Diphtheria Epidemiology in Indonesia During 2010 - 2017

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ABSTRACT

Background: in recent years, diphtheria has reemerged in several countries including Venezuela, Yemen, Bangladesh, and Haiti. Similarly, Indonesia also showed an increased number of diphtheria cases in 2010-2017 despite the Diphteria, Tetanus, Pertussis (DTP) immunization program applied in Indonesia for children. This study

ABSTRAK


Kata kunci: difteria, epidemiologi, imunisasi.
INTRODUCTION

Since the introduction of vaccination program in 1970s, the number of diphtheria cases, one of the leading causes of death in children during pre-vaccine era, quickly declines. However, there were still 5,000 cases of diphtheria reported worldwide each year.\(^1\) Potential outbreaks may also occur when a community has both a large population of non-immune adults and poor vaccination coverage among children, such as occurred in the Russian Federation and the former Soviet Republics in 1990s.\(^1\) Even so, patterns of diphtheria disease epidemiology are known to have altered over time depending on vaccination coverage and socioeconomic condition of the countries.\(^2\)

Several countries experienced diphtheria outbreaks during the last few years, including Bangladesh, Haiti, Venezuela, and Yemen.\(^3\) While disruption of primary health care facilities, crowded urban populations, and migrations were the main contributing factors for these outbreak, low community vaccination coverage is also the stated risk factors for the increased incidence of diphtheria.\(^4\) Similarly, Indonesia was also reported to have an increase in diphtheria incidence in 2017.\(^5\)

In Indonesia, diphtheria becomes a public health problem as diphtheria incidence has increase in 2010 and continue to rise until 2017.\(^6\) Therefore, this study is aimed to evaluate the epidemiology trend of diphtheria cases in Indonesia during 2010-2017.

METHODS

The study reviewed data on diphtheria cases reported in Indonesia during 2010-2017 which was obtained from: 1) Ministry of Health Republic of Indonesia, 2) Indonesian Pediatric Society, and 3) World Health Organization South East Asia Regional Office. The data related to diphtheria or Corynebacterium diphtheria were reported in terms of case definition and classification based on Indonesia national diphtheria guidelines published by Ministry of Health Republic of Indonesia.

Keywords: diphtheria, epidemiology, immunization.
submucosal bleeding or petechiae, heart failure, acute renal failure, myocarditis until death; 3) “Laboratory-confirmed diphtheria case” is a case of diphtheria suspicion with positive Corynebacterium diphtheriae culture results on toxigenic strains or positive PCR (polymerase chain reaction) Corynebacterium diphtheriae confirmed by Elek test; 4) “Epidemiological relationship-confirmed diphtheria case” is a case that meets the criteria for suspected diphtheria and has an epidemiological relationship with laboratory-confirmed cases; 5) “Clinically compatible diphtheria case” is a case that meet the criteria for suspected diphtheria but do not have a link with laboratory-confirmed cases or epidemiological relationships-confirmed case; 6) Contact diphtheria cases” are people at home, playmates, schoolmates, including teachers and co-workers who are close contact with the case; 7) “Carrier diphtheria cases” are people who have no clinical symptoms, but the results of laboratory tests are positive.8,9 Additionally, case fatality rate (CFR) of diphtheria was also described in this study defined as the percentage of cases who died from diphtheria in all cases of clinical diphtheria reported.8 All of these data were collected during surveillance procedure by ministry of health directorate of Disease Control and Environmental Health.

RESULTS

In 2011, there were 811 cases of diphtheria reported in Indonesia, spread across 18 provinces with 38 deaths in North Sumatra, Bengkulu, South Sumatra, Bangka Belitung, Lampung, DKI Jakarta, Banten, West Java, Central Java, Yogyakarta, East Java, West Borneo, South Borneo, East Borneo, South Sulawesi, Southeast

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**Figure 1. Development of diphtheria cases in Indonesia**

![Figure 1](image1.png)

**Figure 2. Distribution of diphtheria cases in Indonesia 2017**

![Figure 2](image2.png)
Sulawesi and Bali (CFR 4.71%). The cases of diphtheria were mostly reported from East Java with 663 cases (82.3%), followed by East Borneo and West Java with 52 cases (6.5%) and 45 cases (5.6%), respectively. These cases were found mostly in the age group of 1-9 years old with 279 cases (72.47%) in 2010 and 524 cases (65%) reported in 2011.9,10

Diphtheria incidence in Indonesia has fluctuated in the period of 2010 to 2017 (Figure 1), where in 2012 there was an increase of 1,192 diphtheria cases with the highest case fatality rate (CFR) 6.38%. East Java was reported to have 954 cases (80%), followed by South Borneo and South Sulawesi with 61 cases (5.1%) and 50 cases (4.2%), respectively.11 In 2017, the case reemerged to 954 cases with CFR 4.61% in 30 provinces. East Java and West Java were the area most severely affected, reported to have 331 cases and 167 cases, respectively.12 Based on data from the Research and Development Ministry of Health Republic of Indonesia, there were 686 suspected or probable diphtheria cases, with 58 toxigenic and 13 non-toxigenic cases respectively (excluding contacts).13

Based on the age group, the highest number of cases occurred in the age group of 5-9 years old and followed by 1-4 years old which accounted for 32.5% and 19.1% of overall diphtheria cases in 2017. This description

![Figure 3. Case fatality rate of diphtheria based on age in 2017](image)

![Figure 4. Chart of diphtheria outbreak causes](image)
showed that routine immunization coverage has yet to reach the target and distributed equally across the regions. The case distribution was also reported among the adults aged 19-40 years old accounting for 19% of overall cases. Therefore, booster immunization of DPT should be considered to initiate routinely in adults.\textsuperscript{13}

Diphtheria vaccine is given as DTP (diphtheria-tetanus-pertussis) included in routine basic immunization program in Indonesia for...
children endorsed by the government. It should be given at the age of 2, 4, and 6 month of age and given booster at 18 months old afterwards. Over the course of 2010-2017, the overall basic immunization coverage in Indonesia was over 95% \(,10-13\). However, the immunization coverage for diphtheria itself still below the target accounting for 67.7% in 2007, 61.9% in 2010, 75.6% in 2013, and 61.3% in 2018. \(,14,15\) Ministry of Health regulated the effort to reduce and prevent diphtheria outbreak through several methods. First method was the study of epidemiology which included: 1) finding additional cases to be treated; 2) identifying and managing contacts through prophylaxis administration to eradicate the bacteria thus stopping the transmission; 3) identifying the risk factors and vulnerable groups to be managed according to evaluation. \(,12,16\) Second step is to stop the immunity gap through three rounds of Outbreak Response Immunization (ORI). The coverage target set was more than 90% for children administered with diphtheria containing vaccine with schedule at 0,1 and 6 months without reviewing the previous immunization status, especially in regions affected and had high risk of diphtheria. The subjects targeted for immunization was the age group of 1-18 years old. As the first step taken, twelve districts were chosen from three provinces which are Banten, DKI Jakarta and West Java considering the condensed population, high risk of transmission potential, and high level of mobilization. \(,12,16\)

Other measurements taken by the health policy makers in Indonesia were community education and logistics provision for diphtheria cases management, laboratory examination, and ORI implementation while private sectors focused on the administering booster of DPT vaccine for adults. \(,17\) The content on community education were about healthy and hygienic life style as prevention of diphtheria transmission as well as the importance of completing routine immunization or ORI. \(,12,16\)

**DISCUSSION**

Diphtheria is an infection of the upper respiratory tract caused by Corynebacterium diphtheria. Generally, it affects children aged 1-10 years old although it can also occur in adults. \(,12\) Risk factors increasing the possibility of diphtheria infection including nutritional status, incomplete immunization history, and previous contact with those infected. \(,18\) Additionally, other factors may also include availability of bacterial transmission, poor condition of the house and its surroundings, and population density. Most problems of diphtheria epidemiology originate from lack of immunization coverage, socioeconomic problems, handling incomplete carriers, and high migrations the community. \(,15\)

Diphtheria remains a public health problem in Indonesia. Over the course 2010-2017, Indonesia’s incidence of diphtheria reached its peaked in 2012 and 2017, accounting for 1,192 cases and 954 cases, respectively. \(,11,12\) The amount of diphtheria cases in 2017 were twice the case number in previous year, leading to declaration of diphtheria outbreak from Indonesian government. Thus, Indonesian
Ministry of Health established the Outbreak Response Immunization (ORI) adapted from WHO recommendation to be implemented across the nation as an effort to reduce diphtheria case in Indonesia.\(^\text{12}\)

East Java was the most severely affected area contributing approximately 80% of total cases in Indonesia.\(^\text{19}\) One of the dominant risk factors was incomplete immunization history (p value = 0.0037; OR = 4.667) as described in the study by Arifin et al\(^\text{18}\), contributing to the rate of diphtheria cases in Bangkalan Primary Health Care, Surabaya. It was found that there was 18% of diphtheria cases with incomplete history of DPT immunization and 82% of those without any DPT immunization at all.\(^\text{17}\) A similar study in East Java also found that the rate of achievement in DPT immunization program was a risk factor in diphtheria transmission. Moreover, the DPT immunization coverage itself in Indonesia has yet to reach 100%.\(^\text{16}\)

The low immunization coverage in Indonesia may be due to several reasons as reported by Ministry of Health Republic of Indonesia, such as rejection towards immunization by certain group/community which results in incomplete immunization status.\(^\text{20}\) Low level of education was an important factor contributing to immunity gap in many regions while some parents also refuse to deal with the side effect of DPT immunization such as the fever. There was also belief that vaccines are prohibited under Islamic law. However, the Indonesian Ulama Council (MUI) has created a countermeasure that vaccines were not prohibited by religion.\(^\text{21}\) Lack of healthy lifestyle education in schools also leads to students’ vulnerability towards diphtheria.

The spread of diphtheria from one province to others, such as occurred in Jakarta, West Java, and Banten may due to antibiotic resistance aside from the dense population and incomplete immunization status. Penicillin and erythromycin are antibiotics given to treat diphtheria, as a study by Rockhill et al\(^\text{22}\) (1982) found that there was 100% susceptibility of ampicillin and erythromycin towards diphtheria pathogen in Cipto Mangunkusumo Hospital, Jakarta. However, another study conducted in 2015 found that there was 84% susceptibility pattern against the bacteria in penicillin and 91.2% susceptibility in erythromycin, thus showing an increase resistance towards the antibiotics.\(^\text{23}\) Therefore, Indonesia requires more research to improve the management of diphtheria.

The WHO recommended Outbreak Response Immunization as an effort made immediately to end the transmission, reduce the number of cases of diphtheria and prevent the disease from expanding. This recommendation was adapted in Indonesian immunization guideline by the Ministry of Health in which three rounds of diphtheria immunization was conducted, covering age 1 year to less than 19 years of age, which was carried out in schools, posyandu, primary health care’s and other health-care facilities. The initial week of vaccination implementation was prioritized in school-based. The vaccines used were DPwT-HB-Hib for ages 1 year to <5 years; DT vaccine for ages less than 7 years and Td vaccine for ages 7 years and over.\(^\text{13,16}\)

This activity involved professional organizations such as the Indonesian Pediatricians Society (IPS), Association of Indonesian Internal Medicine Specialists (PAPDI), the Indonesian Medical Association (IDI), the Indonesian Midwives Association (IBI) and the Indonesian National Nurses Association (PPNI) to assist in the implementation of ORI and primary health care’s, District or City Health Offices and Provincial Health Offices related were responsible for reporting the daily ORI coverage to the Ministry of Health’s Immunization Sub Directorate.\(^\text{13,16}\) The success of controlling diphtheria was influenced by public awareness in obtaining and completing immunizations. Additionally, the role of health-care workers in maintaining the quality of cold-chain vaccine management and immunization services were important. There will be an immunity gap in the population and will lead to the increasing of diphtheria incidence, if immunization coverage did not increase.\(^\text{13}\) Three important strategies for tackling diphtheria were firstly to immunize immediately children aged 1-19 years, early detection and proper handling of diphtheria cases, and identify appropriate diphtheria contact or carrier management procedures. Diphtheria
surveillance supported by the national laboratory surveillance must be reinforced in order to detect early outbreak in the community, treat the diphtheria case and detect diphtheria contacts or carriers appropriately. These efforts require the support of policy makers, the community and the provision of adequate healthcare resources from the local government and the commitment of health workers to carry out all these efforts with full responsibility. 

CONCLUSION

There were increased number of diphtheria cases in Indonesia over the course of 2010-2017. One of the important lessons that diphtheria cases remain a problem was that immunization coverage was not as expected on target and no booster vaccination for adult routinely implemented. The ORI program was an effort to end transmission, reduce the number of cases of diphtheria and prevent the disease from spreading. The ORI program was performed at 0, 1 and 6 months, represented good indicator of all efforts from multi-sectoral departments, health workers, community, leaders and government.

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