Application of Florence Nightingale's Theory in Cases of Pulmonary TB Fisherman and Smoked Fish Industry Communities

ABSTRACT

Introduction: The process of smoking fish in Indonesia was still carried out traditionally and can affect the fishermen and smoked fish industry communities who have pulmonary TB. This study aims to apply the Florence Nightingale Theory in cases of pulmonary TB fishermen and smoked fish industry communities.
Materials and Methods: This study used an analytic observational method with a case-control design. This study used non-probability sampling and purposive sampling techniques with the sample. The number of respondents was 106 consisting of 53 respondents in the case group and 53 respondents in the control group. The data obtained were then analyzed using *Chi-Square.*
Results: The environment exposed to smoke from smoking fish has a p-value of 0.001 with OR 3.718, smoking habit has a p-value of 0.034 with OR 2.842, and window opening habit has a p-value of 0.000 with OR 0.391. Whereas, occupancy density and cooking fuel have no influence on the incidence of pulmonary TB as evidenced by statistical tests with a p-value of >0.005
Conclusion: The incidence of pulmonary TB in fisherman and smoked fish industry communities is influenced by environment exposed to smoke from smoking fish and window opening habit. This is following the emphasis of Nightingale's environmental theory stating that pure air and lighting are included in the main components influencing the environment.

Keywords: Fisherman; florence nightingale; pulmonary tuberculosis; smoked fish industry.

1. INTRODUCTION

Indonesia has a big problem in dealing with tuberculosis. Tuberculosis is a disease that is a major public health problem, especially in developing countries. Today, tuberculosis is still one of the priorities in the eradicating infectious disease program. Tuberculosis is a disease caused by Mycobacterium tuberculosis. Tuberculosis attacks the lungs and can infect other people. Tuberculosis can be transmitted through the air when a person with tuberculosis coughs or sneezes. Tuberculosis is an old disease that is the top killer among other infectious diseases [1].

Globally, the highest number of TB cases in 2017 occurred in the Southeast Asia and West Pacific regions with 62% of new cases, followed by the African region with 25% of new cases. TB cases occur in 30 countries by 87%, eight countries account for two-thirds of new TB cases, namely India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa. Indonesia, along with 13 other countries, is included in the HBC (high burden countries) for the 3 indicators namely TB, TB/HIV, and MDR-TBC [2].

Tuberculosis (TB) is caused by Mycobacterium tuberculosis, which spreads when a person with TB expels the bacteria into the air (e.g., by coughing). Tuberculosis usually affects the lungs and bronchi (Jeremiah et al., 2022). Based on a report from the Bantul health profile data in 2021, the discovery of tuberculosis cases was 48.08

per 100,000 population, with 88 deaths due to tuberculosis with a cure and treatment rate of 79.3%. The recovery rate for tuberculosis treatment in 2020 decreased compared to 2019 by 86% [3].
Pulmonary TB disease occurs when the body's immune system decreases. In an epidemiological perspective that sees disease incidence as a result of interactions between the three components, namely host, agent, and environment, risk factors can be studied from these nodes [4]. Residential environmental sanitation is closely related to disease transmission. A house with good lighting and ventilation will make it difficult for germs to grow, because ultraviolet light can kill germs and good ventilation causes air exchange, thereby reducing the concentration of germs [5].

In addition, the influence of an unfavorable environment can be a cause of infectious diseases, including pulmonary TB. A bad environment is an environment that has never received supervision, for example, toxic vapors or gases which can be harmful to breathing if inhaled and pollute the air, dust which can become a pollutant and pollute the air, humid and dirty environmental temperatures which can be a place for the development of Mycobacterium tuberculosis bacteria, and unhealthy community behavior by not maintaining personal hygiene and so on [6].

Based on a preliminary study, it was found that the number of pulmonary TB patients in Sendana, following data from Puskemas (Community Health Center) Sendana 1, was 59 people in 2019 with the highest number of patients in the Mosso Village area. Mosso Village is one of the areas in Sendana with the livelihoods of the people in the village relying on marine or fishery products.

Fishery business activities from the fish landing sites, fish handling—to fish processing, generally produce waste, ranging from liquid and solid waste. All of this results in the environmental pollution in the form of odors or pollution in the form of smoke from fish processing by smoking or burning. The majority of fish processing businesses are traditional businesses with small scale (households) so they do not manage the waste they produce well.

In the beginning, the process of smoking fish in Indonesia was still carried out traditionally using simple equipment such as firewood while paying little attention to sanitation and hygiene aspects so that it could have an impact on health and the environment. The environmental impact that commonly occurs as a result of smoked fish processing activities is air pollution due to the smoke that arises [5]. According to a study conducted by Harmani et. al. this existing smoke contains chemicals in the form of particulates and gas components that have the potential to cause decreased lung function [7].

Florence Nightingale's theory focuses on the environment, but Nightingale used the term surroundings in her writings. She defines and explains the concepts of ventilation, warmth, light, diet, hygiene, and noise. She believes that a healthy environment is necessary for proper treatment and restoration/maintenance of health. Her theoretical work on the five essential components of environmental health (pure air, pure water, efficient drainage, hygiene, and light) remains as relevant today as 150 years ago [8]. If it is related to the environment in the smoked fish industry and the incidence of pulmonary TB in that environment, the environment has a big role as stated by Florence Nightingale's theory.

Based on interviews with local residents, it was found that fish processing by smoking or burning relies on firewood as fuel. While working, they admit that they have never used masks or goggles to protect themselves from smoke pollution produced by firewood. They also complained that they often experienced coughing or felt disturbed by the smoke generated from the process of smoking fish. Based on this background, it is necessary to conduct further study.

2. MATERIALS AND METHODS

This study used an analytic observational method with a case-control design. This study used non-probability sampling and purposive sampling techniques with the sample inclusion criteria being people in the smoked fish industry area who are willing and cooperative. The number of respondents was 106 consisting of 53 respondents in the case group and 53 respondents in the control group. This study used a questionnaire consisting of 4 questions on demographic data and 5 questions on the environment in the smoked fish industry as a measuring instrument. This study was conducted in the Somba area, West Sulawesi, which is one of the areas with the most smoked fish industry in West Sulawesi.

The statistical test used the chi-square test through two stages. The first stage was knowing the relationship between the independent variable and the dependent variable. The second stage was knowing the risk of the independent variable on the dependent variable. The measurement of risk in this study was carried out by calculating the good ratio because this study used a case-control design. Odds Ratio (OR) is a measure of the association of exposure (risk factor) with disease incidence. OR criteria, namely: OR <1, namely risk factors to prevent illness, OR = 1, namely the risk of the exposed group being the same as the unexposed group, OR > 1, namely the risk of causing illness.

3. RESULTS

Based on Table 1, it is shown that the characteristic description of respondents in the case group (TB) consists of 53 respondents and the control group (Non-TB) consists of 53 respondents. The majority of respondents by gender is male with 55 respondents (51.9), by age is adult with 41 respondents (38.7), by educational background is elementary school graduate with 52 respondents (49.1), by occupation is self-employed with 32 respondents (30.2), by occupancy density is densely occupied with 61 respondents (57.5), by environment exposed to smoke from smoking fish is exposed with 64 respondents (60.4), by smoking habit is not smoking with 83 respondents (78.3), by cooking fuel is kerosene/gas with 83 respondents (78.3), and by window opening habit is yes with 87 respondents (82.1).

Based on Table 2, it is shown that environment exposed to smoke from smoking fish, smoking habit, and window opening habit have an influence on the incidence of pulmonary TB as evidenced by statistical tests with a p-value of <0.005. The environment exposed to smoke from smoking fish has a p-value of 0.001 with OR 3.718, smoking habit has a p-value of 0.034 with OR 2.842, and window opening habit has a p-value of 0.000 with OR 0.391. Whereas, occupancy density and cooking fuel have no influence on the incidence of pulmonary TB as evidenced by statistical tests with a p-value of >0.005

Table 1. Characteristics of TB and Non-TB groups in fisherman and smoked fish industry communities

Category	Group		Total (%)
	Case n(%)	Control n(%)	
Gender			
Male	33 (62.3)	22 (41.5)	55 (51.9)
Female	20 (37.7)	31 (58.5)	51 (48.1)
Total	53 (100)	53 (100)	106 (100)
Age			
Teenager (12-25 y.o)	10 (18,9)	4 (7.5)	14 (13.2)
Adult (26-45 y.o)	9 (17)	32 (60.4)	41 (38.7)
Elderly (46-65 y.o)	26 (49.1)	12 (22.6)	38 (35.8)
Senior (> 65 y.o)	8 (15,1)	5 (9.4)	13 (12.3)
Total	53 (100)	53 (100)	106 (100)
Education			
Elementary School	28 (52.8)	24 (45.3)	52 (49.1)
Junior High School	12 (22.6)	6 (11.3)	18 (17)
Senior High School	10 (18.9)	14 (26.4)	24 (22.6)
University	3 (5.7)	9 (17.0)	12 (17)
Total	53 (100)	53 (100)	106 (100)
Occupation			
Fish smoker	7 (13.2)	6 (11.3)	13 (12.3)
Fisherman	8 (15.1)	11 (20.8)	19 (17.9)
Farmer	6 (11.3)	1 (1.9)	7 (6.6)
Self-employed	15 (28.3)	17 (32.1)	32 (30.2)
Civil servant	2(3.8)	15 (28.3)	17 (16)
Non worker	15 28.3)	3 (5.7)	18 (17)
Total	53 (100)	53 (100)	106 (100)
Occupancy Density			

Densely occupied	26 (49.1)	19 (35.8)	45 (42.5)
Not densely occupied	27 (50.9)	34 (64.2)	61 (57.5)
Total	53 (100)	53 (100)	106 (100)
Environment Exposed to Smoke from Smoking Fish			
Exposed	40 (72.5)	24 (45.3)	64 (60.4)
Not Exposed	13 (24.5)	29 (54.7)	42 (39.6)
Total	53 (100)	53 (100)	106 (100)
Smoking habit			
Smoking	16 (30.2)	7 (13.2)	23 (21.7)
Not smoking	37 (69.8)	46 (86.8)	83 (78.3)
Total	53 (100)	53 (100)	106 (100)
Cooking Fuel			
Wood	6 (11.3)	17 (32.1)	23 (21.7)
Kerosene/Gas	47 (88.7)	36 (67.9)	83 (78.3)
Total	53 (100)	53 (100)	106 (100)
Window Opening Habit			
Yes	34 (64.2)	53 (100)	87 (82.1)
Not	19 (35.8)	0	19 (17.9)
Total	53 (100)	53 (100)	106 (100)

Table 2. Differences in OR value in TB and Non-TB groups in fisherman and smoked fish industry communities

Category	Group		OR	P-Value
	TB (%)	No TB (%)		
Occupancy Density				
Densely occupied	26 (49.1)	19 (35.8)	1.732	0.169
Not densely occupied	27 (50.9)	34 (64.2)		0.792-3.751
Environment Exposed to Smoke from Smoking Fish				
Exposed	40 (72.5)	24 (45.3)	3.718	0.001
Not Exposed	13 (24.5)	29 (54.7)		1.626-8.502
Smoking habit				
Smoking	16 (30.2)	7 (13.2)	2.842	0.034
Not smoking	37 (69.8)	17 (32.1)		1.058-1.058
Cooking Fuel				
Wood	6 (11.3)	17 (32.1)	3.699	0.010
Kerosene/Gas	47 (88.7)	36 (67.9)		1.325-10.330
Window Opening Habit				
Yes	34 (64.2)	53 (100)	0.391	0.000
Not	19 (35.8)	0		0.301-0.508

4. DISCUSSION

According to Florence Nightingale's theory, components related to environmental theory are emphasized on 5 things, namely ventilation, warmth, light, diet, hygiene, and noise. Based on the results of this study, the component influencing the incidence of pulmonary TB in fisherman and smoked fish industry communities is environment exposed to smoke from smoking fish and window opening habit. This is of course following the emphasis of Florence Nightingale's theory where pure air and lighting are included in the emphasis components related to the environment.

Pure air in Nightingale's theory means the air inhaled when breathing is as pure as the air outside without cooling it. Based on the results of this study, environment exposed to smoke from smoking fish has an influence on the incidence of pulmonary TB in fisherman and smoked fish industry communities with a p-value of <0.005. This indicates that the pure air in the environment of fisherman and smoked fish industry communities mixes with smoke from smoking fish.

Based on the results of the analysis, the availability of pure air referred to in Nightingale's theory is not available or reduced, this is caused by smoke from smoking fish produced by firewood. The smoke produced by firewood mixes with the pure air of the surrounding environment and influences the surrounding environment so that when the local residents breathe the air, it is not pure air like what Florence Nightingale's theory meant. This can influence the local community's health imbalances due to substances contained in biomass smoke, including particulate matter, carbon monoxide, nitric oxide, sulfur oxide, formaldehyde, and benzopyrene. These substances may cause bronchial irritation, inflammation, increased reactivity, reduced macrophage response, and reduced immunity so that it is susceptible to bacterial and viral infections [9].

The results of this study are reinforced by a study conducted by Shoimah et.al. stating that the impact of environmental pollution that is very typical and cannot be avoided from the environment of the smoked fish industry is the impact of smoke pollution [5]. Haze pollution has a negative impact on the environment around the smoked fish industry, including air, water, plants, to the workers and owners of the smoked fish industry themselves. Complaints from local residents stated that many babies and toddlers who live in the smoked fish industry in Wonosari Village experience shortness of breath and acute respiratory tract infection (ARTI) and other Prau disorders such as TB, as a result of always breathing air from burning coconut shells for smoking fish since birth.

Light in Nightingale's theory means the light with sufficiently tangible and obvious influences on the human body, as well as purifying influences, especially from direct sunlight, on the air in the room. Based on the results of this study, window opening habit has a significant relationship with the incidence of pulmonary TB in fisherman and smoked fish industry communities with a p-value <0.05.

From the cases studied, of course, this concept will be a dilemma. It is known well that direct sunlight is good for health, for example, in Nightingale's theory, it is advised that we must let the light come into the house by opening the windows every day, but the case is different here. If the residents open the windows, the light will come in, but the air mixed with the smoke from burning firewood will also come into the house. This will certainly have an impact on health because the air that is inhaled in the house is air containing smoke. This is the reason why most local residents tend not to open their windows and let the light come in as they think that if the room is left open, the smoke from smoking fish will also come into the house.

This of course will influence the increase in the incidence of pulmonary TB because tuberculosis bacilli can survive for several weeks in dry sputum and have high resistance to antiseptics, but quickly become inactivated by sunlight, ultraviolet light, or temperatures higher than 60℃ [10]. According to Panagribuan et.al., sunlight can kill disease bacteria, viruses, and fungi, so it is very useful for treating tuberculosis, blood poisoning, and respiratory asthma, and destructing some germ-spreading viruses [11]. According to a study conducted in Ciampea, the risk of developing tuberculosis is 5.2 times higher for people living in a house with poor ventilation compared to people living in a house with ventilation that meets health requirements. People living in a house with lighting that does not meet health requirements have a 2.5 times higher risk of contracting tuberculosis compared to people living in a house with lighting that meets health requirements. In fact, all light can be deadly, but it depends on the type and duration of the light [12]. So from the habit of local residents who tend not to open their windows every day, it can have an influence on the increase in pulmonary TB cases.

5. CONCLUSIONS

The incidence of pulmonary TB in fisherman and smoked fish industry communities is influenced by environment exposed to smoke from smoking fish and window opening habit. This is following the emphasis of Nightingale's environmental theory stating that pure air and lighting are included in the main components influencing the environment. Pure air mixed with smoke from smoking fish can cause pulmonary TB. Similarly, window opening habit can let sunlight come into the house and can influence the growth of bacteria that cause pulmonary TB.

Based on Florence Nightingale's theory of 5 important components influencing environmental health, these 5 components include pure air, pure water, efficient drainage, and light. In this study, not all components were included in the research variables, so the researchers hope that future researchers for subsequent studies will

include the 5 components in question in the research variables.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This study has approved by Sekolah Tinggi Ilmu Kesehatan Nani Hasanuddin under the following registration number 0334a/STIKES-NH/KEPK/ IV/2021.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Maelani T, Cahyati WH. Characteristics of sufferers, side effects of goBat, and dropping out of treatment for pulmonary tuberculosis. Higeia J Public Heal Res Dev. 2019;3(4):625–34.
2. Mathofani PE, Febriyanti R. Factors associated with the incidence of pulmonary tuberculosis (TB) in the Serang City Health Center work area in 2019. J Ilm Public Health. 2019;12(1):1–10.
3. Andhy Sulisty. Mapping tuberculosis disease with geographic information system in Bantul Region. Jurnal Ilmu Kesehatan Bhakti Setya Medika; 2022.
4. Indonesian Ministry of Health. 2018 National Riskesdas Report. Indonesian Ministry of Health, Health Research and Development Agency; 2018.
5. Shoimah H, Purnaweni H, Yulianto B. Environmental management at the fish smoking center in Wonosari village, Bonnag District, Demak Regency. In: Proceedings of the National Seminar on Natural Resources and Environmental Management. Semarang: Environmental Science Study Program, Diponegoro University Postgraduate Program. 2013; 564–70.
6. Rahayu S, Sodik MA. The Influence of the physical environment on the incidence of pulmonary TB. STIKes Surya Mitra Husada; 2014.
7. Harmani N, Linda O, Sulistiadi W. Host and environmental factors in the incidence of pulmonary tuberculosis in Cianjur Regency, West Java Province. Indonesian J Heal Dev. 2019;1(2):40–7.
8. Alligood. Nursing Theorists and Their Work. Singapore: Elsevier; 2017.
9. Sayuti J. Smoke as a risk factor for smear positive pulmonary TB. In: National Seminar on Medical Informatics (SNIMed) IV. Yogyakarta: Indonesian Islamic University. 2013;13–23.
10. Atmosukarto A. Pulmonary tuberculosis, diagnosis, therapy and problems. Jakarta: UI Press. 2012;4.
11. Pangaribuan L, Kristina K, Perwitasari D, Tejayanti T, Lolong DB. Factors that Influence the incidence of tuberculosis in general 15 years and over in Indonesia (analysis of tuberculosis prevalence survey data (SPTB). Health Syst Research Bulletin. 2020;23(1):10–7.
12. Oktafiyana F, Murhan A. Relationship between the work environment of pulmonary TB sufferers and the incidence of pulmonary TB disease. J Nursing. 2016;XII(1):52–7.