



## Letter to the Editor

## Diphtheria outbreak in Indonesia, 2017: An outbreak of an ancient and vaccine-preventable disease in the third millennium



Dear Sir,

Diphtheria, caused by toxin-producing strains of *Corynebacterium diphtheria*, is a highly contagious but vaccine-preventable communicable disease. The bacterium primarily infects the pharynx, tonsils and nose but the toxin could affect vital organs such as the heart, kidneys, and nervous system. Globally, the case-fatality rate for diphtheria is 5%–10% but it could be higher (approximately 20%) among children younger than five years old and the elderly.<sup>1</sup> Although many countries in the world have succeeded in eliminating diphtheria, it is re-emerging in some countries, including in the Republic of Indonesia, the most populous country in the South-east Asia region.

In mid-November 2017, the Ministry of Health of the Republic of Indonesia (MoHRI) announced that there has been an ongoing diphtheria outbreak in Indonesia. Between January 1 and week 44 of 2017, the Director-General of Disease Prevention and Control of MoHRI reported 596 clinically-diagnosed diphtheria cases with 30 deaths from 95 regencies of 21 provinces across Indonesian archipelago.<sup>2</sup> Most of the cases were reported in East Java and West Java provinces, with 271 cases (11 deaths) and 95 cases (10 deaths), respectively (Table 1). Although the highest case numbers occurred in East Java, the highest incidence rate was in Aceh and the highest mortality rate was in West Borneo. Nationally, the incidence and the mortality rates of the ongoing outbreak were 0.23 cases per 100,000 people and 5.03%, respectively, with the provincial mortality rate ranging between 0% and 20%. These figures match CDC estimates of diphtheria mortality, which range between 5%–10% but could reach 20%.<sup>1</sup> To prevent further transmission of the disease and to prevent children from acquiring diphtheria, the MoHRI launched an Outbreak Response Immunisation (ORI) targeting children 1 through 18 years old on December 11th 2017. The targets are the most populous provinces in Indonesia. This program was conducted in close coordination with the South-East Asia Regional Office of the World Health Organization.

Historically, Indonesia successfully eliminated diphtheria in 1998 after promoting a massive vaccination program. However, the number of cases has fluctuated since 2002 and the disease re-emerged in 2009. There are several plausible factors that might relate to the re-emergence of diphtheria and the massive 2017 outbreak. One of them is low vaccination coverage. National data indicate that immunization coverage of diphtheria, pertussis, and tetanus (DPT) of children between 2 and 6 years old was only 75.6%.<sup>3</sup> This is far from the ideal coverage which is above 90%. One of the provinces with the lowest coverage of DPT vaccination was Aceh (52.9%). Therefore, it is not surprising that Aceh had the highest incidence rate during the outbreak. The Aceh Provincial Health Office reported 113 clinically-diagnosed diphtheria cases between 1 January and 31 December 2017, during which time two subspecies were circulating (*C. d. mitis* and *C. d. gravis*). Using the

current DPT vaccine coverage of each province in Indonesia, our analysis has revealed that there is a negative correlation between DPT vaccine coverage and both diphtheria incidence and mortality during the outbreak:  $r = 0.110$  and  $r = 0.145$ , respectively, although these values were not significant. In addition, 66% of the cases during the outbreak never received DPT vaccination while 31% had not completed the full DPT vaccine series. Altogether these provide evidence for the pivotal role of DPT vaccination in preventing diphtheria.

Low vaccination coverage derives from a high degree of vaccine hesitancy, lack of awareness about the benefits of vaccination, and, for some areas, lack of access to vaccination services. Previously, we expressed our concern regarding low vaccine coverage and acceptance towards vaccination in Indonesia.<sup>4</sup> Now, we urge national and local governments to establish comprehensive programs to increase public attitudes towards vaccination and vaccine acceptance. It is well known that decision-making processes regarding vaccination are complex and multidimensional; therefore, designed programs should be able to (a) minimize any distrust and perceived religious barriers; (b) minimize specific barriers to vaccination such as fear of side effects; and (c) increase beliefs and expectations regarding vaccine efficacy.<sup>5</sup> In the Indonesian context, in which 87.2% of the population identifies as Muslim, such programs should be integrated within the religion and health sectors.<sup>6,7</sup> In addition, the general population in most provinces is deeply religious and more likely to obey religious leaders than government health care workers (HCWs).<sup>7</sup> Religion-related issues have been reported to be among the most important barriers for vaccination in several countries.<sup>8</sup> Therefore, vaccination-related information should be disseminated through well informed religious leaders because this format could overcome religion-related issues surrounding vaccination.

In conclusion, the recent diphtheria outbreak in Indonesia reflects inadequate vaccination coverage and has demonstrated the importance of sustaining high levels of vaccine coverage. High vaccination coverage including timely booster doses should be achieved throughout childhood vaccination programmes. In Indonesia, diphtheria vaccine is available for free in government health facilities as a part of Routine Basic Immunisation. Apart from providing free vaccines for the public, governments and their multi-sectoral collaboration partners should launch programs to gain public confidence in diphtheria vaccination. In our perspective, these programs should be integrated with the most trusted sectors, religion and health, because of the critical role played by trusted individuals in the vaccination delivery programs.

<https://doi.org/10.1016/j.cegh.2018.03.007>

Received 25 January 2018

Available online 03 April 2018

2213-3984/ © 2018 Published by Elsevier, a division of RELX India, Pvt. Ltd on behalf of INDIACLEN.

**Table 1**  
Distribution of diphtheria cases and mortality during the 2017 outbreak (update: week 44 of November 2017).

Province	Number of case	Number of death	Population number <sup>a</sup>	Incidence (per 100,000)	Mortality (%)	DPT-HB-3 vaccination coverage (%) <sup>b</sup>
Aceh	76	3	5,096,248	1.49	3.95	52.9
East Java	271	11	39,075,152	0.69	4.06	85.7
Banten	81	3	12,203,148	0.66	3.70	63.3
West Sumatera	30	0	5,259,528	0.57	0.00	70.0
West Java	95	10	47,379,389	0.20	10.53	71.5
East Borneo	6	0	3,501,232	0.17	0.00	81.4
Southeast Sulawesi	4	0	2,551,008	0.16	0.00	75.3
DKI Jakarta	16	2	10,277,628	0.16	12.50	79.1
Riau	8	0	6,500,971	0.12	0.00	70.0
West Borneo	5	1	4,861,738	0.10	20.00	71.9
Gorontalo	1	0	1,150,765	0.09	0.00	93.0
Jambi	3	0	3,458,926	0.09	0.00	76.7
South Sulawesi	4	0	8,606,375	0.05	0.00	69.5
North Sulawesi	1	0	2,436,921	0.04	0.00	83.3
Central Borneo	1	0	2,550,192	0.04	0.00	67.9
Central Sulawesi	1	0	2,921,715	0.03	0.00	72.6
Central Java	11	0	34,019,095	0.03	0.00	89.2
Papua	1	0	3,207,444	0.03	0.00	40.8
South Borneo	1	0	4,055,479	0.02	0.00	72.0
North Sumatera	2	0	14,102,911	0.01	0.00	63.1
Lampung	1	0	8,205,141	0.01	0.00	82.5
Indonesia	596	30	258,704,986	0.23	5.03	75.6

<sup>a</sup> Based on data from Ministry of Health of the Republic Indonesia, 2016.

<sup>b</sup> Based on data from Ministry of Health of the Republic Indonesia, 2013 (Indonesian Basic Health Research 2013).

**Acknowledgement**

The authors declare that there is no conflict of interest.

**References**

- Centres for Disease Control and Prevention. *Diphtheria*. Available from: 2016; 2016 (Accessed 27 December 2017). <https://www.cdc.gov/diphtheria/index.html>.
- Ministry of Health of the Republic Indonesia. *Menkes: Difteri menular, berbahaya dan mematikan, namun bisa dicegah dengan imunisasi*. Available from: 2017; 2017 (Accessed 27 December 2017). <http://www.depkes.go.id/article/view/17121200002/menkes-difteri-menular-berbahaya-dan-mematikan-namun-bisa-dicegah-dengan-imunisasi.html>.
- Ministry of Health of the Republic Indonesia. *Riset kesehatan dasar (Riksesdas). Badan Penelitian dan Pengembangan Kementerian Kesehatan Indonesia, Jakarta*. 2013; 2013.
- Harapan H, Alleta A, Anwar S, Setiawan AM. Socio-demographic factors associated with inhabitants' view related to vaccines in Indonesia. *Iran J Public Health*. 2017;46:708–710.
- Harapan H, Fajar JK, Sasmono RT, Kuch U. Dengue vaccine acceptance and willingness to pay. *Hum Vaccin Immunother*. 2017;13:786–790.
- Harapan H, Anwar S, Setiawan AM, Sasmono RT. Aceh dengue study. Dengue vaccine acceptance and associated factors in Indonesia: a community-based cross-sectional survey in Aceh. *Vaccine*. 2016;34(32):3670–3675.
- Harapan H, Anwar S, Bustaman A, et al. Modifiable determinants of attitude towards dengue vaccination among healthy inhabitants of Aceh, Indonesia: findings from a community-based survey. *Asian Pac J Trop Med*. 2016;9:1115–1122.
- Antai D. Faith and child survival: the role of religion in childhood immunization in Nigeria. *J Biosoc Sci*. 2009;41:57–76.

Harapan Harapan<sup>a,b,c,\*</sup>

<sup>a</sup> Medical Research Unit, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>b</sup> Tropical Disease Centre, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>c</sup> Department of Microbiology, School of Medicine, Syiah Kuala University,

Banda Aceh, Indonesia  
E-mail address: harapan@unsyiah.ac.id

Samsul Anwar  
Department of Statistics, Faculty of Mathematics and Natural Sciences,  
Syiah Kuala University, Banda Aceh, Indonesia

Herlina Dimiati<sup>a,b</sup>

<sup>a</sup> Department of Pediatric, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>b</sup> Department of Pediatric, Dr. Zainoel Abidin Hospital, Banda Aceh, Indonesia

Zinatul Hayati<sup>a,b,c,d</sup>

<sup>a</sup> Medical Research Unit, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>b</sup> Tropical Disease Centre, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>c</sup> Department of Microbiology, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>d</sup> Department of Clinical Microbiology, Dr. Zainoel Abidin Hospital, Banda Aceh, Indonesia

Mudatsir Mudatsir<sup>a,b,c,\*\*</sup>

<sup>a</sup> Medical Research Unit, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>b</sup> Tropical Disease Centre, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

<sup>c</sup> Department of Microbiology, School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia

E-mail address: mudatsir@unsyiah.ac.id

\* Corresponding author at: Medical Research Unit, School of Medicine, Syiah Kuala University, Jl. T. Tanoeh Abe, Darussalam, Banda Aceh 23111, Indonesia.

\*\* Corresponding author at: Medical Research Unit, School of Medicine, Syiah Kuala University, Jl. T. Tanoeh Abe, Darussalam, Banda Aceh 23111, Indonesia.