



Clean Water Supply as an Indicator for Healthy Island in Makassar City

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Abstract

BACKGROUND: Concepts and indicator for a healthy island have existed and are widely used in developed countries. In the context of developing countries, in which the environmental, social, economic, and culture were in contrast with developed countries, these healthy island concepts cannot be simply applied. Moreover, there were still no indicators for a healthy island in Indonesia. Indonesia still conforms to the Healthy Regency/City indicator.

AIM: This research aims to identify the provision of clean water as an indicator for a healthy island.

METHODS: This research was descriptive research using the qualitative method. Data collection was done by *in-depth interviews, participation observation*, and secondary data from sub-health centers and data from urban villages in the islands. The number of informants was five persons.

RESULTS: This study found that the provision of clean water is an indicator of a healthy island by looking at three aspects of clean water sources, water reservoirs, and drinking water treatment. The source of clean water in the archipelago is drilled well water. Tub, drums, and bucket are used as the water container. Treatment of drinking water by cooking using water from the Regional Drinking Water Company (PDAM) purchased from the city as well as drinking water from processed saltwater into freshwater using special tools stored in gallons and then selling it to people in the archipelago.

CONCLUSION: There needs to be a policy that governs the necessity of a steady supply of clean water in the archipelagic area, even though in several areas there are many methods to meet the demand for clean water in archipelagic areas.

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Introduction

Healthy Island is a concept launched in 1995 Minister Level Meeting on the Island of Yanuca and Fiji [1]. The concept of a healthy island is a solution for health problems faced by nations in the Pacific Isle [2]. Problems in environmental level in archipelagic areas need special attention because the condition is far from ideal, for example, basic sanitation and supply of clean water for cooking, washing, and bathing. This is due to the people in small islands having difficulty accessing clean water due to limited supply. Moreover, surface water sources are also contaminated by household waster [3]. Soon or later, this condition can cause health problems for the local society and increase the vulnerability to contagious plague at the local level [4].

Water, Sanitation, and Hygiene (WASH) is the biggest contributor to death in archipelagic areas [5]. According to disability-adjusted life years, bad conditions of water and sanitation contribute to

2.1% of disabilities in 1990 and 0.9% on 2010 [6]. A systematic review has shown that intervention in the form of providing a clean water supply can reduce 25–27% of disease [7], [8], water quality interventions can also reduce the burden of disease by 17% to 42% [7], [8], [9], [10], while sanitation can achieve a 22–37% risk reduction [7], [8], [9], [10].

South Sulawesi is one of the provinces in Sulawesi Island with an area of 46.717,48 km² in 2019 and has 314 islands spread around. The regency/city had expanded from 14 to 24 regencies/cities [11] while Makassar is the capital city of South Sulawesi Province. The development of the healthy island in Indonesia was due to the government administration system. For example, Sulawesi Island consists of several provinces and districts/cities. Therefore, the development of a healthy island follows the district/city where the island is located. Based on the Joint Regulation between the Ministry of Health and the Ministry of Home Affairs No. 34 the year 2005, it is not known that the term healthy island is explicitly stated, there is a healthy district/city [12].

For those reasons, the indicator for a healthy island in Indonesia is not yet applied because it still adhere to local rules in which the indicator for Healthy City is managed by Internal affair and Health Ministerial Decree No.34, the year 2005 and No.1138/Menkes/PB/IX/2005. This decree stated that there should be existing support from local government, inter-sectorial support programs, the utilization of Regency/City/Districts teams, utilization of city forums, utilization of districts/village communication forums, an agreement between society, local government about grading and application of event and its structure thereof, and also society based event empowered or through the forum [13]. Moreover, for the successful global implementation of a healthy city, the WHO admits that collaboration between sectors, organizations, and backgrounds is a must [14], [15], [16], [17], [18], [19]. The previous research [20] showed that the involvement of stakeholders could empower and be effective. Hopefully, it could also work for the formation and implementation of a healthy island indicator.

This research aims to identify the supply of clean water as an indicator for a healthy island in Makassar.

Methods

This research is qualitative research conducted on small islands in Makassar City. Informants in this study consisted of archipelagic communities and practitioners. Archipelago community informants in this study consisted of community leaders and people who have lived in the islands for a long time. Meanwhile, the practitioner informants in this study consisted of village heads and health workers in the islands. The data collection technique was carried out by in-depth interviews, participatory observation, and secondary data. Secondary data in this study were taken from data from sub-health centers and data from urban villages in the islands. Documentation in research in the form of notes from interviews and photos during the study.

To maintain the validity of the information to be obtained, this research uses a triangulation process, namely, triangulation of sources, namely comparing circumstances and perspectives with various opinions and views of other people, in this case, the village head, and assistant health center officers in the islands. Researchers conducted in-depth interviews about problems, rules, and programs that are carried out to overcome existing problems and explore what can be supported in overcoming existing problems; triangulation of methods, namely, efforts to confirm between the results and processes of different data collection techniques on the findings of research results obtained from auxiliary health centers in the

archipelago; triangulation of theory or data, namely, comparing research results with other theories or data [21], in this case, the researcher analyzes the data that have been obtained with the existing theory.

Results

Characteristics of informants

The informants in this study were mostly islanders and most of the others came from practitioners determination of informants in qualitative research using a purposive sampling technique. Purposive sampling in qualitative research is a sampling technique of data sources with certain considerations, for example, the person is considered to know best about what the researcher expects. Determination of informants is based on criteria and considerations, while the criteria for informants are: People who know about the problems that exist in the archipelago (public figure), people who have lived for more than 10 years in the archipelago where the research is located.

Data were collected using in-depth interviews, participatory observation, and secondary data. In-depth interviews in this study, namely conducting interviews 2–3 times for each informant to understand the views of the research subjects, regarding their lives, experiences, or social situations that occur as expressed in their language. Secondary data in this study were taken from data from sub-health centers and data from urban villages in the islands.

Informants in the study consisted of:

1. Rr (34 years), Local Resident
2. As (45 years), Local Resident
3. Hb (52 years), Local Resident
4. Zn (30 years), Practitioner
5. Ms (50 years), Practitioner.

Clean water sources, water containers, and drinking water treatment used by archipelagic communities

Based on the results of interviews and observations that have been made, researchers can describe the three aspects studied in finding clean water supply as an indicator of a healthy island. The three aspects studied include clean water sources, water reservoirs, and drinking water treatment used by the island community.

Rr, as an archipelagic community, said that the sources of clean water, water reservoirs, and drinking water treatment are used by the archipelagic community. Rr said that the source of clean water used for daily

needs for bathing and washing uses well water and drinking water uses water from the Regional Drinking Water Company (PDAM) purchased from Makassar City, but there is also drinking water processed by the islanders stored in gallons. The following is the narrative of the interview.

“Water for bathing and washing uses well water and for drinking tap water from Makassar and the gallon water is treated here.”

Based on the results of the interview above, the author sees that Rr uses clean water sources that are used for daily needs for bathing and washing using well water and drinking water using boiled water from the Regional Drinking Water Company (PDAM) purchased from Makassar City. However, there is also drinking water that is processed by the island community which is stored in gallons. Apart from Rr, another informant who is a practitioner has the same opinion. Zn is a practitioner; he also told that the source of water used for daily needs was the same as Rr. Below is the full narrative.

“The source of clean water for bathing and washing is from drilled wells that are owned by several people privately, the water reservoir has a bath, there is a drum, there is a bucket. For water that is drunk and used for cooking, there is drinking water managed by community groups and there is PDAM water that is purchased from the city and then sold again by the community and here there is also drinking water called baji gau salt water which is converted into freshwater then sold using gallons in the community specifically to drink and there are tools that are managed by community groups.”

The author sees that the source of clean water for daily needs such as bathing and washing uses bore wells; water reservoirs using tubs, drums, and buckets; while for drinking water treatment using water from the Regional Drinking Water Company (PDAM) purchased from Makassar City which is then cooked before consumption. Besides that, there is also gallon water from processing saltwater into freshwater which is managed by the community.

Clean water sources, water storage, and drinking water treatment as indicators of a healthy island

Clean water is a type of water-based resource that is of good quality and is commonly used by humans for consumption or in carrying out their daily activities, including sanitation. Based on the Decree of the Minister of Health of the Republic of Indonesia Nomor 1405/Menkes/SK/IX/2002 Regarding Health Requirements for Office and Industrial Work Environments, there is an understanding regarding clean water, namely, water used for daily needs and its quality meets the health

requirements of clean water by applicable laws and regulations and can be drunk when cooked. Based on the source, water can be classified into four groups, namely: Space water/atmospheric water, surface water, and groundwater. Based on the results of interviews with informants, researchers saw that the source of clean water in the islands is very difficult because the water used is well water that has a smell and taste. This well water is used for bathing and washing purposes.

A water reservoir is a container or place to hold water. The water reservoir should be closed, however, things are different. Based on the results of interviews and observations, researchers found water reservoirs in the islands consisting of tubs, drums, and buckets. However, the shelter is open to allow the mosquito habitat to breed.

Drinking water treatment is the process of separating water from impurities physically, chemically, and biologically. The main purpose of this treatment is to obtain clean and healthy water that meets quality standards so that it can be used as drinking water. Based on the results of interviews, drinking water treatment in the islands uses water from the Regional Drinking Water Company (PDAM) and gallon water. PDAM water comes from Makassar City and is resold on the island. The water from the Regional Drinking Water Company (PDAM) that has been purchased is then cooked before being consumed. Meanwhile, the gallon water on the island is saltwater that is processed into freshwater using a special filter that is stored in gallons and sold. Gallon water is an effort of the island community group which is named baji gau drinking water.

Discussion

This study found that the provision of clean water is one of the indicators in implementing a healthy island by looking at clean water sources, water reservoirs, and drinking water treatment. The availability of clean water in the archipelago requires various special efforts so that efforts to provide clean water in the islands can run effectively. The government needs to pay attention to clean water sources, water reservoirs, and drinking water treatment. Clean water received by the archipelagic community must be by existing clean water standards, this is regulated in the Regulation of the Minister of Health of the Republic of Indonesia Nomor 32 the year 2017 Regarding Environmental Health Quality Standards and Water Health Requirements for Sanitary Hygiene, Swimming Pools, Solus Per Aqua, and Public Baths. This study only discusses three aspects related to the availability of clean water, namely, clean water sources, water reservoirs, and drinking water treatment.

In this study, it was found that the source of clean water comes from drilled wells. Drilling well is one method to get clean groundwater which is processed through the excavation of soil at a certain depth. Drilled well water is used for the daily needs of the island people for bathing and washing needs. However, the borehole water used tastes and smells, so it does not meet the clean water quality standards. Water used for daily purposes or water for sanitation hygiene purposes is the water of a certain quality used for daily purposes whose quality is different from the quality of drinking water [22]. Based on Environmental Health Quality Standards for Water media for Sanitary Hygiene Purposes include physical, biological, and chemical parameters which can be in the form of mandatory parameters and additional parameters. The parameter is a measure of a relative state. The parameters in this study are water quality parameters. Water quality parameters are determined to provide an assessment of water standards that are clean and free from harmful chemicals, have a suitable pH and temperature, have low ammonia and nitrite content, and are not polluted. Mandatory parameters in this study are parameters that must be checked periodically by the provisions of laws and regulations, while the additional parameters are only required to be checked if the geohydrological conditions indicate potential pollution associated with the additional parameters [23].

Based on the results of research conducted [3] found that water conditions in the islands around Makassar City using the calculation of the water quality index, found that the condition of 11 well water is moderately polluted, 3 well water is lightly polluted, and 4 well water is categorized as good. Other research conducted [24] found that the main sources of clean water on Barrang Caddi Island are tap water and protected dug well water. In terms of quantity, the need for clean water has met the requirements, but in terms of quality it has not been met.

Another finding in this study is water reservoirs in the archipelago. Water reservoirs in the archipelago use tubs, drums, and buckets where the reservoirs are not closed or left open. Open water reservoirs can cause various dirt or insects to enter and breed which can cause various diseases including dengue fever.

Research conducted [25] found that houses with open water containers had a 2.7 times greater risk of dengue hemorrhagic fever (DHF) transmission, house larvae found in water reservoirs inside and outside the house (CI >20%) have a 5.6 times greater risk of getting DHF, and houses around which water reservoirs are found have a 5.1 times greater risk of suffering from DHF. Other research conducted [26] in the Type E Office Housing, Motu Village, Baras District, North Mamuju Regency in 2015 with a $p = 0.000$, This means that the condition of the lid on the water reservoir

greatly affects the presence of larvae. This is because the *Aedes aegypti* mosquito breeds in water reservoirs (TPA) containing clean water, permanent, and protected from direct sunlight [26]. Therefore, it is necessary to provide a cover for the TPA (water reservoir) to reduce the number of mosquitoes that perch and breed in the TPA (water reservoir) [27].

Another finding in this study is the treatment of drinking water in the islands. For drinking purposes, the local residents use water from PDAM, which is cooked before consumption. A study by Wijayanti *et al.* [28] stated the PDAM water was treated by reverse osmosis before being sold to the population in bottles for drinking purposes with several water quality parameters not exceed water quality standard by the Ministry of Health Nomor 492/MENKES/PER/IV/2010.

In addition to using water from the Regional Drinking Water Company (PDAM) purchased from the city of Makassar. Another source of drinking water consumed by people on the island in this study is drinking water that comes from the processing of saltwater into freshwater using certain tools then put into gallons and sold to the public. This drinking water is named *baji gau* drinking water and is a community group effort.

Various efforts have been made by the Indonesian government in overcoming the problem of clean water on the island, including water supply technology, macro rain, and several other efforts. However, the efforts made are constrained by asset management. Therefore, there is a need for better government intervention, especially about asset management to address the clean water problem on the island.

Results of the 2020 household drinking water quality study (SKAM-RT) found that 7 out of 10 households in Indonesia consume drinking water from facilities contaminated with *Escherichia coli*. The results of the study also stated that access to safe drinking water was 93% of which 97.6% were in urban areas and 87.1% in rural areas. Only 11.9% access to safe drinking water with 15.3% in urban areas and 8.3% in rural areas. This is a challenge that needs to be faced because the SDGs 2030 target is 100% decent access and safe drinking water.

Regulation of the Minister of Health of the Republic of Indonesia No. 492/Menkes/Per/IV/2010, regarding Terms of Drinking Water Suitable for Consumption. As for the quality of drinking water that is safe for consumption, it must meet two standard parameters, namely, mandatory and additional. For the mandatory parameters themselves, it consists of Microbiology, which means, does not contain *Escherichia coli*, and Coliform Bacteria. Then, Free of toxic chemicals, PH 6.5–8.5. The water you drink is odorless, tasteless, maximum TDS 500 mg/l, a maximum color level of 15 TCU, and a maximum

temperature of $\pm 3^{\circ}\text{C}$. Meanwhile, for additional parameters, two things must be considered, first, chemical, meaning that the water must be made sure that there are no organic or inorganic chemicals, contaminated with disinfectants and pesticides. And second, the maximum radioactive which contains Gross Alpha and Beta Activity 0.1 Bq/l.

Conclusion and Recommendations

The provision of clean water in the islands has not been provided optimally. The two sources of water in the island for bathing and washing, the local inhabitants use bore well water. While, for drinking water purpose, PDAM water and Baji Gau water were used by residents. Meanwhile, for drinking purposes, the island community must buy water from the Regional Drinking Water Company (PDAM) and processed water made by the island community group. Various efforts have been made by the Indonesian government in overcoming the problem of clean water on the island, including water supply technology, macro rain, and several other efforts. However, the efforts made are constrained by asset management. Therefore, there is a need for better government intervention, especially about asset management to address the clean water problem on the island.

A special policy is needed regarding the availability of clean water in the archipelago so that the archipelagic community can use water without having to buy it from the City.

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