The ageing immune system is characterised by reduced bone marrow and thymus production of B and T cells and diminishing function of lymphocytes, increasing risk of infection in older people. (1) Prevention of infections with immunisation has been shown to reduce hospitalization and death. However, only half of people 70 years and older are receiving recommended vaccinations. (2, 3) ANZSGM recommends the following for older adults. These recommendations differ slightly from those in the immunisation schedules of the health departments of Australia and New Zealand, referenced below, as those schedules are influenced by other factors including availability of the vaccines and cost effectiveness.

KEY POINTS

1. **Influenza Vaccination**
   Yearly vaccine is recommended for all people age 65 and over, Aboriginal and Torres Strait Islander people over age 15, residents of residential care homes and healthcare providers and staff of residential care homes and hospitals. Regular, repeated vaccination may be more effective. Higher dose trivalent and adjuvant flu vaccination, both available in Australia under the National Immunisation Program (NIP) 2018 improve the response to immunisation and are currently available for those over age 64. Quadrivalent vaccine is available to people over age 64 in New Zealand.

2. **Pneumococcal Vaccine**
   Vaccination with the current 23-valent polysaccharide vaccine is recommended for adults aged 65 and over, Aboriginal and Torres Strait Islander people over age 50 and those aged 15 – 49 with conditions that increase the risk of invasive pneumococcal disease. The pneumococcal conjugate vaccine (PCV13) should be considered as an alternative first vaccination in unvaccinated older people, followed 2-6 months later by the polysaccharide vaccine (23vPPV).

3. **Herpes Zoster Vaccination**
   Live attenuated Zoster virus vaccine is recommended for adults aged 60 and above without previous vaccination, whether or not they report a prior episode of shingles, unless that episode was within the last year. Two doses of the Zoster adjuvanted subunit vaccine, two months apart, should be considered as an alternative, when registered, but is associated with a higher rate of adverse reactions and the risk that the second dose may not be administered, limiting efficacy. It can be given to immunocompromised individuals.

4. **Tetanus Vaccine**
   Previously unvaccinated people should have a primary course of two doses 1-2 months apart, followed by a third dose 6-12 months later. Where there is any uncertainty about primary vaccination, this should be repeated.

5. **Other Vaccines**
   There is insufficient evidence to justify routine vaccination of older people with other vaccines. Certain higher-risk older adults warrant consideration for a range of vaccines. Pertussis vaccination should be considered for those in regular contact with young children, including their grandchildren. Meningococcus vaccination should be considered for higher risk older people. Oral Haemophilus influenza vaccine is not recommended for the prevention of recurrent acute exacerbation of chronic obstructive pulmonary disease.

This Position Statement represents the views of the Australian and New Zealand Society for Geriatric Medicine. This Statement was approved by the Council of the ANZSGM on 26th June 2018. This revision was coordinated by Associate Professor Michael Woodward AM and Dr Chia Pei Chong.
BACKGROUND PAPER

INFLUENZA VACCINATION

Epidemiology

Influenza shows marked seasonal variation, mainly related to frequent changes in the surface antigens through mutations of genes coding for hemagglutinin (H) and neuraminidase (N) glycoproteins. The great pandemics, such as the 1918 outbreak, were caused by major antigenic shift. In contrast, the 2017 influenza season, was largely driven by a mismatch between the vaccine and the circulating H3N2 strain. This 2017 season had the highest level of absenteeism, burden on primary care and increase in hospitalisation since the 2009 H1N1 pandemic. Deaths in laboratory confirmed influenza were largely in the older population - 91% in people aged 65 years and older. (6)

There are four different types of influenza vaccine available in Australia: They trivalent, quadrivalent, high dose and adjuvanted influenza vaccine. Trivalent and Quadrivalent influenza vaccines are available in New Zealand.

Vaccine Efficacy

The most recent Cochrane review concluded that available evidence is of poor quality and provided no guidance regarding the efficacy or safety of influenza vaccinations in those over 65 years old. (7) Vaccine efficacy (VE) varies by season depending on the strains of circulating influenza. The efficacy of inactivated influenza vaccine against influenza-like illness in persons ≥65 years of age living in the community is estimated to be 43% when viral circulation is high, although there have been few randomised controlled trials of influenza vaccine in older people.

In 2017, the Quadrivalent influenza vaccine had a zero effectiveness in the population aged 65 years and above mainly due to the predominant H3N2 influenza. (8) Even though VE is at times lower than for other vaccinations, the small percentage who respond translates worldwide to the prevention of millions of cases of illness, hospitalisation and deaths.

In nursing home settings, influenza vaccination is approximately 45% effective against hospitalisations due to influenza and pneumonia and 60% effective against all-cause mortality in persons aged >65 years. A separate Cochrane systematic review of close to 5000 participants in both residential and community settings has shown older adults receiving influenza vaccination may have a lower risk of influenza, from 6% to 2.4%, and lower risk of influenza-like-illness. (9) This review was underpowered to detect differences in mortality, pneumonia and hospitalization. (9) Other studies over 8 seasons in The Netherlands have shown a reduction in mortality of at least 31% in those immunised.(10) Influenza increases hospitalisation and deaths in elderly nursing home residents each winter. (6)

High Dose Vaccine

Although vaccination is currently the most effective intervention against influenza and its associated complications, lower antibody response and reduced protection is seen in older people (1). Strategies to overcome this include increasing the amount of antigen in the vaccine and use of an adjuvanted flu vaccine or higher dose vaccine.

One commercially available vaccine contains 4 times the amount of antigen compared to regular flu vaccine. A randomized controlled trial in close to 32,000 participants over 65 years old showed high dose vaccine recipients had 24% fewer influenza infections as compared to those who received standard dose flu vaccine. The high dose vaccine also reduced hospitalization, cardiopulmonary events, and serious adverse events. (11) Further analysis also found no significant reduction in VE on patients with medical comorbidity, frailty or higher in age. (12) This is especially significant when H3N2 is the predominant circulating strain (13) as seen in the 2017 Australia influenza season. The results were replicated in patients in residential care. (14) It will likely to be more cost effective than standard trivalent or quadrivalent vaccines. (15) Fluzone® was listed in the Australian National Immunisation Program in Feb 2018 for people 65 years of age and older.

Adjuvanted Flu Vaccine

FLUAD™ is a standard antigen dose vaccine with the MF59 adjuvant that leads to a stronger immune response. A systematic review of 11 studies done to evaluate the effectiveness of this adjuvanted vaccine showed 51% effectiveness against hospitalisation for pneumonia and influenza amongst older people in the community. It is also effective in reducing influenza like symptoms for older people in residential care. (16) This is available under the NIP 2018 in Australia for people 65 years of age and older.
Cost Effectiveness
Some 10 studies have evaluated the cost effectiveness of influenza vaccination. In a review, influenza vaccination, was generally found to be cost saving, (17) particularly among elderly people at higher risk.

Adverse Effects of Vaccine
Influenza vaccine is well tolerated. (9) However, local tenderness does occur in around 10% of recipients (18). The risk of the vaccine causing Guillain-Barre syndrome is very small – probably no more than one excess case per million vaccinated although it is not known if this rate is higher in older people. MF-59 adjuvanted vaccine has a good safety profile (19) and whilst the higher dose influenza vaccine is associated with higher rates of local reaction (20) both enhanced vaccines have a similar increased rate of local reactions versus standard vaccines. These usually resolve within a few days. As the current vaccines contain egg protein, those with severe allergies to egg products should only be vaccinated where there are staff who can recognize and treat anaphylaxis.

Methods to Increase Vaccine Usage
The 2009 Australian Vaccine Survey estimated that 74.6% of Australians aged 65 and over received influenza vaccine. The survey was not administered to people living in residential aged care. The main reasons for not being vaccinated were the perception of not being at risk of getting the flu and that vaccination will result in flu (21). The most important factor influencing older people to vaccinate was positive advice from their doctor. Rates of vaccination in Aboriginal and Torres Strait Islanders has improved over the years but still remains lower than in non-indigenous target groups. (22)

Difficulties in identifying and reaching eligible people and missed opportunities to vaccinate during healthcare encounters are the main contributing factors to low vaccination rates. Strategies to increase uptake include advice from the healthcare worker (especially from the doctor), reminder notices through mail or by telephone, and institutional policies to offer the vaccine to all residents/patients, or to vaccinate all unless they refuse. Such strategies are less effective when there is a higher background immunisation rate. General advertising campaigns (e.g. the frequent ‘killer flu approaches’ headlines) seem less effective, especially in non-epidemic years, but social media is likely to have an increasing role in vaccination rates and perceptions. Establishing vaccination ‘stations’ in busy clinic areas is another effective strategy (23).

Other trialled strategies include vaccinating inpatients on hospital discharge, specialists (including geriatricians) emphasising and individualising vaccination advice in their communications with primary care physicians, using educational forums to emphasise the benefits of and the barriers to vaccination, setting up displays in communal areas including pharmacy shop fronts, on site pharmacy vaccinations and rewarding doctors for achieving certain vaccination rates. The Australian Immunisation Register, expanded in 2017 to all age groups, can also provide information to drive policies to improve vaccination rates, especially in identified low-vaccination regions.

Impact of Repeated Vaccination
Annual vaccination is recommended as the influenza virus undergoes antigenic drift. Vaccination in consecutive seasons offers better protection against influenza than single season vaccination only. (24) There are fewer studies in older populations, but a negative impact of repeated vaccination has not been observed except for H3N2. (25)

Antiviral Drugs
Neuraminidase inhibitors, including oseltamivir and zanamivir, have been proven effective in both treating and preventing influenza in older people and other high-risk groups including those in residential care. Treatment with these drugs is associated with fewer complications, hospitalisations and mortality from influenza (26-28). Treatment should be started within 48 hours of symptom onset. Antiviral drugs should not replace vaccination. (29) Older people may have difficulties using the zanamivir inhalation device. (30) The IV influenza antiviral agent peramivir, recently licenced for use in Australia but not yet New Zealand, can be used in hospital settings.

Influenza Vaccination of Healthcare Workers
Healthcare workers, including staff of residential aged care homes, are a potential reservoir of influenza in healthcare and residential care settings, and should be a target group of any vaccination program. In a study of 20 long term care geriatric hospitals across Scotland with a total of 1600 patients, vaccination of healthcare workers decreased total mortality among residents from 22.4% to 13.6% (odds ratio 0.58; 95% CI 0.4 – 0.84) (31).
Vaccinating healthcare workers is likely to be cost effective to the employer, through reducing days off work due to illness. Despite this, only around 26% to 40% of healthcare workers receive vaccination. (21) Strategies to improve vaccination include educational programs, offering free vaccine, maintaining a vaccine status register, directly requesting healthcare workers to be vaccinated and requiring compulsory vaccination. A systematic review of such efforts showed that combined interventions, rather than a single intervention, were effective although they only improved vaccine uptake moderately. (32)

PNEUMOCOCCAL VACCINATION

**Epidemiology**

Streptococcus pneumoniae (pneumococcus) is a gram-positive coccus that is found in the upper respiratory tract. Invasive pneumococcal disease, often pneumonia with bacteraemia, is more common in the older people, especially those with medical comorbidities and those living in residential care. (33) There is an overlap between pneumococcal pneumonia and invasive pneumococcal disease (IPD). The annual incidence of pneumococcal pneumonia requiring hospitalisation in Australian older people was 274 per 100,000 population in year 2011–2012 and the fatality rate was 6.1%. (34) IPD had a lower incidence of 19 cases per 100,000 population. (34) Strategies to reduce IPD are primarily through vaccination. (35) Given the majority of pneumococcal disease is non IPD, determining vaccine efficacy against non-bacteraemic pneumococcal pneumonia is very important but there are limitations on accurately defining the aetiology of non-bacteraemic pneumonia using available diagnostic tests.

**Antibiotic Resistance**

Risk factors for infection with resistant organisms include age greater than 70, prolonged hospitalisation and attendance at a day care centre (36). World data have shown that 30% of the time pneumococci are resistant to one or more antibiotics. (37, 38) Multidrug-resistant S. pneumoniae can cause outbreaks of pneumonia and bacteraemia in residential care homes (39). Pneumococcal vaccine use may reduce the problem of antibiotic resistance. (38)

**Pneumococcal Vaccine Efficacy**

Two types of pneumococcal vaccine are available in Australia and New Zealand, 23-valent pneumococcal polysaccharide vaccine (23v PPV) and 13-valent pneumococcal conjugate vaccine (PCV 13).

**Polysaccharide Vaccine (23vPPV)**

The current polysaccharide vaccine immunises against 23 of the common pneumococcal serotypes – these serotypes are estimated to cause 88% of cases of pneumococcal bacteraemia although that has fallen since the conjugate vaccine (PCV) has reduced the prevalence of some of these serotypes in both young and older people. 23vPPV induces a significant immune response even in the elderly, similar to that of a younger subject, but poorer response in the immunocompromised or adults with chronic illness. (35, 40)

Recent Cochrane systematic reviews conducted on 18 randomised controlled trials (RCT) involving 64,852 patients and 7 non-RCTs found strong evidence of efficacy of 23vPPV against IPD (OR 0.26, 95% CI 0.14 – 0.45) They also found efficacy against all cause pneumonia in the low-income population (OR 0.54, 95% CI 0.43 – 0.67) but not in the high-income countries in either general population or those with chronic illness. (35) Efficacy for all-cause pneumonia and mortality was not demonstrated.

In a recent Cochrane systematic review of 12 RCT involving 2171 subjects with average age of 61, polyvalent pneumococcal vaccination provided protection against community acquired pneumonia (CAP) in patients with chronic obstructive lung disease (OR 0.62, 95% CI 0.43 – 0.89). The number needed to treat (NNT) to prevent one episode of CAP was 21 (CI 15 – 74) while NNT to prevent a patient from experiencing an acute exacerbation was 8 (95% CI 5 – 58). (41) There were no differences in rates of hospitalisation or mortality rates.

There is little doubt about the efficacy of the polysaccharide vaccine in preventing invasive pneumococcal disease, as supported by the recent Cochrane review. (35) It is notable that after the introduction of free vaccine in Victoria, Australia, overall hospitalisation with pneumococcal pneumonia fell by 39%. (42) A Japanese study in 23 hospital-affiliated nursing homes showed vaccination significantly reduced all-cause pneumonia and deaths from pneumococcal disease (from 35.1% in the placebo group to 0% in the vaccine group) and insignificantly reduced
death from all cause pneumonia (from 28.0% to 20.6%). (43)

As invasive pneumococcal disease is associated with high mortality, a vaccine which reduces this is clinically justified. In addition, elderly people have a significant prevalence of coexisting chronic illness, for which the vaccine is most effective. Thus, it is safer simply to vaccinate all older people, the approach taken in Australia, where the National Health & Medical Research Council has recommended vaccinating all people over age 65. The New Zealand Handbook (2017) makes an identical recommendation, but the vaccine is unfunded for adults except for those with asplenia. Centres for Disease Control and Prevention, and the World Health Organisation, have recommended vaccinating all people from the age of 65. Smokers and people with diabetes less than 65 years old were recommended to have the polysaccharide vaccine as well but not conjugated vaccine. (44)

The recommendation for earlier vaccination of Aborigines and Torres Strait Islander people is based, as for influenza vaccination, on the higher risk of infection in these groups at these ages.

**Conjugated Vaccine (PCV13)**

A second approach to pneumococcal vaccination utilises the conjugate vaccine (PCV). The polysaccharide antigens are joined to a highly immunogenic protein carrier to enhance the immunogenicity of pneumococcal vaccines. Extensive use of PCV in younger people has been shown to alter pneumococcal serotype prevalence and may impact on pathogenicity in older people (45). It can be used in those who have already received the polysaccharide vaccine but if both are to be given sequentially to an unvaccinated person, the PCV should be given first, to avoid blunting the immune response by the polysaccharide vaccine. Indeed, the greater immunogenicity of the conjugated vaccine then the need to cover those serotypes not included in the conjugate vaccine has led to recommendations (by the Advisory Committee on Immunisation Practices) to vaccinate older people who are pneumococcal vaccine naive with the conjugate vaccine first, then the polysaccharide vaccine 12 months later. (44)

As this 12-month gap may leave the recipient unprotected against the non-PCV serotypes for too long, the ANZSGM recommendation is to reduce this gap to 2-6 months.

The efficacy of PCV in older people has been supported by the CAPITA study, an RCT involving 84,496 unvaccinated adults older than 65 years. The study evaluated the efficacy of 13 PCV in preventing first episode vaccine-type strains of pneumococcal CAP, non-invasive and non-bacteraemic CAP and IPD. Vaccination with PCV13 reduced CAP due to the serotypes covered by the vaccine by 45.6% (CI 21.8 – 62.5), non-invasive, non-bacteraemic CAP by 45% (CI 14.2 – 65.3) and IPD by 75% (CI 41.4 – 90.8). The numbers of adverse events and deaths were no different compared to placebo group. (46)

Childhood PCV use is predicted to cause a 90% reduction within a mean time of 8.9 years in population invasive pneumococcal disease due to the serotypes in PCV. (47) PCV vaccination in older people is thus likely to become less effective with this large indirect protection from childhood vaccination.

**Adverse Effects of Vaccine**

Approximately 50% of people given polysaccharide pneumococcal vaccine develop mild side effects such as erythema and pain at the injection sites. Fever, myalgia and severe local reactions have been reported in less than 1% of those vaccinated. Severe systemic reactions, such as anaphylaxis, have rarely been reported. Use of the conjugated vaccine on the other hand caused 18.7% to suffer adverse events (mainly injection-site reactions and muscular pain) within 1 month of vaccination compared to 14.3% in placebo. (46)

**Cost Effectiveness**

Cost analysis done in 10 European countries has shown that pneumococcal vaccine to prevent IPD in the elderly is very cost effective. (48) It is also cost effective even when only a small number of additional cases of non-bacteraemic pneumococcal pneumonia were prevented. (49) An Australian analysis of the cost of vaccination to prevent one hospitalisation from invasive pneumococcal disease in those over age 65 showed the pneumococcal vaccine to be of similar cost effectiveness to the influenza vaccine ($11,494 compared to $10,787 respectively) and more cost effective in preventing death from invasive pneumococcal disease ($49,972 per death prevented each year) than influenza vaccination ($74,801 per death prevented each year). (50)

**Patient receiving immunosuppressants**
Patients receiving potent anti-inflammatory drugs such as adalimumab, infliximab, certolizumab pegol or etanercept that block activity of tumour necrosis factors are considered immunosuppressed and should receive PCV 13 only. (44)

Methods to Increase Vaccine Usage

Introduction of free pneumococcal vaccination in 2005 in Australia has seen an increase vaccination uptake from 39% to 73% in a cohort of a large inpatient hospital in New South Wales Australia. (51) The study showed that being aged over 80 years and having a diagnosis of dementia significantly predicted under-vaccination. (51) The influenza season has been shown to trigger pneumococcal vaccination. (52)

The strategies to increase vaccine uptake are similar to those for influenza vaccination, but greater emphasis needs to be placed on convincing healthcare professionals of the need for and effectiveness of the vaccine, as this knowledge is less widespread than it is for influenza vaccination. In a US study, only 81% of specialist physicians strongly recommended pneumococcal vaccinations to their elderly patients. (53) As influenza and other respiratory viral infections increase both the risk of invasive pneumococcal disease and the spread of pneumococcus, influenza vaccination is also important in reducing pneumococcal disease. Suggesting co-administration of influenza and pneumococcal vaccine, which is safe and does not reduce efficacy of either, is thus another strategy to increase utilisation, and is practical as those over 65 are recommended to have both. Co-administration may slightly increase the risk of local reactions (from 28% to 44%) but has not been associated with an increased risk of serious reactions. (54)

Revaccination

Antibody levels have been shown to fall after pneumococcal vaccination. (55) In frail, chronically ill older people living in residential aged care, revaccination at least 5 years after primary vaccination was associated with a significant immunological response (greater than 1.4-fold increase in antibodies against 6 serotypes assessed), and was well tolerated (56). There is no evidence on the additional efficacy of revaccination in preventing pneumococcal disease so the benefit of a second or further doses given after age 65 to a healthy adult are uncertain (44).

Based on antibody levels and the need to protect the individual through the whole of their later life, a second and perhaps even a third dose of 23vPPV seems prudent, but not less than 3 years after the previous dose of 23vPPV, to reduce the risk of adverse reactions, and best 5-6 years later. Revaccination with PCV is not recommended as there is no evidence to support efficacy and particularly as it is likely that within a few years, those serotypes will be even less common in Australia and New Zealand.

HERPES ZOSTER VACCINATION

Epidemiology

Herpes zoster (shingles, HZ) affects 20-30% of adults with more than 50% of cases occurring in those over age 60. A decline in cell-mediated immunity appears to be the major risk factor for developing shingles. Previous primary infection with Varicella Zoster virus (VZV) is a prerequisite for the development of shingles. More than 95% of adults in Australia had antibodies to VZV. (57) Complications, which occur in up to 40% of cases are more common with increasing age and include post herpetic neuralgia (PHN), stroke and muscle paralysis. (58, 59) Both acute and chronic HZ pain reduces physical, emotional and social functioning. (60)

Live Zoster Vaccine

A single dose of live attenuated (Zostavax) Zoster virus vaccination administered subcutaneously is funded on the Australian NIP for adults aged 70. Catch up immunisation is available for those aged 71 to 79 till October 2021. This vaccine is also funded in New Zealand for adults older than 65 years from April 2018. Two doses of the Zoster adjuvanted subunit vaccine, two months apart, should be considered as an alternative, when registered, but is associated with a higher rate of adverse reactions and the risk that the second dose may not be administered, limiting efficacy.

Vaccine Efficacy

The Shingles Prevention Study (SPS) enrolled over 38,000 adults 60 years of age and older and demonstrated that this live attenuated vaccine, containing 15 times as much antigen as the current childhood varicella vaccine, reduced shingles by 51% and post herpetic neuralgia by 55.5%. It reduced acute and chronic herpes zoster-associated pain by 61%. (61) The VE is 64% (95% CI 56- 71) in persons aged 60 – 69; while in adults above 70 years old, the VE is 38% (95% CI 25 – 48).
Subsequent analyses reveal that the number needed to vaccinate (NNV) to prevent a case of HZ was 13 at age 60 and 64 at age 80, and the NNV to prevent PHN was 60 – 80 at all ages. Whilst there may be some reduction in VE in those 80 and over, retrospective data from a large (> 750,000 people) cohort does not demonstrate this, with VE 49% in this age group, (62) and the vaccine should be offered to those over 79, even if not funded for that group.

Duration of Protection
A subset of participants from the SPS followed up for 11 years found some waning of vaccine efficacy over time. Over a median of 3 years follow up, efficacy against shingles was 51.3%. It was reduced to 39.6% at 4-7 years after vaccination, and 21.1% efficacy at 7-11 years. (63) The role of revaccination is not yet defined (61) but may be required every 10 years.

Adverse Effects of Vaccine
The vaccine is safe and well tolerated (61) with 48.3% experiencing reaction at injection site, 6.3% with headache and fatigue, and 0.1% had varicella-like rashes around the injection site. In rare instances, it has been documented to cause disseminated rash and herpes zoster in immunocompetent recipients. (64)

Contraindications
As this is a live vaccine, people who are significantly immunocompromised due to diseases or medications should not receive the vaccine. Doses of less than 20mg prednisolone daily or higher doses used for only a short term, steroids used for replacement therapy and inhaled corticosteroids do not cause sufficient immunocompromise to disallow this vaccine. Those with known anaphylaxis to varicella zoster virus-containing vaccine should not be vaccinated. Patients with chronic medical illness such as hypertension, arthritis, chronic renal failure and diabetes were included in the trial and can safely receive zoster vaccine.

Vaccination of People with Negative Clinical History of Chickenpox
In seronegative individuals, the vaccine is well tolerated. Serological testing prior to vaccination or eliciting a history of previous varicella or shingles infection has not been shown to predict efficacy of vaccination and is not recommended.

Vaccination of People with Previous History of Shingles
Efficacy of zoster vaccine to prevent recurrence of shingles has not been examined, and recollection of past episodes may be imprecise. Shingles can reoccur in about 6.2% in one study. (65) It seems best therefore to offer the vaccine to this group, but not less than one year after a well recollected or documented attack of shingles.

Concomitant Administration with Influenza or Pneumococcal Vaccination
Vaccination at the same time as influenza vaccination is well tolerated in those over age 50, and antibody responses are similar to those of sequential administration. Concomitant pneumococcal polysaccharide vaccination may reduce the immunogenicity of zoster vaccination and the two are best given no less than 4 weeks apart, although the Australian Immunization Handbook supports giving both together.

Newer Vaccines – Recombinant Zoster Vaccine
A new HZ vaccine contains subunit Zoster antigens and an adjuvant to boost the immune system’s response. It is not yet (2018) registered in Australia or New Zealand but that registration is likely to be soon. It was found to provide 97% protection against shingles in adults aged 50 to 59 and 91% (95% CI 86.8 – 94.5) in adults age 70 and above. It also reduced PHN risk by 86% (66). This efficacy is not directly comparable to the findings of the SPS as the occurrence of shingles and PHN in the two placebo groups differed, suggesting the populations were not similar. There was a high rate of local reactions (67), which may lead to some recipients failing to attend for the required second dose. The Advisory Committee on Immunisation Practices has recommended the use of Recombinant Practices has recommended the use of Recombinant zoster vaccine to prevent herpes zoster. (68)

TETANUS VACCINATION
In Australia, since 1980, 80% of tetanus notifications and 90% of tetanus deaths have been in adults over 50 years of age (69, 70) and in the US, 60% of cases occur in persons older than age 60 (71).

Almost all adult cases of tetanus occur in those who never completed a primary childhood immunisation series. A history of immunisation from patients, families or medical charts may be an unreliable indicator of tetanus immunity. Thus, the main thrust of any adult tetanus vaccination policy should be
to ensure that everyone receives a primary immunisation series and boosters.

Sero-prevalence studies in the US have shown that more than half of adults lack antibody levels that are considered protective against tetanus (72) and support the need to give primary courses and boosters, especially to those with tetanus-prone wounds. Older people have a good response to single administration of a single dose of tetanus vaccine (73).

The 2018 edition of the Australian Immunisation Handbook recommends a single booster at age 50 and booster doses in those reaching age 50 who have not been vaccinated in the last 10 years. Those who have had 5 or more doses of vaccine over their life do not require a booster. A primary course of three doses should be given to unvaccinated adults, followed by boosters at 10 and 20 years. It is available in combination with diphtheria (dT) or diphtheria and pertussis (dTpa) (70). This is different to child formulation (DTPa) that contains a larger amount of diphtheria and pertussis antigens. The New Zealand Immunisation Handbook recommends a single booster dose for older adults at age 45 and 65.

**OTHER VACCINATIONS**

**Travel Vaccinations**
Older people should be offered the same travel vaccination as younger people recommended for the countries that they are visiting. This is particularly important as traveling is becoming easier and safer, and thus more frequently undertaken by older people. Individualised advice according to older people’s medical conditions and other degree of immunosuppression is recommended.

**Higher risk groups**
Older people in high risk groups, such as injecting drug users and healthcare workers, should be offered the same vaccination advice as younger people.

**Pertussis**
Routine vaccination with pertussis is not advised. Vaccination is supported if close contact with infants (<6 months old) is intended. An opportune time for pertussis vaccination is at the time of tetanus vaccination, using the combined tetanus, diphtheria and acellular pertussis vaccine (dTpa) - the only adult pertussis vaccine. Due to increase in morbidity associated with pertussis in an older people, it is recommended that a single booster dose of dTpa is given to those who have not received it in the last 10 years. (74)

**Meningococcus**
Meningococcus strain W has emerged as the predominant strain in Australia, surpassing strain B in 2016. (75) It is a hypervirulent strain associated with higher risk of invasive disease and mortality. In 2017, adults over 65 years accounted for 25% (24/94) of the total cases reported in Australia. Two vaccines, 4vMenCV (quadrivalent meningococcal conjugate vaccine A,C,W,Y) and MenBV (meningococcal B vaccine) are available through private prescription for adults. Vaccination is recommended in adults with immunodeficiency including splenectomy, HIV, part of outbreak population or taking eculizumab. (76) It is not known if patients taking other types of monoclonal antibodies are at increased risk of meningococcal disease. Victoria in Australia currently funds one vaccine (MenACWY) for all gay and bisexual men and men who have sex with men, at any age. (77)

**Haemophilus Influenzae**
Haemophilus influenzae oral vaccine is not recommended for the prevention of recurrent acute exacerbation of chronic obstructive pulmonary disease and chronic bronchitis, based on a recent Cochrane systematic review. (78)
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