The Potential of River Utilization as Public Health Leverage in Indonesia

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Abstract Rivers has tremendous benefits for human life generally and for Indonesian's health and wellbeing's society in particular. One of them is the function of the river to support peoples who live in the watershed. However, river basin could become health menace if not well maintained, for example, the flood that might be caused by silting of the river as the impact from littering. Public health is not only measured by the high rates of morbidity in an area but can also be triggered by extraordinary events or disasters such as floods. This paper was made to analyze the ability of the river as a community health leverage through identification and review of various articles. Based on extensive article reviews, this study was found that disease prevention and environmental control were the two main factors that could be the foundation of levers public health degrees. Therefore, it is essential to prevent transmissions of infectious diseases and to maintain a sustainable environment.

1 INTRODUCTION

Healthy is a state of being free from pain both physically, mentally, psychologically, spiritually and being able to work productively (Indonesian Law, 2009). Public health is a condition where a group of individuals have optimum health conditions so that they are able to carry out activities to achieve welfare. A person's health can be influenced by individual genetic factors, accessible health services, daily behavior and hygiene, also influenced by environmental factors (Health, Durch, Bailey, & Stoto, 1997). Environmental factors, especially river basins, need to get more attention because they can be the core of a public health development planning roadmap (Van den Brandeler, Gupta, & Hordijk, 2018).

Indonesia is known as a great nation, in terms of territory, population and also histories. In the various history books studied, many historical large kingdoms recorded was located on the banks of the river, not on the coast or on the top of mountain. The very first documented kingdom in Indonesia called Kutai Kartanegara, is believed to be located around the Mahakam River. The famous Sriwijaya Kingdom was believed to be located in the vicinity of Musi River, and the mighty Majapahit kingdom was found located near the Brantas River. At that time, river's functionality besides as the main route of international trading, river could also function as a defense zone, considering how foreigners would have difficulty carrying large ships if they wanted to attack. This example could become one of the keys for future generations to be able to utilize the river potential as optimally as possible, such as to levers public health and environmental sustainability triggers.

According to the Indonesian Ministry of Health, the health leverage consists of economic benefits, sanitation, access to clean water and provide adequate intake of nutrition where the existence of the river is able to create these four factors (Kemenkes RI, 2018). Firstly the economic benefit, rivers have many benefits such as transportation, freshwater aquaculture, ecotourism, at cetera. Secondly sanitation factors, it depends on microbiological activity in the river which is able to degrade various organic substances that pollute the environment and turn it into a relatively less harmful element, for example, the ability of water hyacinth to break down Natrium and Phosphate elements from household

waste is one of the process, but it run within certain limitations. The factor of access to clean water, most of the rivers in big cities on the Island of Java such as Jakarta and Surabaya, use river as a source of drinking water which is processed in advance by the local government. The water was then channeled to residential area through closed pipes, so it can suppress contamination in the distribution process. Lastly, nutrition factors could occurs from river use as fish ponds to farm freshwater fish like Patin or Catfish, which has double impact to economic and healthy diet.

2 METHODS

This analysis was done by reviewing various articles that have been published both online and also in print. With the design of a retrospective observational study, we collect articles and identified within key words as determined above.

3 RESULT AND DISCUSSIONS

Various pollution and environmental degradation from human activities on rivers and watersheds, change the river functionality. The river as an economic driver, sanitation facilities and access to clean water turn out to be a frightening figure. When the dry season started, it becomes mosquito's nests because the water flow is suitable for their larvae. Whereas on rainy season, it turns into giant flood monster who's ready to flatten what it passes due to waste generation clogging channels.

From various literature that have been collected and analysed, there are at least two main factors that are obtained, namely from the factors of disease prevention and environmental sustainability. Disease control factors consist of:

1) Prevention of direct infectious diseases such as diarrhoea, cholera, chickenpox, typhus and PES;
2) Control of vector and zoonotic diseases such as helminthiases, malaria, DHF and Chikungunya;
3) Prevention of mental health problems.

Whereas from the environment factors, the existence of the river can play a major role in:

1) Environmental health such as safe water preservation and basic sanitation, and waste disposal;
2) Nutritional benefit from freshwater fish diet which are farm in fish ponds.

3.1 Infectious Diseases Prevention

Research shows that the river can bring disasters such as diarrhea outbreaks when floods occurs. Preventive actions and mitigation measures are needed to reduce the risk of flooding and impacts that may occur after the flood. Ironically, more than 10 cities studied were most of the incidence of diarrhea concentrated in areas of the poor (Liu et al., 2018).

In order to prevent transmission of infectious diseases the river must be clean and healthy, it is not permissible to dispose of garbage carelessly because the large amount of garbage that accumulates on the banks of the river can be a breeding ground for infectious animals such as flies.

River that contaminated by E. coli can also trigger the spread of typhus, because if we found pathogenic bacteria in a banks it means that water is contaminated with human feces. Grey water shelter such as septic tanks which rarely drained and well treated, can cause seepage to water bodies and pollute rivers.

In 2017 in Indonesia, there were several cases in some province of diarrhea outbreaks that need to be taken seriously. Although the number of victims/death can still be counted on fingers, this disease is often undetectable, and there are still many people who think that diarrhea is a common disease so they are not go to the hospital to get help immediately. Diarrhea is a disease that have double burden to public health, directly it has high fatality rate and indirectly it can decrease productivities.

Table 1: Diarrhoea Outbreak with Highest Case in Indonesia 2017

Province	Cases	Case Fatality Rate (CFR)
Papua	642	3,4
West Borneo	282	0,35
West Sulawesi	262	1,5
Gorontalo	149	0,67
Central Sulawesi	101	2

Source: (Kemenkes RI, 2018)

From the table we found that Papua Province has the highest case fatality rate with more than 3%, and the lowest is West Borneo Province with not more than 0,35%. Papua has many rivers that have small flow, however, West Borneo had vice versa. Thus, with controlling the river we can preventing outbreak indirectly. Using continuous monitoring to detect pathogenic viruses in river water bodies could provide accurate data for further improvement (Guo, Wang, Zhao, Li, & Zhong, 2018).

3.2 Vector Control

River basin could became a place for mosquito breeding like Anopheles sp. The state of the river which has calm, clear water, and less predators are optimum places for mosquito breeding. The area has potentially become a place of malaria transmission. Malaria cases in Indonesia can be found everywhere from Sumatra Island to Papua.

From the graphic below we can see that annual malaria incidence has downtrend from 1,8 in 2008 to 0,99 in 2017. Moreover, there are three Provinces that documented as a free malaria incidence in 2017 there are DKI Jakarta, East Java, and Bali Province (Kemenkes RI, 2018).

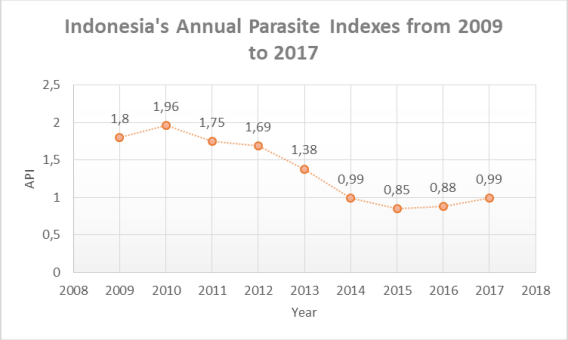

Figure 1. Malaria Incidence per Year from 2008 to 2017. (Source: Kemenkes RI, 2018).

Using river environment manipulation and modification, we can reduce the risk of malaria transmission, for example by adding natural predators to larvae and mosquitoes such as cork fish. Spreading of *Channa striata* has been proved to be effective in reducing larvae of anopheles mosquitoes, but this method needs continuous monitoring, because some vulnerable fish tend to be harvested by community when they grow up at productive stage which is effective to reduce larvae (Suprayogi, 2010).

3.3 Mental Health Prevention

The use of the river for recreational activities has become latest trend for many people nowadays. The existence of social media makes the function of the river as a playground quickly spread. Playing water on the river can be joyful and could be an activity to reduce stress not only for workers, but also children, and elders.

Releasing stress has a positive aspect to reduce the tension so that blood vessels can run smoothly. From the study of coronary diseases, stress could be related to heart failure, but it is need more investigation to make a conclusion (Cirelli, Lacerda, Lopes, de Lima Lopes, & de Barros, 2018).

However, on the other hand (Esler, 2017) state that accumulate negative emotion like upset, depression, and agitated can drive other disease such as cardiac arrhythmias, myocardial infarction, and sudden death.

One of the efforts to boost up river tourism in Indonesia is Community-Based Tourism (CBT). Study by Tisnawati (2017) in Gajah Wong River, Jogjakarta emphasize some fundamentals, namely:

1. Prioritizing environmental sustainability,
2. Fostering love for local culture,
3. Build good communication in the community,
4. Encourage the establishment of business entities by the community to manage tourism,
5. Invite people in communities to take a part
6. Divide profits fairly,
7. Set aside results for community development,
8. Build public trust,
9. Help people understanding and accept foreign culture,
10. Appreciate differences.

Subsequently, success of river tourism may could escalate people's mental health. Afterward, it is possible to improve and this affect the rise of public health and wellbeing.

3.4 Safe Water and Sanitation

Water security is the reservoir's ability to provide water both in quality and quantity related to health, life and ecosystems in a sustainable manner from an environmental and economic perspective (Grey & Sadoff, 2007). Clean water has an important role in human health because water has the potential to spread diseases, both infectious and non-communicable diseases. Clean water that contaminated by heavy metals and pesticides for example can cause cancer and other health problems. Processing clean water to safe water need so many resource, especially if raw river water as a convenience. With poor water quality, there will high cost to process such as nanotechnology to eliminate free radicals in water (Yousefzadeh et al., 2018).

Safe water basin which consumed by community could prevent the spreading of infectious diseases. However, it could be hard to do in urban area, because the waste water intensities and qualities that is discharged into the environment exceeds the river threshold to degrade, and by reducing the waste discharged into the river we can reduce the burden. Hereupon, sanitation has an important role in preventing waste and waste disposal into rivers.

The main point of community-based total sanitation is the creation of a conducive environment and community admission, in an instance by

preserving the river. However, it is necessary to conduct triggering activities, so that people want to change their behaviour from littering into the trash that has been provided (Kemenkes RI, 2018). Nevertheless, clean river can make people feel reluctant to throw litter, which is beneficial to reduce the potential pollution and spreading of disease.

3.5 Freshwater Fish Diet

The last potential of the river is to freshwater cultivation. In some regions in Indonesia, rivers are used as the main source of food that can collect by hunting or freshwater fish farming. Freshwater fish farming can be an alternative for those who are allergic to saltwater fish, and it is also adequate to be daily protein intake for the community. Moreover, the presence of large-scale marine fishing can reduce the number of fish in the sea significantly.

Patin (Pangasius sp.) and Catfish (Clarias sp.) are freshwater fish commodity that common found in Indonesia. Patin has protein about 89 kkal and Catfish has 88 kkal, and also the two kind of fish is cheaper than others.

One remarkable thing that is mandatory in making fish ponds is that they have to make sure there is no pollution in the water, so fish can live well and not contaminated with hazardous substances such as heavy metals and pesticides which is harmful to human. Because heavy metals and pesticides are remarkable as carcinogenic substances (Abhishek et al., 2017; Polanco Rodríguez et al., 2017).

4 CONCLUSSION

Infectious and vector-borne diseases are two important things that must be considered in the use of rivers, both in normal conditions or in a state of disaster. This is useful to prevent transmission of diseases to a wider area so they would not cause extraordinary events like an outbreak. Maintaining the environment in order to stay healthy is an inseparable part of river utilization activities, because with a clean and healthy river, the foundations to escalate the public health has been created.

REFERENCES

Abhishek, A., Singh, V., Sinha, R. J., Ansari, N. G., Siddiqe, M. K. J., Verma, M., & Kumar, M. (2017). To study the relationship between cadmium, zinc and mtDNA copy number in North Indian patients suffering from prostate cancer: A case control study. *African Journal of Urology*, *23*(2), 126–132. https://doi.org/10.1016/j.afju.2016.05.011

Cirelli, M. A., Lacerda, M. S., Lopes, C. T., de Lima Lopes, J., & de Barros, A. L. B. L. (2018). Correlations between stress, anxiety and depression and sociodemographic and clinical characteristics among outpatients with heart failure. *Archives of Psychiatric Nursing*, *32*(2), 235–241. https://doi.org/10.1016/j.apnu.2017.11.008

Esler, M. (2017). Mental stress and human cardiovascular disease. *Neuroscience & Biobehavioral Reviews*, *74*, 269–276. https://doi.org/10.1016/j.neubiorev.2016.10.011

Grey, D., & Sadoff, C. W. (2007). Sink or Swim? Water security for growth and development. *Water Policy*, *9*(6), 545–571. https://doi.org/10.2166/wp.2007.021

Guo, X., Wang, S., Zhao, C., Li, J., & Zhong, J. (2018). An integrated cell absorption process and quantitative PCR assay for the detection of the infectious virus in water. *Science of the Total Environment*, *635*, 964–971. https://doi.org/10.1016/j.scitotenv.2018.04.223

Health, I. of M. (US) C. on U. P. M. to I. C., Durch, J. S., Bailey, L. A., & Stoto, M. A. (1997). *Understanding Health and Its Determinants*. National Academies Press (US). Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK233009/

Kemenkes RI. (2018). *Profil Kesehatan Indonesia 2017*. Jakarta.

Liu, Z., Zhang, F., Zhang, Y., Li, J., Liu, X., Ding, G., … Jiang, B. (2018). Association between floods and infectious diarrhea and their effect modifiers in Hunan province, China: A two-stage model. *Science of the Total Environment*, *626*, 630–637. https://doi.org/10.1016/j.scitotenv.2018.01.130

Polanco Rodríguez, Á. G., Riba López, M. I., DelValls Casillas, T. Á., Araujo León, J. A., Mahjoub, O., & Prusty, A. K. (2017). Monitoring of organochlorine pesticides in blood of women with uterine cervix cancer. *Environmental Pollution*, *220*, 853–862. https://doi.org/10.1016/j.envpol.2016.10.068

Suprayogi, D. (2010). *Upaya Peningkatan Program Pengendalian Vektor Malaria di Kabupaten Trenggalek, Jawa Timur*. (Master Thesis). Universitas Airlangga.

Tisnawati, E. (2017). PENGEMBANGAN KONSEP PARIWISATA SUNGAI BERBASIS MASYARAKAT, *11*, 13.

Indonesian Law, Pub. L. No. 36 (2009). Retrieved from http://www.hukor.depkes.go.id/up_prod_uu/UU%20No.%2036%20Th%202009%20ttg%20Kesehatan.pdf

Van den Brandeler, F., Gupta, J., & Hordijk, M. (2018). Megacities and rivers: Scalar mismatches between urban water management and river basin management. *Journal of Hydrology*. https://doi.org/10.1016/j.jhydrol.2018.01.001

Yousefzadeh, S., Matin, A. R., Ahmadi, E., Sabeti, Z., Alimohammadi, M., Aslani, H., & Nabizadeh, R. (2018). Response surface methodology as a tool for modeling and optimization of Bacillus subtilis spores inactivation by UV/ nano-Fe 0 process for safe water production. *Food and Chemical Toxicology*, *114*, 334–345. https://doi.org/10.1016/j.fct.2018.02.045