PAPER POLICY

RELATIVE RISK AND DEMOGRAPHIC ANALYSIS ON HOUSEHOLDS CONSUMPTION OF DRINKING WATER IN INDONESIA

Sri Hartini Rachmad, shrachmat2@gmail.com

I Gede Heprin Prayasta,

BPS Statistics Indonesia

Presenting at

World Water congress XV

International Water resources Association (IWRA)
Edinburgh, Schotland. 25th to 29th May 2015

PS1.1 Water Supply and Demand: The Domestic Dimension

at the World Water Congress on Tuesday 26th May 12:00.

Abstract

This paper aims to assess the relative risk of Indonesian households for accessing decent drinking water sources linking to some demographic-development characteristics, namely: level income as an approach of poor-prosperous family, urban-rural and national-provincial level as a regional administrative indicator, and type of drinking water sources. The probability and tendency of households in terms of relative risk assume to derive the access level to clean and healthy drinking water. The water demand cuts across to many of the development goals from poverty, to health, energy and the environment; so this must reflect on the interactions and identify locally appropriate solutions to managing water for. In further, water is a basic necessity for human life, especially for use as drinking water, cooking food, washing, bathing and toilet facilities. Availability of water supply system is the part that should be prioritized to meet the needs of every person as human rights basis. Until now, the provision by governments faces constraints, both human resources and other resources. For those reasons stated, water management in terms of supporting the equality and equity access achievement as a human rights basis this will be key to success for Post MDGs 2015+ (Millennium Development Goals) toward SDGs agenda (Sustainable Development Goals) acheivement.

Keywords: *Relative risk, demographic, drinking water source, SDGs, water management and Indonesia*

Background

Associated with the first Millennium Development Goals (MDGs) of reducing poverty, hence, the availability of access to clean drinking water "included in the scope of the 4th goal of Goals – 1". Given the importance of the availability of clean drinking water will be closely linked to the achievement of public health and a high quality of life (high life expectancy), then clean drinking water will affect directly towards achieving the target of the other MDG goals.

According to the United Nations report (2013), it is stated that water use has been growing at more than twice the rate of population in the last century, and an increasing number of regions are chronically short of water. At the same time, water is a crucial resource for meeting the development aspirations of poor countries, especially in Asia and Africa.

The proposed Sustainable Development Goals (SDGs), a set of goals drafted by 70 nations and presently being discussed in the UNs General Assembly to end poverty and hunger and sustain the environment, it will guide social policy and investments for decades to come. Sustainable Development goals offer unique opportunity to transform management of critical water resources and promote efficient, nationally and locally appropriate water use will be key to achieving the SDGs. Key challenges include setting realistic targets, carefully considering the local context to address the needs of the poor, and promoting sustainable water resources development in a way that values healthy ecosystems.

One of the objectives in the point 7 Millennium Development Goals (MDGs) is to ensure environmental sustainability. In the points listed target to reduce the proportion of households without sustainable access to safe drinking water and adequate sanitation by half in 2015. Nowadays, relatively low access to drinking water reflects that rate of supply of drinking water infrastructure cannot keep pace with population growth, in addition to plenty of drinking water infrastructure is not maintained and the management is not sustainable. The SDGs follow the UNs led MDGs, which focused on reducing extreme poverty. The SDGs focus on sustainable development, taking into account such factors as water scarcity, food insecurity, ecosystem loss, and climate change.

In comparison cases to other natural resources, water underpins sustainable development perhaps more than any other. Whilst, providing everyone with access to water whether male, female, wealthy or poor also is vital to achieving the SDGs on health, livelihood improvement and economic growth. "This is especially important in rural and urban fringe areas," said Julie van der Bliek, the publication's lead editor of the Institute of Management Water International (2014). Water concerns permeate the SDGs. Goal 6 calls for ensuring the availability and sustainable management of water and sanitation for all.

Objective

This research paper purposes to study on the drinking water consumption patterns of Indonesian households' links to demographic characteristics. The specific objective is assessing the difference of urban-rural where significant infrastructure of water management included related to policy demand. To guide meaningful action, SDGs targets will need to support the aspirations of developing nations for development of which can be obtained from this research result.

Assessing the relative risks of households' drinking water consumption access in Indonesia in order to support better policy on improving drinking water sources. Particularly: 1) Measuring the level of risk of household access to decent drinking water sources according to the socioeconomic characteristics of demography and region. 2) The focus of the analysis of demography and region, then the results of this study are able to provide a macro picture of the pattern of drinking water supply. 3) The findings of this study will be utilized for consideration of policy determination by all parties concerned and involved in the achievement of the Development sustainable. 4) Promoting statistical measurements on relative risk of the theory of probability by odds ratio approach to see the level of vulnerability in terms of 'the availability of clean water in the review of access' for meeting public.

Data Source

The data used are secondary data which are the results of the SUSENAS the third quarter of 2013 collected by the BPS Statistics Indonesia. Some other sources derived from the literature studies help refine the analysis in the study and simultaneously as a previous literatures study. Processing data uses SPSS 13 software in terms of producing tabulation data analysis from macro dataset directly.

Methods

Data Source

Sample of the SUSENAS module consumption obtained by two-stage stratified sampling (classification of rural/urban). The sampling frame used is of two types namely the selection of primary sample frame which is a list of regular census block mapping in the 2010 population census. Meanwhile, the secondary sampling frame is a list of common household results in a block listing Population Census (PS) 2010. The sample size was set at 300,000 households. Hereafter, there are 75,000 samples per quarter as an independent household and in 4^{th} quarterly samples. The analytical method used is a cross-tabulation table and relative risk. Results are expected to be

considered in the formulation of policies related to compliance with drinking water in Indonesia.

Noted: packed-branded water and refill water are excluded into statistical test of RR (relative risk) & OR (odds ratio) due to been recognized at the prior cross tab analysis; do not classified into 'decent water drinking source concept of Susenas'

Research Analysis Method

Relative Risk Approach

Relative risk is generally stated the chances of an event risk. The value of the relative risk is the ratio between the two odds of success. In the epidemiological study of this method is used to obtain a picture of the patterns and determinants that occur in the target population which in this case is the fulfillment of 'drinking water'. This method can also be used to study the important events experienced by the individual targets so-called prevalence studies. The benefit of the relative risk method in this research is to produce analysis that is easily understood. Moreover this method is suitable studies, efficient, and robust in terms of methodology for observational studies because it does not force the subject to experience factors that cause risks. The weakness of this method is not to have the ability to explain the dynamics of changing conditions or the relationship of the population observed in different time periods as well as dynamic variables that influence it. This method is able to explain the cause-effect relationships by ignoring the direction of the causal relationship between, or regardless of the direction of causation). A causal relationship can be explained, but is unable to explain the direction of the relationship and in vice-versa.

Relative Risk (RR) =[(Probability of the 1st group)/ (Probability of the 2nd group)]

$$= [(n_{11}/ n_{1+}) / (n_{12}/ n2_{+})]$$

Interpretation of RR value as follow:

$0 < RR < \infty$
RR < 1, the probability of the 1st group is less than the 2nd group
RR = 1, the similarity of probability between the 1st group and the 2nd group
1 < RR, the probability of the 1st group is bigger than the 2nd group

Odds Ratio

Odds are the ratio between the incidence chance of success and the incidence of failed opportunities. In the design of epidemiological studies of this method is part of a case control study design by comparing the case group with control groups based on the status of his presentation. This method is quite popular because it is cheap and

easy, research subjects were selected based on the status of researchers determined that the researcher has the discretion to determine the ratio of the size of the sample of cases and controls were optimal. If the chances are denoted by pi (π), then the odds are defined :

$$Odds = \frac{\pi}{1-\pi}$$

or in another form can be written as follows :

$$\frac{Odds}{1+Odds} = \pi$$

$$Odds\ ratio\ (\theta) = \frac{odds\ for\ grup\ 1}{odds\ for\ grup\ 2}$$

$$Odds\ ratio\ (\theta) = \frac{\frac{\pi_{11}}{\pi_{21}}}{\frac{\pi_{21}}{\pi_{22}}} = \frac{\pi_{11}\pi_{22}}{\pi_{12}\pi_{21}}$$

The value of estimation (π) can be derived from p thus the odds ratio value of sample can be obtained by :

$$Odds\ ratio\ (\theta) = \frac{(n_{11}/n_{++})(n_{22}/n_{++})}{(n_{12}/n_{++})(n_{21}/n_{++})} = \left(\frac{n_{11}n_{22}}{n^2{}_{++}}\right)\left(\frac{n^2{}_{++}}{n_{12}n_{21}}\right) = \frac{n_{11}n_{22}}{n_{12}n_{21}}$$

It is important in the interpretation of the odds ratio that is referenced category of the incident (hereinafter defined as the occurrence of success) in calculating the odds and defining group or groups as group 1 and group 2 in calculating the odds.

Findings

The distance from drinking water source (for pump, well, and spring) to the toilet hole also affect drinking water quality. The distance between the two of that is considered healthy is at least 10 meters (WHO concept). Nevertheles, there were about 22.98 percent of households whose drinking water was taken from from pump, well or spring located less than 10 meters away from toilet hole. Between urban and rural areas, the magnitude of the problem was different, while 29.64 percent of urban households had their drinking water sources located less than 10

meters from toilet hole only 19.38 percent of rural households belonged to similar situation (BPS 2013).

In general, the 2013 Susenas shows that a majority of household 61.81 percent used private facility, with which the highest percentage was in DKI Jakarta 81.98 percent, and the lowest was in East Nusa Tenggara 19.32 percent. At national level, percentage of households which have no drinking water facility is 3.55 percent and the highest is West Kalimantan reached 44.37 percent. The most households in Indonesia having access to their dringking water freely. The highest percentage is West Kalimantan province shows 80.78 percent and the lowest one is DKI Jakarta 14.04 percent.

Drinking water quality is to a large degree determined by its source. The concept of decent water source for drinking consists of drunk tap water, drunk retail water, rain water, pump water, protected well water, and protected spring water. Special for (pump water, protected well water, and spring water) the distance to final disposal of feces should be at least 10 meters. The perecentage of households who use source of clean water shows, at national level 41.09 percent of households drank decent water source for drinking. DI Yogyakarta is the province with the highest use of decent water source for drinking i.e. 60.01 percent, followed by East Java 53.58 percent and Middle Java 53.51 percent. On the contrary, Riau Islands is the lowest one by 15.71 percent, Banten 20.20 percent and DKI Jakarta 22.48 percent of their access to decent water source for drinking are categoried into bad source or worst access.

Regarding water quality control of pollution by Indonesia Government Regulation number 20 of 1990, the quality is divided into four categories, namely A class (directly drinkable), B class (as a source of drinking water), C class (for fisheries and animal husbandary purposes), and D Class (for agricultural industry, and hydropower purposes). Therefore, the quality of river water had to be maintained and improved to meet the needs for clean water. Water management and water pollution control should be conducted by cross-sectional aaproach in the integrated cooperation, also taking into account the economic, ecological and social function of water for public community.

Industrial, agricultural and domestic wastes have mostly caused water pollution. The burden of water pollution is more in Java island due to centralized industrialization and a high-dense of population area been allocated in Java. The most serious waste pollution problem are allocated in big cities and indetified as urban, such as: DKI Jakarta and Surabaya (East Java).

The availability of clean water as a source of drinking water for daily needs is one of the indicators of the household health. There are 46.87 percent of poor households in Indonesia who have enjoyed clean water as drinking water. Meanwhile, the percentage of poor households who do not have access to clean water is 66.73 percent. There are 56.52 percent of poor households in urban areas who have access to clean water, while there are only 41.44 percent of them in rural areas. This indication shows that the provision of access to clean water to rural areas in order to

be prioritized. Urban households have 1.25 times easier access to clean water for drinking than in the countryside. The disparities prove that poor households have limited access to clean water supply as drinking water. Relative risk values of 0. 833 suggest that poor households 0.833 times relatively easy to get clean water rather than from the household that is not poor. Values less than 1 indicate that the non-poor households actually the one that is much easier to access clean water. Increasing income will secure an economic access for every single household to consume clean water as well as the increasing odds ratio from the higher classes.

Head Count Index by water availability shows that 6.56 percent of households are considered poor of all households have the availability of clean water as drinking water. While 13.76 percent of households categorized as poor of all households are not able to provide clean water for drinking water. Figures of the head count index shows the percentage of poor people according to the availability of clean water indicates that the government plays an important role in building water supply for poor households.

In further, mapping the prevalence pattern of water consumption for drinking water is expected to be a material consideration in the provision of facilities to improve access to clean water as well as a variety of related policy formulation. Moreover, these findings can be a solution problem for supporting better strategy and policy formulation related to water management in urban-rural and access for community in equality and equity as human rights basis.

Conclusion

Fulfilling the decent-water drinking needs for society simultaneously will multiply the effect toward SDGs targets achievement integrated with health, poverty, mother mortality rate and child mortality rate and unsustainable environment.

Public community living in the urban area are having higher risk of indecent drinking water access compared to the rural people in Indonesia. Water quality consumption for community decrease steadily in Indonesia for both in urban and rural area in the last four years. Inequality access of better quality of drinking water in Urban–Rural area is very significant. Greater inequality of poor and prosperous society for water access represents the unfulfilled human basic rights on water access. Greater demand of healthier, more safety-economic-efficient happened in urban area rather than in rural area due to water provision related to water sources become scarcity and costly.

People living in rural area are having relative risk at 1.19 point times compared to urban community in terms of consuming decent drinking water. However, households were not poor in the whole country having the ratio tendency 1.03 points times to use source of decent drinking water than poor households. The higher income level households tend to have greater access and consumption healthier and

saferdrinking water source, on contrast, for the poor due to costly-unavailability (access & sources provision). Greater inequality of poor versus prosperous society for water access represents the unfulfilled human basis rights on water access.

Poor economic status at rural area shows insufficient enough to drive the choice of household's drinking water.The more prosperous households tend to push consuming packed drinking water in their households (urban & rural).The higher of income level of households tend to have more access and consumption healthier and safer drinking water source. The poor community has less access of health and safety drinking water for their households' member due to cost and availability reasons, low level of purchasing power parity.

This statistical measurements on relative risk of the theory of probability by odds ratio approach to see the level of vulnerability in terms of 'the availability of clean water in the review of access' for meeting public is very applicable and easy to understand the analysis result for policy intervention program.

Some suggestion could be promoted, among others:

Stabilization of the price of packed-decent drinking water should be into high priority concern by all stakeholders particularly Government control in terms greater economic access for all as human rights.
Developing main water system by empowering surface water use in order to support meeting the household's drinking water needs at the households, urban area and industry.
Formulating new regulation for conditional water management from industry.
Promoting new technology application for recycling and reuse water.

Short bio of authors:

Sri Hartini Rachmad is currently a researcher on Social-Economic Demography and Statistics Applied at BPS Statistics Indonesia; lecturer and research student adviser at Statistics Institute in Jakarta-Indonesia; also columnist at financial and entrepreneurship national magazine. Graduated from the Australian National University, Canberra in Demography. Researcher and writer for Human Development Report for UNDP's Provincial in 2013. Principle investigator for pilot project on Disability measurement improvement for Developing country in Indonesia funded by UNs' coalition in 2012/3. Researcher on "Gender Overview on Earthquake Disaster in Padang-West Sumatra" coordinated with Oxfam International 2010. Her research interests are International and Population Development: climate change and vulnerability including disaster and water management, data assurance & quality, MDGs, poverty, employment, migration, education, health, gender, and family planning. A book chapter been published 2011 at Amazon with title "Gendered patterns of urban commuting with better connectivity in Jakarta megapolitan area". The Indonesian Demographic and Health Survey (IDHS) 2003-2004. Water Management: Export-Import and Food Security (2012). Contact person: E-mails: shrachmat2@gmail.com and shrachmat@yahoo.com, *Mailing address*: Lurus III–12,

Rt/w:10/6, Jkt-14320, Indonesia. Phone: +62(0) 818 955 652 / 813 87 098 324 and +62(0)21- 3810291 Ext.7331-3

I Gede Heprin Prayasta is graduated Statistics Economy from Statistics Institute (STIS) in 2012 (awarded scholarship by Indonesian Government). Posting at Local Statistics Office directly after graduated from (STIS) in 2012, at Bangli Regency and Bali Province of Statistical Office Branch. Particularly, he posts as junior statistician at Regional Account and Statistical Analysis Section. He has been involving in some research project in socio-economic and attending some local/regional/international of conference/seminar/ workshop. *E-mail*: gedeheprinprayasta@gmail.com

Refferences

_____.2014. *Progress on Drinking Water and Sanitaion-2014 Update*. Luxembourg : WHO Press.

_____.2014. *Water Safety in Distribution System*. Luxembourg : WHO Press.

Agenuresti , Alan (1990). Categorical Data Analysis . New York : John Wiley & Son.

Bappenas, National Development Planning Board (2010). Achievement of Millennium Development Goals Report. Jakarta : The Republic of Indonesia.

BPS Statistics Indonesia (2013). Calculation and Analysis Macro Poverty 2013. Jakarta : BPS , Statistics Indonesia.

BPS .2012. Environment Statistics of Indonesia 2012. Badan Pusat Statistik. Jakarta. Indonesia.

BPS .2013. Welfare Statistics 2013. Badan Pusat Statistik. Jakarta. Indonesia

Department of Water Affairs and Forestry.1994. *Water Supply and Sanitation Policy*. Cape Town : Department of Water Affair and Forestry South Africa.

KCM.2006. Konsumsi Air Terkontaminasi Dirasakan 70 Persen Warga Indonesia. [Water Consumption in Contaminated Been Accessed by 70 percent of Indonesian Population] , KOMPAS, 21 March 2006, page.13, available to be downloaded in the [http://www.menlh.go.id/ringkasan-berita-media-massa-21032006/].

Peraturan Menteri Kesehatan Republik Indonesia Nomor 492/MENKES/IV/2010 Tentang Persyaratan Kualitas Air Minum [Ministry of Health's Regulation of The Republic Indonesia Number 492/MENKES/IV/2010 about the quality requirement of drinking water]

Santono, Hamong. September 2013. MDGs dan Agenda Pembangunan Post 2015. [MDGs and Development Agenda] in the SNO Infid. Magazine. Jakarta : SNO infid

BPS Statistics Indonesia. 2013. *Perhitungan dan Analisis Kemiskinan Makro 2013*. [Measuring and Analysis of Macro Poverty 2013]. Jakarta: BPS, Statistik Indonesia.

Undang-Undang Republik Indonesia Nomor 7 Tahun 2004 Tentang Sumber Daya Air. [Law of the Republic of Indonesia Number 7 of 2004 on Water Resources]

United Nations (2013). Setting and Achieving Water-Related Sustainable Development Goals. UNs. NY. 2013.

World Health Organization.2013.*Progress on Sanitation and Dringking Water-2013 Update*. France : WHO Press.