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GLOBAL BURDEN, CHALLENGES AND RECOMMENDATIONS ON ADULT HEALTH IMMUNIZATION

Medical Science

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ABSTRACT

Immunization is recommended throughout life to prevent vaccine-preventable diseases and their sequel. The primary focus of vaccination programs has historically been directed to childhood immunizations. For adults, chronic diseases have been the primary focus of preventive and medical health care, though there has been increased emphasis on preventing infectious diseases. Adult vaccination coverage, however, remains low for most of the routinely recommended vaccines. Though adults are less susceptible to fall prey to traditional infectious agents, the probability of exposure to infectious agents has increased manifold owing to globalization and increasing travel opportunities both within and across the countries. Thus, there is an urgent need to address the problem of adult immunization.

KEYWORDS

Immunization, Adult health immunization, communicable disease, Vaccine preventable disease, Disease burden

INTRODUCTION

Immunization is one of the most effective public health interventions, reducing or eliminating the burden of many infectious diseases.[1] The primary focus of vaccination programs has historically been directed to childhood immunizations. For adults, chronic diseases have been the primary focus of preventive and medical health care, though there has been increased emphasis on preventing infectious diseases. Adult vaccination coverage, however, remains low for most of the routinely recommended vaccines.[2]Protecting adults through vaccination has never been considered a preventive strategy likely to have a great impact on population health. Though adults are less susceptible to fall prey to traditional infectious agents, emergence of HIV/AIDS, and re-emergence of malaria and tuberculosis world over has complicated the prevailing fragile health scenario. Also, the probability of exposure to infectious agents have increased manifold owing to globalization and increasing travel opportunities both within and across the countries. Despite the availability of vaccines, many adults remain unvaccinated because they are unaware of the need for adult vaccines or are misinformed about vaccines and the diseases they are designed to prevent. Thus, there is an urgent need to address the problem of adult immunization.[3]

BURDEN OF VACCINE-PREVENTABLE DISEASE AMONG ADULTS

According to world health statistics 2013, in a year, there were 4880 reported cases of diphtheria, 162 047 reported cases of pertussis, 14 272 reported cases of tetanus, 354 820 reported cases of measles, 726 169 reported cases of mumps, and 114 449 reported cases of rubella.[3] Globally, in 2011, there were 2500 deaths due to diphtheria,[4]158 000 measles deaths about 430 deaths every day or 18 deaths every hour.[5] Worldwide, annual epidemics of influenza result in about three to five million cases of severe illness, and about 250 000 to 500 000 deaths.[6] Among healthy adults, influenza vaccine can prevent 70% to 90% of influenza-specific illness. Among the elderly, the vaccine reduces severe illnesses and complications by up to 60% and deaths by 80%. The Hepatitis A virus has a worldwide distribution and causes about 1.4 million cases of clinical hepatitis each year.[7] More than 240 million people have chronic (long-term) liver infections. About 600 000 people die every year due to the acute or chronic consequences of hepatitis B. Hepatitis B prevalence is highest in sub-Saharan Africa and East Asia. Most people in these regions become infected with the hepatitis B virus during childhood and between 5–10% of the adult population are chronically infected.[8]HPV is estimated to cause 100% of cervical cancer cases, 90% of anal cancer cases, 40% of cases of cancers of the external genitalia (vulva, vagina, and penis), at least 12% of oro-pharyngeal cancer cases, and at least 3% of oral cancer cases.[9] Cervical cancer is the second most common cancer in women, with an estimated 530 000 new cases every year. Every year, more than 270 000 women die from cervical cancer; more than 85% of these deaths are in low- and middle-income countries.[10]

Knowledge On Adult Health Immunization Among Health Care Workers

Adult immunization is an emerging issue that has seen an increasing emphasis in clinical care and health professional training programs. The organization of the childhood and adult immunization enterprises are very different. The childhood immunization program involves a universal schedule encompassing a limited age range and involves a relatively narrow network of provider types. The adult immunization enterprise is more complex, encompassing a wide variety of vaccines and a very diverse target population ranging from healthy young adults to young adults and elderly with chronic conditions to those who are less likely to have a medical home and seek medical care in non-traditional settings. This diverse patient population is in turn served by an equally diverse network of health care providers.[11]

Kashyap, Chandrapal N, Thamke R, Singhania M, Tayade A et.al (2024)

A cross-sectional study was conducted among 261postgraduate resident doctors of tertiary care medical institutions in Navi Mumbai.About 27.6% of resident doctors did not even know that an adult immunization schedule exists. The best known to them were COVID-19 (98.3%, i.e. 57 residents) and hepatitis B vaccine (82.8%), i.e. 42 residents). Some of the special conditions were known to them i.e. Td or TdaP during pregnancy. The lack of knowledge and practices were clearly observed during the study among postgraduate resident doctors.[12]

Abdulla E, Johnson J, Munir S, Robin O'Dwyer et.al (2020)

A cohort study was conducted in which the total number of nurses who participated in the program was 340. Power analysis using the Australian Bureau Statistics online website (2018). Immunization knowledge was statistically analyzed using the SPSS Software version 25 and Microsoft Excel. The study findings revealed that specific areas were identified as knowledge gaps among the participants of the two cohorts.Moreover, the developed education program showed overall improvement in participants' knowledge.[13]

BARRIERS & CHALLENGES OF ADULT IMMUNIZATION

The common barrier to immunization in adulthood include.[14]

- Lack of recognition of the importance of adult immunization,
- Lack of recommendation from health care providers,
- Lack of health care provider knowledge about adult immunization and recommended vaccines,
- Misrepresentation/misunderstanding of the risks of vaccine and benefits of disease prevention in adults,
- Lack of understanding of vaccine safety and efficacy,
- Missed opportunities for vaccination in health care providers' offices, hospitals, and nursing homes,
- Lack of publicly-funded vaccine and reimbursement to vaccine providers,
- Lack of coordinated immunization programs for adults,
- Lack of regulatory or legal requirements,
- Fear of injections, and
- Lack of availability of up-to-date records and recording systems.

RECOMMENDED ADULT (AGED 19 Y AND OLDER) IMMUNIZATION SCHEDULE

Cholera Vaccine

Acute diarrheal diseases continue to be a major source of morbidity

and mortality worldwide. 15% of under five mortality worldwide is due to acute diarroheal diseases. Cholera is an important cause of acute infectious diarrohea and therefore vaccines against cholera are an attractive disease prevention strategy. Vaccines for cholera are available as injectable killed whole cell vaccine; and oral cholera vaccine. The injectable killed whole cell vaccine has been found to have a poor efficacy (45%) and the protection lasts for a duration of only 3 months.

Recommendations

Two types of oral cholera vaccines are available: (i) a monovalent vaccine – not licensed for children < 2 years of age) and (ii) bi-valent vaccines. The injectable vaccine prepared from phenol-inactivated strains of V. cholerae is still manufactured in a few countries; the use of this vaccine is not recommended mainly because of its limited efficacy and short duration of protection.

WHO recommends that Cholera control should be a priority in areas where the disease is endemic. Given the availability of 2 oral cholera vaccines and data on their efficacy, field effectiveness, feasibility and acceptance in cholera-affected populations, immunization with these vaccines should be used in conjunction with other prevention and control strategies in areas where the disease is endemic and should be considered in areas at risk for outbreaks. Although all age groups are vulnerable to cholera, where resources are limited immunization should be targeted to the high-risk age groups (children, pregnant women, and the elderly)

Diphtheria, Pertussis & Tetanus

Recommendations

Primary Vaccination:

For unvaccinated individuals 7 years of age and older, WHO recommends that Td combination vaccine can be administered, 2 doses, 1-2 months apart and a third dose after 6-12 months can be used with subsequent boosters at least 1 year apart for a total of 5 appropriately spaced doses to obtain same long term protection. Pertussis whole cell vaccine is not recommended for adolescents or adults.

Booster Dose:

A booster dose of tetanus and diphtheria toxoid- containing vaccine should be administered to adults who have completed a primary series and if the last vaccination was received >10 years previously. Tdap, Td or TT vaccine may be used, as indicated.

Tetanus Vaccination In Pregnancy:

Since 1983 in India, the nationwide Expanded Program on Immunization policy has been implemented to provide 2 doses of tetanus toxoid (TT2) to all pregnant women during each pregnancy (1 dose is provided if <3 years have passed since the previous pregnancy, and this is designated as TT-B). The policy aims at preventing neonatal and maternal tetanus.

Hepatitis A

The virus has a worldwide distribution and causes about 15 million cases of clinical hepatitis each year. Different studies in India have shown HAV sero- prevalence to be between 38% to 92% in different age groups.

Recommendations

WHO considers that in countries where hepatitis A is highly endemic, exposure to HAV is almost universal before the age of 10 years. In such countries clinical hepatitis A is usually a minor public health problem, and large-scale immunization efforts against this disease may not be undertaken. Hence, universal immunization for hepatitis A is not recommended as yet. More epidemiological data is required to ascertain the benefits of the vaccine.

Currently, four inactivated vaccines against HAV are internationally available. All four vaccines are safe and effective, with long-lasting protection. None of the vaccines are licensed for children less than one year of age.

The (HAV) vaccines are given parenterally, as a two- dose series, 6-18 months apart. The dose of vaccine, vaccination schedule, ages for which the vaccine is licensed, and whether there is a paediatric and adult formulation varies from manufacturer to manufacturer

In developed countries with low endemicity of hepatitis A and with high rates of disease in specific high-risk populations, vaccination of those populations against hepatitis A may be recommended. The high-risk groups include injection-drug users, homosexual men, persons travelling to high-risk areas, and certain ethnic or religious groups. However, it should be noted that vaccination programmes targeting specific high- risk groups may have little impact on the overall national incidence of disease.

Hepatitis B

Hepatitis B causes a spectrum of liver diseases, including acute self limiting hepatitis, acute fulminant hepatitis and chronic HBV infection. Burden of HBV infection across India varies across regions. A systematic review of literature concluded the prevalence of Hepatitis A in India to be between 1- 2%. A recent met-analysis showed the prevalence of Hepatitis A among tribal population to be 15.9% (95%CI-11.4-20.4) and amongst non tribal population 2.4% (95%CI-2.2-2.7%).

Recommendations

Hepatitis B vaccination is indicated for all unvaccinated adults at risk for HBV infection and all adults seeking protection from HBV infection including post-exposure prophylaxis.

WHO recommends inclusion of hepatitis B vaccine in the routine immunization schedule. Three doses (for high-risk groups if not previously immunized) is also recommended.

Additional target groups for vaccination include people with risk factors for acquiring HBV infection, such as those who frequently require blood or blood products, dialysis patients, recipients of solid organ transplantations, people interned in prisons, injecting drug users, household and sexual contacts of people with chronic HBV infection, people with multiple sexual partners, as well as health-care workers and others who may be exposed to blood and blood products through their work.

In countries with intermediate to low endemicity where a relatively large part of the disease burden results from acute HBV-related disease and is attributable to infection acquired by older children, adolescents and adults, catch-up strategies targeted at adolescents as a supplement to routine infant vaccination are also recommended.

People with risk factors for acquiring HBV infection and travelers who have not completed their hepatitis B vaccination series should be offered the vaccine before leaving for endemic areas.

Human Papilloma Virus

HPV infection is one of the most common sexually transmitted infections. HPV is associated with >95% cervical cancers which is the second most common cancer among women worldwide and the commonest in India.

Two vaccines are currently available. Quadrivalent (HPV types 6,11,16 and 18) licensed for use in females as young as 9 years of age to prevent cervical precancers and cancers. In addition, the quadrivalent vaccine is licensed for prevention of vulvar and vaginal pre-cancers and cancers as well as of anogenital warts in females. In some countries, the vaccine is also licensed for the prevention of anogenital warts in males. Bi-valent (HPV types 16 and 18) has been licensed for use in females as young as 10 years of age to prevent cervical pre-cancers and cancers. HPV vaccines are designed for prophylactic use only; they do not clear existing HPV infection or treat HPV- related disease. The mechanisms by which these vaccines induce protection have not been fully defined but seem to involve both cellular immunity and neutralizing immunoglobulin G antibodies.

The vaccine has to be delivered prior to exposure to the HPV virus. Therefore, the immunization must precede the sexual debut. Evidence suggests the age for initiation for vaccination to be 10 - 12 years. Screening for cervical cancer and primary prevention should be continued in spite of HPV vaccination.

Recommendation

- Since both vaccines are intended for females before the onset of sexual activity, i.e. before first exposure to HPV infection, a three-dose schedule is recommended. The quadrivalent is given at baseline and after 2 and 6 months. A minimum interval of 4 weeks between the first and second dose, and a minimum interval

between the second and third does of 12 weeks is recommended by the manufacturer. The bivalent vaccine is given at baseline and after 1 and 6 months. If flexibility in the schedule is necessary the manufacturer recommends that the second dose is administered between 1 and 2.5 months after the first dose.

- For both vaccines, alternative schedules are being explored. Restarting the 3-dose series is not necessary if interrupted, but remaining doses should be administered as close to the schedule intervals as possible.
- Currently, the manufacturers do not recommend any booster dose following completion of the primary series.
- Catch-up vaccination can be advised up to the age of 26 years for Gardasil® vaccine (quadrivalent vaccine) and 45 years for Cervarix® vaccine (bivalent vaccine)
- HPV vaccination of males for prevention of cervical cancer is not recommended at this time. Vaccination strategies that achieve high coverage (>70%) in the primary target population of young adolescent girls are expected to be more cost- effective in reducing cervical cancer than including vaccination of males.

Influenza

Influenza caused by Influenza A and Influenza B are the most common illness experienced by otherwise healthy adults and children and causes significant morbidity. Ramamurty N et al have reported a monthly incidence of respiratory infections to be 23% in urban areas and 17.7% in rural areas in Chennai among the peadiatric age group. Although the rates of infection are highest among children, risks for complications, hospitalizations and deaths from influenza are higher among persons aged over 65 years, young children and persons of any age who have co-morbid medical conditions that place them at increased risk for complications from influenza.

Recommendations

In the absence of epidemiological surveillance regarding the influenza serotypes in our country, presently the use of influenza vaccine in India is not recommended.

However, in response to the current influenza (H1N1) pandemic, the WHO strategic advisory group of experts (SAGE) have recommended the use of H1N1 influenza vaccine for health-care workers as a first priority to protect the essential health infrastructure. SAGE recommends that vaccination is also particularly important for people who are at increased risk of severe outcomes if they catch pandemic influenza, including pregnant women and people with underlying medical conditions. As vaccines available throughout is initially not sufficient, a step-wise approach to vaccinate particular groups is to be considered.

The WHO is also currently assessing a trivalent vaccine effective against the H1N1 pandemic virus, the seasonal H3N2 virus, and influenza B viruses, and a bivalent seasonal vaccine, effective against H3N2 and influenza B viruses, which might need to be supplemented with a separate monovalent H1N1 pandemic vaccine. SAGE concluded that both options should remain available for vaccine formulations in the southern hemisphere, subject to national needs.

In terms of protective efficacy, the live influenza vaccines appear to be comparable with the TIVs (trivalent, inactivated influenza vaccines.) However, CAIV-T (cold-adapted influenza vaccine) is licensed only for healthy people aged 5-49 years, given reports of an increase in reactive airway disease in vaccinees <5 years of age and insufficiently documented protective efficacy in older people.

Japanese Encephalitis

Japanese encephalitis (JE) is a form of viral encephalitis spread by arthropod borne virus belonging to the family Flaviviridae and genus Flavivirus. It is spread by the bite of infected culicine mosquito. In India, the disease is endemic in southern India and cases occur sporadically throughout the year, while in north India the cases occur in the form of epidemics during the summer and monsoon months. It is predominantly a disease of children living in rural areas although people residing in semi urban areas may also be affected. The control measures for JE are two pronged, namely vector control and prophylactic vaccination.

The vaccines used for immunization against Japanese encephalitis (JE) are (i) mouse brain-derived inactivated vaccine that uses the Nakayama strain (e.g., BIKEN/JE-VAX®) and (ii) PHK cell-cultured, live- attenuated vaccine (e.g., SA 14-14-2 vaccine). With effect from 2007, the production of the mouse brain- derived inactivated vaccine has been stopped at the Central Research Institute (CRI), Kasauli and this vaccine is not available for use in India. The SA 14- 14-2 live attenuated vaccine is currently in use in China, India, Korea, Sri Lanka and Nepal. It is administered subcutaneously as a single 0.5 ml dose and a booster dose may be given at one year.

Recommendations

The JE vaccine is primarily useful in the pediatric age group in JE endemic areas as JE is mainly a disease of children. Currently, the JE vaccine is not recommended for routine use in adults

Meningococcal Meningitis

Meningococcal disease is an acute bacterial disease caused by Gram negative capsular diplococcal bacteria, the meningococcus (Neisseria meningitides). At present 13 serogroups of meningococcus are known viz. A, B, C, E, H, I, K, L, M ,X, Y, Z, W 135. Meningococcal disease occurs worldwide as endemic infections. Strains of serogroup B and C cause majority of infections developed countries, where as strains of serogroup A and to a lesser extent serogroup C dominate in the developing world. In India the disease is endemic in some states like Delhi and sporadic cases are reported from other states such as Haryana, UP, Rajasthan, Gujarat, West Bengal and Orissa. Meningococcal disease is potentially preventable through vaccination and or chemoprophylaxis in special circumstances.

Two types of vaccines are in use for meningococcal meningitis (i) the polysaccharide vaccines and (ii) conjugate vaccines. A third type based on outer membrane protein [OMP] has not been found to be very effective and is not widely used. Internationally marketed meningococcal polysaccharide vaccines are either bivalent (groups A and C) or tetravalent (groups A, C, Y and W135).

Recommendations

Routine vaccination of all adults is not recommended in view of low efficacy of meningococcal vaccines in children below 2 years and the short-lived protection provided by the currently available polysaccharide vaccines.

Vaccination of adults with meningococcal vaccine should be done if they meet any of the following indications and any person seeking protection from hepatitis A virus (HAV) infection.

- **Medical:** Adults with anatomic or functional asplenia, or persistent complement component deficiencies.
- **Other:** First-year college students living in dormitories; microbiologists 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 through 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.

In older children and adolescents group C disease may be prevented by a single dose of (group C conjugate meningococcal) vaccine. Where disease in children above two years of age is the main concern, or where resources are limited, several years of protection may be achieved by single injection of the combined groups A and C polysaccharide vaccine.

Pneumococcus

Lower respiratory infections including community acquired pneumonia (CAP) are an important cause of morbidity and mortality worldwide. A vast majority of the lower respiratory infections are caused by viral infections. However, most cases of CAP are of bacterial origin. Among the bacterial pathogens causing CAP, S. Pneumoniae is the single most common organism worldwide. A study conducted by International Clinical Epidemiology Network (INCLEN) on pneumococcal infection during 1993-97 in India showed pneumococcal pneumonia, bacteremia and meningitis were associated with case fatality rates of 19%, 21% and 34% respectively. Moreover nearly one third (33%) of patients with proven IPD were younger than 5 years and about 23% were older than 50 years.

Currently, a 7-valent polysaccharide–protein conjugate vaccine (PCV-7) and an unconjugated polysaccharide vaccine covering 23 serotypes

are marketed internationally. A three dose regimen before one year of age along with a booster after one year is recommended for the 7-valent polysaccharide–protein conjugate vaccine. 23-valent vaccine is primarily designed for use in older children and adults who are at high risk for pneumococcal disease. It is not licensed for use in children aged <2 years.

Recommendations

More than 15 meta-analyses with conflicting results have been published so far the efficacy of PPV in adults. Available evidence is insufficient to recommend routine use of PPV in adults. Although PPV is efficacious in preventing invasive pneumococcal disease among adults, routine PPV administration to adults is not likely to be cost-effective in India. Pneumococcal vaccination is recommended in patients undergoing splenectomy (preferably at least 2 weeks prior to splenectomy)

Currently the WHO states that in resource-limited settings where there are many competing health priorities, the evidence does not support routine immunization of the elderly and high-risk populations with PPV.

Rabies

Rabies is an acute viral disease which causes encephalomyelitis in virtually all warm blooded mammals including man. Rabies virus is transmitted to other animals and to humans through close contact with their saliva (i.e. bites, scratches, licks on broken skin and mucus membrane). Rabies occurs in all continents with the exception of Antarctica. Estimates suggest that in India, around 20,000 human deaths occur due to rabies annually which accounts for about 1/3rd of total global mortality (APCRI 2004). It is estimated that 17.4 million animal bites occur per year; of these many do not seek post exposure prophylaxis.

As rabies has a long incubation period, it is possible to institute prophylactic post exposure vaccination.

Recommendations

Currently, cell culture rabies vaccines are used for rabies prophylaxis, which may be administered by intramuscular or intradermal route. For post exposure prophylaxis, five doses of the vaccine are administered on days 0, 3, 7, 14, and 28 in the deltoid muscle or in the anterolateral part of the thigh. They are not to be injected in the gluteal region. For intradermal inoculation of cell culture vaccines, Updated Thai Red Cross Regimen is approved for use in India. In this, 0.1 ml of vaccine, irrespective of reconstituted volume, is administered at 2 sites intra-dermally in the deltoid region on days 0, 3, 7 and 28. Intradermal inoculation of cell culture vaccines not only makes post exposure prophylaxis economical but also enables wider coverage in available quantity of vaccines.

Pre-exposure prophylaxis is recommended in high risk groups such as veterinary personnel, medical doctors, dog catchers, postmen, wild life wardens etc. Vaccine is given intramuscularly (1ml/0.5ml) or intra-dermally (0.1ml, irrespective of reconstituted volume) on days 0, 7, 21 or 28.

Rubella

There are a number of rubella vaccines available, either as single antigen vaccines or combined with either measles vaccine (MR), mumps vaccine or measles and mumps vaccine (MMR). Most of the currently- licensed vaccines are based on the live, attenuated RA 27/3 strain of rubella virus, propagated in human diploid cells.

Rubella is a mild childhood disease. However infection during pregnancy may cause fetal death or congenital rubella syndrome (CRS). The primary purpose of rubella vaccination is to prevent the occurrence of congenital rubella infection including congenital rubella syndrome (CRS), which is an important cause of deafness, blindness and mental retardation. Women of child bearing age should consider vaccination with rubella if not immunized during childhood. Rubella vaccination should be avoided in pregnancy because of the theoretical, but never demonstrated, teratogenic risk.

Recommendation

For adult immunization, two doses of the vaccine are recommended for health care workers; in the setting of outbreaks; recent exposure to these infections; women who could become pregnant; and college students.

WHO recommends two approaches for rubella vaccination. (a) prevention of CRS only, through immunization of adolescent girls and/or women of childbearing age; or (b) elimination of rubella as well as CRS through universal vaccination of infants, surveillance and assuring immunity in women of childbearing age. The WHO also emphasizes the need for a childhood vaccination programmes achieving and maintaining high levels of coverage to avoid the risk of increasing the number of susceptible among adults, including women of childbearing age, and the possibility of increased numbers of cases of CRS. On the other hand a policy of rubella vaccination of adults is essentially free of risks of altering rubella transmission dynamics.

Varicella

The currently marketed varicella vaccines are based on the so-called Oka strain of VZV, which has been modified through sequential propagation in different cell culture. Following a single dose of the above- mentioned vaccines, seroconversion is seen in about 95% of healthy children. From a logistic as well as an epidemiological point of view, the optimal age for varicella vaccination is 12-24 months.

Recommendations

Varicella vaccine may be used either at an individual level to protect susceptible adolescents and adults. But will not have a significant impact on the epidemiology of the disease on a population basis. Varicella in persons who have received the vaccine ("break-through varicella") is substantially less severe than the disease in unvaccinated individuals.[20]

Treatment

At the present time WHO does not recommend the inclusion of varicella vaccination into the routine immunization programmes of developing countries. However, (Varicella) vaccine may be offered in any country to individual adolescents and adults without a history of varicella, in particular to those at increased risk of contracting or spreading the infection. This use in adolescents and adults entails no risk of an epidemiological shift, as childhood exposure to VZV remains unaffected.

CONCLUSION

Substantial improvement in adult vaccination is needed to reduce the health consequences of vaccine-preventable diseases among adults. Health-care provider recommendations for vaccination are associated with increased uptake of patient vaccination.[16-18] It is the responsibility of health care providers to routinely assess the adult patient vaccination needs, recommendation, and offer of needed vaccines for adults. Successful vaccination programs combine:

- education of potential vaccine recipients and publicity to promote vaccination;
- increased access to vaccination services in medical and complementary settings, such as workplaces and commercial establishments (e.g., pharmacies); and
- use of practices shown to improve vaccination coverage, including reminder-recall systems, efforts to remove administrative and financial barriers to vaccination, use of standing order programs for vaccination, and assessment of practice-level vaccination rates with feedback to staff members.[19]

In addition to increasing routine vaccination delivery to adults, development of a comprehensive and sustainable adult immunization program will improve public health preparedness and emergency response capability (e.g., delivery of medical counter measures, dissemination of information).

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