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Household Perception on the Water Quality, Sanitation and Hygiene in Brgy. Baan Riverside, Butuan City

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A B S T R A C T

Water, snitation, and hygiene (WASH) are crucial to human health and well-being. Access to water quality, sanitation, and hygiene are significant indicators of community health. The numerous health and environmental impacts associated with the water system accessibility, sanitation, and quality are brought forth by potential hazards and pollution hotspots. Butuan City, a highly urbanized city and a developing smart city, continues to face challenges on water quality and sanitation and hygiene practices particularly in Brgy. Baan Riverside. In order to determine the WASH status of the area, perceptions of the households were collected to further understand the factors that contribute to the poor water quality in the area based on existing data. A survey was conducted among 30 households using a standardized questionnaire. Data were then descriptively analyzed using frequency tables and figures. The findings of the study showed that households have access to safe drinking water, and they are satisfied with the water supplied by the BCWD for household utilization. Results show that the respondents are knowledgeable and aware of the implications of good quality water and practicing good hygiene and sanitation practices in their households. The respondents are also satisfied with the information provided by the barangay regarding hygiene and sanitation. Moreover, the respondents have expressed environmental awareness to the nearby surface of water, the Agusan River. Thus, the concern for low sanitation and hygiene in Barangay Baan-Riverside is little to non-existent, however, the researchers recommend conducting studies that further investigate and assess the water quality in the area.

Keywords: community health, hygiene, household perception, sanitation, water quality

1. INTRODUCTION

One of the most important factors to sustain human life and ecosystems is access to an adequate supply of clean and safe water as stated in Goal Six (6) of the seventeen global Sustainable Development Goals (SDGs). Domestic water supplies are one of the fundamental requirements for human life. Without water, life cannot be sustained beyond a few days, and the lack of access to adequate water supplies leads to the spread of disease. Children bear the greatest health burden associated with poor water and sanitation. Diarrhoeal diseases attributed to poor water supply, sanitation, and hygiene account for 1.73 million deaths each year and contribute over 54 million Disability Adjusted Life Years, a total equivalent to 3.7% of the global burden of disease (WHO, 2002). Several diseases are related to poor water, sanitation, and hygiene such as trachoma, schistosomiasis, ascariasis, trichuriasis, hookworm disease, malaria and Japanese encephalitis, contributing to an additional burden in the community's health.

Lack of access to safe and adequate water supplies contributes to the ongoing issue of poverty - both through the economic costs of poor health and in the high proportion of household expenditure on water supplies in many poor communities, arising from the need to purchase water and/or time and energy expended in collection. The importance of adequate water quantity for human health has been recognized for many years, and there has been an extensive debate about the relative importance of water quantity, water quality, sanitation and hygiene in protecting and improving health (Howard et al., 2003). Hence, irregular and uncertain access to safe water affects not only these activities directly but also households' health and workforce productivity indirectly (Asim & Lohano, 2015). Water supply in rural and urban areas is an issue of prime concern, especially in developing countries (Lopez et al., 2018).

In particular, Butuan City, located at the Northeastern part of Agusan Valley sprawling across the Agusan River, is known for its colorful history and culture. It has been categorized as a highly urbanized city since 1985 and as the regional center of the Caraga region since 1998. The City of Butuan in Agusan del Norte province occupies an important niche as a regional commercial and institutional center in the northeast quadrant of Mindanao island and heart of commercial and industrial activities in Caraga Region (Gomez Jr., 2019). By 2020, it is visioned that Butuan City will be a model for a sustainable forest-based economy in the country with the highest per capita and growth rate in Mindanao. Butuan City is now aiming to be a Smart City and Forest-based Economic City in the country like other highly urbanized cities in Asia (Lopez et al., 2018).

By most visible manifestations, Butuan City, being a Highly-Urbanized City (HUC) and administrative and regional center of the Caraga Region (Region XIII) of Mindanao island, in the Philippines, is a thriving urban center. The city has 86 barangays with more than half of the total barangays of Butuan City classified as urban barangays (PSA, 2020). Out of 86 barangays, only 55 barangays are currently dependent and have access to Butuan City Water

District (BCWD) for their water supply, while some barangays are still utilizing groundwater via water wells. Taguibo Watershed in Barangay Anticala is the main source of water that has supported the city since 1974 (BCWD, 2015).

However, as the City continues to develop as a Smart City, the demand for sanitary and potable water in the City also increases as residential, industrial, agricultural and commercial establishments rapidly consume the City. The demand for human consumption of good water quality accelerates, leading to eventual insufficient water supply in the near future. During rainy seasons, the citizens experience intermittent water supply since the BCWD limits the supply due to the water turbidity from the Taguibo Watershed. The everyday lives of the people are greatly affected by this intermittent water supply (Serviano et al., 2017).

Due to the water crisis, there is a need to evaluate the perception of households with regards to the water, sanitation, and hygiene in the community, especially those living nearby the Agusan River since the area is frequently flooded and existing data shows poor water quality in the area. Moreover, studies that focus on identifying and understanding the households' perception on the water, sanitation, and hygiene of communities in the Philippines are lacking. In this study, the households' perception on water, sanitation, and hygiene will be conducted through a survey.

1.1 Conceptual Framework

The concepts cited in this section were used as guidelines of the researchers in the organization of the study. This study was anchored on Helmholtz' Theory on Perception and on existing literature.

Helmholz' vacillating terminology indicates an equivocation in his discussion of perception between perceiving (seeing, hearing, smelling, etc.) something and perceiving that such and such is the case, or, between perceiving something and judging that such and such is the case. This becomes evident in his account of perception as the resultant of mental operations on sensations. In his view, we never directly perceive so-called "external objects". What we perceive directly are "invariably simply the nervous stimulations".

Perceptions are then considered as resultants of a synthesis of, and inferences from, sensations. Helmholz, however, was convinced that all perception is essentially a matter of inference. He characterized perceptions as conclusions of unconscious inferences. He thought that perceptions or perceptual judgments are conclusions of unconscious inferences the premises of which are unconscious and indescribable sensations and generalizations about correlation between past sensations and objects perceived (Hacker, 1995). Perception is psychological processes through the experience gained by the five senses, individuals can process responses into positive or negative perceptions. Obtaining responses is obtained through the stages of selection, interpretation, and reaction (Erin, & Maharani, 2018). Hence, it can be concluded that perception arises based on experience and feeling of each individual. Perception is a response owned by each individual through the process of sensing. According to Irwanto in Shandi's thesis (2020), perception is divided into two, positive and negative perceptions. a) Positive perception is a perception that describes all knowledge and responses that continue with the effort to use it. This will be continued by activating or accepting and supporting the perceived object. b) Negative perception is a perception that describes all knowledge and responses that are not in harmony with the object in perception. It will proceed with passivity or reject and oppose the perceived object. Thus, it can be said that perception is both positive and the negative will always affect someone in doing something. Positive perception or negative perception all depends on how individuals describe all their knowledge about an object that is perceived. Perception is determined by personal perception and situational factors (Rahmat in Arifin, Fuady & Kuswarno, 2017). The explanation as follows: a) Functional Factors: functional factors come from needs, experience, and other things that are included in personal factors. b) Structural Factors: Structural factors originate from the nature of physical stimuli and the neurological effects they cause on the individual nervous system. Restiyanti Prasetijo (in Arifin, Fuady & Kuswarno, 2017), states that the factors that influence perception can be grouped into two main factors: 1) Internal factors, including experience, needs, rating and expectations 2) External factors, including external appearance, the nature of the stimulus, and environmental situation. According to Toha (in Arifin, Fuady & Kuswarno, 2017), there are some factors that influence someone's perception as follows: a) Internal Factors: feelings, attitudes, desires or hopes, attention (focus), learning process, physical state, psychiatric disorders, values and needs are also interests and motivation. b) External Factors: family background, information obtained, knowledge, intensity, size, resistance, repetition and motion, new and familiar things, or alienation of an object.

1.2 Statement of the Problem

This study is aimed at determining and understanding the perceptions of the households in Brgy. Baan Riverside, Butuan City on hygiene, sanitation, and the quality of water available in the area. The following questions are the possible problems of the households which could be answered by this study.

1.) What are the perceptions of the households on present community health indicators in terms of the:

1.1 Water quality;

1.2 Sanitation;

1.3 Hygiene?

2.) What is the level of knowledge and awareness of the households regarding sanitation and hygiene?

3.) Is the spread of diarrhea present in the area?

4.) Do the responses from the survey relate with existing data on the water quality of a nearby surface water, the Agusan River?

1.3 Significance of the Study

This study presents a baseline data on the perceptions of households on the water, sanitation, and hygiene quality in Brgy. Baan Riverside, Butuan City. This data can be useful as a basis in policy making for sustainable water, sanitation, and hygiene projects. Moreover, this study may aid in other studies that focus on further assessing the water, sanitation, and hygiene in the community.

2. METHODOLOGY

2.1 Project/Research Environment

Butuan City, a growing metropolitan area located in the flood plains of the Lower Agusan River Basin. The central part of Butuan City has a geographical coordinate of 8° 56′ 57″ North, 125° 32′ 37″ East. Butuan has a total land area of about 820,000 square meters with a population being 306,000 (6,300 households). This study was conducted in Baan Riverside, a barangay in Butuan City, with an estimated population of 5000 as determined by the 2020 census. The Agusan River is located in the eastern part of Mindanao. It is the third longest river in the Philippines with an estimated length of about 350 kilometers from its origin headwaters in Compostela Valley; traversing the central part of Butuan City and draining into Butuan Bay. In the eastern side of Agusan River, the floodplains irregularly undulate and incline in two directions. One direction points gently to the south-southwest direction (Mahay River and Aupagan Creek) and the other direction inclines gently to the north-northwest where Taguibo and Baan rivers flow (Sarmiento et al., 2017)

2.2 Project/Research Design

The study utilized the descriptive method supported by qualitative techniques. It is descriptive because it described the perceptions of the households on water quality, sanitation, and hygiene in Brgy. Baan Riverside, Butuan City.

2.3 Instrumentation

The researchers used a standardized survey instrument adopted from UNICEF and WHO (2018) to gather the data needed in the study. The instrument was composed of three parts: the first part is on water sources and sanitation facilities, second part is on knowledge/attitudes/awareness on sanitation and hygiene, and the third part is on awareness on water quality in nearby body of water. The rating scale presented in the questionnaire with the mean value and the verbal descriptions included are the following:

Part I

Rating	Verbal Description	Interpretation
3	High	Excellent
2	Neutral	Acceptable
1	Low	Poor

Part II

Rating	Verbal Description	Interpretation
5	Extremely	Very happy
4	Mostly	Happy
3	Moderate	Neutral
2	Somewhat	Not so happy
1	Not at all	Not happy

Part III

Rating	Verbal Description	Interpretation
3	Excellent	High quality
2	Acceptable	Acceptable
1	Poor	Poor quality

3. RESULTS AND DISCUSSION

In accordance with the objectives of the study, the researchers were able to successfully gather and analyze the data needed to consolidate the conclusion by conducting a survey in Brgy. Baan Riverside, Butuan City. A total of 30 households participated in the survey regarding the water quality, sanitation, and hygiene in the area. Majority of the respondents were female (60%), with ages ranging from 20 to 66 years old. With regards to their addresses, all respondents reside near the riverside of the target location with the majority having access to water in one way or another. The survey answered by the respondents is divided into 3 categories: Water Sources and Sanitation Facilities, Knowledge/Attitudes/Awareness on Sanitation and Hygiene, and Awareness on Water Quality in the Nearby Body of Water. The survey considers the respondents' access and quality to clean water, sanitation, and hygiene; the community's health; and the environmental status of the nearby surface water, the Agusan River.

3.1 Water Sources and Sanitation Facilities

In this part of the survey, access to water sources for both drinking and other household uses are taken into consideration. How they access them, how they use them, and how they rate it would be considered as being close to the riverside may have effects on both the water quality they receive and their access to it. When considering the water sources of people living near surface waters, it is important to consider how they would have access to clean water. For water used for drinking to other household uses like washing dishes and bathing, the quality of water is important.

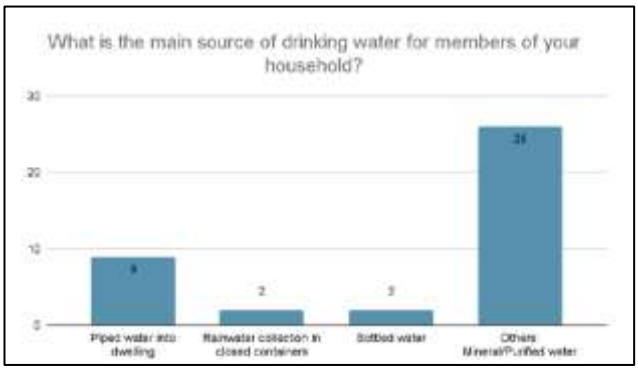

Figure 1. Bar Graph showing the number of responses in each main source of drink water for the respondents' members of their household.

Results from the data gathered (Fig. 1) show that the twenty-five (25) out of the thirty (30) respondents consider mineral water or purified water as their drinking water source. Meanwhile, other respondents utilize different water sources such as piped water into dwelling, rainwater collection in closed containers, and bottled water. Although some respondents (23.2%) use different water sources interchangeably, most respondents (76.67%) have different water sources for drinking and for household purposes respectively. The households acquire mineral water or purified water from local water refilling stations while certain households utilize bottled water bought from grocery stores for drinking because of the young children in the household who are prone to waterborne diseases, especially diarrhea. Some households resort to other water sources as alternatives when the main source of drinking water is unavailable. Nevertheless, the respondents' main drinking water sources are considered as improved drinking water sources (UNICEF and WHO, 2018).

Table 1. Total number of data of the Rate of the Quality of the Respondents' Drinking water.

	How would you rate the quality of your drinking water source? [A. Clarity]	How would you rate the quality of your drinking water source? [B. Color]	How would you rate the quality of your drinking water source? [C. Smell]	How would you rate the quality of your drinking water source? [D. Taste]
Excellent	19	21	20	20
Acceptable	11	9	10	10
Poor	0	0	0	0

The quality of the respondents' drinking water is considered based on the parameters: clarity, color, scent, and taste, as these are the primary determinants of the quality of water they are inclined to drink. Based on the respondents' answers (Table 3), nineteen (19) respondents rated the water source's clarity as excellent while eleven (11) respondents rated it as acceptable. On the other hand, the majority rating for color is excellent (70%) while the majority rating for smell is excellent with a response rate of 66.67%. The majority rate the taste of the water as excellent (66.67%). High ratings are observed for

the drinking water sources since households feel secure and safe drinking the water available in local water refilling stations and grocery stores. These presents to us the idea of how clean the water is on the respondents' personal ratings. Although personal ratings of the households do not determine the total cleanliness of the water, it still represents the satisfaction of households on their water sources.

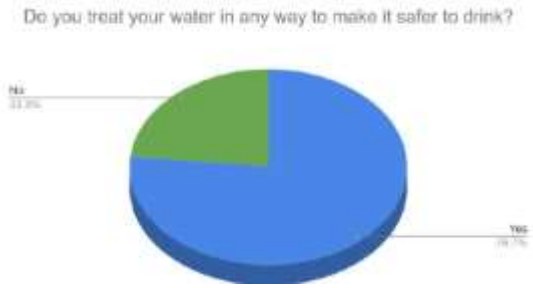

Figure 2. Pie Graph showing the percentage of the number of Respondents who treat their water in any way to make it safer to drink.

In relation to drinking water sources, other factors such as a proper drinking water storage and its qualities are considered. Survey responses determined that all respondents have a clean and functional drinking water storage container with a clean cup/dipper/ladle and a cover. To further ensure the safety of the water being consumed, most respondents (76.6%) treat their water (Fig. 2), and they expressed that disinfection is necessary as it ensures their safety and wellbeing. It is a form of security for them as water has the potential to carry all sorts of bacteria and diseases. This is further expounded in the following question, in which the respondents are asked to identify the methods of disinfection that they utilize.

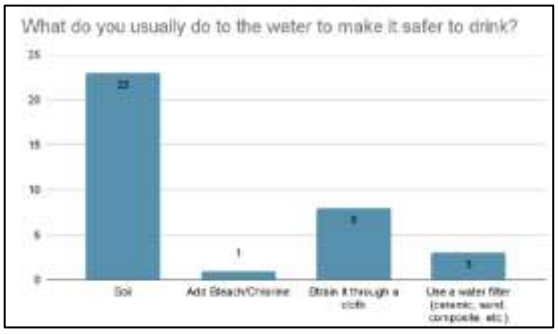

Figure 3. Bar graph showing the number of responses in each specific method in treating water.

As shown in Figure 3, the most common method of treating water at home is to boil it. Studies have found that most pathogenic organisms, particularly viruses and bacteria that cause waterborne infections, are killed by heating water to a high temperature of 100°C. The water must boil for at least 20 minutes in order to be most effective (Rosa et al., 2010). In addition, not much materials are needed for this process as fire or heat is the only requirement for it, so households with electricity can easily use this method to disinfect their water while households that don't have electricity can still easily conduct this process by creating a fire and other similar methods. This method isn't only effective but also efficient in making the water safer for the people using it. Other households treat water by straining it through a cloth, using a water filter, or adding bleach/chlorine. Moreover, some households utilize a combination of the aforementioned methods to make water safer to drink.

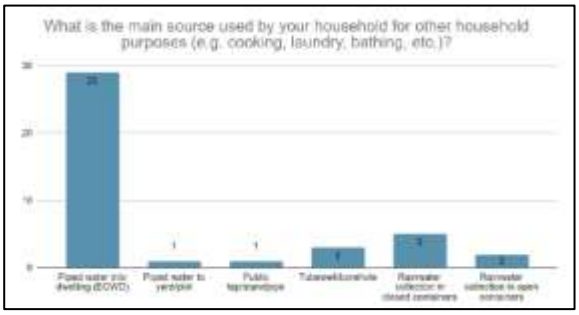

Figure 4. Bar graph showing the number of responses in each of the main sources used by the respondent's household purposes

Moving on to the water used in household chores, Figure 4 shows that most of the respondents use piped water into dwelling, or the water from the Butuan City Water District. The BCWD is responsible for both water resource management and sanitation in Butuan City. It also helps residents acquire, install, improve, manage, and operate water supply and distribution systems for domestic, industrial, municipal, and agricultural needs, making it the water source of the majority living in Butuan City. Sources such as rainwater collection, tube well/borehole, public tap/standpipe, and piped water to

yard/plot are likely used as alternative sources or for emergency cases. Moreover, all of the identified water sources of the respondents are considered as water sources for household utilization (UNICEF and WHO, 2018).

Table 2. Total number of data of the Rate of the Quality of the Respondents' main water source for household purposes.

	How would you rate the quality of your water source for household purposes? [A. Clarity]	How would you rate the quality of your water source for household purposes? [B. Color]	How would you rate the quality of your water source for household purposes? [C. Smell]
Excellent	8	8	18
Acceptable	22	21	10
Poor	0	1	2

As seen in the table above (Table 2), twenty-two (22) respondents out of thirty (30) considered the clarity of the water as acceptable while the other eight considered it as excellent. Majority of the respondents considered the color and the scent of the water as acceptable and excellent respectively. Other respondents reported that sediments, particularly gravel, were occasionally present in the water, making the water turbid. These were often observed during the occurrence of heavy rain and flooding, and the sediments may be caused by erosion from the upper riverbanks and the wastes of nearby industries. Also, the respondents noted that there is the occasional smell of rust in the water, which is likely due to the pipes of the BCWD. Regardless of those observations, the households remain satisfied with their water source for household uses.

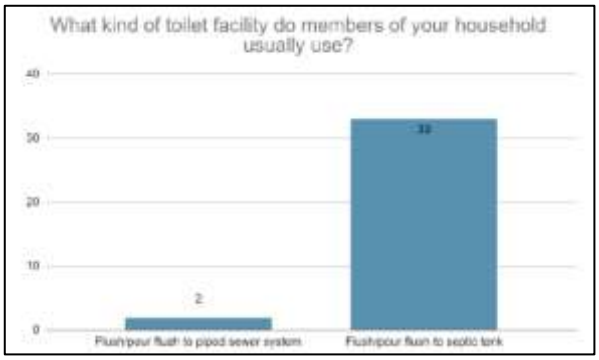

Figure 5. Bar graph showing the number of responses in each of the toilet facilities used by the members of the respondents' household.

With regards to the toilet facility being used, flush/pour flush to septic tank is mostly utilized by the respondents (Fig. 6). Flushing or pouring flush to septic tanks is considered as improved sanitation facilities (UNICEF and WHO, 2018), which goes the same for flushing or pouring flush to piped sewer system. Ensuring universal access to improved sanitation is complex and challenging. However, as residents near surface waters, it is their responsibility to be conscious of the disposal of their wastes, especially of human excreta, as untreated waste from poor sanitation services has negative effects on the environment and the community such as the spread of diseases, causing poor health and nutrition, loss of income, decreased productivity and missed educational opportunities for the affected households (Abeyasinghe, 2020).

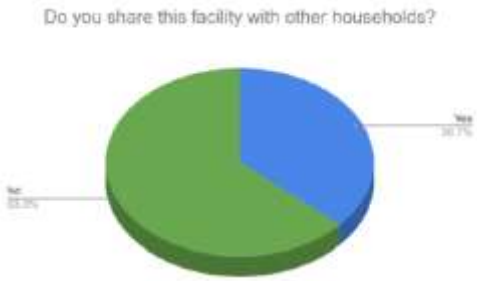

Figure 6. Pie Graph showing the percentage of the respondents who share toilet facilities with other households.

Majority of the households own private toilet facilities (Fig. 6) and are considered as safely managed as their human wastes are safely disposed of on-site - through a septic tank - or removed and treated off-site - through a piped sewer system. However, there are a few households whose toilet facilities are considered as limited since their toilets are shared with other households, but not open for public use (CDC, 2022).

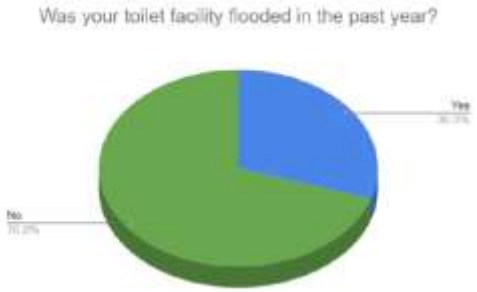

Figure 7. Pie Graph showing the percentage of the number of respondents' toilet facilities that got flooded in the past year.

When asked about flooded toilet facilities in the past year (Fig. 7), most respondents (70%) did not experience such an event, but 30% of them experienced it. This is likely due to their houses being of close proximity to the Agusan River, and the overflowing of the river can immediately reach their houses. Flooding from the river only heightens environmental and health risks as it can bring polluted waters in direct contact with people and contaminate the toilet facilities. For those with an operating toilet in a home with a sanitation system that allows seepage and contamination, flooding is a big issue (Saruta et al., 2017). Moreover, toilet facilities that are easily flooded and prone to flooding are likely to be of poor quality and made with substandard materials; hence, such facilities put the households at risk of contamination and improper sanitation (Borges Pedro et al., 2020).

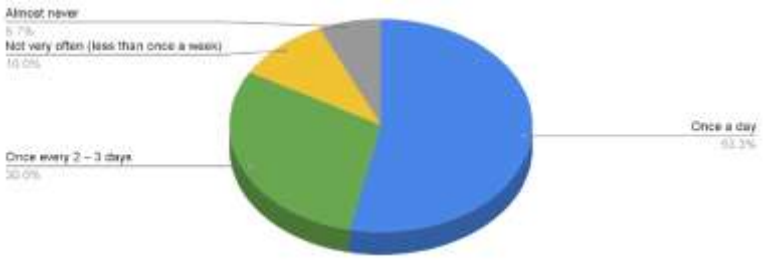

Figure 8. Pie Graph showing the percentage of how often the respondents' family members clean their toilet facilities.

In relation to observing cleanliness of their toilet facilities (Fig. 8), many respondents (53.3%) clean their toilets once a day. Other respondents claimed that they clean after every use of the toilet, especially in households with young children. Unfortunately, some households clean their toilet not very often or almost never. Despite those households being a minimal percentage, it is still a concern that some people do not clean their toilets frequently. It may be due to them not prioritizing such cleanliness or lacking the time to clean. However, the cleanliness of the toilet facilities is essential to prevent the waste from infected individuals to contaminate a community's land and water and increase the risk of infection for other individuals (CDC, 2022).

3.2 Knowledge/ Attitudes/ Awareness on Sanitation and Hygiene

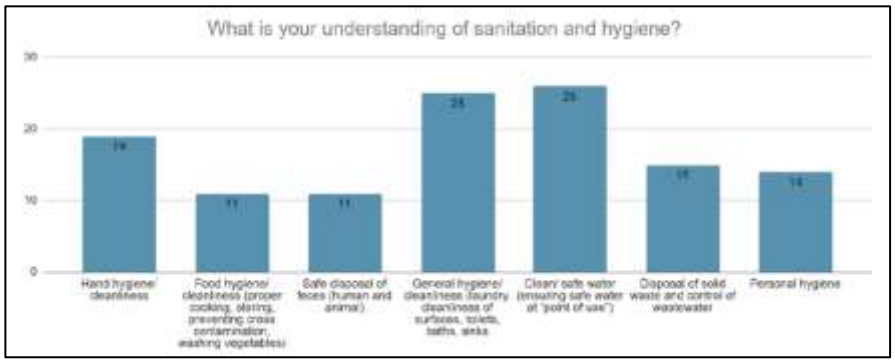

Figure 9. Bar graph showing the number of responses of the respondents' understanding of sanitation and hygiene.

Most respondents understand sanitation and hygiene as clean/safe water or ensuring safe water at "point of use", followed closely by general hygiene/cleanliness (laundry, cleanliness of surfaces, toilets, baths, and sinks). Figure 9 shows the respondents' understanding of sanitation and hygiene, suggesting that they have sufficient knowledge on the various aspects covered by sanitation and hygiene.

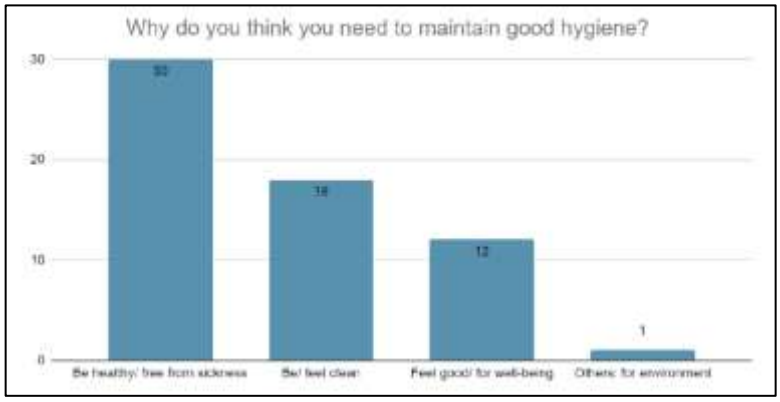

Figure 10. Bar graph showing the number of responses on why the respondents need to maintain good hygiene.

When asked why there is a need to maintain good hygiene (Fig. 10), many respondents believe it is a need to maintain good hygiene in order to be healthy or free from sickness. Others believe it is a need so that they can be/feel clean, feel good/ for well-being, or for the environment. This indicates that the respondents are well-aware of the importance of good hygiene. Good hygiene is critical for preventing the spread of infectious diseases and helping children lead long, healthy lives (CDC, 2018b). For families, good hygiene means avoiding illness and spending less on health care. However, important hygiene behaviors are difficult to practice without the right knowledge and skills, adequate community support, and the belief that one's own behavior can actually make a difference (UNICEF, 2020a).

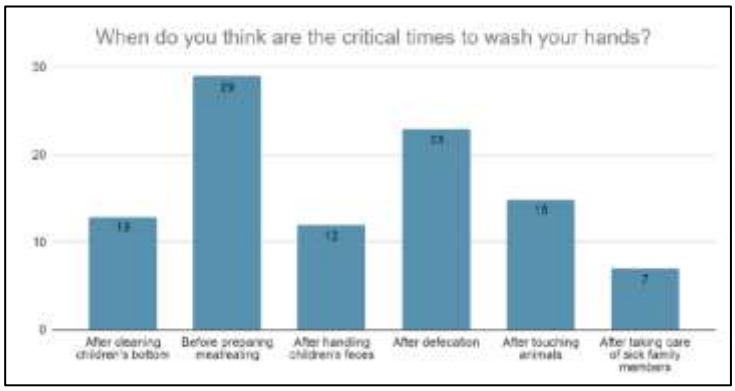

Figure 11. Bar graph showing the number of responses on when the respondents' think are the critical times to wash their hands.

In Figure 11, the majority of the respondents identified that the most critical time to wash hands is before preparing a meal or before eating. This is to ensure that the food that is being prepared for the people is safe and clean to consume. In addition, washing hands after defecation, after touching animals, after cleaning children's bottoms, after handling children's feces, and after taking care of sick family members are identified to be critical times to wash hands as all activities involve physical contact with a potential source of pathogens and contamination.

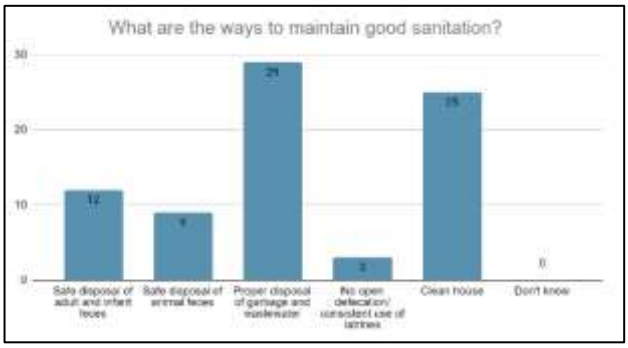

Figure 12. Bar graph showing the number of responses in each of the ways in maintaining good sanitation.

Based on Figure 12, proper disposal of garbage and wastewater and cleaning of the house are commonly done by the households to maintain good sanitation. Other households also safely dispose of human (adult and infant) and animal feces and avoid open defecation or utilization of inadequate toilet facilities.

Sanitation and hygiene are critical to health, survival, and development (CDC, 2018a). Poor sanitation puts children at risk of childhood diseases and malnutrition that can impact their overall development. Lack of sanitation can be a barrier to individual prosperity and sustainable development, posing a risk to health and livelihoods (UNICEF, 2020b). From the findings, most of the respondents have basic knowledge of hygiene and sanitation techniques and maintenance.

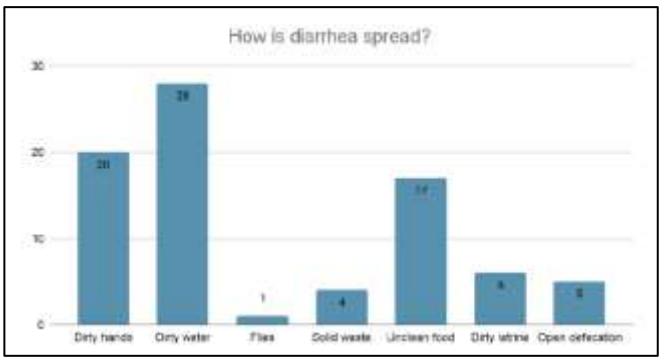

Figure 13. Bar graph showing the number of responses in each of the ways how diarrhea is spread.

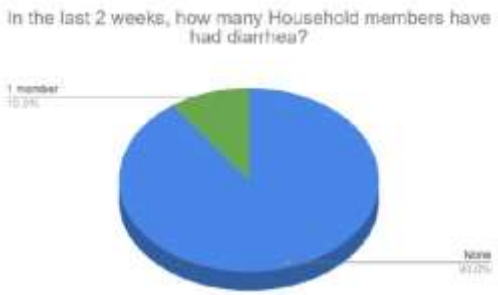

Figure 14. Pie Graph showing the percentage of the Household members who have had diarrhea.

In relation to sanitation and hygiene, respondents were also asked about their knowledge of diarrhea prevention. Most respondents believe that dirty water causes the spread of diarrhea, followed by dirty hands (Fig. 13). Others also believe that unclean food, dirty latrine, open defecation, and flies also spread diarrhea. In Brgy. Baan Riverside, there has only been one (1) reported case of diarrhea for the past two weeks (Fig. 14). Although the case represents only a small fraction of the entire surveyed population, it still poses a concern as most households have the same water sources being used.

Diarrhea is usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person-to-person as a result of poor hygiene. Interventions to prevent diarrhea, including safe drinking water, use of improved sanitation and hand washing with soap, can reduce disease risk (WHO, 2017). It can be inferred from the results that the households are aware of the consequences of poor water quality and bad hygiene and sanitation practices.

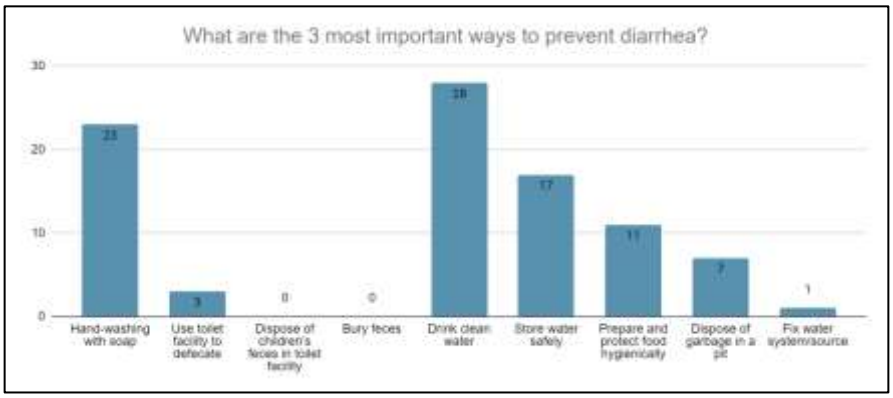

Figure 15. Bar graph showing the number of responses in each of the ways in preventing diarrhea.

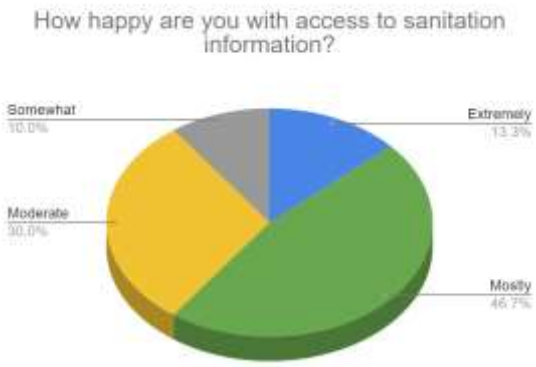

Figure 16. Pie Graph showing the percentage of how happy the respondents are with their access to sanitation information.

Figure 16 shows that the majority of the respondents feel mostly happy with their access to sanitation information (46.7%). This implies that the majority of the respondents are knowledgeable about sanitation information, and it is reflected also with their responses to the prior questions about hygiene and sanitation.

3.3 Awareness on Water Quality in the Nearby Body of Water

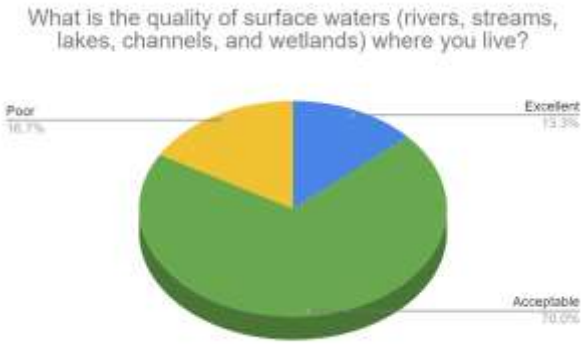

Figure 17. Pie Graph showing the percentage of the quality of surface waters (rivers, streams, lakes, channels, and wetlands) where the respondents live.

Figure 17 shows that the majority of respondents believe the water quality of the river is acceptable (70.0%). When asked about any suspected pollutants in the river, household wastes and industrial chemicals are the most suspected pollutants while the least suspected pollutants are direct sewage and fertilizers, or agricultural chemicals (Fig. 18). Overall, industrial chemicals and wastes were identified by the respondents as the top source of pollution in the river with a consensus of 56.7% (Fig. 19).

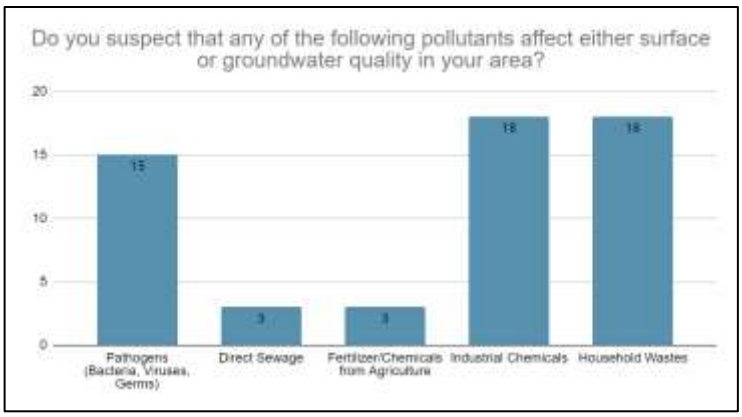

Figure 18. Bar graph showing the number of responses in each of the pollutants that is suspected to be affecting either the surface or groundwater quality of the respondents' area

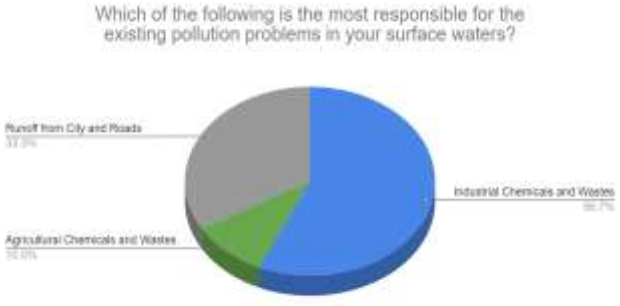

Figure 19. Pie Graph showing the percentage of the respondents' opinion on which is the most responsible for the existing pollution in their surface waters.

The land situated near the Agusan River is a target of several recent urban development projects. For instance, the Lower Agusan River Bank Protection was initiated during 2019 and finished in early 2020 with the goal to mitigate severe flooding in Butuan City with the construction of a river wall and the

reinforcement of existing flood wall, flood gates, and relief pumping stations (DPWH, 2019; Crismundo, 2020). Moreover, there is the on-going construction of the Butuan River Park & Marina Development, headed by the local government for the city's eco-tourism (Mercado, 2018). The wastes of the projects may be disposed of into the river, affecting the water quality. In relation to this, several industries, especially wood industries such as sawmills, are located near the Agusan River. A number of wood industries violated certain provisions of the Anti-Illegal Dumping Ordinance and Republic Act 9003, also known as the Ecological Solid Waste Management Act, further affecting the water quality of the river. In the 2018 State of the Brown Environment Report of the Department of Environment and Natural Resources Environmental Management Bureau (DENR-EMB) of Region XII, the annual water quality assessment report of Agusan River showed concerning results for total suspended solids (TSS) and fecal coliform in the river. For total suspended solids, 53.6% of the samples met the water quality criteria while none of the samples (0%) met the water quality criteria for fecal coliform, consequently, failing the two important parameters. However, it is reassuring to note that the presence of agricultural chemicals such as nitrates and phosphates in the river is minimal, thus passing the water quality criteria for such parameters. For the TSS, the significant contributors to the exceedances in Agusan River can be attributed to non-point pollution sources, usually due to soil erosion from disturbed forestlands and vast agricultural lands, which causes high turbidity and total suspended solids that make the river appear murky, especially during rainy seasons. However, the river has inherently high TSS concentration because the river's beds and banks are made of soil mass, not sands or gravel, and the high volume of water that passes through allows erosion of the river's bank to naturally occur. There are no significant industries located near the river that contributed to high TSS; however, the vast agricultural lands and disturbed forests are also located mostly by the river tributaries (DENR-EMB, 2018).

For the fecal coliform organisms, the settlers or the communities and other human activities located within the drainage area of the river are the possible sources of contamination for fecal coliform organisms. This contamination may come from commercial and institutional establishments and from communities and households because the improper disposal and handling of the wastes - especially human feces and animal wastes/excreta - will cause fecal contamination of the river. It is important to note that there are several households in Butuan City that reside by the riverside, including the respondents of this study, and there is a recent rise of establishments by the river. Moreover, there are some portions of the river, mostly by the receiving water body (Butuan Bay), that were used for aquaculture, and the possibility for e-coli and other pathogenic organisms' contamination is inevitable to contaminate these aquaculture products (DENR-EMB, 2018). Hence, there is really a need to bring down the concentrations of the fecal coliform counts to avoid possibilities of pathogenic organisms' contamination to the aquaculture food products supply and to the riverside community, which may lead to outbreaks of waterborne diseases in households. In Butuan City, there is a high incidence rate of waterborne diseases (92%), with simple diarrhea as the most prevalent disease, followed by intestinal worms (Berame et al., 2018). Therefore, the condition of the Agusan River reflects the environmental health of the area and the community health of the barangay, especially that the respondents live in close proximity to the river. Evaluating the respondents' awareness on the river's water quality also shows their environmental concern.

4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary of Findings

A. Access to Sanitation and Water

This study aimed to determine and investigate the perceptions of the households in Brgy. Baan Riverside, Butuan City to present a baseline data on the quality of water and sanitation and hygiene practices in the area.

Most 76.67% (23 out of 30) of the respondents have a separate water source used for drinking and sanitation/household use. Majority (93.33% or 28 out of 30) of the household respondents did have working latrines, consisting of flush /pour-flush type to septic tank. For those with unimproved latrine types, the most common are the bucket and fluch/pour-flush to elsewhere. In addition to a private toilet facility owned by the majority-63.33% (19 out of 30)- of residents, most of them also responded to conducting regular cleaning (73.33%) once a day. Despite this positive response, proponents of this study receive responses such as: less than a week (10%), and almost never (6.67%).

B. Knowledge and attitudes on sanitation and hygiene

In general, the knowledge levels and attitudes of households with and/or without proper water, sanitation-hygiene and toilet facilities conform to that of the overall findings.

The respondents associated sanitation and hygiene mostly to (i) hand hygiene/cleanliness and (ii) clean, safe water. Safe disposal of feces was also among their priorities since this item gathered high percentages. Differences in gender hardly have an effect on the responses.

In the respondent's opinion, it is important to maintain good hygiene in order (i) to be healthy and free from sickness and (ii) to feel good, and (iii) to feel clean. In order to maintain hygiene, the majority of the respondents (i) agreed that proper disposal of garbage and wastewater, (ii) cleaning the house, and (iii) safe disposal of adult and infant feces is crucial. Majority of the respondents also agreed that the intake of dirty water, no/lack of personal-food hygiene are the most common modes of transmission for diarrhea. The most critical times to wash one's hands according to the respondents are (i) before eating, (ii) before preparing meals, (iii) after using the latrine and (iii) after defecation. In addition, according to them the most important way to maintain good sanitation is to keep the house clean. The three most important ways to prevent diarrhea, according to the respondents, were to (i) drink clean water, (ii) wash hands with soap and (iii) use toilet facility to defecate. According to the respondents, diarrhea is spread mostly through (i) dirty water, ii) flies, (iii) unclean food, and (iv) dirty hands, although proportion-wise, more HH with latrine identified the above items.

4.2 Conclusions

The results of this study show that the availability of quality clean water resources and appropriate toilet facilities influence one's attitude, and even values on sanitation and hygiene. Households with latrines mentioned items that barely concerned those without latrine, for instance, washing hands after using the latrine; no open defecation or consistent use of latrines to maintain good sanitation and hygiene, and; defecate in toilet facilities to prevent diarrhea. The household representatives' response has shown no influence associated with their own niches. For instance, both male and female respondents in this community showed awareness of sanitation and hygiene despite socially conservative cultural norms, thus, washing hands before cooking, cleanliness of the environment, garbage and wastewater disposal and cleanliness of latrines were among their concerns. Both were concerned about their comfort, thus, feeling good/well-being, feeling clean, being healthy, washing hands and not getting sick were their priorities.

In general, results show that the respondents understand the implications of good quality water and sanitation in their households. Results also show that they were satisfied with the information provided by the barangay regarding health and hygiene. Therefore, the proponents conclude that the concern for low sanitation and hygiene in Barangay Baan-Riverside is little to non-existent, although maintenance is always given.

4.3 Recommendations

Based on the findings of this study, the researchers recommend that the following studies be conducted in the future to provide further understanding of the current study:

1. Increase the number of respondents in the survey location;

2. Assess the quality of drinking water, potable water, and surface waters in the area;

3. Perform studies on physico-chemical analysis and heavy metal analysis on the BCWD water;

4. Identify communicable and non-communicable diseases present in the area; and

5. Assess how socio-economic factors, livelihood, and other possible indicators of health affect the sanitation and hygiene practices of the households.

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