

## ADULT VACCINATION GUIDE – WHICH VACCINES SHOULD WE RECOMMEND FOR UNIVERSAL VACCINATION?

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### ABSTRACT

Universal vaccination is a planned programme of vaccine coverage for all in the whole population or populations at risk for the prevention of relatively ubiquitous infectious diseases. Most of the vaccines in the childhood vaccination programme can be considered 'universal' vaccines. Some of the newer vaccines already available or in development have the potential to become 'universal vaccines' e.g. HPV vaccines, Dengue vaccine, TB vaccine. Unlike childhood vaccinations, adult vaccinations are usually not mandated, with the exception of Yellow Fever vaccine. In order to achieve its long term goals, a systematic and rational approach to adult vaccination is required. Vaccines included in the suggested vaccination scheme for adult vaccination are Tetanus-diphtheria +/- Pertussis, MMR (Measles, Mumps, Rubella), Varicella, Influenza, Pneumococcal (polysaccharide), Hepatitis A, Hepatitis B, and Meningococcal (polysaccharide).

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### INTRODUCTION

The benefits of immunization and its potential as the most cost effective public health measure for the control of infectious diseases have been recognized by all doctors. The benefits are not only personal; in the form of acquired immunity to diseases, but also societal; in the form of achievement of herd immunity and consequently, societal cost savings from reduction in mortality and morbidity of diseases. The final ultimate goal of any immunization programme has to be the eradication of a disease as exemplified by the success of smallpox vaccination and followed closely by 'near eradication' of poliomyelitis.

### PARADIGM SHIFT

There are many strategies adopted by public health authorities when embarking on an immunization program. The strategies can be targeted at different populations and age groups. There are strategies targeted at Child, Adolescents and Adults as well as combined strategies such as Child-Adolescents and so forth. The future of such programmes may target the entire population from child to adult, in what we call universal immunization. Recent changes in recommendation by the ACIP (Advisory Committee on Immunization Practice, CDC, USA) have seen target groups for influenza and hepatitis A vaccination expanded

to involve a larger sector of population. The recent influenza vaccination recommendation for the influenza season 2006/2007 would cover an estimated 73% of the American population and the hepatitis A vaccine recommendation may be changed to include all children and perhaps become integrated into the childhood vaccination programme to 'further reduce hepatitis A morbidity and mortality in the United States'.

The current childhood vaccination programme has been very successful in reducing and sometimes eradicating some common childhood infectious diseases. The programme has the support of the government and is heavily subsidized, which partly accounts for its success. The fact that the adult immunization has been an under-discussed, under-supported and under-rated component of the public health programme, makes it a topic for medical practitioners to begin a similar vaccination programme for adults. Recent outbreaks of adult mumps in the US (MMWR Apr 7, 2006) and ongoing sporadic cases of adult varicella, measles and pertussis in the community illustrate the importance to re-look into the need for an adult vaccination programme. Adults have often been incriminated as index cases responsible for outbreaks in pediatric populations. Excess healthcare dollars and manpower allocation has been utilized in supportive care of vaccine-preventable adult infectious diseases which can be channeled towards other more deserving health needs if medical practitioners are able to decrease such disease burden by comprehensive vaccination coverage. The concern would therefore be how cost-beneficial such programme would be which is relative to the economic standing of the country. Hence, a well-planned adult vaccination programme will complement and enhance a successful childhood immunization programme.

### UNIVERSAL VACCINATION

Universal vaccination is a planned programme of vaccine coverage for all in the whole population or populations at risk for the prevention of relatively ubiquitous infectious diseases. A good example is the hepatitis B universal immunization. Ideally, the coverage should be close to 100%. Most of the vaccines in the childhood vaccination programme can be considered 'universal' vaccines. These include polio vaccine, MMR vaccine, diphtheria, pertussis and tetanus vaccines. The Singapore childhood immunization programme has achieved >90% coverage for most of the components. Ideally, a 'universal' vaccine should satisfy these criteria:

- safe and effective for all age groups
- prevents a relatively common disease
- cost effective
- provides life-long and complete immunity
- easy to administer
- few vaccine-associated side effects

There are proponents for hepatitis A universal vaccination although the current cost of vaccination is a prohibitory factor. The vaccine has satisfied all the above criteria and universal coverage in high risk groups is a real possibility.

Some of the newer vaccines already available or in development have the potential to become ‘universal vaccines’ e.g. HPV vaccines, Dengue vaccine, TB vaccine.

**ADULT VACCINATION**

Adult vaccination is largely based on the assumption that one has completed a basic programme of childhood vaccination and only requires maintaining the acquired immunity with timely boosters during the adulthood. There are also situations whereby particular vaccines are indicated because of special risk factors or medical problems. Some adults have not been immunized against certain childhood diseases or have incomplete vaccination history. Sometimes, a primary series may need to be initiated (e.g. Tetanus-diphtheria vaccine at 0, 1, 6 months or MMR at 0, >4 weeks). Most of the time, a catch-up vaccination schedule may be all that is needed (e.g. varicella vaccine at 0, 4-8 weeks). Unlike childhood vaccinations which are required for entries into schools, adult vaccinations are usually not mandated, with the exception of Yellow Fever vaccine which is regulated under the International Health Regulation (WHO). Other limited mandatory vaccinations are meningococcal vaccination for entry into Saudi Arabia for Haj and Umrah pilgrims and certain entry requirements for university students (meningococcal vaccine). For most of these diseases, the mortality rate in adults is probably lower than in childhood (e.g. pertussis) although morbidity rate may be more significant (e.g. chickenpox and hepatitis A). The driving force for adult vaccination is usually media reports of outbreaks which will prompt them to seek immunization. A good example is the bird flu reports and the SARS outbreak which prompted a rush for influenza vaccination.

A systematic and rational approach to adult vaccination is required in order to achieve its long term goals instead of the current erratic, sentiment driven and haphazard situation. Some effort in the direction is exemplified by the hepatitis B vaccination campaign for adults whereby the government allows Medisave coverage. More needs to be done including providing subsidies to encourage increased uptake. Table 1 shows a recommended schedule for adult vaccination.

**Tetanus-diphtheria +/- pertussis vaccine**

There has been a recent increase in reported cases of pertussis in adolescents and adults in many countries despite high immunization rates in children. It is a matter of concern as adults remain the most important source of transmission of Bordetella pertussis to young unprotected infants. No booster vaccine for pertussis in adolescents or adults were available till recently, a combined vaccine containing tetanus, diphtheroid toxoids and pertussis antigens (BoostrixW) became available for use by adults and adolescents. The vaccine elicited robust immune responses while exhibiting a safety profile similar to currently available tetanus-diphtheria vaccines. Booster interval is every ten years for those who have completed primary immunization in childhood.

**Measles, Mumps, Rubella (MMR) vaccine**

The previous one dose MMR was revised to a two-dose regimen in the childhood immunization programme to increase herd immunity after a series of outbreaks of measles and mumps occurred. Adults who are born after 1957 and who have only received one dose of the MMR vaccine should complete a second dose. As a general rule, all females should be immunized against rubella before planning a pregnancy. Individuals who present at antenatal clinics with no immunity will be vaccinated immediately after the birth of their first child. However, one has to note that MMR being a live vaccine should not be given to those who are pregnant or may be pregnant in the 4 weeks

**Table 1: A Suggested Schedule for Adult Vaccination**

Vaccine	Routinely recommended	Recommended (optional)	Recommended (Risk group)
Tetanus-diphtheria +/- Pertussis	Booster every 10 years after 1° series Start primary series if not done in childhood		
MMR (Measles, Mumps, Rubella)	1 or 2 doses 4 weeks apart in non-immune adults if not done in childhood		
Varicella	2 doses (0, 4-8 weeks) in non-immune adults		
Influenza			1 dose annually
Pneumococcal (polysaccharide)			1-2 doses, 1 dose after age 65 yrs
Hepatitis A		2 doses (0, 6-12 months) in non-immune adults	
Hepatitis B	3 doses (0, 1-2, 4-6 months) in non-immune adults	Give combined Hepatitis A/B vaccine if non-immune to both	
Meningococcal (polysaccharide)			1 or more doses

Other vaccines excluded in this table are generally travel-related vaccines which are recommended based on relative risks and visits to endemic areas, e.g. typhoid, cholera, Japanese encephalitis, rabies vaccines, etc, and will not be discussed here.

Footnote: Routinely recommended = potential for universal vaccination

following vaccination. Immunized parties should be counseled regarding congenital rubella and to defer pregnancy planning for four weeks following immunization.

### Varicella

Medical Practitioners continue to see a background disease burden from varicella despite the vaccine being available in Singapore for more than 10 years now. Each year, mortalities from complications associated with chickenpox continue to be reported. All non-immune adults should be immunized as the disease tends to be more severe and more likely to be complicated in adults especially immunocompromised adults. Varicella immunization is especially indicated in the following situations:

1. Healthcare workers
2. Caregivers of immunocompromised patients
3. Teachers and care workers in nursery and daycare, correctional institutions, long term care facilities
4. Military personnel
5. International travelers

Several studies have demonstrated concomitant reduction in varicella-related healthcare utilization, costs and varicella-associated mortality among children in the vaccinated cohorts as well as adults. The concern about the incidence of late zoster in vaccinees whose natural immunity may wane in the absence of endemic varicella may not be a real one with the availability of a new zoster vaccine.

### Influenza vaccine

Currently licensed influenza vaccines are trivalent inactivated split virion or subunit vaccines (adjuvanted or non-adjuvanted). The widely accepted indications for influenza vaccinations are:

1. All adults who are 50 years or older
2. Children 0-23 months
3. All caregivers of the above groups
4. Healthcare workers
5. Pregnant women in their second trimester
6. Patients with chronic disorders of cardiovascular and pulmonary systems including asthma
7. Chronic metabolic disorders like diabetes and renal dysfunction
8. Cognitive dysfunction or neuromuscular dysfunction predisposing to aspiration

In the US, influenza took lives of 36,000 people annually and hospitalized more than 200,000 people. In Singapore, it is estimated that the excess mortality due to influenza is 500-600 annually. The problem with influenza vaccination is vaccine supply, which may be erratic or unevenly distributed. Another problem is that of vaccine strain mismatch when prediction is off. The vaccine technology also requires upgrades to produce vaccine in a shorter time to meet demands, especially in an event of an imminent pandemic. Supply disruption, delayed delivery and vaccine shortage have occurred in the last 5 out of 6 years. Universal influenza vaccination may be a means of resolving these recurring crises.

### Hepatitis A and B vaccine

Singapore was one of the first countries to adopt hepatitis B vaccination in the 1980s. It is incorporated into the childhood vaccination programme and we have seen steadily decreasing incidence of hepatitis B associated chronic liver diseases and liver cancer. A catch-up programme has also been implemented for adolescents and adults to immunize them at every health opportunity or healthcare contact. This is best achieved at the primary healthcare contact level i.e. general practitioners and Polyclinics. High risk individuals who should receive the vaccine include:

1. All healthcare workers
2. Contacts and sex partners of persons with chronic hepatitis B infection
3. Intravenous drug users
4. Individuals with multiple sexual partners
5. Men who have sex with men
6. Recipients of clotting factors and plasma-based products (e.g. hemophiliacs)
7. Patients on hemodialysis

Hepatitis A was initially touted as a 'travel' vaccine for travelers outside of the US, Western Europe, Canada, New Zealand, Australia and Japan. However, there are other medical indications for this vaccine:

1. Non-immune patients with chronic liver diseases like hepatitis B and C
2. Men who have sex with men
3. Illicit drug users
4. Laboratory workers working with hepatitis A virus or primates
5. Sewage workers
6. Individuals exposed to infectious hepatitis A patients
7. Food-handlers

### Pneumococcal vaccine

Two types of pneumococcal vaccines are currently available – a 7-valent conjugate vaccine for paediatric use and a 23-valent polysaccharide vaccine for those over 2 years old. Pneumococcal vaccine is recommended for those 65 years and above as well as for those 2-64 years old with any of the following medical conditions:

1. Chronic cardiac or pulmonary disease
2. Chronic liver disease
3. Alcoholism
4. Diabetes
5. CSF leak
6. Anatomic/Functional asplenia
7. Sickle cell anemia
8. HIV infection
9. Leukemia/lymphoma/multiple myeloma
10. Immunosuppressive/chemotherapy
11. Chronic renal failure or nephritic syndrome
12. organ/bone marrow transplant

An economic evaluation of pneumococcal vaccination strategies in Belgium showed that targeted vaccination age groups between

65-75, was found to be relatively cost-effective for the healthcare payer. It is controversial whether it is cost-beneficial in universal vaccination of those < 65 years old. However, none of the data or studies is conclusive in estimating the impact of vaccination on anti-microbial resistance.

#### Meningococcal vaccine

Except for epidemic outbreak of meningitis in the meningitis belt in SubSaharan Africa and Saudi Arabia, most parts of the world have sporadic outbreaks. Meningococcal vaccination is indicated in the following situations:

1. Mandatory for Hajj and Umrah pilgrims travelling to Saudi Arabia
2. Freshmen entering college in US, UK, Australia
3. Laboratory workers working with meningococcus
4. Military recruits
5. Travel to meningitis belt of SubSaharan Africa during transmission season

#### CONCLUSIONS

Adult vaccination is still considered a luxury afforded only by first world countries while most developing countries are still grappling with deadly childhood infectious diseases. We should however aim towards a more concerted effort to reducing further the morbidities associated with vaccine-preventable infections or even eradicating them completely. The missing piece in this jigsaw is the adult vaccination component.

#### RECOMMENDED READING

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9. Economic evaluations of pneumococcal vaccination strategies in adults. A summary of the results. Thiry N, Beutels P, Van Damme P. Acta Clin Belg Nov-Dec 2005; 60(6):338-44.
10. Assessing the introduction of universal varicella vaccination in the Netherlands. Boot HJ, de Melker HE, Stolk EA, de Wit GA, Kimman TG. Vaccine 2006 Jun 8;(Epub ahead of print).

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#### LEARNING POINTS

- o Universal vaccination is a planned programme of vaccine coverage for all in the whole population or populations at risk for the prevention of relatively ubiquitous infectious diseases.
  - o To achieve its long term goals, a systematic and rational approach to adult vaccination is required.
  - o Suggested vaccines adult vaccination scheme are: Tetanus-diphtheria +/- Pertussis, MMR (Measles, Mumps, Rubella), Varicella, Influenza, Pneumococcal (polysaccharide), Hepatitis A, Hepatitis B, and Meningococcal (polysaccharide).
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