tetanus-diphtheria-acellular pertussis (Tdap) vaccine has been administered, and offer a catch-up dose if necessary.

The late teens is also an age during which hepatitis B transmission is likely, so ensure three doses of hepatitis B vaccine were administered in infancy. If needed, refer to the catch-up schedules in the *Immunisation Handbook 2014*.

The vaccine for HPV is important for women as it provides such a high level of protection against infection with high-risk HPV types and the consequences of those infections. The duration of immunity is not known and is limited simply by the length of time the vaccine has been available. Current data indicate clinical protection is stable for at least eight years and likely much longer.[4]

The HPV vaccine generates immune memory and robust anamnestic responses have been demonstrated – also to eight years – suggesting stable, long-term protection is likely.[5,6]

Males should consider having the HPV vaccine as well, given the protection it provides against genital warts and the cancers associated with HPV: anal, oropharyngeal, penile. It is important to remember the risk of all of these conditions is much greater in men who have sex with men (MSM); any men so identified should be offered vaccination.

In my view, it is simply a matter of time (and the sooner the better) until universal adolescent HPV vaccination is funded, quite likely using two rather than three doses.

Meningococcal vaccination should also be considered for this age group. In New Zealand, the main groups causing disease in this age group are meningococcal groups B and C.

At present, no group B vaccine is available in New Zealand, but there are two conjugate group C vaccines available. I would recommend group C vaccine for individuals leaving home and moving to communal accommodation. Two quadrivalent (ACYW135) conjugate meningococcal vaccines are also available and could be offered to provide broader protection (see later for travel considerations).

A group B vaccine (Bexsero) is licensed in Australia and may become available here. It contains four antigens: three proteins derived from a genetic analysis of meningococci and the outer membrane protein that was the key antigen in MeNZB. For those aged more than 11 years, two doses one month apart are recommended. During the period 2008 until 2012, group B caused approximately 50 per cent of meningococcal disease in the 15 to 19-year age group and approximately 70 per cent in those aged 20 years and older. When it becomes available, I would be likely to recommend the group B vaccine in addition to group C conjugate vaccine for those moving to communal accommodation.

**Males should consider having the HPV vaccine as well**

Varicella vaccine could also be considered for this age group if there is no prior history of chickenpox. As two doses are required, it is not funded and many adults (70 to 90 per cent) with no history of chickenpox are immune, a blood test for immunity prior to vaccination is recommended.[7]

Vaccination with varicella vaccine post exposure has been found to be effective in preventing or ameliorating illness, if the vaccine is given within three and possibly five days of exposure.[8]

# Healthy adults aged 20 to 65 years can be too easily forgotten

## Currently funded

**Tetanus-diphtheria (Td) vaccine but not its administration is funded, and certain high-risk patient groups are funded for some vaccines – see the *Immunisation Handbook 2014***

Varicella vaccine should be considered for those with no history of chickenpox

For healthy 20 to 65-year-old people, consider also the vaccines for catch-up listed in the section for the school leaver to 20 years age group.

Adults should be offered Tdap vaccine to reduce the risk of exposure of infants to pertussis. This applies to parents, older siblings, grandparents and other adults who may expose infants too young to be vaccinated to pertussis. Special considerations regarding vaccination against pertussis apply in pregnant women – see later, "Pregnancy and occupational risk".

Tdap instead of Td vaccine should be offered following injury or prior to travel if the above consideration applies. No minimum time interval following a dose of Td is required if the administration of Tdap is to prevent the potential exposure of infants to pertussis.

While 10-yearly administration of a tetanus toxoid-containing vaccine simplifies tetanus-related wound management, it is not routinely recommended. Instead, a number of years ago, a pragmatic decision was made to recommend two ages at which tetanus immunisation status should be reviewed and updated: ages 45 and 65 years.

When conducting this immunisation review, remember to consider whether a booster – or a course if there is no prior vaccine history – is required, and whether at least one dose of Tdap vaccine should be offered rather than Td.

**HPV vaccine ...should be offered to women who have had abnormal smears**

Influenza vaccination should be offered to high-risk adults; see the *Immunisation Handbook 2014* for a list of those for whom it is funded. Adults may be offered influenza vaccine as a result of their employment (eg, in healthcare or education), particularly if involved in the care of young children – see later, "Pregnancy and occupational risk". I would not, however, hesitate to offer influenza vaccine to any adult who requests it.

HPV vaccine is licensed for women up to the age of 45 years, and men to age 26 years. Given the high level of protection it offers against HPV-related disease, it should be offered to women who have had abnormal smears and MSM, the recommendation being stronger for younger individuals.

Note, the HPV vaccine is a prophylactic and not a therapeutic vaccine (ie, it does not protect against HPV types with which the individual is already infected).

Hepatitis A vaccine should be offered to adults (and children) who have been in contact with an individual who is infected with hepatitis A (this use is funded). It should be offered to those who are infected with hepatitis B or C and those with chronic liver disease. It is also an important, frequently recommended travel vaccine, and is recommended for those in certain occupations – see later, "Pregnancy and occupational risk".

Varicella vaccine should be considered for those with no history of chickenpox, but the same considerations regarding testing apply to this age group as for those aged 18 to 20 years.

Shingles vaccine (Zostavax) is licenced for use in people aged from 50 years. It offers 70 per cent protection against shingles when administered between the ages of 50 and 60 years. This drops to 60 per cent for those aged between 60 and 70 years and 40 per cent between 70 and 80 years. Above 80 years of age, the protection against shingles is only 18 per cent, but the protection against severe illness remains.[9,10] For example, the efficacy of the vaccine in maintaining activities of daily living remains at approximately 60 per cent, comparable with other age groups.[11]

It appears that the duration of protection of a single dose of shingles vaccine is around seven to 10 years, and the response to a subsequent dose is neither impaired nor enhanced by the receipt of a prior dose.[12]

# At 65 years and older, infectious illness can take a greater toll

Grandparents can be a source of pertussis infection for their grandchildren

## Currently funded

**Influenza vaccine is funded, and so is Td vaccine but not its administration**

For the considerations around tetanus-containing vaccines, see the previous section. And, remember, grandparents can be a source of pertussis infection for their grandchildren.

Annual influenza vaccine is recommended for all people aged 65 years and older. To quote the *Immunisation Handbook 2014*: "A 1995 meta-analysis of 20 cohort studies in older people estimated that influenza vaccine prevented 56 per cent of upper respiratory illnesses, 53 per cent of pneumonias, 50 per cent of all hospitalisations and 68 per cent of deaths."[13] On the basis of this evidence, influenza vaccine is strongly recommended.

Pneumococcal vaccination for those aged 65 years and older is recommended but not funded. What is advised is one dose of the pneumococcal conjugate vaccine PCV 13 (Prevenar 13) followed a minimum of eight weeks later by the pneumococcal polysaccharide vaccine PPV 23 (Pneumovax 23).[1] However, there is controversy about the effectiveness of the polysaccharide vaccine in preventing IPD.

Data exist to support the use of PCV 13 in adults aged 65 years and older. In a study conducted in the Netherlands on approximately 85,000 adults, the efficacy of PCV 13 against vaccine-type IPD was 75 per cent (95 per cent CI: 41.4 – 90.8 per cent) and against vaccine-type pneumococcal pneumonia was 45 per cent (95 per cent CI: 21.8 – 62.5 per cent).[14]

The main argument against this recommendation is the cost of the two vaccines. For the individual, the cost including administration of the two vaccines is likely to be around $400 and, given the modest benefit, is difficult to justify. Nevertheless, those who can afford it may choose to receive the modest benefit.

Another expensive vaccine is that against shingles – described earlier, "Healthy adults aged 20 to 65 years". The argument for the use of shingles vaccine gets stronger with increasing patient age. Shingles severity and associated morbidity increases with age and, although the vaccine is less effective at preventing shingles as age increases, it remains effective at reducing its severity. (See "How to treat: Shingles", *New Zealand Doctor*, 30 July 2014 for more details.)[15]

**Annual influenza vaccine is recommended for all people aged 65 years and older**

## CASE VIGNETTE 2

**How long to delay giving Zostavax after shingles?**

A female patient aged 68 years, who six months ago had an attack of ophthalmic shingles, wants to avoid another attack and requests the shingles vaccine. When should it be given?

There is no clear answer to this question. Second attacks of shingles can occur, though recurrences are probably less likely in the first year or two after an attack. Reasonable advice might be to vaccinate one to three years after an attack of shingles; this may be too early, however. The duration of protection following vaccination appears to be between seven and 10 years. The response to a second vaccine dose 10 years after a first dose is the same as the response seen in individuals of the same age receiving their first dose. So I would advise that this patient receives her second dose in her late seventies.

# Pregnancy and occupational risk

## CASE VIGNETTE 3

**Tdap vaccine in every pregnancy?**

A colleague asks if a patient who is currently 26 weeks' gestation should receive Tdap vaccine in this pregnancy. She received Tdap two and four years ago.

The answer is yes, she should receive it. Tdap vaccine is recommended in every pregnancy because when given between 28 and 38 weeks the baby receives some passive antibody, which may provide protection until pertussis vaccine is administered to the infant.

## CASE VIGNETTE 4

**Two doses of hepatitis A vaccine one week apart**

A 25-year-old man inadvertently receives a second dose of hepatitis A vaccine one week after the first. What should be done?

The patient should be fully informed, and the second dose should be ignored. An alternative approach might be to test his hepatitis A IgG at six months and if positive give no further doses, but repeat his hepatitis A IgG after a further three to five years.

### Currently funded

**In pregnancy, Tdap and influenza vaccines are funded**

### Currently funded

**Funded occupational vaccines are only those funded by the employer**

It is important that two vaccines are administered in pregnancy: influenza and Tdap.

Influenza is a more severe illness in pregnancy, and women who are pregnant during the influenza season should be offered vaccine from when the vaccine becomes available and the second trimester has commenced. If influenza is circulating, offer the vaccine to women in their first trimester, as recommended in the *Immunisation Handbook 2014*.

Tdap vaccine should be administered between 28 and 38 weeks' gestation in every pregnancy, for two reasons. First, the vaccine is to protect mothers, who are the most frequent source of infant pertussis. Second, if administered in the third trimester, the infant receives passive maternal antibody and some protection against pertussis if exposure does occur.

There is also evidence to suggest high levels of maternal antibody do not impair an infant's response to infant doses of pertussis vaccine.[16]

The use of vaccines for employment-related situations is determined by potential exposure risk, the potential to infect the vulnerable, susceptible others and the need to maintain the provision of essential services when absence from work could put the community at risk.

The mode of transmission of infection determines risk: is it airborne, through contact with infectious droplets, via faecal-oral routes or through exposure to body fluids?

In addition, for some infections, the risk of transmission to hospitalised patients who may be immunocompromised is significant. Thus, all healthcare workers should be immune to hepatitis B, measles, mumps, rubella and varicella, and receive annual influenza vaccination. If healthcare workers have contact with children, they should also receive Tdap for the pertussis component and hepatitis A vaccine.

Laboratory staff may require, in addition to the above, inactivated poliovirus vaccine (IPV), and meningococcal vaccine (probably the quadrivalent conjugate vaccine) depending on potential exposure.

**All healthcare workers should be immune to hepatitis B, measles, mumps, rubella and varicella**

Caregivers and other individuals who work with children require similar protection to healthcare workers.

Emergency personnel should be protected against tetanus and hepatitis B and, because they are part of an essential service, should receive annual influenza vaccination.

Armed forces personnel may require some travel-related vaccines depending on potential deployment – see later, "Travel vaccination".

Individuals who work with animals may require influenza, BCG and hepatitis A vaccines, again dependent on potential exposure.

Individuals who work with body fluids (eg, undertakers) require to be protected against hepatitis B. Those who work with sewage require protection against hepatitis A and polio. For sex workers, hepatitis B and HPV vaccines are recommended. See also table 4.6 in the *Immunisation Handbook 2014*.

# Travel vaccination requires a sound assessment of risk

**Currently funded**

**Travel vaccines are not funded**

Most travellers to countries other than Western Europe, North America and Australia are recommended to receive some vaccines. However, vaccination is only part – and, at times, a very small part – of a travel-related consultation.

First, it is important to ensure all travellers have received the routine childhood vaccines, in particular two doses of a measles-containing vaccine. If not, a dose of MMR vaccine should be offered, unless the individual was born before 1969 and is considered immune.

Measles may not be controlled in some parts of the world, and this approach reduces the possibility of the importation of measles into New Zealand.

Second, for most travellers, I would advise a dose of Td or Tdap vaccine if it is more than 10 years (or close to 10 years) since receipt of a prior dose of a tetanus-containing vaccine. Minor injuries are common, and this approach simplifies tetanus-related wound management.

### Specific travel-related vaccines

Hepatitis A vaccine is recommended for all travellers other than those going to Australia, Western Europe and North America. If born in an endemic country or for those with a history of prior hepatitis, I would usually offer blood testing for immunity prior to vaccination. A second dose at least six months after the first dose offers long-term protection against hepatitis A, possibly lifelong. An interval of several years between doses does not require repeating the first dose.

Typhoid vaccine should be considered for travellers visiting rural areas in Africa, Asia and Central and South America, or any country where there is currently an outbreak of typhoid.

Many younger travellers from New Zealand have already received hepatitis B vaccine in childhood but, if not, it is advisable they receive it. For older travellers, I generally inform them that the risk of hepatitis B relates to sexual transmission and/or intravenous drug use, and let them decide whether it is required.

Yellow fever vaccine is advised for travellers to parts of South America and Africa; detailed maps of risk areas are available on the Centers for Disease Control (CDC) and World Health Organization (WHO) websites.

If an individual is visiting an area where the risk of infection exists, the decision to offer yellow fever vaccine is easy. However, there are also border-crossing issues to consider. Some nations require evidence on entry of yellow fever vaccination if an individual is travelling from a country with a risk of yellow fever transmission. However, for many countries, only part of the country is in the yellow fever risk area, and the traveller who does not visit the risk area has no risk of exposure and therefore no risk of infection.

As yellow fever vaccine carries a rare risk of a yellow fever-like illness which may be fatal, this makes the decision to offer vaccine when there is no risk of disease problematic.

An additional problem is nations do not have to agree with the WHO recommendation that some countries (eg, Tanzania) have low or no risk of yellow fever, and this may lead to difficulties for those transiting through such a nation after visiting one of the "low" or "no-risk" countries.

This situation, of no risk of disease but a vaccination required for border crossing, is a frequent problem for those authorised to provide yellow fever vaccine, but it is important that others who provide travel medicine advice are aware of this potential problem.

Clinical rabies is universally fatal but post-exposure prophylaxis is highly effective if received promptly. In a previously unvaccinated individual, this requires rabies immunoglobulin and four or five doses of rabies vaccine.[17]

Rabies immunoglobulin is in limited supply and is difficult to access in many countries where significant rabies risk exists. Individuals are likely to have to interrupt their itinerary and travel (possibly back home) to obtain proper post-exposure prophylaxis. Comprehensive travel insurance is essential.

Post-exposure prophylaxis requires only two doses of rabies vaccine in those who have received pre-exposure vaccination.[17] Pre-exposure vaccine involves three doses of vaccine on days zero, seven and 21 to 28.

The rabies vaccine may be administered at a reduced dose if given intradermally – to reduce the cost – though this use is off-label and, in my view, requires a blood test one week after the third vaccine dose to ensure seroconversion (>0.5IU/ml). With rabies, certainty is everything.

Once an individual has received pre-exposure prophylaxis, it is probably not required ever again but, of course, post-exposure doses on days zero and three are required in the event of a potential exposure. For this reason and because parents may be inclined to pay for it, I encourage young travellers to Africa, Asia or South America to receive pre-exposure vaccine. There remains the concern, however, that the younger traveller may not be so insistent in obtaining post-exposure treatment as the older traveller.

A comprehensive review of the prevention and management of rabies can be found in the 17 January 2015 issue of the *British Medical Journal*.[17]

Japanese encephalitis is a viral infection carried by mosquitoes and is the leading cause of vaccine-preventable encephalitis in Asia. It is passed to humans by the bite of an infected mosquito, but fewer than 1 per cent of

**Measles may not be controlled in some parts of the world**

these infections result in illness.

In those who do develop illness, the incubation period for Japanese encephalitis is five to 15 days after the bite, and the outcome is often severe, with 20 to 30 per cent dying from the illness. Thirty to 50 per cent of survivors incur nervous system damage.

The main mosquito vector usually breeds in rice fields and so potential exposure is more likely in rural travellers.[18]

Vaccination for Japanese encephalitis is available in New Zealand but is very expensive and so is probably underutilised. However, it is a vaccine-preventable disease, and the risks should be discussed with travellers visiting areas where it occurs.

Quadrivalent meningococcal conjugate vaccine (two doses eight weeks apart) is available and should be offered to those travelling to the meningitis belt in sub-Saharan Africa or to the Hajj in Saudi Arabia.

IPV should be offered to those travelling to Nigeria, Pakistan or Afghanistan, or any other countries where polio is occurring. IPV is not required for those who have received a dose as an adult within the last 10 years. ●

## CONCLUSION

- Adult vaccination is a challenging area for practitioners because of the age range and variety of circumstances that require careful consideration, whereas childhood vaccination is largely proscribed with a comprehensive schedule.
- Apart from Tdap and influenza vaccines in pregnancy, annual influenza vaccine for those aged 65 years and older, and tetanus-containing vaccine at ages 45 and 65 years, adult vaccination is not well proscribed.
- This article has hopefully helped to demystify adult vaccination and made the practitioner's approach to it simpler.

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