Measles*

1. Brief description of the condition/disease

Measles is an acute disease characterized by fever, cough, coryza, conjunctivitis, and an erythematous maculopapular rash caused by infection with the measles virus (an RNA virus classified as *Morbillivirus* in the *Paramyxoviridae* family). Complications such as otitis media, bronchopneumonia, croup, and diarrhoea occur more commonly in young children. Acute encephalitis occurs in approximately one in every 1000 cases. Subacute sclerosing panencephalitis develops rarely (about 1 per 100 000) several years after infection. Measles is more severe in malnourished children in whom it can cause haemorrhagic rash, protein-losing enteropathy, oral sores, diarrhoea with dehydration, and severe skin infections. In children who are borderline nourished, measles often precipitates acute kwashiorkor and exacerbates vitamin A deficiency leading to blindness. In the USA, 1–2 of every 1000 reported cases are fatal. Case-fatality rates in developing countries are 3–5% and can reach 30% in high-risk communities. Case-fatality rates are also high in immunocompromised children, including those with HIV infection and leukaemia; the characteristic rash sometimes does not develop in these patients.

2. Current global burden and rating within the overall burden of disease

The number of measles cases reported worldwide to WHO declined from 4.4 million in 1980 to 1.3 million in 1990 and 0.8 million in 1996. However, measles reporting is incomplete; the actual burden from measles in 1996 was an estimated 36.5 million cases and 1 million deaths. The *Global burden of disease* attributes 10% of mortality from all causes among children <5 years of age to measles; it is the eighth leading cause of death worldwide, representing 2.7% of disability-adjusted life years in 1990.

3. Feasibility (biological) of elimination/eradication

Although nonhuman primates can be infected with measles virus, humans are believed to be the only reservoir capable of sustaining transmission of the virus. Acquired immunity after illness is permanent. Live attenuated measles virus, when administered at the recommended ages, produces >85% immunity after one dose and >90% immunity after two doses; and vaccine-induced immunity is long-lasting. Widespread vaccination (mass campaigns and routine vaccination) has resulted in interruption of measles virus transmission in a number of settings (e.g. the Gambia in 1968–69, the English-speaking Caribbean islands, Cuba, Chile, and possibly other countries in Latin America in the 1990s, and the USA over short periods in 1993, 1995, and 1996). However, sustaining elimination in large populations or regions is difficult because of importations of measles virus from endemic areas, which is facilitated by the frequency of air travel. This experience suggests eradication of measles is technically feasible with existing vaccines but will require a coordinated global effort over a relatively short period of time.

4. Estimated costs and benefits of elimination/eradication

Measles vaccination is one of the most cost-beneficial public health interventions. A preliminary economic analysis performed by the Children's Vaccine Initiative estimated expenditure of US$ 1100 million in 1995 for treatment of measles disease, and US$ 480 million for implementing the existing vaccination programme. Accelerating measles control, particularly in areas of low vaccination coverage and high disease burden, will probably be highly cost-effective. Cost-benefit and cost-effectiveness analyses for global measles elimination/eradication are under way.

5. Key strategies to accomplish the objective

Measles transmission can be interrupted if high population immunity is achieved rapidly through mass vaccination campaigns and/or routine immunization services. The Pan American Health Organization (PAHO) measles-elimination strategies are as

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follows: conduct a one-time "catch-up" vaccination campaign targeting all children aged 9 months to 14 years; achieve and maintain high routine vaccination coverage; conduct periodic "follow-up" campaigns targeting all children aged 1–4 years; and enhance surveillance for cases with laboratory confirmation of measles virus infection and virus isolation to enable molecular identification of the geographical origin of the virus.

6. Research needs

The following areas warrant further investigation and research: the importance of adults in sustaining measles transmission and strategies to prevent adult outbreaks; the effectiveness of PAHO-style elimination strategies in African settings with large urban slums and high HIV-infection rates; the interrelations between HIV infection (or other immunocompromising conditions) and measles disease/vaccination, strategies to improve the safety and ease of administration of measles vaccine in mass campaigns; and monitoring the safety of measles vaccination

7. Status of elimination/eradication efforts to date

In 1996, the estimated global coverage with one dose of measles vaccine was 81%. Nevertheless, nearly 1 million measles-related deaths occur each year, half of them in Africa. The countries of the Americas are committed to eliminate measles by the year 2000, and the Pacific Island nations are expected to make a similar commitment in the near future. The European Advisory Group on the Expanded Programme on Immunization has recommended that measles be eliminated from Europe by the year 2007. The Regional Committee of the Eastern Mediterranean has adopted an elimination target of 2010. China and several southern African countries have embarked on accelerated measles control/elimination approaches.

8. Principal challenges to elimination/eradication

Challenges include: perception in developed countries that measles is a minor disease of little consequence; lack of political and financial support; ease of importation of measles virus, particularly through air travel; and need to mobilize global resources and collaboration among partner organizations and focus these over a relatively short period of time (3–5 years).