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Determinants of Improved Drinking Water Access in Bengkulu and Papua

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Abstract:
Indonesia's National Medium Term Development Plan 2020-2024 stated that the target of households with improved drinking water access is a hundred percent by 2024. Indonesia's performance of household access to improved drinking water is 90.21 percent and relatively close to the target. This target seems achievable at the national level but to achieve 100 percent by 2030, the performance of each province needs to be analyzed. Bengkulu and Papua are two provinces with the lowest percentages on this indicator with 62.47 percent and 62.73 percent respectively. The study's objective is to analyze the determinants of improved drinking water access in two provinces. Logistic regression models were performed to determine the determinants of improved drinking water and using socio-economic survey data published in 2020.

The result shows that the highest education level of household head, place of residence, sanitation access, and quintile of expenditure are the determinant of improved drinking water access in Bengkulu and Papua. Moreover, electricity access and time needed to get drinking water affect drinking water access in Papua. In addition, household size is only significant in Bengkulu and sex of household head does not affect access to improved drinking water in both provinces.

We propose several recommendations based on this study result. The government of Bengkulu and Papua should prioritize education access and provide drinking water access for low-income household to increase awareness about the importance of improved drinking water for a better-quality life. In addition, the government of Papua also needs to accelerate infrastructure development by providing drinking water facilities.

Keywords:
drinking water; household; sustainability

1. Introduction:

The Sustainable Development Goals (SDG) indicators related to access to improved drinking water in Indonesia showed progress over the year. Based on 2018-2020 Socio-Economic Survey data, the percentage of households with access to improved drinking water has grown from 89.27 percent in 2019 to 90.21 percent in 2020. This indicator increases about 0.94 percent from 2019 to 2020 at national level.

The government has several programs related to access to improved drinking water such as Pamsimas program to provide drinking water and sanitation facilities, special transfer funds for regions, and access to piped drinking water (ten million house connections). All programs are stated in the development plan, RPJMN, and it aims to improve infrastructure to provide access to improved drinking water and sanitation.

Furthermore, this national progress does not represent a good performance at the provincial level. The lowest percentage of this indicator at the provincial level are Bengkulu and Papua with 62.47 percent and 62.73 percent respectively. Bengkulu had a performance of 57.60

percent in 2019 and 62.47 percent in 2021. Meanwhile, Papua province has a performance of 60.85 percent in 2019 and 62.73 percent in 2020. Although every year the percentage increases, these two provinces' performance are relatively low in compare to other provinces. Based on this background, we propose a study to identify the determinants of household access to improved drinking water in Bengkulu and Papua.

2. Methodology:

Based on the health ministry regulation number 492 in 2010 about drinking water quality criteria, drinking water is the water that meets health criteria and can be consumed directly. Furthermore, SDG metadata stated that improved drinking water sources include: piped water into dwelling, yard or plot; public taps or standpipes; boreholes or tube wells; protected dug wells; protected springs; packaged water; delivered water and rainwater.

The dependent variable of this study is household access to improved drinking water. It is categorized into households have access to improved drinking water sources and households do not have access to improved drinking water sources. This research uses independent variables of household head (HH) such as the highest education level of household head (elementary school, junior high school or below, high school, tertiary), sex of household head (male, female), age of household head (11-35 years old, 35-54 years old, more than 55 years old). Physical characteristics of household such as household size (less than four persons, 4-6 persons, more than six persons), place of residence (urban, rural), electricity access (with electricity, without electricity), sanitation access (improved sanitation, unimproved sanitation), time needed to get drinking water (less than or equal to 30 minutes, more than 30 minutes), quintile of expenditure.

The statistical model is developed using a logistic regression with categorical predictors, with the general form below:

$$logit(\pi) = ln\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p$$

In this model π is used to represent the probability of "success" or the probability that the (binary) outcome $Y_i=1$, α represents the intercept parameter, and βj represents the coefficient associated with the j_{th} predictor, X_j. The logistic model with categorical predictors needs the latter to be coded such that $(C - 1)$ indicator variables are required to represent a total of C categories. Dummy coding for predictors is applied. Logistic model predicts a binary outcome, and so the distribution of the random component is the binomial distribution. To formulate this model, we use the logit function, which is the canonical link for the binomial distribution. This provides a function that relates the systematic component to the outcome more accurately because the relationship between the predictor(s) and the outcome is not linear and the predicted values of the outcome are bounded between 0 and 1. The exponentiated value of the intercept, $e^{\alpha}, e^{\beta_1}, \ldots, e^{\beta_p}$ can be interpreted as the predicted odds that are associated with the reference category. In other words, the odds ratio for a dummy variable is the factor of the odds that $Y=1$ within that category of X, compared to the odds that $Y=1$ within the reference category (Azen and Walker, 2011).

3. Result:

The data of socio-economic survey 2020 is used to achieve the research goal. The survey uses Probability Proportional to Size (PPS) with a size of total population for each province. The total sample of households in Bengkulu and Papua is 5,310 households and 13,856 households. Estimated population of Bengkulu is 2,01 million while Papua has a total population of 4,03 million.

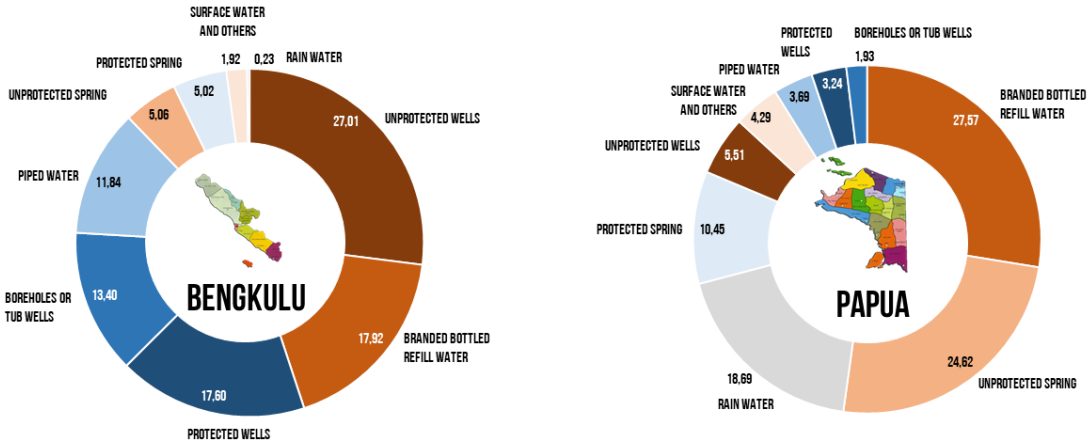

Figure 1. The percentage of household based on drinking water sources Bengkulu and Papua, 2020

Figure 1 shows the percentage of households by main source of drinking water used in Bengkulu and Papua. Almost a third of households in Bengkulu use unprotected water wells as the main source of drinking water, while in Papua, they tend to use branded bottled water or refillable water. These two kinds of drinking water sources are categorized into unimproved drinking water sources by SDG definition.

Table 1. The determinants of households' access to improved drinking water sources in Bengkulu and Papua

	Bengkulu	**Papua**
The highest education level of HH		
<= Junior High School	1	1
Senior High School	1.34 (1.13-1.58)*	1.25 (1.08-1.45)*
Tertiary	1.68 (1.26-2.25)*	1.28 (1.02-1.61)*
Sex of HH		
Female	1	1
Male	0.82 (0.67-1.02)	0.91 (0.76-1.10)
Age of HH in years		
<35	1	1
35-54	0.98 (0.81-1.18)	0.92 (0.81-1.03)
>54	1.07 (0.87-1.31)	1.20 (1.00-1.43)*
Household Size		
1-3	1	1
4-6	1.44 (1.23-1.68)*	0.93 (0.82-1.06)
7 and more	1.24 (0.83-1.85)	0.92 (0.69-1.22)
Place of residence		
Rural	1	1
Urban	1.69 (1.43-2.00)*	4.73 (3.75-5.97)*
Electricity		
With Electricity	1	1
Without Electricity	0.98 (0.48-2.00)	1.45 (1.28-1.66)*
Sanitation Access		
Unimproved sanitation	1	1
Improve sanitation	1.99 (1.69-2.34)*	3.41 (2.95-3.93)*
Time needed to get drinking water		
> 30 minutes	1	1
<= 30 minutes	1.17 (0.68-2.03)	3.16 (2.72-3.67)*
Quintile of household expenditure		
1st Quintile	1	1
2nd Quntile	1.30 (1.04-1.62)*	0.75 (0.62-0.91)*
3rd Quintile	1.80 (1.43-2.27)*	0.89 (0.75-1.06)
4th Quintile	2.13 (1.69-2.68)*	0.79 (0.66-0.93)*
5th Quintile	4.07 (3.03-5.47)*	0.78 (0.65-0.93)*
Constant	0.34 (0.14-0.87)*	0.33 (0.25-0.43)*

*) Significant at p<0.05, and HH=Household Head

The sample distribution in Bengkulu and Papua shows that they have a similar demographic characteristic. The highest education level of most household heads in two provinces is junior high school or below, male, and aged between 35-54 years old. Most household samples in two provinces are located in rural areas with electricity access and had a less than 30 minutes duration to drinking water sources.

More than fifty percent of the household sample in Bengkulu has a household size of 4-6 persons. In contrast, 46.13 percent household sample in Papua has a size of 1-3 persons. Bengkulu and Papua also have a different pattern on sanitation access. Furthermore, 74.29 percent of household sample in Bengkulu have access to improved sanitation while 61.28 percent of Papua's households do not have improved access to sanitation.

Table 1 shows the result of logistic regression models. In Bengkulu, determinants of household access to improved drinking water are education level of household head, household size, place of residence, sanitation access, and quintile of expenditure. Meanwhile, in Papua, the determinants are education level of household head, place of residence, age of household head, electricity access, sanitation access, time needed to get drinking water and quintile of expenditure.

4. Discussion and Conclusion:

The study written by Irianti, et al mentioned that better sanitation facilities are associated with higher odds of having access to better drinking water systems. This result is in line with our research that households with improved sanitation access tend to have a higher odds ratio of having improved drinking water access. The odds ratio is two times higher in Bengkulu, and 3,5 times higher in Papua.

The household access to improved drinking water in Papua is significantly affected by time needed to get drinking water and electricity access, but these two variables are not significant in Bengkulu. In Papua, the time needed to get drinking water is significant. Households with less than thirty minutes on water collection time have three times more access to improved drinking water rather than households with more than thirty minutes on water collection time.

Access to electricity in Papua significantly affects households' access to improved drinking water, while Bengkulu shows otherwise. Housing and Environment Health Indicator 2020 confirmed that the electricity access in Bengkulu has reached 98.98 percent while Papua has only 73.83 percent. In Bengkulu, access to electricity cannot be considered as an influencing factor on drinking water access because electricity has evenly distributed. On the other hand, access to electricity in Papua is still not evenly distributed.

The result also shows that households living in urban areas tend to have a higher odds ratio of having improved drinking water access in comparison to households living in rural areas. This result is confirmed by research from Nurzanah, et al. They analyze drinking water infrastructure using community level data, which is village potential census 2018. Their result confirmed that villages in urban areas have better drinking water infrastructure access than villages in urban areas.

The provision of improved sanitation facilities affects access to improved drinking water in the two provinces. For Bengkulu, the contribution of significant variables came from the highest education level completed by household head, household size, quintile of expenditure, place of residence, and sanitation access.

As for the province of Papua, beside those variables access to electricity, the time of water collection, and the age of the household head also affect household access to safe drinking water sources.

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