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Indonesia Measles Immunization Program Monitoring: An Analysis of 5 Years Measles Surveillance Data

[1]Vivi Setiawaty*, [2]Ratna Budi Hapsari, [2]Cornelia Kelyombar, [2]Devi Anisiska, [3]Subangkit, [3]Mursinah, [4]Niprida Mardin, [4]Rusipah Rusipah

[1]Sulianti Saroso Hospital – National Infectious Disease Center, Ministry of Health, Jakarta, Indonesia, [2]Center for Disease Prevention and Control, Ministry of Health, Jakarta, Indonesia
[3]Health Policy Agency, Ministry of Health, Jakarta, Indonesia, [4]World Health Organization country office, Jakarta, Indonesia

Abstract

Background: Measles remains a leading cause of death among young children. Maintaining high coverage of routine immunization should be a top priority to achieve the elimination target in 2020. This study aims to determine the progress of the national measles immunization program.

Method: We analyzed the measles surveillance data from January 2008 to December 2013. A measles case is a clinical measles case with a positive measles virus infection through a serology test (measles IgM positive) and no measles vaccination 4-6 weeks before the rash appears.

Results: We found that 115,105 measles cases were reported. During that period, a series of measles immunization campaigns were conducted from 2009 – to 2011. There was a decrease in laboratory-confirmed measles cases, from 10 per 100,000 population in 2008 to 4.6 in 2013. From 2010 to 2013, the proportion of suspect measles cases tested in the laboratory increased from 16 to 37% of the total suspect cases. Among those tested specimens, we found the increasing number ranged from 12 to 26% measles positive and 24 to 44% rubella positive.

Conclusion: These findings indicate that the measles immunization program in Indonesia has effectively reduced the number of measles cases.

Keywords: immunization, Indonesia, measles, surveillance

Introduction

Measles is a highly contagious disease that causes morbidity and mortality among young children in the world. Measles remains a leading cause of death among young children. The data shows that measles with complications killed approximately 139,300 children in 2010 and 145,700 in 2013 (Simon *et al*., 2010). Almost 400 deaths occur every day, or 16 deaths occur every hour (WHO, 2015). Recognizing the vital contribution of measles to child mortality, the world is committed to eliminating measles (WHO, 2009). High vaccination coverage of 95% attained via routine immunization and supplementary immunization activities (SIAs) is key to bringing the world closer to eliminating measles (WHO, 2009). Maintenance of progress towards elimination is being carried out at the regional level. The WHO Region of the Americas achieved regional measles elimination in 2002.

* **Corresponding authors:** Dr. Vivi Setiawaty, Phone: +62216506559, E-mail: spu.rspiss@gmail.com

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The other WHO regions have also established elimination goals: Eastern Mediterranean (2010), Europe (2010), Western Pacific (2012), Africa (2020), and Southeast Asia (2020) (WHO, 2009).
Indonesia has set the target of elimination with the following strategies: 1) to achieve the first dosage of measles immunization coverage >95% nationally and >80% in all districts; 2) to decrease measles incidence rate to less than 5 per million population; 3) decrease measles case fatality rate at least 95% from baseline data by the year 2000; and 4)to increase the sensitivity of measles surveillance with CBMS, including conduct laboratory confirmation. Measles elimination is defined as no endemic area for more than 12 months and no evidence of measles transmission (zero transmission) through the implementation of an adequate surveillance system (WHO, 2013).

Indonesia has over 250 million people and about 9.6 million square kilometres of landmass. It is the second largest country among the SEAR countries. Measles is endemic in Indonesia, but Indonesia is committed to eliminating the disease by strengthening routine immunization and conducting Supplementary immunization Activities (SIAs). From 2009 to 2011, SIAs were conducted in all provinces gradually: 4 provinces in 2009, 8 provinces in 2010, and other provinces were conducted in 2011, with coverage reaching more than 70% of the population target (WHO, 2015).

Despite the great efforts to eliminate measles from Indonesia in recent years, the measles virus continues to circulate and cause morbidity and mortality across the country. The progress of the measles immunization program in Indonesia should be monitored through analysis of surveillance data. The measles surveillance system in Indonesia was developed before 1980 to track measles cases and deaths due to measles. Measles surveillance is also used to inform the development and improvement of immunization programs. In 2010, the sensitivity of the measles surveillance system was increased by implementing laboratory Case-Based Measles Surveillance (CBMS) throughout provinces.

The individual data collected from CBMS, including information on age, sex, immunization status, and laboratory test results of clinical measles cases (suspected measles cases), completes the aggregate data available previously in the surveillance system, including outbreak data. The individual data in CBMS comes from Primary Health Centers, while aggregate data comes from sub-national (district, province) and national levels. This study aims to provide an overview of the achievement of the measles immunization program in Indonesia, especially after a series of measles immunization campaigns conducted from 2009 to 2011.

Methods

We used laboratory Case-Based Measles Surveillance data collected from January 2008 to December 2013 to monitor the progress of the measles elimination program. A clinical measles case has fever and maculopapular rash symptoms with coryza and conjunctivitis. A measles case is a clinical measles case with a positive measles virus infection through a serology test (measles IgM positive) and no measles vaccination 4-6 weeks before the rash appears. The clinical measles case has an epidemiological link to another laboratory-confirmed measles case (CDC, 2002).

A discarded measles case is a clinical measles case with negative evidence of measles virus infection through the laboratory test (measles IgM negative). Since 2000, genotypes have also been carried out on urine or throat swab specimens during

an outbreak. Specimens with a negative laboratory result (measles IgM negative) are subsequently tested for rubella virus infection.
The study was a surveillance data analysis from sub-directorate surveillance under the Directorate of Surveillance, Immunization and Matra Health, Directorate General of Disease Control and Environment Health, Ministry of Health (Approval Number: TU.01.01/D.3/II.2/2227/2015).

Results

Between January 2008 and December 2013, about 115,105 clinical measles cases were reported. The reported data show a decrease in the incidence rate from 10 per 100,000 population in 2008 to 4.6 per 100,000 in 2013. The number of clinical measles cases in 2013 was 11,521, lower than in 2012, with 18,798 cases. Figure 1 shows a similar seasonal pattern per year from 2008 to 2013, with the peak mostly occurring in the first three months. The clinical cases tend to decrease at the end of the year.

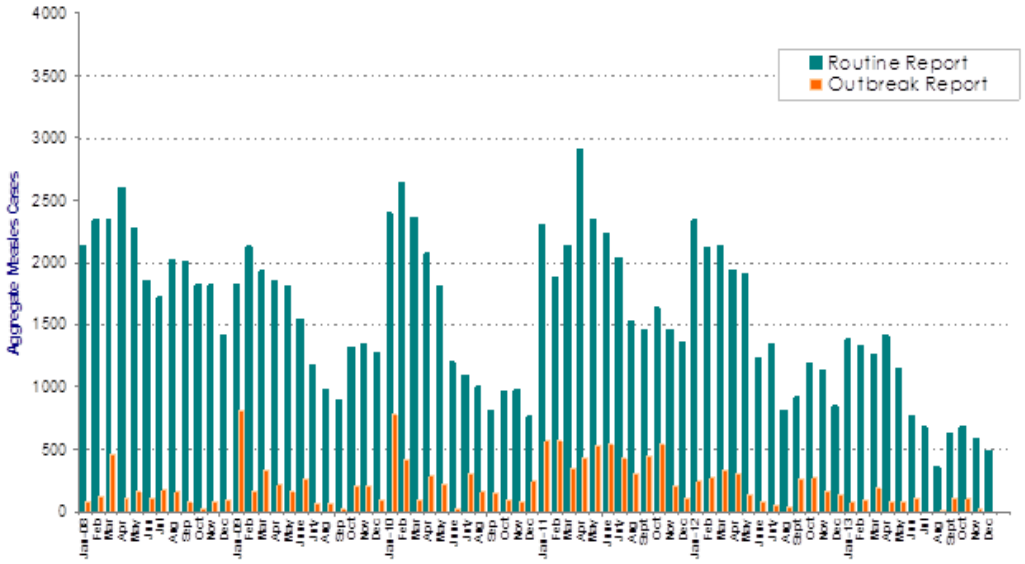

Figure 1. The number of clinical measles by month in 2008-2013

Every year, the highest proportion of measles cases occur in the 5-9 and 1-4 year age groups. Figure 2 shows that there was no significant decrease in these two age groups, which were targeted during the measles immunization campaign from 2009 to 2011. The trend of cases in children 10-14 and >14 does not significantly change over time either.

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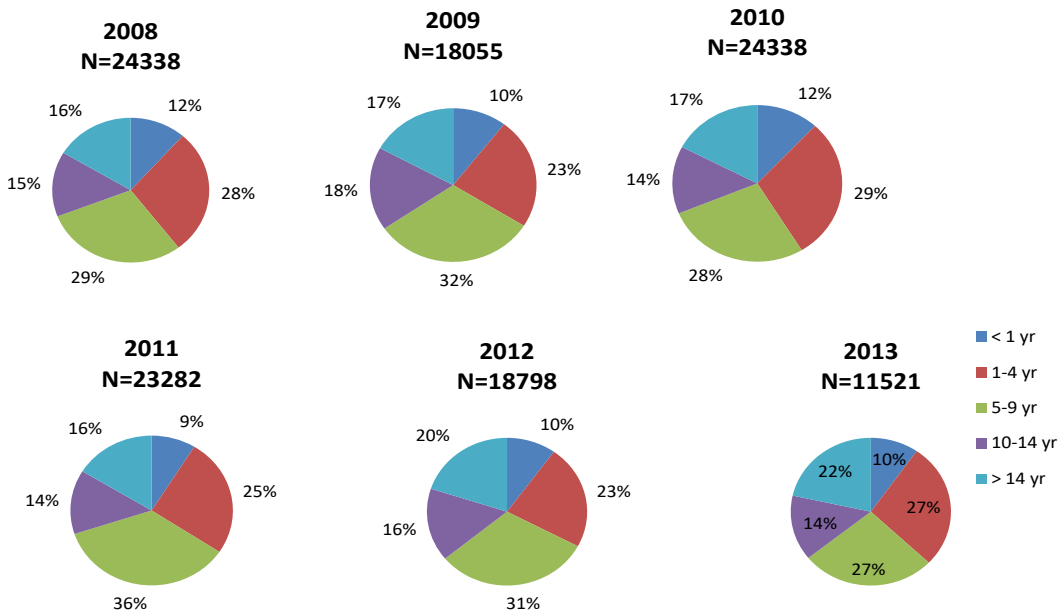

Figure 2. The distribution of clinical measles cases by age, 2008-2013

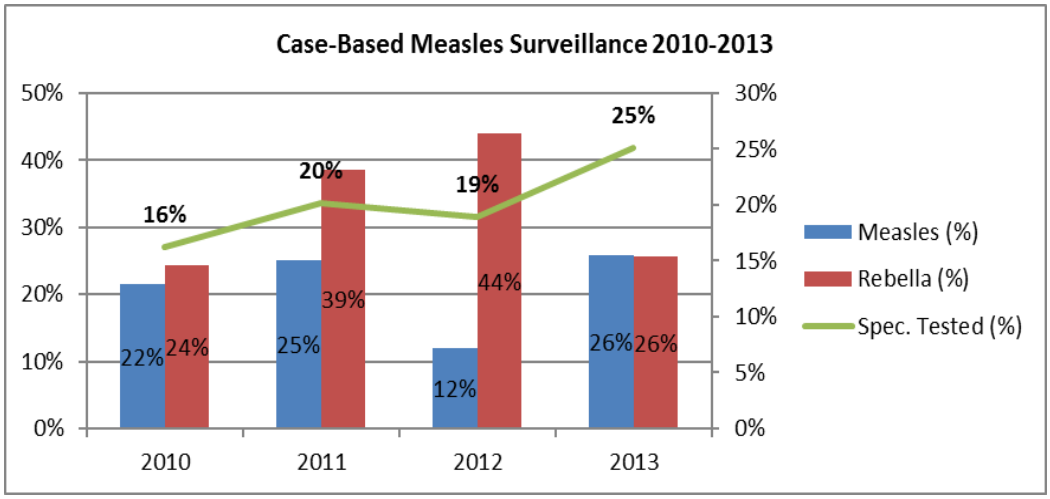

Figure 3. Case Base Measles Surveillance Indonesia, 2010-2013

Nationally, measles diagnosis confirmation by laboratory examination started in 2010. In Figure 3, from 2010 - to 2013, the proportion of measles cases conducted in laboratory tests ranged from 16 to 37% of the total cases per year. Specimens with measles tested positive ranged from 12 to 26%, while rubella positive ranged from 24% to 44% and 36-54% measles discarded. The proportion of cases with laboratory tests increased from 16% in 2010 to 25% in 2013.

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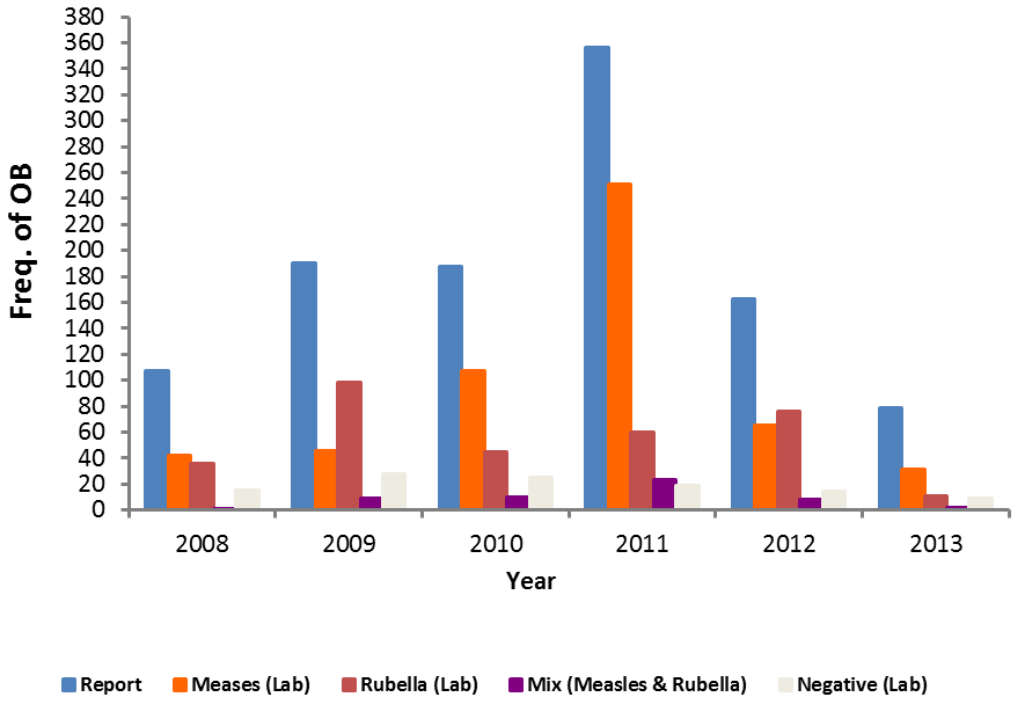

Figure 4. The Measles Outbreaks in Indonesia, 2008-2013

In Figure 4, measles outbreaks were reported in several areas. The frequency of outbreaks from 2008 to 2013 ranged from 42 to 251. The highest outbreak frequency was 251 times and was reported in 2011.

Discussion

Measles control in Indonesia was initiated in 1982. The National Immunization Program was expanded, and it was started to apply the standard of the routine immunization schedule to give a dosage of measles vaccine for 9-month-old children. The measles immunization coverage increased to over 90% in 1990 (WHO, 2014). In 2000, to overcome the measles outbreaks and to provide a second chance of immunization for children or those who have not yet gotten immunity, three measles control strategies have been arranged as follows: measles programs for all children 5 years old and under in high-risk areas; measles catch-up campaign for school children; introducing the second dosage of measles vaccines through immunization program for school children called Bulan Imunisasi Anak Sekolah or BIAS as routine activities for the first grade of primary school students in the following year after the catch-up campaign program (WHO, 2007).

The catch-up campaign program started gradually. The national coverage of measles immunisations in children aged less than 12 months from 1990 - to 2004 ranged between 58 - and 76%. This measles immunization coverage is slightly higher than in the SEA Region, 59 – 69% (WHO, 2017). To accelerate the measles elimination goals, measles immunization campaigns were conducted for children aged 9-59 months from 2005 to 2007, and a follow-up campaign from 2009 to 2011 resulted in targeted coverage levels ranging from 94.5% to 97.5%. In 2014, to increase the children's

immunity, there was a policy to give a booster immunization against measles to 24-month-old children. In addition, advanced immunization for school-age children is still ongoing. These efforts lowered the number of measles cases in Indonesia, although not as expected. These efforts should be conducted continuously to achieve the elimination target by 2020.

The seasonal pattern shown in Figure 1, with increasing measles cases at the beginning of the year and decreasing at the end of the year, can be influenced by some factors, such as the circulation pattern of the measles virus and the descent of surveillance officer performance at the end of the year, which is always overcrowding by so many kinds of health program activities.

Every year, the highest proportion of measles occurs in the 5-9 years and 1-4 year age groups. From Figure 2, it can be seen that there was no significant decrease. Logically, after the measles immunization campaign in 2009 - 2011 at 9-59 months, there should be a substantial decline in cases in those age groups. However, the data did not show this declination as expected. This might happen because not all targeted groups of ages have received immunizations (outreach), aside from the limitation of measles-containing vaccine efficacy.

Besides the effort to strengthen measles immunization, strengthening measles surveillance has also been carried out. Indonesia began to implement measles case-based surveillance of individuals (Case-Based Measles Surveillance / CBMS) in 2008 in two provinces (Bali and Jogjakarta). Strengthened CBMS was started in 2010 by gradually implementing laboratory tests throughout the provinces in Indonesia. At first, the test was carried out for 20% of suspected measles cases, and the proportions improved from year to year.

Measles laboratory tests are conducted in four national reference laboratories accredited by WHO, including Bio Farma, National Institute of Health Research and Development (NIHRD), BBLK Surabaya, and BLK Jogjakarta (Subangkit *et al.*, 2017). When CBMS started in 2008, the number of specimens examined was only 2%. From 2010 to 2013, the number of examined specimens ranged between 16% - and 37%. Measles reporting cases from 2010 to 2013 ranged between 40% and 70%. This rate is lower than the estimated number of measles cases, about 10 / 100.000 population. Meanwhile, the discarded rate, used to measure the sensitivity of case findings, is a targeted minimum of 2/100.000 population; the accomplishment in 5 years is still around 0.5/100.000 population. It was reported that 12-25% are measles IgM positive, and about 24-43% are rubella IgM positive.

Besides strengthening measles surveillance to decrease measles transmission, each measles outbreak should be thoroughly investigated to ensure a prompt response. In 2008, it was reported that 926 clinical measles outbreaks occurred, consisting of 584 measles outbreaks and 342 rubella outbreaks. After 2008, the outbreak frequency decreased to less than 200. The highest measles outbreak during the study period after 2008 occurred in 2011, with 251 outbreaks (Kemenkes, 2014).

One of the activities conducted during an outbreak investigation is active measles case finding by tracking from one house to another, taking notes of the cases individually, and examining 5 serum specimens (WHO, 2008). Public health response measures will be taken based on the findings from the outbreak investigation, including if there is a need for Outbreak Response Immunization (ORI) to stop further transmission. Not all outbreaks were reported to health authorities, and public health

responses could not be taken promptly. This matter has some constraints, including limited human resources and operational costs.

Conclusion

The measles immunization program in Indonesia has reduced the number of measles cases. However, measles is still endemic in Indonesia, and some outbreaks occur sporadically. At a certain time, immunization campaigns should be conducted regularly to decrease the number of susceptible populations caused by outreach targets and the limited efficacy of the measles-containing vaccine. To ensure the validity of measles surveillance data, the sensitivity of the measles surveillance system should be increased by strengthening Case-Based Measles Surveillance (CBMS). A full investigation of all measles outbreaks is important as evidence to ensure a prompt public health response is being taken timely to stop further transmission.

Conflict of Interest

The authors declared they have no conflicts of interest. Authors' contributions: Conception and design of the study as the main contributor: RBH, VS. Acquisition of data: CK, DA, S, M, NM, R. Analysis and interpretation of data: RBH, CK, N, R. Drafting the article or revising it critically for important intellectual content and final approval of the version to be submitted: VS, RBH, and CK. All authors have read and agreed to this manuscript's final version and contributed equally to its content and case management.

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