

Extraordinary events of diphtheria cases with the achievement of first-rate basic immunization

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Abstract

Background:Diphtheria is a lethal disease caused by a type of microorganism from a group of bacteria called *Corynebacterium diphtheria*. In 2015, 1 case was found, and one died, in 2016, there were 8 cases, and one died, and in 2017, there were 36 cases, and 2 children died.

Aims:The purpose of this study is to analyze the extraordinary causes of diphtheria cases continue to increase despite good basic immunization coverage.

Methods:This study used the literature review that was obtained from various sources, namely Google Search, Google Scholar, Scimedirect.com, E-book, and SAGA Journal, Scientific Work with the keywords of immunization and diphtheria from 2015-2019.

Results: From the results of observations on the physical environmental conditions of the house carried out by chi-square statistical tests, the significance of 0.008 or p-value was <0.05 ($p < \alpha$) [6]. The results of statistical analysis using multiple linear regression showed a significance value of 0.01, indicating that there was an effect of population density ($p < 0.05$) (2)

Conclusion: It can be concluded that the cause of diphtheria outbreaks in Sampang District is independent of basic immunization coverage, including (1) poor vaccine management, (2) inadequate physical environment of the house, and (3) population density. Therefore, further and more detailed research is to be carried out.

Keywords: *Diphtheria, Immunization, Vaccines*

1. Introduction

Diphtheria is a lethal disease caused by a type of microorganism from a group of bacteria called *Corynebacterium diphtheriae*. These bacteria can form pseudo-membranes in the respiratory tract and damage them, while other effects can attack the skin and some other organs. *Corynebacterium diphtheriae* usually attacks anyone, whether it is a child or older person and can cause death[1]. Epidemiology of cases of diphtheria does not only occur in young children but can also occur in adults who can be affected by diphtheria[9]. Prevention related to extraordinary cases of diphtheria has begun to be applied by the Ministry of Health in the complete national basic immunization program, which includes: (1) Three primary doses of immunization for DPT-HB-Hib (Diphtheria, Pertussis, Tetanus, Hepatitis-B and Haemophilus influenzae type b) at the age of 2, 3 and 4 months, (2) One dose of continued immunization DPT-HB-Hib at 18 months, (3) One dose of continued immunization DT (Tetanus-Diphtheria) for grade 1 elementary school/equivalent, (4) One dose of continued immunization Td (Tetanus diphtheria) for grade 2 of elementary school students/equivalent, and (5) One dose of advanced Td immunization for 5th grade/equivalent children[3]. Data released by the World Health Organization (WHO) shows that diphtheria emergency still in various countries, which is currently occurring in diphtheria outbreaks in the states of Yemen and Bangladesh which are mostly found occur in refugee areas. In no more than four months at the end of 2017, 333 reported cases of diphtheria in the Yemeni state were affected by diphtheria symptoms, and 35 of them died (mortality = 10.5%). Whereas in the State of Bangladesh where reports of diphtheria cases were found in Rohingya ethnic refugee camps in Bangladesh, 804 cases of diphtheria were found, and 15 of them died.

Indonesia is one of the countries that have diphtheria emergencies in which the data submitted by the Indonesian Ministry of Health at the end of 2017 reports of diphtheria cases that occurred on January 1 to November 4, 2017, showed that 591 cases of diphtheria had been found in which 32 of them died. Data obtained from 95 regencies/cities in 20 provinces in Indonesia. The death rate or Case Fatality Rate (CFR) is 4.6%, which means the death rate ratio of 4-5 deaths from 100 people suffering from diphtheria[3]

East Java Province is one of the areas that are most severely affected by diphtheria, wherein 2017 diphtheria was 48% of the incidence in Indonesia. The East Java Provincial Health Office noted that the prevalence of diphtheria from recent years remained high, wherein 2015, there were 265 cases of diphtheria found. In 2016, 354 cases were found while in 2017, there were 318 cases of diphtheria, and 12 children died. Meanwhile, the data obtained from the Sampang District Health Office in 2015 found 1 case of diphtheria and one died. In 2016, furthermore, there were 8 cases of diphtheria, and one died, while in 2017, there were cases of 36 cases of 2 children died.

The coverage of complete basic immunization, especially in Sampang district, has increased every year. The annual coverage obtained from the Sampang District Health Office in 2015 for complete basic immunization, moreover, was 91.74%, while in the following year, the basic immunization coverage was at 92.44%. In 2017, the achievement of basic immunization was 94.42% and was targeted in 2018 to reach 94.57% (Profile of Sampang District Health Office). Complete immunization according to age is a must; because through this effort, the increase in diphtheria immunity can be obtained optimally while from the data above the level of achievement of complete basic immunization cannot guarantee the prevention of diphtheria. The purpose of this study, thus, is to analyze the extraordinary causative factors in cases of diphtheria in Sampang district, which continued to increase despite the appropriate basic immunization coverage.

2. Method

This study was conducted by collecting literature from various sources which were obtained from Google Search, Google Scholar, Scienedirect.com, e-books, and SAGE Journal, Scientific Caries with the keywords: immunization, diphtheria from 2015 to in 2019.

3. Search Pattern For Literature Review

The search pattern for literature review shown in Figure 1. As much as 36 papers screened from 4 sources, 13 papers included on this study and 23 papers rejected.

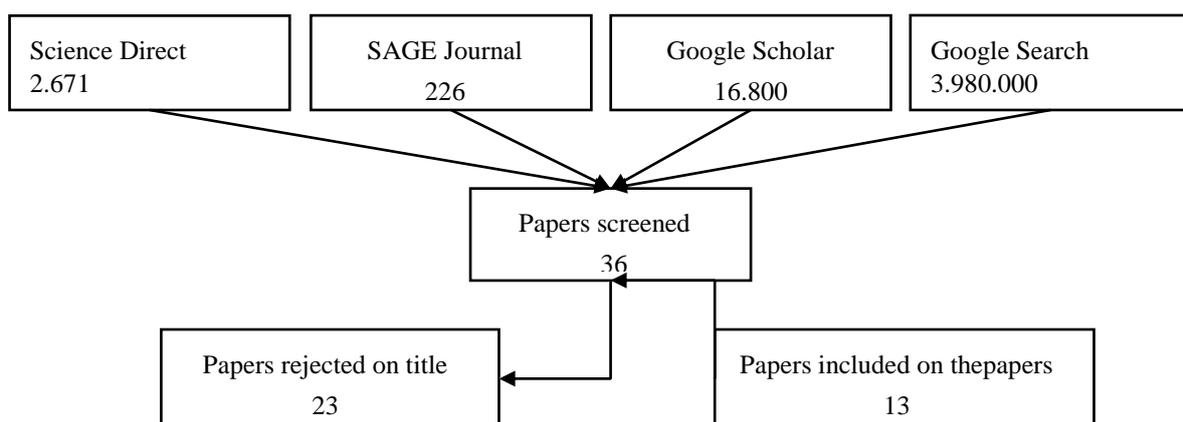


Figure 1. Search pattern for literature review

4. Results

Based on the result of 5 (five) papers, the table below (Table 1) shows the summary. The papers used different research methods.

Table 1. Results of the literature review of diphtheria

No	Researcher	Research Title	Research Method	Result
1	Noer Endah Pracoyo et al., 2013	The Relationship Between Knowledge and Attitude Of Vaccine Managers With Vaccines Management Scores In The Diphtheria Case Area In East Java	Cutting-edge Research Design	From the results of research on the quality of Freeze tags, most of the respondents had poor freeze-tag quality (23 respondents). As many as 17 (56.7%) respondents were still not good at managing vaccines. The results of the statistical analysis showed a significant effect, with $p < 0.05$, namely ($p = 0.181$). And the OR value of 2.8.
2	Isnaniyanti Fajrin Arifin, 2016	The Factors Related to Children's Diphtheria Case in Bangkalan Public Health Center In 2016	Case-Control Design	From the results of observations on the physical environmental conditions of the houses carried out with chi-square statistical tests, the obtained p-values for each variable condition of the physical environment of the houses (house walls, the presence of ceilings, the presence of house floors, humidity, natural lighting, ventilation/windows, and occupancy density) was at 0.008 or p-value < 0.05 ($p < \alpha$).
3	Dwi Elsa Mardiana, 2018	The Effect of Population Immunization and Population Density On The Prevalence Of Diphtheria Disease In East Java	Cross-Sectional Design	The results of the statistical analysis using multiple linear regression tests of population density on the prevalence of diphtheria in East Java Province in 2016 showed a significance value of 0.01, which indicated that there is an influence of population density ($p < 0.05$) on the prevalence of diphtheria in East Java in 2016.
4	Tri Amelia Rahmitha Helmi, 2019	Description of Cold Chain Condition of Basic Immunization Vaccines in Semarang City Public Health Center	Descriptive Observational	The result of the observational analysis of vaccine management showed that health personnel used generator sets in emergencies (75.5%), vaccines stored at temperatures of $+ 2^{\circ}\text{C} - + 8^{\circ}\text{C}$ (67.5%). The vaccines used were based on the FIFO principle (89.2%), EEFO principle (97.3%), after using immunization vaccines (94.6%), vaccines are regulated based on expiration dates (94.6%), by type of vaccines (64.9%), refrigerator maintained by ice (40.5%), monitored temperature on inactive days (2.7%), record temperature for twice a day (73.0%), did not meet any material in the refrigerator (97.3%), spaced 15 cm from the refrigerator wall (24.3%), and made a package in another refrigerator (73.0%).
5	Nanang Saifudin, 2016	Spatial Analysis and Modeling of Risk Factors in Diphtheria Events in Blitar District 2015	Case-Control Design	The results of the bivariate analysis by using the chi-square test showed immunization status (0.001), room humidity (0,000), lighting (0,000), ventilation (0,000), and presence of health services (0,000). Multivariate analysis using logistic regression showed

that there were only two variables, namely risk factors for the occurrence of diphtheria cases, such as room humidity (OR = 29,983) and lighting (OR = 5,115).

5. Discussion

5.1 Relationship between Management of Vaccines and Diphtheria Cases

Noer Endah Pracoyo, 2013[7] in an article entitled the relationship between knowledge and attitudes of vaccine managers and vaccine management scores in diphtheria cases in East Java showed that training on vaccine management officers affected the truth in vaccine management in health services. Vaccine storage and its handling must be carried out carefully and monitored continuously to ensure that the temperature is following the immunization for health competency guidelines issued by the Public Health agencies of Canada by participating in training on vaccine storage and handling. It is expected that health personnel can implement the SOP (Standard Operational Procedure) for storing, handling, and sending vaccines. Health personnel are also likely to be able to access and implement guidelines for the latest vaccine storage, handling and delivery to maintain the quality of the vaccine itself (immunization for health competencies.) In the management of maintaining the cold quality of vaccines, the preferred refrigerators for vaccine storage are refrigerators without freezers and refrigerators with only freezers. Refrigerators with a combination of both, on the other hand, are still permitted as long as they have different doors and each has a separate thermostat control because when combined, it can affect the temperature of each room[11].

5.2 Relationship between Physical Environmental Conditions of Houses with Child Diphtheria Cases

From the results of Isnaniyanti Fajrin Arifin's[6] research in 2016 entitled "Factors Related to Diphtheria Cases of Children in Bangkalan Health Centers in 2016" showed that there was a relationship between the physical environment of the houses in Bangkalan Public Health Center in 2016 of 7 houses variables and the Ministry of Health Regulation No. 1077 In 2011 the Guidelines for Air Restoration in Indoor Houses, including (1) the walls of the house, (2) the existence of ceiling, (3) the presence of the floor, (4) ventilation/windows of the house, and (5) occupancy density. However, there are variables that exceed the required limitations, namely the humidity that exceeds the limit of 40% -60% Rh and natural lighting that exceeds the limit requirement of <60 lux. Furthermore, one of the characteristics of a healthy house is that the floor of the house is following the health requirements, which are made of waterproof materials, not moist, and a minimum height of 10 cm from the yard and 25 cm from the road.

5.3 Relationship between Population Density and Diphtheria Case Prevalence

From the results of Dwi Elsa Mardiana's research in 2018[2], the population density significantly affected the prevalence of diphtheria in East Java in 2016 ($p < 0.05$). The results further implied that the higher the density is, the higher the contact of diphtheria patients with healthy people is. In consequences, more people are exposed to diphtheria germs. Population density variable, moreover, is one component of environmental factors that play a role in influencing infectious diseases. Additionally, it was revealed that the disease transmission process is related to population density. If the areas have a dense population, the transfer of diseases, especially airborne diseases (droplets), then, will also be easier and faster, including the infection to diphtheria, given the fact that diphtheria can spread through droplets[4].

6. Conclusion and Suggestion

Based on the results of the literature analysis conducted by the researcher from several works of literature related to the increase in extraordinary diphtheria cases despite the proper basic immunization in Sampang district, some conclusions were drawn. First, extraordinary diphtheria cases based on the results of the study by Pracoyo in 2013[7] revealed the effect of vaccine management that will be used for unfavorable basic immunization. Second, in addition to the management of vaccines

for extraordinary diphtheria cases cited from the study of Arifin in 2016[6], diphtheria cases can be caused due to physical conditions of the houses that can facilitate infection of diphtheria. Third, from the research of Mardiana in 2018[2], it can be seen that the extraordinary diphtheria cases can also be triggered by the population density since diphtheria can also be transmitted through the air. Therefore, based on those conclusions, the authors suggest that further research is to be carried out particularly on the event of extraordinary diphtheria cases in Sampang district.

7. References

- [1] Daskalaki, I. 2018. *Corynebacterium diphtheriae* Principle and Practice of Pediatric Infectious Disease (Fith Edition). Philadelphia: Elsevier, Inc. All right reserved
- [2] Dwi Elsa Mardiana, 2018 . Pengaruh Imunisasi dan Kepadatan Penduduk Terhadap Prevalensi Penyakit Difteri di Jawa Timur Jurnal Berkala Epidemiologi, 6 (2) 2018, 122- 129
- [3] Depkes RI, 2017. Biro Komunikasi dan Pelayanan Masyarakat, Kementerian Kesehatan RI. Untuk informasi lebih lanjut dapat menghubungi Halo Kemkes melalui nomor *hotline* 1500-567, SMS 081281562620, faksimili (021) 5223002, 52921669, dan alamat *email* kontak[at]kemkes[dot]go[dot]id.
- [4] Fitria, L., Wahjudi, P., &Wati, D. M. (2014). Pemetaan Tingkat Kerentanan Daerah Terhadap Penyakit Menular (TB paru, DBD, dan diare) di Kabupaten Lumajang Tahun 2012. E Jurnal Pustaka Kesehatan, 2(3), 460–467.
- [5] Goldwood G, Diesburg S. The Effect of Cool Water Pack Preparation on Vaccine Vial Temperatures in Refrigerators. Elsevier. 2018;36(1):128–33.
- [6] Isnaniyanti Fajrin A, 2016. Faktor Yang Berhubungan Dengan Kasus Difteri Anak Di Puskesmas Bangkalan Tahun 2016 ©2016 fkm_unair all right reserved.open access under cc by – sa license doi:10.20473/jbe.v5i1.2017.26-36 received 29 december 2016, received in revised form 18 january 2017, accepted 19 january 2017, published online: 28 april 2017 Immunization for health competencies.
<http://www.phacaspc.gc.ca/publicat/2007/nvshglp-Idemv/section2-eng.php#23> Keman, S. 2005. Kesehatan Perumahan Dan Lingkungan Pemukiman. *Jurnal Kesehatan Lingkungan*.Vol 2(1);pp.29-42
- [7] Noer Endah Pracoyo dkk, 2013. Hubungan Antara Pengetahuan dan Sikap Pengelola Vaksin Dengan Skor Pengelolaan Vaksin di Daerah Kasus Difteri di Jawa Timur, *media litbangkesvol* 23 no. 3, sept 2013, 102-109
- [8] Notoatmodjo, S. 2007. Promosi Kesehatan dan Ilmu Perilaku.Jakarta: Rineka Cipta Nanang Saifudin, 2016. Analisis Spasial dan Pemodelan Faktor Risiko Kejadian Difteri Di Kabupaten Blitar Tahun 2015, Tesis Universitas Airlangga Fakultas Kesehatan Masyarakat Program Magister Program Studi Epidemiologi Surabaya 2016.
- [9] Sunarno, K. Ariadji, H. A. Wibowo. 2013. Potensi Gen *dtxdandtxR* Sebagai Marker Untuk Deteksi dan Pemeriksaan Toksigenisitas *Corynebacterium diphtheriae*. *Bul. Penelit. Kesehat* 41(1): 1 –10
- [10] Tri Amelia Rahmitha Helmi, 2019. Gambaran Kondisi Rantai Dingin Vaksin Imunisasi Dasar di Puskesmas Kotasamarang, *Jurnal Kesehatan Masyarakat (e-Journal)* Volume 7, Nomor 1, Januari 2019 (ISSN: 2356-3346)<http://ejournal3.undip.ac.id/index.php/jkm>
- [11] WHO, 2014a. *WHO-recommended surveillance standard of diphtheria*. [Online] Available at: http://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/passive/diphtheria_standards/en/ [Accessed 10 June 2014].
- [12] WHO IV B. 06. Temperature Sensitivity Of Vaccine