Responding to measles outbreak: closing the immunity gap in children of Timor-Leste

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Background: An outbreak of measles was reported in Timor-Leste during 2011. A concerted response at national level utilized this opportunity to improve measles immunization coverage rates.

Methods: Health Management Information System and Surveillance System data were utilized to describe the outbreak. Attack rates and case fatality rates (CFR) were calculated using standard methods. Evaluation surveys were used to access immunization coverage. Proceedings of weekly meetings of the National Committee for Control of Disease Outbreaks were reviewed.

Results: A total of 739 cases and 8 deaths were reported to the Surveillance Unit. Most (>82%) of the measles cases were reported from Dili and Ermera districts. The attack rate was 1.3 per 1000 population and CFR was 1.1%. The response was coordinated by the National Committee for Control of Disease Outbreaks, which included case management, active and passive surveillance, communication and measles immunization among six-month to 14-year old children. Immunization activity targeted 495 000 children, i.e. almost one-half of the Timor-Leste population and achieved high coverage (85%).

Conclusions: The outbreak highlighted gaps in the immunity against measles. The National Committee for Control of Disease Outbreaks ensured a coordinated response which led to prevention of deaths from measles due to early case management with vitamin A supplementation, and high measles immunization coverage.

Key words: Measles, outbreak, immunization, surveillance, Timor-Leste.

Introduction

In May 2010, the World Health Assembly endorsed a new measles mortality reduction goal.\(^1\) A South-East Asia Regional Consultation in 2009, agreed that measles elimination was technically, biologically and programmatically feasible. In 2010, the sixty-third session of the Regional Committee adopted the regional interim goals towards measles elimination as approved by the sixty-third World Health Assembly. The interim goals to...
be achieved by 2015 are: (a) Exceed 90% coverage with the first dose of measles-containing vaccine nationally, and exceed 80% vaccination coverage in every district or equivalent administrative unit; (b) Reduce annual measles incidence to less than five cases per million and maintain that level; and (c) Reduce measles mortality by 95% or more in comparison with 2000 estimates.

According to global estimates, 36,000 measles deaths occurred in the countries of WHO’s South-East Asia Region in 2007. In 2009, a total of 469 outbreaks of suspected measles were reported with measles incidence ranging from 0.10 per 100,000 population in Sri Lanka to 9.57 per 100,000 population in Thailand. Immunization coverage rates were variable, ranging from 98% in Bhutan, DPR Korea, Maldives and Thailand to 70% in Timor-Leste. However, to achieve measles elimination, all countries in the WHO South-East Asia Region are providing second dose of measles vaccine through routine immunization programmes or through Measles Supplementary Immunization Activity (SIA).

In Timor-Leste, the first measles SIA activity was done in 2003 targeting 9-59-month-old children. Another SIA was done for the Internally Displaced Population in 2006, for children six months to 14 years of age. Again, in June 2009, measles vaccine was offered to all children in the country in the age group of 6-59 months, as part of the national tetanus toxoid campaign. The Demographic Health Survey (DHS) shows that only 53% of children were fully immunized in 2009-2010. As shown in Figure 1, routine immunization coverage for measles appears to have leveled off at 55% to 67% over the past several years.

**Figure 1: Suspected measles cases, supplementary immunization activity (SIA), and reported measles immunization coverage (MCV1), Timor-Leste, 2002-2010**

![Graph showing suspected measles cases, supplementary immunization activity (SIA), and reported measles immunization coverage (MCV1), Timor-Leste, 2002-2010.](source: South-East Asia Region Measles and Rubella Factsheet. World Health Organization, 2010)
The surveillance system in Timor-Leste largely depends on cases reported by health facilities. In the last few years cases of measles had been reported (Figure 1), but considering the low utilization of health services, data only from health facilities may underestimate the actual incidence of measles cases and deaths. The impediments of distance, cost and poor infrastructure along with low levels of awareness contribute to poor access to government health services.\textsuperscript{5} Outbreak investigation revealed the existence of a large immunity gap of measles in 2011. This report presents characteristics of the outbreak and the concerted response that led to the bridging of the measles immunity gap in Timor-Leste.

**Methods**

Measles cases were detected by both active and passive surveillance. During the period of the outbreak all health facilities were required to submit daily reports to the Health Management Information System (HMIS) and Surveillance Unit at the Ministry of Health including a nil report if cases did not occur. Cases reporting to the health system were then followed up at home with a house-to-house search for more cases in the immediate vicinity of the household with the measles case. Cases were identified based on the “Standard Case Definition for Measles”. A few cases were also subjected to measles serology testing (Ig M antibody) by the National Laboratory, to confirm the diagnosis of measles.

The Surveillance Unit was responsible for providing updates during the weekly meetings of the National Committee for Control of Disease Outbreaks. The Surveillance Unit also conducted a special investigation in Laclo village of Ermera District, which recorded a large number of cases, to enquire about the immunization status of children. The proceedings of the Committee meetings, which recorded the discussions and decisions, were reviewed. In addition, the outbreak reports prepared by the Surveillance Unit, the EPI unit, UN agencies and other partners were also analyzed. A line list of cases was prepared using WHO case definition. Attack rates and case fatality ratio (CFR) were calculated using the WHO SEARO Measles and Rubella Surveillance and Outbreak Investigation Guidelines, 2009. Outbreak data were analyzed by using SPSS version 14.0 for Windows. The reports of the measles immunization catch-up activity were also analyzed using Epi Info software version 3.5.3. An independent coverage evaluation survey (CES) commissioned by the Ministry of Health in partnership with UNICEF and WHO using the standard WHO 30-cluster method for immunization cluster survey assessed the coverage of measles vaccine after the supplementary measles immunization activity.\textsuperscript{6} Differences in proportions/rates were compared using the chi-square test. Statistical significance level was set at \( p < 0.05 \).

**Results**

**The measles outbreak**

Measles cases started occurring in early February 2011, reached its peak in April to May 2011, and a decline began after 15 May 2011. The progression of the outbreak over time is depicted by the epidemic curve, representing the weekly frequency of cases reported (Figure 2). Of the first 18 suspected measles cases, 15 cases were confirmed to be measles by laboratory tests.

The outbreak affected 12 out of 13 districts of Timor-Leste (Figure 3).\textsuperscript{7} A total of 739 measles cases and eight deaths were reported to the Surveillance Unit of the Ministry of Health. More than 82\% of measles cases were reported by two districts - Dili (343 cases) and Ermera (264 cases). The age distribution of
**Figure 2: Epidemic curve of measles outbreak, Timor-Leste, February – July 2011**

![Epidemic curve of measles outbreak](image)

**Figure 3: Geographic distribution of measles cases during 2011 outbreak in Timor-Leste**

![Geographic distribution of measles cases](image)
the measles cases ranged from 1 month to 25 years. Most (90%) of the cases were between 6 month to 14 years of age (Figure 4). The percentage of male cases (52%) was slightly higher than females.

The special investigation carried out by the Surveillance Unit in Laclo village, Ermera district found significant difference ($p < 0.05$) in the attack rates between vaccinated and unvaccinated children in age groups of 1 to 4 years. The vaccine effectiveness among children 1–4 years and 5-14 years was 68% and 42% respectively. The data on history of measles immunization was collected by trained investigators, who visited the households with cases and then conducted a door-to-door search for cases in the neighbouring households. Only the data of children whose vaccination status was known were used in calculating the vaccine effectiveness.

Nationally, the attack rate was 1.3 per 1000 population. The highest attack rate was in Ermera district (3.1 per 1000 population). The difference in attack rate in $< 1$ year (2.5), 1 to 4 year (2.8), and 5 to 14 year (2.7) age groups was not statistically significant. There was no significant difference in the attack rates between males and females also. The case fatality ratio was 1.1%. Measles-related deaths were reported by Ermera (three deaths, CFR 0.9%) and Dili district (five deaths, CFR 1.9%). All measles-related deaths were due to pneumonia.

**Response to the outbreak**

A concerted response was launched involving officials of the Ministry of Health at national and district levels along with UNICEF, WHO and nongovernmental organizations (NGOs) which was essentially coordinated by the

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**Figure 4: Age and sex distribution of cases in measles outbreak, Timor-Leste, 2011**

![Figure 4: Age and sex distribution of cases in measles outbreak, Timor-Leste, 2011](image_url)
National Committee for Control of Disease Outbreaks (Komisaun Nacional Kontrola Moras Surtu) chaired by the Health Minister. It has representatives from various health departments and agencies like WHO, UNICEF and NGOs. The committee implemented its tasks through six sub-committees - Surveillance, Medical Management, Laboratory, Environmental Health, Logistics/Medical Supplies, Media and Communications. During the outbreak, the committee met once every week to review the situation and to decide the line of action.

The measles outbreak response plan basically included surveillance, case management, communication and measles immunization. Both active and passive surveillance methods were used to identify cases of measles. Health care providers were oriented on the standard case management of measles and administration of vitamin A supplementation. In addition, the health facilities were equipped with the required drugs and supplies. In areas with high case load, like Atsabe sub-district in Ermera, a special team equipped with an ambulance and essential supplies provided support to the Community Health Centre staff. Communication activities used mass media such as television, community radio, public and church announcements.

Measles immunization catch-up activity was undertaken after a detailed plan in a phased manner. It included measles immunization to all children in the age group six months to 14 years, vitamin A (100 000 IU) for children from six months to one year, vitamin A (200 000 IU) and de-worming for children from one year to four years. This activity was carried out over three weeks, with the first week dedicated to immunization in schools and the second and third weeks dedicated to immunization in outreach sites. Daily sessions were also conducted in the health facilities.

The immunization catch-up activity was preceded by a nationwide micro-planning exercise. The Ministry of Health coordinated the involvement of a number of partners who supported a wide range of activities – from providing additional vaccinators and mobilizing communities for immunization to helping transport health workers to be able to immunize children in remote areas. Operational guidelines and briefing materials were prepared. The doctors at the health facilities and medical students received training in the recognition and clinical handling of Adverse Events Following Immunization. Communication materials were developed, translated into Tetum, and distributed to health workers, local leaders and other community influencers. The coverage evaluation survey revealed coverage of 85% (95%CI: 81.1%-88.9%) for the measles catch-up activity, while the reported coverage (HMIS reports) was 92% (Figure 5).

Discussion

The delivery of immunization services in Timor-Leste is challenged by populations living sparsely in mountainous terrain with poor infrastructure coupled with human resource shortages. The capital Dili and certain other districts had significant numbers of unimmunized children, potentially posing a huge risk for measles outbreaks. The Measles Strategic Plan (MSP) tool after considering the existing immunization coverage and the measles supplementary immunization activities in the past, had demonstrated a large pool of children unprotected against measles in 2010 (this, however, does not include the children protected by natural infection with measles virus).8

Similar outbreaks, following low levels of immunization coverage and the consequent existence of a large susceptible pool of
unprotected children have been documented in other settings.\textsuperscript{9,10} The low case fatality rate (1.1\%) could be attributed to the immediate response implementing the case management protocols including vitamin A supplementation. The higher CFR of 1.9\% in the capital Dili, the largest urban area of Timor-Leste, is a cause of concern. The Demographic Health Survey 2010 also showed that though about seven in ten children with Acute Respiratory Infection symptoms were taken for treatment, only 45\% were treated with antibiotics. The Ministry of Health has been actively pursuing the implementation of SISCa or Servico Integrado Saude Communitaria, which is an innovation to make health services more accessible to communities to improve health-seeking behaviour.\textsuperscript{11}

The poor vaccine effectiveness is a cause of concern. However, the values need to be viewed with caution due to the small sample and wide confidence intervals. Moreover, since only the data from children whose vaccination status was known, were used in calculating the vaccine effectiveness, it may have possibly resulted in misclassification as many caretakers who did not know the status of vaccination are likely to have not vaccinated their child. This may have resulted in calculation of lower than expected attack rates in the unvaccinated group and consequently calculation of lower vaccine effectiveness than expected. Low levels of vaccine effectiveness have also been recorded from other developing countries, where cold chain and other programme failures have shown to adversely impact the effectiveness of measles vaccine.\textsuperscript{12,13}

The measles immunization catch-up campaign launched in response to the outbreak, reported a national coverage of 92\% in the age group of six months to 14 years. After the completion of campaign activities, an independent coverage evaluation survey (CES) commissioned by the Ministry of Health in partnership with UNICEF and WHO using the standard WHO 30-cluster method for
immunization cluster survey, arrived at a lower coverage (85%). A comparison between the reported and evaluated coverage (Figure 5) revealed that the largest discrepancy was in the age group of 6-11 months. This could be largely attributed to the errors in reporting of the numerator or denominator data in this age group.

The outbreak response also resulted in a few spin offs and important learning. The guidance provided by the National Committee for Control of Disease Outbreaks was vital in ensuring a coordinated response that led to prevention of deaths from measles due to early initiation of case management with vitamin A and higher coverage of the countrywide immunization response. This committee has been further strengthened and has become a regular forum for information sharing. It has played a vital role in controlling outbreaks of dengue and acute diarrhoeal disease in the recent past. The oversight and feedback provided by the committee has also helped in improving the quality of the surveillance and HMIS data.

The lessons learned have been utilized while developing a Measles Mortality Reduction Strategy and action plan. Based on modeling estimates, the plan advocates for providing a second opportunity for measles immunization through SIA in 2011 and 2014, moving from outbreak-based surveillance to case-based surveillance, achieving and maintaining high coverage for routine measles immunization, ensuring proper case management with vitamin A supplementation, and strengthening laboratory capacity for timely collection of specimens, diagnosis and feedback. On achievement of greater than 90% coverage of routine measles immunization in all districts, the plan calls for introduction of MCV2 (second opportunity with measles virus containing vaccine) in routine EPI programme from 2015 onwards. The experience from the outbreak also indicates that the main pillar for the movement towards measles elimination remains a strengthened Routine Immunization System. The Ministry of Health in its recent Country Multi-Year Plan for Routine Immunization has identified its priorities as addressing the bottlenecks for routine immunization and sustaining high routine vaccination coverage, addressing the funding gap, vaccinating the hard-to-reach population and improving micro plans and systems of supportive supervision and community mobilization.

To conclude, the outbreak of measles in Timor-Leste was a result of low coverage with routine immunization and the subsequent buildup of a large pool of children unprotected against measles. A comprehensive response, which included appropriate case management and vitamin A supplementation under the aegis of the National Committee for Control of Disease Outbreaks was responsible for the low case fatality rates. The lessons learned in the outbreak indicate that the government of Timor-Leste, and partners should work jointly to put in place a comprehensive measles mortality reduction strategy and invest in strengthening routine immunization systems. Operational research could help in understanding the bottlenecks like poor geographic access and low demand for routine immunization services. High coverage achieved in the measles immunization catch-up campaign, along with sustained high rates of routine Immunization coverage would help in closing the immunity gap for measles in Timorese children.

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References


