

Editorial




Revisiting measles in Sri Lanka: an epidemiological overview

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Measles is a highly contagious airborne disease with a basic reproduction number (R_0) of 12-18. The virus initially infects the respiratory tract and then spreads throughout the body causing symptoms such as high fever, cough, coryza, conjunctivitis and generalized non-vesicular maculopapular rash. While typically manifesting in the majority as a mild illness, it can also lead to severe complications and even death. Although individuals of any age can be affected by measles, it primarily affects children who are more susceptible to complications compared to other age groups.

The measles vaccine is considered one of the most effective and safe vaccines available, showing 97% effectiveness after two doses, providing long-term immunity lasting a lifetime in most cases, with extremely rare serious adverse events. Before it was introduced in 1963, approximately 90% of the children contracted measles within the initial 15 years of life. In 1980, 2.5 million annual fatalities were reported due to measles globally. The World Health Organization (WHO) launched a global measles elimination campaign in 2001, aiming to achieve measles elimination in five WHO regions by 2020, primarily with the objective of averting morbidity and mortality in children under 5. Significant progress was made with efforts by

governments and international development partners, resulting in saving an estimated 5.6 million lives during the period of 2000-2020 through immunization. However, measles continues to represent a significant cause of childhood mortality globally, as evidenced by 128 000 deaths caused by measles in 2021.

The history of immunization in Sri Lanka dates back to 1886, the year when the vaccination ordinance was enacted targeting the eradication of smallpox. In 1978, the immunization programme was further strengthened as the Expanded Programme of Immunization. The measles vaccine was introduced to the National Immunization Programme (NIP) in 1984 as a single dose monovalent (measles-only) vaccine given at the age of 9 months. At the time, the disease was endemic in Sri Lanka, with 12-49 cases reported per 100 000 population annually during 1971-1980. By 1996, the immunization coverage reached the over 90% mark and along with it, the incidence of measles gradually declined until 1999. However, despite the high immunization coverage followed by a period of low incidence, the country experienced an unexpected massive outbreak of measles in 1999-2000. During this outbreak, 15 000 suspected cases of measles were reported to the Epidemiology Unit. These cases

were predominantly among the unvaccinated adolescents, while the highest age-specific mortality was reported among infants less than 9 months of age. Also, a substantial proportion of cases had a history of immunization against measles, hinting inadequacy of a single dose of vaccine to render full protection against the disease. Therefore, in April 2001, a second dose of measles containing vaccine (MCV) was introduced to the NIP for all children completing 3 years of age. It was in the form of Measles and Rubella (MR) vaccine, with the objective of boosting immunity. In addition, a nationwide measles catch-up immunization campaign was conducted, with its first phase launched in 2003 targeting adolescents aged 10-14 years who were either unvaccinated or vaccinated with a single dose of measles. This led to a 95% vaccine coverage. The second phase launched in 2004 targeting individuals aged 16-20 years, leading to a coverage of 72%.

With the introduction of Measles, Mumps and Rubella (MMR) vaccine to the NIP in 2011, the age of the first MCV dose was shifted to one year to achieve better seroconversion, in keeping with the disease epidemiology of the country. The country continued with a very low incidence of measles for a considerable period, however, during 2013-2015, on the brink of elimination, Sri Lanka experienced another outbreak of measles predominantly affecting infants below the age of one year who were awaiting immunization with MCV through the NIP. In response to this outbreak, a nationwide supplementary immunisation activity (SIA) targeting infants aged 6-12 months was carried out in 2013.

In 2015, a seroprevalence study was conducted in four districts among individuals aged 9 months to 39 years to assess herd immunity against measles. It revealed high population-level immunity among vaccinated age groups, however, a decline in immunity in the 15-16-year age group was also observed. The latter was attributed to the waning of

antibodies with advancing age among those who had received only one dose of MCV at the age of 9 months. The study further showed that infants aged 6-11 months were not adequately protected against measles, mostly due to inadequate maternal antibodies. In response, the age of administration of the first dose of the MMR vaccine was reverted back to 9 months in 2015, while the second dose remained scheduled for 3 years of age.

With the use of measles vaccine becoming widespread, the incidence of measles dropped dramatically on a global scale. By then, Sri Lanka already had a robust surveillance system established for all vaccine-preventable diseases including measles, which was integrated into the routine communicable disease surveillance system, well-aligned with the requirement of the measles elimination strategy of the WHO. In 2004, surveillance of measles was intensified and made case based. In 2017, the case definition for surveillance was broadened to include "any individual with fever and maculopapular rash". All cases that fit into the definition would be notified to the medical officer of health (MOH) of the residential area of the patient. Blood samples as well as throat and nasal swabs from all notified cases would be tested for anti-measles IgM and viral RNA by RT-PCR tests respectively, at the National Reference Laboratory at the Medical Research Institute. All suspected cases would also be informed to the Epidemiology Unit through a special reporting form – "the Blue Form" by the first contact health worker. All hospitals with a paediatrician and/or physician would be considered sentinel sites for active surveillance for measles. Infection control nursing officers (ICNO) would maintain a measles, rubella/congenital rubella syndrome (CRS) register in all sentinel site hospitals, actively look for cases in the wards and promptly inform the Epidemiology Unit if any cases are found. A weekly return (a "nil-return" if no cases are reported) to the Epidemiology Unit would be sent. A special field investigation would be

performed by the MOH for all notified cases and a special investigation form would be filled and sent to the Epidemiology Unit. Even a single confirmed case would be considered as an outbreak. Tracing of household and neighbourhood contacts by surveying 30-50 households within a 1 km radius of the index case, immunization of any eligible unvaccinated individuals and follow-up of contacts for two incubation periods (minimum of 28 days) would be conducted by the field health staff.

The country had successfully attained and maintained a very high immunization coverage against measles for over two decades, with the last indigenous case reported in 2016. In 2017, the measles, rubella/CRS elimination plan was accelerated to achieve and maintain zero endogenous transmission in the country, and to identify and contain any imported outbreaks, setting the goal of elimination of measles, rubella/CRS by 2020. With the high immunization coverage complemented by the strong surveillance together with the continuous dedication of the health workforce at all levels, the incidence of measles reduced significantly in the country, and on 9 July 2019, the WHO declared Sri Lanka as having eliminated measles, interrupting the transmission of the indigenous virus. Regional Director WHO South-East Asia, congratulating the country stated, “Sri Lanka’s achievement comes at a time when globally measles cases are increasing. The country’s success demonstrates its commitment and the determination of its health workforce and parents to protect children against measles”.

The COVID-19 pandemic caused heavy disruption to routine immunization programs globally. Many countries reallocated resources originally earmarked for these programs toward pandemic control efforts, resulting in shortages of vaccines and immunisation services. Lockdown measures and disruptions in transportation services significantly impeded access to healthcare facilities and many parents expressed hesitancy in bringing their children to immunisation

clinics due to concerns about the risk of contracting COVID-19. Consequently, a significant reduction in immunisation coverage including that of measles was observed. In this backdrop, with the world returning to normalcy, measles outbreaks began to emerge both globally and regionally. Some countries with significant human travel connections with Sri Lanka were also experiencing large outbreaks of measles.

Despite the obstacles presented by the global pandemic, Sri Lanka successfully sustained its immunization services, ensuring high immunization coverage nationwide. However, a small segment of vaccine-hesitant individuals had emerged, mostly confined to small groups with different opinions about vaccination, particularly in recent years. These hesitant individuals comprised less than 0.5% of the birth cohort each year and are primarily clustered in specific districts, forming groups of families in localized areas. In most instances, these families were either related or connected in some manner. Misconceptions surrounding COVID-19 vaccines may have also played a role in fostering this hesitancy during the post-pandemic period. Field health staff persistently engage with these families, maintaining consistent, close contact making repeated home visits and providing counselling to encourage acceptance of immunization. Line lists are meticulously kept, and logbooks are maintained at the local level to methodically document the progress and outcomes of visits and interactions with these families.

Although Sri Lanka successfully maintained its measles-free status for four years despite the threat of importation from countries with outbreaks, cases of measles were reported among vaccine-hesitant individuals in the Colombo Municipal Council area in mid-2023. The first case reported in May 2023 was a young male who had not taken any MCV dose. The outbreak then spread to other parts of the Colombo district, limited to a few MOH areas where vaccine-hesitant families were clustered,

subsequently extending into a few other districts. A time trend analysis showed that the outbreak initially propagated through vaccine-hesitant individuals and subsequently involved vulnerable individuals from other groups and communities. Phylogenetic analysis of the viral samples identified two imported strains as responsible for the outbreak, an Australian and an Indian strain.

Three mostly affected groups were identified during the first 6 months of the outbreak; (1) infants below the age of 9 months who had not yet received their routine first dose of the MCV, (2) older children mostly who were in the vaccine-hesitant group, (3) and young adults aged 20-30 years. The susceptibility among infants could be attributed to the weaning off of immunity derived through maternal antibodies. Due to the high immunization coverage against measles, natural infection in the community was very rare by this time. Therefore, the immunity acquired by most of the mothers of infants had been only through immunization. Consequently, the amount of maternal antibodies transferred to the foetus would be inadequate to protect them against measles making them susceptible. Most affected adults aged 20-30 years on the other hand could be those who were not fully protected with two doses of MCV. They were born before a second dose of MCV was introduced to the national immunization schedule, received the first dose at 9 months with a higher probability of the vaccine antigens being neutralized by still-existing maternal antibodies and may have also missed the SIA campaigns launched in 2003 and 2004.

The peak of the outbreak was observed in August and September 2023. Due to the overall high immunization coverage against measles and activation of the outbreak response strategies including strengthened case-based surveillance and field-level outbreak mitigation activities, it was possible to limit the number of cases to just above 700 by end of November 2023. Out of the total number of 358 MOH areas, 179 have not reported

any confirmed cases while 155 have reported less than 10 cases. Only 24 MOH areas have reported more than 10 cases. According to the field-level special investigations, nearly 55% of the confirmed cases had not received any MCV dose, while 42% had received only one dose. Ironically, about 9% of the cases had received both doses. This susceptibility could probably be due to the first dose of MMR vaccine being given at the age of 9 months, where neutralizing maternal antibodies could still be present in some infants, leading to a low seroconversion rate.

In early December, on the recommendations of the National Advisory Committee on Communicable Diseases (ACCD), it was decided to launch an SIA for infants aged 6-9 months and a special catch-up immunization campaign for 9 months to 15-year-old children who were unimmunized or partially immunized. An extra dose of MMR vaccine was offered through the SIA to all children aged 6-9 months, in addition to their routine doses at the age of 9 months and 3 years. The SIA was conducted in nine high-risk health districts selected based on the caseload, population density and the prevalence of vaccine hesitancy. The activity was conducted through existing child immunization clinics of these districts starting on 6 January 2024, followed by 4 consecutive Saturdays. The special catch-up immunization activity targeting the vaccine-hesitant children was conducted in all districts through routine immunization clinics including the central clinics at the MOH office.

With the support of the Health Promotion Bureau, public awareness of the SIA and the special catch-up campaign was created using a multitude of methods. Hand delivery of a printed invitation emphasizing the importance of immunization against measles, to all parents of infants eligible for the SIA and parents of hesitant children, television and radio spots, media briefings for journalists of mainstream electronic and print media, newspaper articles, interviews and talk shows, public

announcements, banners and posters were among the main communication strategies. Customized approaches were employed by the field health staff to engage hesitant families effectively at the local level. A series of preparatory and planning meetings were conducted at all levels, utilizing both in-person and online formats. Training sessions for all categories of public health and hospital staff involved in the SIA were organized using a cascade training approach. The SIA was successfully completed, achieving a coverage of over 95%. The special catch-up immunization programme targeting the vaccine-hesitant individuals also achieved a coverage of 25%.

A gradual reduction in the number of cases has been observed during the past few months. The proportion of cases reported among the infants aged 6-9 months are currently much lower, while the majority of cases reported are among the young adults aged 20-30 years.

In conclusion, the recent measles outbreak in Sri Lanka, though challenging, has demonstrated the resilience of the country's immunization programme. Despite minor setbacks caused by vaccine hesitancy, Sri Lanka has successfully contained the outbreak through its high immunization coverage, robust surveillance system, and swift and targeted response measures, including supplementary immunization activities and catch-up campaigns. The high coverage achieved in these campaigns reflects the dedication of health workers and the commitment of the community to combat measles and ensure the health of future generations. Moving forward,

ongoing efforts to address vaccine hesitancy, continued vigilance and sustained efforts will be essential to maintain Sri Lanka's measles-free status and protect vulnerable populations from this preventable disease.

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