UNIT NO. 2A

UPDATE ON ADULT VACCINATION

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ABSTRACT

Updated recommendations from the US Advisory Committee on Immunisation Practices continue to be issued on vaccines. The relevance of two "new" vaccines, the HPV (Human papilloma virus) vaccine, and the VZV (Varicella zoster) vaccine is discussed. Gardasil, a quadrivalent human papilloma virus vaccine is currently indicated for girls between the ages of 9 and 26 years for prevention against HPV types 6, 11, 16, and 18. It is not intended for use in the treatment of genital warts or cancers. It is also not a substitute for cervical cancer screening, hence, does not obviate the need for routine Pap smear. The varicella zoster (VZV) vaccine is recommended as a single dose vaccine in those 60 years or older. Alternative schedules for hepatitis vaccines for rapid protection are now available. The new ACIP guidelines for meningococcal vaccination call for vaccination of all adolescents 11–18 years old. An FDA approved avian influenza vaccine for use in adults at risk for exposure to H5N1 virus is available for the agricultural setting. An adult vaccination schedule for Singapore is proposed consisting of tetanus-diphtheria vaccine, hepatitis B vaccine, MMR vaccine for all age groups; hepatitis A vaccine, varicella vaccine, and HPV vaccine for specific age groups; and influenza vaccine, meningococcal vaccine, and pneumococcal vaccine for target population with risk factors.

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INTRODUCTION

Last year, we discussed the various vaccinations recommended for adults and their specific indications. It was also highlighted that adult vaccination was an under-discussed, under-rated, under-emphasised topic, and that more needed to be done. It is therefore not surprising that the field is not moving at leaps and bounds. There have been updated recommendations from the US ACIP (Advisory Committee on Immunisation in the past one year[1,2,3]. These recommendations are based on continuous review of the epidemiological evidence, definitive research evidence and recommendations of experts in the work-group when conclusive data were lacking. The final recommendations are also a result of consultations with various professional societies, e.g. American Academy of Paediatrics, American Academy of Family Practitioners, and American College of Obstetricians & Gynaecologists.

The two 'new' vaccines, HPV (Human papilloma virus) vaccine and Zoster vaccine will first be discussed. In addition, the recent changes in recommendations for older vaccines and their reasons, and new data on dosing regimens for hepatitis vaccines will also be discussed. Some of the newer vaccines will become available in Singapore in the near future. The aging demographics in Singapore for example will see more demand for a vaccine like zoster vaccine.

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HUMAN PAPILLOMA VIRUS (HPV) VACCINES

A 'new' vaccine that has recently been registered in Singapore is Gardasil®. (MSD), a quadrivalent human papilloma virus (HPV) vaccine. This is a recombinant viral vaccine directed against HPV types 6, 11, 16 and 18[4,5].

These four HPV types are responsible for:

- 70% of cervical cancer, adenocarcinoma-in-situ (AIS), cervical intraepithelial neoplasia grade 2 and 3 (CIN 2/3), and HPV related vulvar and vaginal cancer cases;
- 30 – 50% of all CIN 1, VIN 1 and VaIN 1 cases;
- 90% of genital warts and recurrent respiratory papillomatosis (RRP) cases.

Early vaccination strategy in the developed world has resulted in reduced cancer rate by 75% and shifted the burden of managing cervical cancer to managing a large number of pre-malignant lesions.

The vaccine schedule is given as three intramuscular injections at 0, 2 and 6 months; the need for booster dose is not established and the duration of protection is unclear. The vaccine is currently indicated for girls between the ages of 9 and 26 years for prevention of infection against HPV types 6, 11, 16 and 18. It is not intended for use in the treatment of active genital warts or cancers. It is also not a substitute for cervical cancer screening, hence, does not obviate the need for routine PAP smear.

Individuals with immunocompromised states are expected to have a reduced antibody response to the vaccine, although the vaccine is not contraindicated in such individuals. However, it must be mentioned that the safety, immunogenicity and efficacy of the vaccine has not been studied in HIV infected individuals.

Side effects that are common include fever, pain, erythema and swelling at the injection site. There are currently ongoing studies evaluating the use of these vaccines in men and older women.

Another HPV vaccine may soon be available - Cervirix® (GSK), a bivalent adjuvanted viral recombinant vaccine against HPV types 16 and 18. The adjuvanted vaccine gives a superior antibody response close to 100%. Studies published in the Lancet 2006/2007 also reported vaccinees showing cross-protection against other oncogenic non-vaccine strains of HPV. The adjuvanted vaccine showed prophylactic efficacy against

CIN2+ associated with HPV 16 or 18 and thus, could be used for cervical cancer prevention.

The advent of these vaccines helps to set the stage for adoption of wide scale HPV vaccination for the prevention of cervical cancer. This has led to an expanded recommendation by the US ACIP (Advisory Committee on Immunization Practices) to include HPV vaccine into the adolescent/adult immunisation program for those in the age group 9-26 years old who lack immunity.

VARICELLA ZOSTER VACCINE

It has been determined that the life-time risk for zoster is up to 30%. The incidence and severity of herpes zoster and post-herpetic neuralgia increase with age in association with a progressively decline in cell-mediated immunity to varicella zoster virus (VZV). A new zoster vaccine Zostavax® will be available in the near future for vaccination against VZV to protect against zoster.

This vaccine is a live attenuated viral vaccine containing more that 14x the regular varicella vaccine dose and is indicated in elderly patients > 60 years old[2].

In a study published in the NEJM 2005 involving more than 38,000 subjects, the vaccine was shown to markedly reduce morbidity from herpes zoster and post-herpetic neuralgia in older adults. Compared with a placebo group, there was a 51% reduction of zoster episodes, less severe disease, 66% less post-herpetic neuralgia and no significant safety issues.

ACIP recommends a single dose in those 60 years or older. We anticipate that this vaccine will play an important role in the healthcare landscape for the geriatric population in Singapore in the years to come.

UPDATED GUIDELINES ON VARICELLA VACCINATION

The ACIP has also recently updated guidelines for varicella prevention in children, teens and adults. The current regimen of varicella vaccination involves a single dose immunisation in children from 12 months to 12 years and a two-dose regimen given 4-8 weeks apart for those 13 years and above[3].

The attack rate of varicella in vaccinated children has been observed to be between 11-17%, subset analysis also showed that most of these children had been vaccinated at 12-15 months suggesting that some of these children may not produce adequate immune response when vaccinated early.

The new recommendations are as follows:

- Routine two-dose varicella vaccination for children with the first dose given at 12-15 months and a second dose at age 4-6 years old.
- Give a second dose as catch-up vaccination in children, adolescents and adults who have previously received one dose.
- Routinely vaccinate all healthy persons aged 13 years or older without evidence of immunity.
- Perform prenatal assessment and post-natal vaccination.
- Expanded use for HIV infected children for CD4 percentage of 15-24% and adults with CD4 > 200 cells/ul.

These guidelines also include the use of combination vaccines with MMRV (Measles, Mumps, Rubella, Varicella) for use in healthy children from 12 months to 12 years and use of monovalent varicella vaccines in immunocompromised children.

- Age group: 12 months to 12 years – Interval: three months.
- Age group: 13 years or older – Interval: 4 – 8 weeks.

This regimen may be difficult to implement in Singapore as the childhood vaccination program is already quite cluttered. The second dose in childhood may be given in nursery school or on entering primary one. The School Health Services may try to incorporate the catch-up dose in primary one for those who are vaccinated in the preschool period but this will add to the workload of their already busy schedule. Also, many parents have not bought into varicella vaccination as a routine childhood vaccination, hence, more education and awareness promotion may be a starting step.

The government may also need to consider subsidising such vaccinations to show their support and commitment in promoting routine chickenpox vaccination for our children.

ALTERNATIVE SCHEDULES FOR HEPATITIS VACCINES

Hepatitis vaccines are available in separate hepatitis A and hepatitis B vaccines as well as a combined A and B vaccine (TwinRix®, GSK). The combined vaccine and the hepatitis B vaccines are given in a three dose schedule at 0, 1, and 6 months. There is also a special formulation for immunocompromised adults and those receiving hemodialysis, 1 dose of 40 ug/mL (Recombivax HB® – this vaccine is not available in Singapore). For those who need rapid protection, there is an accelerated regimen as well[6]. See Table 1.

Hepatitis A vaccination in children

1995: Hepatitis A vaccination recommended for children two years or older who are at increased risk of acquiring hepatitis A infection.

2005: US FDA approved the vaccine for use in children more than 12 months old, lowering the youngest approved age for use of the vaccine from 24 months to 12 months. The revised recommendation encourages incremental vaccination of children age 12-23 months in an approved immunisation schedule.

July 2007: Recommendations of the American Academy of Paediatrics Committee on Infectious Diseases:

- Universal vaccination against hepatitis A for all children at one year (12 months) as a two-dose vaccine incorporated into the US Childhood Immunisation Program.
- Hepatitis A vaccine not contraindicated in immuno-compromised individuals.

Table 1. Alternative Schedules for Hepatitis Vaccines

Vaccine	Primary Dose	Booster
Engerix B (Paeds) 0-19 years	3 doses at month 0, 1 and 6 Accelerated : month 0, 1, 2	1 dose at month 12
Engerix B (Adult) > 20 yrs	3 doses at month 0, 1 and 6 Accelerated : month 0, 1, 2 Rapid : Day 0, 7, 21	 1 dose at month 12 1 dose at month 12
Havrix (Junior) 1-18 years	1 dose at month 0	1 dose at month 6 - 12
Havrix (Adult) > 19 years	1 dose at month 0	1 dose at month 6 - 12
TwinRix 1-15 years	2 doses at month 0, 6-12	
TwinRix >16 years	3 doses at month 0, 1 and 6, or Rapid : Day 0, 7, 21	 1 dose at month 12

- Catch-up vaccination recommended for children 2 – 18 years old.
- Vaccine is contraindicated in individuals with hypersensitivity to vaccine components including aluminium hydroxide and phenoxyethanol.
- Immunocompromised patients can receive the vaccine.

The success of a universal hepatitis A vaccination program will very much be dependent on the enthusiasm that the physicians and members of the health care team display toward implementation of the program. Another factor is the attitude of the family towards the introduction of yet another vaccine into the already 'crowded' vaccination schedule and that may critically affect the program.

NEW GUIDELINES FOR MENINGOCOCCAL VACCINATION

ACIP updated its recommendation for meningococcal vaccination in June 2007. The new guidelines call for vaccination of all adolescents between 11–18 years old with the new meningococcal conjugate vaccine[6].

The conjugate vaccine is safe and effective and should be given to adolescents 11-18 years old throughout the year. This vaccine should confer longer lasting immunity and could even interrupt disease transmission if enough people are vaccinated.

Meningococcal meningitis is the most frequent cause of bacterial meningitis in infants, children, adolescents and young adults. It occurs sporadically, can be difficult to diagnose, and is serious and rapidly fatal in one or two days if not treated.

The impetus behind the expanded recommendation was the growing recognition that adolescents in the age group 11-18 years of age are at increased risk for meningococcal disease. Lifestyle factors typical in older adolescents that may facilitate transmission include kissing, living in crowded conditions such as in the dormitory, active and passive smoking, 'pubbing', and group activities. This is particularly important for those entering high school, freshmen entering college and those with indications for meningococcal vaccinations, e.g. asplenia, military recruits, etc, and other indications that were previously discussed. Revaccination is recommended in 3-5 years if continued protection is needed.

Although a number of meningococcal disease cases are of the serogroup B, there is no commercially available vaccine for serogroup B. The four strains A,C,Y, W135 account for 75% of the disease causing strains in adolescents and young adults. The quadrivalent polysaccharide vaccine, as well as the conjugate vaccine, protect against these four strains. The conjugate vaccine can be given up to 55 years of age and the polysaccharide vaccine can be given to children two years or older.

There were some initial concerns about the quadrivalent conjugate vaccine when it was first used in the US because of a possible association with Guillain-Barré Syndrome (GBS). A total of eight cases of GBS were reported through February 2006, but a causal relationship was not proven. However, a previous episode of GBS has been listed as a contraindication to vaccination.

The most common adverse events have been redness, pain and swelling at the injection site, which usually lasts two days and syncope related to needlestick.

We do not see a great demand for meningococcal vaccination in Singapore. There is the occasional panic-driven vaccination when an index case has died, e.g. in the case of a Nanyang kindergarten school teacher who allegedly died of meningitis some years ago, triggering a wave of panic-driven vaccination amongst the school kids and their families. Currently, the largest group of vaccinees are the Haj and Umrah Muslims who have to take mandatory vaccination for their pilgrimage. The next largest group are students enrolling into overseas college in US, UK, Australia where it is often a requirement for freshmen to be vaccinated against meningococcal disease. Occasionally, the vaccine is given to travellers to the SubSaharan Africa meningitis belt during transmission season and for others going to outbreak areas.

FDA APPROVED AVIAN INFLUENZA VACCINE

In April 2007, FDA approved an avian influenza vaccine for use in adults at increased risk for exposure to H5N1 virus. The vaccine is a monovalent H5N1 inactivated viral vaccine (Sanofi Pasteur – Aventis) for active immunisation of adults aged 18-64 years who are at increased risk for exposure to H5N1 viral subtype contained in the vaccine. The vaccine regimen consists of two doses of intramuscular injections given 28 days apart.

The approval of this vaccine represents an important step forward in our armamentarium of protection against a pandemic. The approval is based on clinical study data showing the use of a two-dose regimen elicited an adequate immune response against the H5N1 virus in 45% of subjects. Although this figure is suboptimal for an influenza vaccine, current scientific information suggests that the disease severity and influenza-related hospitalisation and death may be significantly reduced.

The vaccine is well tolerated with acceptable adverse events profile, the most commonly encountered being injection site pain, headache, general ill feeling and muscle pain. The vaccine contains chicken and egg proteins, therefore, caution is advised when considering its use in patients with known egg allergy or a history of life-threatening adverse reactions to previous influenza vaccinations, e.g. Guillain-Barré Syndrome.

The next generation of avian influenza vaccine is being developed using technologies to boost immune responses with lower doses. There is also an urgent need to develop such vaccines using non-egg technologies and recombinant technologies in the future.

Being a non-agricultural country with limited life-stocks and practically no commercial animal husbandry, Singapore sees little need to stock up on avian influenza vaccine. However, this may change as the disease epidemiology of avian influenza changes.

TOWARDS AN ADULT VACCINATION SCHEDULE FOR SINGAPORE

The United States has a recommended adult immunisation schedule, which is updated yearly. An adolescent/adult vaccination schedule for use in Singapore is proposed for your consideration. It is shown in Table 2. The details relevant to the vaccines recommended follow those given by the ACIP for the October 2006-Sep 2007 (Ref 8).

Table 2. Proposed Adolescent / Adult Vaccination Schedule in Singapore

VACCINE	ALL AGE GROUPS	TARGETPOPULATION SPECIFIC AGE GROUPS	TARGET POPULATION : WITH RISK FACTORS
TETANUS-DIPHTHERIA VACCINE 1º - 0, 1, 6 months Booster every 10 yrs	YES		
HEPATITIS A VACCINE 1º - 0, 6 months		FROM 12 MONTHS	Those with medical indications; occupational indications; and other indications – see details in text
HEPATITIS B VACCINE 1º - 0, 1, 6 months	YES		
HPV VACCINE 1º - 0, 2, 6 months Booster interval unknown		9 – 26 YEARS OLD	Those with potential exposure to HPV through sexual activity
VARICELLA VACCINE 1º - 0, 1 or 2 months in adults 1º - 0, > 3 months in children		FROM 12 MONTHS	Those with close contact with persons at high risk for severedisease; those at high risk for exposure or transmission
VARICELLA -ZOSTER VACCINE Single dose		> 60 YEARS OLD	Severity of herpes zoster and post-herpetic neuralgia increased with age
MEASLES, MUMPS, RUBELLA VACCINE 1º - 0, >1 months No booster	YES		
INFLUENZA VACCINE yearly			YES
MENINGOCOCCAL VACCINE Every 3 years			YES
PNEUMOCOCCAL VACCINE One dose for > 65 yrs Every 5 years for risk factors			YES

Tetanus-diphtheria vaccine, Hepatitis B vaccine, Measles, Mumps, Rubella (MMR) vaccine are indicated for all age groups if they have not received these vaccines or are incomplete in their immunisations, or are at risk of infection.

- **Tetanus, diphtheria, and acellular pertussis (Td/Tdap) vaccination**
  Adults with uncertain histories of a complete primary vaccination series with diphtheria and tetanus toxoid containing vaccines should begin or complete a primary vaccination series. A primary series for adults is three doses; administer the first two doses at least four weeks apart and the third dose 6-12 months after the second. Administer a booster dose to adults who have completed a primary series and if the last vaccination was received ≥10 years previously. Tdap or tetanus and diphtheria (Td) vaccine may be used.

- **Hepatitis B vaccination**
  Medical indications: persons with end-stage renal disease, including patients receiving hemodialysis; persons seeking evaluation or treatment for a sexually transmitted disease (STD); persons with HIV infection; persons with chronic liver disease; and persons who receive clotting factor concentrates.

  Occupational indications: health care workers and public safety workers who are exposed to blood or other potentially infectious body fluids.

  Behavioral indications: sexually active persons who are not in a long-term, mutually monogamous relationship (i.e., persons with >1 sex partner during the previous six months); current or recent injection-drug users; and men who have sex with men.

  Other indications: household contacts and sex partners of persons with chronic hepatitis B virus (HBV) infection; staff members of institutions for persons with developmental disabilities; all patients of STD clinics; international travellers to countries with high or intermediate prevalence of chronic HBV infection; and any adult seeking protection from HBV infection.

  Settings where hepatitis B vaccination is recommended for all adults: STD treatment facilities; HIV testing and treatment facilities; facilities providing drug abuse treatment and prevention services; health care settings providing services for injection drug users or men who have sex with men; correctional facilities; end stage renal disease programs and facilities for chronic hemodialysis patients; and institutions and nonresidential daycare facilities for persons with developmental disabilities.

  Special formulation indications: for adult patients receiving hemodialysis and other immunocompromised adults, one dose of 40 μg/mL (Recombivax HB®) or two doses of 20 μg/mL (Engerix-B®).

- **Measles, mumps, rubella (MMR) vaccination**
  Measles component: adults born before 1957 can be considered immune to measles. Adults born during or after 1957 should receive ≥1 dose of MMR unless they have a medical contraindication, documentation of ≥1 dose, history of measles based on health-care provider diagnosis, or laboratory evidence of immunity.

  A second dose of MMR is recommended for adults who: (1) have been recently exposed to measles or in an outbreak setting; (2) have been previously vaccinated with killed measles vaccine; (3) have been vaccinated with an unknown type of measles; (4) are students in postsecondary educational institutions; (5) work in a health care facility; or (6) plan to travel internationally.

  Withhold MMR or other measles-containing vaccines from HIV-infected persons with severe immunosuppression.

  Mumps component: adults born before 1957 can generally be considered immune to mumps. Adults born during or after 1957 should receive one dose of MMR unless they have a medical contraindication, history of mumps based on health-care provider diagnosis, or laboratory evidence of immunity.

  A second dose of MMR is recommended for adults who: (1) are in an age group that is affected during a mumps outbreak; (2) are students in post secondary educational institutions; (3) work in a health care facility; or (4) plan to travel internationally. For unvaccinated health care workers born before 1957 who do not have other evidence of mumps immunity, consider giving one dose on a routine basis and strongly consider giving a second dose during an outbreak.

  Rubella component: administer one dose of MMR vaccine to women whose rubella vaccination history is unreliable or who lack laboratory evidence of immunity. For women of childbearing age, regardless of birth year, routinely determine rubella immunity and counsel women regarding congenital rubella syndrome.

  Do not vaccinate women who are pregnant or who might become pregnant within four weeks of receiving vaccine. Women who do not have evidence of immunity should receive MMR vaccine upon completion or termination of pregnancy and before discharge from the health care facility.

Hepatitis A vaccine, and Varicella vaccine are offered for those at risk of infection. Varicella zoster is indicated for those 60 years and older. HPV vaccine is indicated for females between 9 to 26 years old.

- **Hepatitis A vaccination**
  Medical indications: persons with chronic liver disease and persons who receive clotting factor concentrates.

  Occupational indications: persons working with hepatitis A virus (HAV)-infected primates or with HAV in a research laboratory setting.

Other indications: persons travelling to or working in countries that have high or intermediate endemicity of hepatitis A; and any person who would like to obtain immunity.

Current vaccines should be administered in a two-dose schedule at either 0 and 6-12 months, or 0 and 6-18 months. If the combined hepatitis A and hepatitis B vaccine is used, administer 3 doses at 0, 1, and 6 months.

- **Varicella vaccination**
  All adults without evidence of immunity to varicella should receive two doses of varicella vaccine.

  Special consideration should be given to those who:
  (1) have close contact with persons at high risk for severe disease (e.g., health care workers and family contacts of immunocompromised persons), or
  (2) are at high risk for exposure or transmission (e.g., teachers of young children; child care employees; residents and staff members of institutional settings, including correctional institutions; college students; military personnel; adolescents and adults living in households with children; non-pregnant women of childbearing age; and international travellers),

  Do not vaccinate women who are pregnant or might become pregnant within four weeks of receiving the vaccine. Assess pregnant women for evidence of varicella immunity.

  Women who do not have evidence of immunity should receive dose 1 of varicella vaccine upon completion or termination of pregnancy and before discharge from the health-care facility. Dose 2 should be administered four to eight weeks after dose 1.

- **Human papillomavirus (HPV) vaccination**
  HPV vaccination is recommended for all women aged ≤26 years who have not completed the vaccine series.

  Ideally, vaccine should be administered before potential exposure to HPV through sexual activity; however, women who are sexually active should still be vaccinated. Sexually active women who have not been infected with any of the HPV vaccine types receive the full benefit of the vaccination. Vaccination is less beneficial for women who have already been infected with one or more of the four HPV vaccine types.

  A complete series consists of three doses. The second dose should be administered two months after the first dose; the third dose should be administered six months after the first dose.

  Vaccination is not recommended during pregnancy. If a woman is found to be pregnant after initiating the vaccination series, the remainder of the three-dose regimen should be delayed until after completion of the pregnancy.

Influenza vaccine, meningococcal vaccine, and pneumococcal vaccine are indicated for target populations with risk factors.

- **Influenza vaccination**
  Medical indications: chronic disorders of the cardiovascular or pulmonary systems, including asthma; chronic metabolic diseases, including diabetes mellitus, renal dysfunction, hemoglobinopathies, or immunosuppression (including immuno-suppression caused by medications or HIV); any condition that compromises respiratory function or the handling of respiratory secretions or that can increase the risk of aspiration (e.g., cognitive dysfunction, spinal cord injury, or seizure disorder or other neuromuscular disorder); and pregnancy during the influenza season.

  Occupational indications: health care workers and employees of long term care and assisted living facilities.

  Other indications: residents of nursing homes and other long term care and assisted living facilities; persons likely to transmit influenza to persons at high risk (i.e., in-home household contacts and caregivers of children aged 0-59 months, or persons of all ages with high-risk conditions); and anyone who would like to be vaccinated.

  Healthy, nonpregnant persons aged 5-49 years without high-risk medical conditions who are not contacts of severely immunocompromised persons in special care units can receive either intranasally administered influenza vaccine (FluMist®) or inactivated vaccine. Other persons should receive the inactivated vaccine.

- **Meningococcal vaccination**
  Medical indications: adults with anatomic or functional asplenia, or terminal complement component deficiencies.

  Other indications: first-year college students living in dormitories; microbiologists who are routinely exposed to isolates of *Neisseria meningitidis*; military recruits; and persons who travel to or live in countries in which meningococcal disease is hyperendemic or epidemic (e.g., the "meningitis belt" of sub-Saharan Africa during the dry season [December-June]), particularly if their contact with local populations will be prolonged. Vaccination is required by the government of Saudi Arabia for all travellers to Mecca during the annual Hajj. Meningococcal conjugate vaccine is preferred for adults with any of the preceding indications who are aged ≤55 years, although meningococcal polysaccharide vaccine (MPSV4) is an acceptable alternative. Revaccination after five years might be indicated for adults previously vaccinated with MPSV4 who remain at high risk for infection (e.g., persons residing in areas in which disease is epidemic).

- **Pneumococcal polysaccharide vaccination**
  Medical indications: chronic disorders of the pulmonary system (excluding asthma); cardiovascular diseases; diabetes

mellitus; chronic liver diseases, including liver disease as a result of alcohol abuse (e.g., cirrhosis); chronic renal failure or nephrotic syndrome; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy [if elective splenectomy is planned, vaccinate at least two weeks before surgery]); immunosuppressive conditions (e.g., congenital immunodeficiency, HIV infection [vaccinate as close to diagnosis as possible when CD4 cell counts are highest], leukemia, lymphoma, multiple myeloma, Hodgkin disease, generalised malignancy, or organ or bone marrow transplantation); chemotherapy with alkylating agents, antimetabolites, or high-dose, long-term corticosteroids; and cochlear implants.

Other indications: Alaskan natives and certain American Indian populations and residents of nursing homes or other long-term care facilities.

- **Revaccination with pneumococcal polysaccharide vaccine**

  One-time revaccination after five years for persons with chronic renal failure or nephrotic syndrome; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy); immunosuppressive conditions (e.g., congenital immunodeficiency, HIV infection, leukemia, lymphoma, multiple myeloma, Hodgkin disease, generalised malignancy, or organ or bone marrow transplantation); or chemotherapy with alkylating agents, antimetabolites, or high-dose, long-term corticosteroids.

  For persons aged ≥65 years, one-time revaccination if they were vaccinated <65 years previously and were aged <65 years at the time of primary vaccination.

CONCLUSIONS

ACIP provides updates on vaccines and their use. A recommended adult vaccination schedule for use in Singapore is proposed.

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LEARNING POINTS

- **Updated recommendations from the US Advisory Committee on Immunisation Practices continue to be issued on vaccines.**
- **The HPV vaccine is not intended for use in the treatment of genital warts or cancers. It is also not a substitute for cervical cancer screening, hence, does not obviate the need for routine Pap smear.**
- **The varicella zoster (VZV) vaccine is recommended as a single dose vaccine in those 60 years or older.**
- **Alternative schedules for hepatitis vaccines for rapid protection are now available.**
- **The new ACIP guidelines for meningococcal vaccination calls for vaccination of all adolescents 11–18 years old.**
- **An FDA approved avian influenza vaccine for use in adults at risk for exposure to H5N1 virus is available for the agricultural setting.**
- **An adult vaccination schedule for Singapore is proposed consisting of tetanus-diphtheria vaccine, hepatitis B vaccine, MMR vaccine for all age groups; hepatitis A vaccine, varicella vaccine, and HPV vaccine for specific age groups; and influenza vaccine, meningococcal vaccine, and pneumococcal vaccine for target population with risk factors.**