ANALYSIS OF RISK FACTORS ASSOCIATED WITH THE INCIDENT OF DIPHTHERIA: STUDY OF DIPHTHERIA OUTBREAK IN THE WORKING AREA OF THE KENALI INPATIENT HEALTH CENTER, WEST LAMPUNG DISTRICT, 2023

Sendra Okta Fernando [1*], Dian Isti Angraini [2], Jhons Fatriyadi Suwandi [3]

[1]Master Program of Public Health, Faculty of Medicine, University of Lampung, Bandar Lampung
[2]Department of Community Medicine and Public Health, Faculty of Medicine, University of Lampung, Bandar Lampung
[3]Department of Microbiology and Parasitology, Faculty of Medicine, University of Lampung, Bandar Lampung

Sendraoktafernando@gmail.com

ABSTRACT

Diphtheria is an infectious disease that attacks the upper respiratory tract caused by the bacteria Corynebacterium diphtheriae. An area is declared a Diphtheria Outbreak if at least one Diphtheria Suspect is found. Lampung Province is one of the provinces that has experienced extraordinary cases of diphtheria. The number of diphtheria cases in Lampung Province in 2023 was 23 cases. West Lampung was declared a different KLB in 2023 with one person dying. Different transmissions are caused by several factors, namely host, agent and environment. This research aims to determine the relationship between host and environmental factors with different events in West Lampung. This research is an analytical observational study with a case-control approach. This research was carried out from April 2024 to August 2024. The sample in this study was 44, consisting of 11 case samples and 33 control samples. Data analysis used chi-square analysis. The results of this study indicate a relationship between host factors (contact history P-value 0.000 <0.05 OR 72.5 and knowledge P-value 0.030 < 0.05 OR 6.4). Environmental factors (house ventilation P-value 0.031 <α : 0.05 OR 6.2, house floor P-value 0.037 <0.05 OR 6.9 house lighting P-value 0.028 <0.05 OR 5 .5). With different incidents in the working area of   the Kenali Inpatient Health Center, West Lampung Regency.

Keywords: *Outbreak, Diphtheria, Risk Factors,host,environment, west lampung*

1. INTRODUCTION

Diphtheria is one of the most feared epidemic infectious diseases globally, given its high morbidity and mortality rates, especially among children. Diphtheria is a health threat in various countries because routine vaccination coverage is low or because immunization is not carried out. However, after the diphtheria vaccine was discovered in 1923 and then used on a large scale in the United States and industrialized countries in the 1940s to 1950s, diphtheria cases rapidly decreased. The downward trend continued until the implementation of the Expanded Program on Immunization (EPI), which began in 1977, recorded almost ± 10,000 cases/year from 2000 to 2004 to 5,288 cases/year from 2005 to 2009 (1)

Humans are the only reservoir of Corynebacterium diphtheriae. Transmission occurs through droplets from coughing, sneezing, vomiting, through eating utensils, or direct contact with skin lesions. Signs and symptoms include upper acute respiratory infection (URTI), sore throat, pain when swallowing, low fever (less than 38.5ºC), and the presence of white/grayish pseudomembrane on the tonsils, pharynx, or larynx that is not easily removed and bleeds when removed. As many as 94% of diphtheria cases affect the tonsils and pharynx. In more severe cases, it can be characterized by difficulty swallowing, shortness of breath, stridor, and swelling of the neck that looks like a cow's neck (Bullneck). Death usually occurs due to obstruction/blockage of the airway, heart muscle damage, and abnormalities in the central nervous system and kidneys. Therefore,

diphtheria treatment must be carried out as soon as possible to avoid complications and death (2).

Other data from the World Health Organization states that from 2011 to 2015 in the world, India was the country with the highest number of reported diphtheria cases, 18,350 cases, followed by Indonesia (3,203 cases) and Madagascar (1,633 cases). Indonesia has contributed to diphtheria cases globally, from 2012-2019 Indonesia experienced an increasing trend in cases, namely, there were 4,040 cases with the highest number in 2018 being 1,386 cases with 29 deaths. Based on the province, the highest number of diphtheria cases was in East Java Province, 178 cases. On the other hand, there were 12 provinces where no cases of diphtheria were found in 2019 (3).

Lampung Province is one of the provinces that has experienced extraordinary cases of diphtheria. The number of diphtheria cases in Lampung Province in 2023 was 23 cases. Lampung Province experienced an extraordinary incident of diphtheria which contributed to the death rate, namely one patient who died in West Lampung Regency due to diphtheria.

An Extraordinary Event (KLB) is the emergence or increase in the incidence of morbidity and/or death that is epidemiologically significant in an area within a certain period and is a situation that can lead to an outbreak. Diphtheria is a certain type of infectious disease that can cause outbreaks/outbreaks as stated in Minister of Health Regulation 1501 of 2010. Diphtheria outbreak prevention activities are carried out by involving related programs, namely epidemiological surveillance, immunization programs, clinicians, laboratories and other health programs as well as across related sectors. An area is declared a Diphtheria Outbreak if at least 1 Diphtheria Suspect is found (4).

According to the epidemiological triangle proposed by John Gordon, the cause of diphtheria is influenced by 3 factors, namely the disease germ (agent), (host) and (environment) (5)

Hosts are humans or other living creatures, host factors related to the occurrence of infectious diseases include age, gender, race, ethnicity, body anatomy and nutritional status.

Human factors are very complex in the process of disease and depend on the characteristics of each individual (6)

The environment is everything that exists outside the host (host), whether inanimate objects, living objects, real or abstract, such as an atmosphere formed due to the interaction of all elements including other hosts. Environmental factors play an important role in transmission, especially in a home environment that does not meet the requirements. Home environment is one of the factors that has a major influence on the health status of its residents (7).

Based on the introduction above, the aim of this research is whether there is a relationship between host and environmental factors on the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

2. METHOD

This research method uses analytical observational using a case-control design. The sample in this study was all sufferers diagnosed with diphtheria, namely 11 samples with a case-control ratio of 1:3 so that the total sampling for this study was 44, divided into 11 groups of diphtheria cases and 33 control groups with matching for age, gender, time and location. This research aims to analyze the relationship between host and environmental factors with the incidence of diphtheria in the working area of the Kenali Inpatient Health Center, West Lampung Regency.

Data collection was carried out by going directly to the field which included, Primary Data taken by direct observation and examination of respondents and secondary data, namely data that already existed and was obtained from the working area of the Kenali Inpatient Health Center. Secondary data are demographic data, diphtheria epidemiological investigation data, and data on the number of diphtheria incidents in the Kenali Inpatient Health Center working area.

The results of the data were then tested statistically with a significance level of 95% ($p<0.05$) using the chi-square test. This research was conducted after obtaining a research ethics

certificate from the Health Research Ethics Committee, Faculty of Medicine, University of Lampung with Number: 1764/UN26.18/PP.05.02.00/2024.

3. RESULT

Characteristics of respondents based on age group, the majority of respondents were mostly in the adult age group, namely 22 or (50.0%) respondents, while in the age group, the fewest were children, there were 4 or (9.1%) respondents. The gender of the respondents was mostly male, namely 28 or (63.6%) respondents, and female, there were 16 respondents or (36.4%). The highest number of respondents had education at the high school level and those without school, namely 17 respondents or (38.6%) with high school/high school level education, while 12 respondents did not attend school or (27.3%).

Table 1 Characteristics of Research Subjects

Characteristics of Respondents	Number f	Percentage %
Age		
Babies and Toddlers	12	27,3
Children	4	9,1
Mature	22	50,0
Elderly	6	13,6
Gender		
Man	28	63,6
Woman	16	36,4
Education		
No School	12	27,3
Primary School	4	9,1
Junior High School	3	6,8
Not Graduate Junior High School	4	9,1
High School	17	38,6
Not Graduate High School	1	2,3
Bachelor's Degree	3	6,8

The results showed that in the group of diphtheria cases with low education, there were 72.7% (8 respondents) higher than the control group with low education which was 48.5% (16 respondents). The results of the chi-square analysis showed a p-value of 0.294 > α: 0.05. This means that there is no significant relationship between education and different events in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

The results showed that in the group of diphtheria cases with low income, there were 63.6% (7 respondents) and in the control group with low income there were 69.7% (23 respondents). The results of the chi-square analysis showed a p-value of 0.722 > α: 0.05, this means that there is no significant relationship between income and different events in the Working Area of the Kenali Inpatient Health Center, West Lampung Regency.

The results of the study showed that in the group of diphtheria cases who had contact there were 90.9% (10 respondents) higher than the control group who had contact there were 12.1% (4 respondents). The results of the chi-square analysis show a p-value of 0.000 <α: 0.05. This means that there is a significant relationship between contact history and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

Respondents who had contact with diphtheria sufferers were a risk factor for diphtheria transmission with OR=72.5 (95% CI 7.22-727.6). This means that respondents who have had contact with diphtheria sufferers are 72.5 times more likely to experience diphtheria than respondents who have never had contact with diphtheria sufferers in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

The research results showed that in the group of diphtheria cases with incomplete immunization status, there were 63.6% (7 respondents) and in the control group with incomplete immunization status there were 63.6% (21 respondents). The results of the chis square analysis show a p-value of 1,000 > α: 0.05. This means that there is no significant relationship between immunization status and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

The results showed that in the group of diphtheria cases with poor nutritional status, there were 18.2% (2 respondents) and in the control group with poor nutritional status there were 12.1% (4 respondents). The results of the chi-square analysis show a p-value of 0.630 > α: 0.05. This means that there is no significant relationship between nutritional status and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

The results showed that the diphtheria case group with poor knowledge was 45.5% (5 respondents), higher than the control group with poor knowledge, 12.1% (4 respondents). The results of the chis square analysis show a p-value of 0.030 <α: 0.05. This means that there is a

significant relationship between knowledge and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency. Respondents with poor knowledge were a risk factor for diphtheria transmission with OR=6.04 (95% CI 1.24-29.3). This means that respondents with poor knowledge are 6.04 times more likely to experience diphtheria than respondents with good knowledge.

The results showed that in the group of diphtheria cases with ventilation that did not meet the requirements, there were 72.7% (8 respondents), higher than the control group with ventilation that did not meet the requirements, which was 30.3% (10 respondents). The results of the chi-square analysis show a p-value of 0.031 <α: 0.05. This means that there is a significant relationship between ventilation and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency. Respondents with ventilation that does not meet the requirements are a risk factor for diphtheria transmission with OR= 6.1 (95% CI 1.3-28.0), meaning that respondents with ventilation that does not meet the requirements are 6.1 times more likely to experience diphtheria than respondents with ventilation that meets the requirements. Requirements in the Working Area of the Kenali Inpatient Health Center, West Lampung Regency.

The results showed that the diphtheria case group with lighting that did not meet the requirements was 63.6% (7 respondents) higher than the control group with lighting that did not meet the requirements, which was 24.2% (8 respondents). The results of the chi-square analysis show a p-value of 0.028 <α: 0.05. This means that there is a significant relationship between lighting and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency. Respondents with lighting that does not meet the requirements are a risk factor for diphtheria transmission with OR= 5.4 (95% CI 1.265-23.640), meaning that respondents with lighting that does not meet the requirements are 5.4 times more likely to experience diphtheria incidents than respondents with lighting that meets the requirements in the Work Area Kenali Inpatient Health Center, West Lampung Regency.

The results showed that in the group of diphtheria cases with floors that did not meet the requirements, there were 81.8% (9 respondents), higher than the control group with floors that did not meet the requirements, there were 39.4% (13 respondents). The results of the chi-square analysis showed a p-value of 0.037 <α: 0.05. This means that there is a significant relationship between the floor of the house and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency. Respondents whose house floors do not meet the requirements are a risk factor for diphtheria transmission with OR= 6.9 (95% CI 1.285-37.287), meaning that respondents whose house floors do not meet the requirements are 6.9 times more likely to experience diphtheria than respondents whose house floors meet the requirements. In the Working Area of the Kenali Inpatient Health Center, West Lampung Regency.

The results showed that in the group of diphtheria cases with house walls that did not meet the requirements, there were 72.7% (8 respondents) and in the control group with house walls that did not meet the requirements, there were 84.8% (28 respondents). The results of the chi-square analysis show a p-value of 0.391 > α: 0.05. This means that there is no significant

relationship between house walls and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

The results of the study showed that in the group of diphtheria cases with a housing density that did not meet the requirements, there were 72.7% (8 respondents) higher than the control group with a housing density that did not meet the requirements, there were 39.4% (13 respondents). The results of the chi-square analysis show a p-value of 0.117 > α: 0.05. This means that there is no significant relationship between residential density and the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

Table 2 Relationship between Host and Environmental Factors with the incidence of diphtheria

Variable	Control		Case		OR 95% CI	p
	n	%	n	%		
Education						
Low	8	72,7	16	48,5		
Tall	3	27,3	17	51,5		0,294
Income						
Low	7	63,6	23	69,7		0,722
Tall	4	36,4	10	30,3		
Contact History						
Have been in contact	10	90,9	4	12,1	72,5 (7,2-727)	0,001
Never contact	1	9,1	29	87,9		
Immunization Status						
Incomplete	7	63,6	21	63,6		1,000
Complete	4	36,4	12	36,4		
Nutritional status						
Bad	2	18,2	4	12,1		0,630
Good	9	81,8	29	87,9		
Knowledge						
Not good	5	45,5	4	12,1	6,04 (1,2-29,3)	0,030
Good	6	54,5	29	87.9		
Ventilation						
Not eligible	8	72,7	10	30,3	6,13 (1,3-28,0)	0,031
qualify	3	27,3	23	69,7		
Lighting						
Not eligible	7	63,6	8	24,2	5,46 (1,2-23,6)	0,028
qualify	4	36,4	25	75,8		
Floor						
Not eligible	9	81,8	13	39,4	(6,92 1,2-37,2)	0,037
qualify	2	18,2	20	60,6		
Wall						
Not eligible	8	72,7	28	84,8		0,391
qualify	3	27,3	5	15,2		
Occupancy Density						
Not eligible	8	72,7	13	39,4		0,117
qualify	3	27,3	20	60,6		

4. DISCUSSION

The education variable does not have a significant relationship with the incidence of diphtheria. This research is in line with research results (8) that the level of education does not affect the occurrence of diphtheria transmission, The level of education does not always influence the magnitude of diphtheria disease in an area (9).

Based on the research results, there is no significant relationship between income and the

incidence of diphtheria because there is no difference between low income in the case and control groups. The distribution of this disease is spread throughout the world, especially in poor countries where the population lives in densely packed residential areas. Poor hygiene and sanitation, and inadequate health facilities. People who are at high risk of contracting diphtheria are people with low socioeconomic backgrounds (10)

The majority of cases stated that it was in the home environment of diphtheria sufferers where transmission or close contact occurred. The group of cases who had contact with diphtheria sufferers was 90.9%. From the chi-square test, the results showed that a history of contact gave the chance of diphtheria occurring 72.5 times compared to not having it. Contact history. An important factor that plays a role in diphtheria transmission is a history of close contact. A person's history of close contact with diphtheria sufferers carries a risk of transmission of diphtheria disease. It is spread through physical contact and breathing. Transmission occurs through droplets from coughing, sneezing, vomiting, eating utensils, or direct close contact with lesions on the skin. Anyone who has had close contact with the case in the last 7 days is considered to be at risk of infection and all close contacts should be checked for symptoms of diphtheria. And supervised every day (4). In line with the results of research conducted by (11) it is revealed that there is a close relationship between contact and the incidence of diphtheria in Sana'a, Yemen. The results of the research also conducted by (12) showed that there was a significant influence between contact history on the incidence of diphtheria disease in Sidoarjo Regency.

The immunization status variable did not have a significant relationship with the incidence of diphtheria because the immunization status was incomplete in the case and control groups. The results of this study are in line with the results of research conducted (13) in the city of Surabaya which stated that there was no significant influence between immunization status on the incidence of diphtheria. In line with the results of previous research (14). In Blitar Regency in 2015, 91%

of diphtheria cases were experienced by people who received complete immunizations.

Nutritional status in this study did not have a significant relationship with the incidence of diphtheria because poor nutritional status in the case and control groups did not differ, oor nutritional status is food intake that is less nutritious because children often consume snacks and rarely eat rice, side dishes or vegetables (15). this is to the results of previous research that there was no significant influence between nutritional status and the incidence of diphtheria (16)

Respondents' knowledge in this study had a significant relationship with the incidence of diphtheria. Respondents who have poor knowledge about diphtheria are one of the causes of transmission and behavior that does not support the prevention and treatment of diphtheria. Poor knowledge is caused by respondents who do not receive information or socialization about diphtheria. Knowledge about diphtheria needs to be increased to improve behavior in preventing and transmitting diphtheria disease. Based on research (8) respondents whose level of knowledge is below the average have a 4.45 times greater tendency to contract diphtheria than respondents whose level of knowledge is above the average.

The ventilation variable in this study has a significant relationship with the incidence of diphtheria, based on the results of research on respondents' house ventilation, namely windows and only a few have ventilation holes. The absence of good ventilation (<10% of the floor area) in a room increasingly endangers health or life, if the room is contaminated by bacteria such as diphtheria sufferers or various organic or inorganic chemicals. Ventilation also functions to free the room air from bacteria, especially pathogenic bacteria such as diphtheria, because there is always a continuous flow of air. The results of this study are in line with the results of research conducted (17) that there is a relationship between ventilation and the incidence of diphtheria.

Natural lighting in the house is indoor lighting in the morning, afternoon or evening that comes from direct sunlight entering through windows, ventilation or glass tiles for at least 10 minutes per day. The presence of sunlight

entering the house can reduce room humidity and can kill germs (18). Based on Environmental Health Quality Standards, direct or indirect natural and/or artificial lighting can illuminate the entire room with a minimum lighting intensity of 60 lux (19). The results of this study are in line with the results of research conducted (17) that there is a relationship between lighting and the incidence of diphtheria.

Most of the floors in the respondents' houses are not permanent, many are still planks and some are also earthen and not yet ceramic. Earthen floors play a role in the process of diphtheria transmission. A house whose floors are still dirt and boards that are not watertight will cause damp and stuffy conditions, which will prolong the survival of diphtheria germs, for this reason, it needs to be coated with waterproof cement or ceramic. Based on (18) research, houses with floors that do not meet the requirements have a 20.7 times greater risk of contracting diphtheria than houses that have floors that meet the requirements.

From the results of the research that has been carried out, it was found that many of the walls of people who are suffering and healthy are still not permanent, namely wood/boards so the walls of houses that are not yet permanent or are still boards are where bacteria and dust can nest in the cracks of the boards. So the best solution to prevent the growth of bacteria in the walls (between the walls) is that the walls should be permanent or watertight. House walls that meet health requirements are wall materials that are watertight and easy to clean, for example, walls, because if the walls are not made of materials that are watertight and easy to clean, such as bamboo/wood, stones, and stones that are not plastered easily. become damp and dusty (crevices) so it has the potential to be a breeding ground for pathogenic bacteria.

In this study, there was no significant relationship between the population density variable and the incidence of diphtheria. The more densely populated the house, the faster the air in the house will become polluted. Because the increasing number of occupants will affect the oxygen levels in the room, as well as the water vapor levels and air temperature. By increasing CO_2 levels in the air in the house, it will provide more opportunities for bacteria to grow and reproduce. In this way, more germs will be inhaled by the occupants of the house through the respiratory tract (7). The results of this study are in line with research conducted (20) that there is no significant relationship between residential density and the incidence of diphtheria.

5. CONCLUSION

Based on the research results, it was concluded that there was a relationship between host factors, namely (contact history variable P-value 0.001 <α: 0.05 OR 72.5 and Knowledge variable P-value 0.030 <α: 0.05 OR 6.4) and environmental factors, namely (House ventilation P-value 0.031 <α: 0.05 OR 6.2, House floor P-value 0.037 <α: 0.05 OR 6.9 House lighting P-value 0.028 <α: 0.05 OR 5.5). with the incidence of diphtheria in the Kenali Inpatient Health Center Work Area, West Lampung Regency.

REFERENCES

1. Clarke K. Review of the epidemiology of diphtheria 2000-2016. US Centeres Dis Control Prev. 2017;

2. Kemenkes RI. Kebijakan Surveilans Penyakit Yang Bisa Dicegah Dengan Imunisasi (Pd3I). Modul Pelatih surveilans PD3I. 2021;201–2.

3. Kemenkes RI. Kementerian Kesehatan Republik Indonesia 2019. Short Textbook of Preventive and Social Medicine. 2019. 28–28 hal.

4. Kemenkes. Pedoman Pencegahan dan Pengendalian Difteri. Buku pedoman Pencegah dan Pengendali Difteri [Internet]. 2017;1–34. Tersedia pada: https://sehatnegeriku.kemkes.go.id/wp-content/uploads/2018/01/buku-pedoman-pencegahan-dan-penanggulangan-difteri.pdf

5. Acosta A, Moro P, Hariri S, Tiwari T. Pinkbook: Diphtheria . Cdc. 2021;97–110.

6. Darmawan A. Epidemiologi Penyakit Menular Dan Penyakit Tidak Menular. Jmj [Internet]. 2016;4(2):195–202. Tersedia pada: https://online-journal.unja.ac.id/kedokteran/article/view/3593

7. Purnama SG. Buku Petunjuk Teknis Penyakit Berbasis Lingkungan. Minist Heal Repub Indones. 2016;112.

8. Sanjani VPA. Kajian Penyebab Kejadian Difteri Di Kabupaten Pasuruan. 2017;104–11.

9. Izza N, Soenarnatalina. Analisis Data Spasial Penyakit Difteri di Provinsi Jawa Timur Tahun 2010 dan 2011. Bul Penelit Sist Kesehat. 2015;18(2):211–9.

10. Maya P. Analisis Faktor KLB Difteri Di Wilayah Kerja Puskesmas Wringin Kecamatan Wringin Kabupaten Bondowoso. Jurnal Kesehatan Masyarakat Nasional. 2012.

11. Ali A, Nassar H, Al-amad MA, Ahmed Y. Risk factors for diphtheria in Sana ' a , Yemen , 2019 : a matched case – control study. IJID Reg [Internet]. 2022;2(September 2021):40–4. Tersedia pada: https://doi.org/10.1016/j.ijregi.2021.11.010

12. Lestari KS. Faktor – Faktor Yang Berhubungan Dengan Kejadian Difteri Di Kabupaten Sidoarjo. 2012;

13. SARI PMM. Pengaruh kondisi sanitasi rumah, status imunisasi, dan pengetahuan ibu terhadap kejadian difteri pada bayi di kota Surabaya. Swara Bhumi. 2022;1(2):1–7.

14. Alfiansyah G. Penyelidikan Epidemiologi Kejadian Luar Biasa (Klb) Difteri Di Penyelidikan Epidemiologi Kejadian Luar Biasa (Klb) Difteri Di Kabupaten Blitar TAHUN 2015 Epidemiological Investigation of Diphtheria ' s Outbreak at Blitar District in. 2019;(June 2017).

15. Hidayati R. Faktor-Faktor Yang Mempengaruhi Angka Kejadian Penyakit Difteri Di Kota Padang Factors. 2017;2(2):180–7.

16. Susanti R, Ifroh RH, Noviasty R. Risk factors for diphtheria outbreak in children aged 1-10 years in East Kalimantan Province , Indonesia [version 1 ; peer review : 2 approved] Iwan Muhamad Ramdan. 2019;1–10.

17. Saifudin N, Wahyuni CU, Martini S. Faktor Risiko Kejadian Difteri Di Kabupaten Blitar Tahun 2015. J Wiyata. 2016;3(1):61–6.

18. Kartono B. Lingkungan Rumah dan Kejadian Difteri di Kabupaten Tasikmalaya dan Kabupaten Garut. Kesmas Natl Public Heal J. 2008;2(5):200.

19. Kementerian Kesehatan. Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2023. Kemenkes Republik Indones. 2023;151(2):Hal 10-17.

20. Feranita Utama, Chatarina U.W. Sm. Determinan Kejadian Difteri Klinis Pasca Sub Pin Difteri Tahun 2012 Di Kabupaten Bangkalan Determinants.