Research Paper

The struggle for water in Indonesia: the role of women and children as household water fetcher

S. Irianti and P. Prasetyoputra

ABSTRACT

Globally, billions of people are still without access to safe water. Every day they need to travel far to fetch water, and most of them are women. The gender and water fetching issue in Indonesia is under-researched. Hence, this article addresses the spatial, environmental, and socio-demographic correlates of women or children as the household water fetcher in Indonesia. Using data from the 2013 Baseline Health Research (Riskesdas) from the Ministry of Health, we fitted a multivariable multinomial logit regression model (MNLM) to examine the relationship between women and children as water fetcher and spatial, environmental, and socio-demographic characteristics of households. We found that two in five households delegate women household members to carry water. Moreover, women and children are more likely to take the role of water fetcher in rural and less affluent households. Furthermore, the time required to collect water is significantly associated with women as water fetcher in the household. The longer the duration it takes to collect the water, the less likely women, as opposed to men, are the primary water collector in the household. These findings can be used to inform policymaking in Indonesia.

Key words | gender, Indonesia, water collection, water fetcher, water source

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INTRODUCTION

Having access to safe water is crucial to everyone's rights. Globally, the water component of the Millennium Development Goal (MDG) target 7c has been met (Graham *et al.* 2016). However, billions are yet to enjoy the luxury of directly accessible access to safe water (WHO/UNICEF JMP 2015), meaning that they must travel some distance to fetch water for their daily needs. According to the WHO/UNICEF JMP (2017), 844 million people spent over 30 minutes per trip to fetch water from an improved source, used unprotected wells and springs, or fetched water directly from surface water sources. This figure is why the burden of water collection has been incorporated into the new indicator for the Sustainable Development Goals (SDGs) for universal and equitable access to water by 2030 (WHO/UNICEF JMP 2017; Cassivi *et al.* 2018).

The burden of fetching water is not borne solely by men. Around the world, women predominantly do the water collection, and they spend a substantial amount of time every day undertaking this chore (Sorenson *et al.* 2011). This burden on women means that they lose time that otherwise could be spent on more useful activities. Moreover, this chore could psychologically impact women, who have long walks to collect water, in an adverse manner (Bisung & Elliott 2016; Thomas & Godfrey 2018). Furthermore, this time-consuming activity in developing countries can also cause malnourishment and impair the health of women (Buor 2004; Geere *et al.* 2010, 2018a, 2018b). The effect of water collection on malnutrition may extend beyond the nutritional status of women, as Cairncross & Cliff (1987) found that households living far from a water source cook

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less frequently. This reduced activity may then affect the nutritional intake of their children. Furthermore, children, especially schoolchildren, may miss class due to their daily water collection tasks (Mwamila *et al.* 2016).

In recent years, water collection has received more significant attention. Boone *et al.* (2011) analysed survey data from Madagascar and revealed that women and girls are burdened by water collection. Graham *et al.* (2016) analysed the Demographic and Health Survey (DHS) and the Multiple Indicator Cluster Survey (MICS) for 24 sub-Saharan African countries. Their results suggest that women (adult females) were the main water fetchers in all 24 countries. Moreover, among children, female children were more likely to carry the burden of water collection across all 24 countries (Graham *et al.* 2016).

The rural disadvantage of access to improved water sources (Osei *et al.* 2015; Irianti *et al.* 2016; Roche *et al.* 2017) may translate into a similar disadvantage with regards to the water collection labour. Geere & Cortobius (2017) analysed MICS data from 23 countries and found that almost half of the households residing in rural areas do not have access to on-premise water sources. Results from the same study also suggest that the mean single trip time to fetch water is higher in rural areas than in urban areas.

Distance to the water source is associated with water insecurity (Nounkeu & Dharod 2018). Given the importance of time needed to travel to and distance to the water source, the reduction of time could be beneficial to society. Cassivi *et al.* (2018) drew MICS data from 17 countries to simulate the effect of the time needed to fetch water on access to drinking water sources. Their research suggests that by considering time reduced the proportion of the population with access by 13%. Another study carried out by Pickering & Davis (2012) employed the DHS data from 26 countries. They observed that a reduction of time spent walking to the water source would reduce diarrhoea prevalence, reduce malnutrition among children and reduce child mortality (Pickering & Davis 2012).

Addressing water fetching would have many implications regarding the issue of gender (Coles & Wallace 2005). Such an effort would also encompass many of the SDGs. The most notable ones would be SDG 5 ('Achieve gender equality and empower all women and girls') and SDG 6 ('Ensure availability and sustainable management of water and sanitation for all'). With regard to women, they could use their time to be more active in the economy and thus economically improve their livelihood. However, Sorenson *et al.* (2011) argue that besides economic rationale, there are more critical justifications behind reducing women's burden of water collection, for instance, health status, quality of life, privacy and dignity of women (Fisher 2008; Sorenson *et al.* 2011). Concerning children, being free from water collection duty would improve their likelihood of going to school (Hemson 2007; Ivens 2008; Sorenson *et al.* 2011; Koolwal & van de Walle 2013; Agesa & Agesa 2019). Moreover, water collection activities put women and children at risk of injury and violence (Sorenson *et al.* 2011; Alhassan & Kwakwa 2013; Pommells *et al.* 2018).

In Indonesia, it has been reported that 38% of water fetchers are women (NIHRD 2013). Although this figure is considerably less than the global one, it is still worrisome. Moreover, little research has been devoted to exploring water fetching and gender in Indonesia. Nainggolan & Kristanto (2013) analysed data from the 2010 Indonesian Baseline Health Research data to examine the pattern of clean water supply from the gender perspective of household water fetchers. However, the research only focused on selected regions of Indonesia. Therefore, the objective of this study is to investigate the spatial, environmental, and socio-demographic correlates of women and children as household water fetcher in Indonesia. The authors hope that this study will enrich the existing literature by providing an empirical analysis of water collection labour. The remainder of this article is as follows. The next section describes the data source, study variables and statistical methods used in this study. The penultimate section then presents and discusses the main empirical findings with the final section drawing conclusions.

METHODS

Data source

This article employed data from the 2013 round of the Indonesian Baseline Health Research (*Riset Kesehatan Dasar*, henceforth Riskesdas) collected by the National Institute of Health Research and Development (NIHRD) of the

Indonesian Ministry of Health. Riskesdas is a nationally representative survey that started in 2007. It collects data on the health indicators mandated by the Millennium Development Goals (NIHRD 2013). The 2013 Riskesdas comprises data from 1,027,763 individuals residing in 294,959 households in 33 provinces. There is a newer round of Riskesdas fielded in 2018, but it did not collect information on household water fetcher which is the primary variable of interest in this article.

Ethical considerations

We obtained the 2013 Riskesdas dataset from the Data Management Laboratory of the NIHRD. The Institutional Review Board of the NIHRD has issued an ethical clearance for the 2013 Riskesdas (No. LB.02.01/5.2/KE.006/2013). A more detailed explanation regarding methodology and ethical aspects of Riskesdas, such as informed consent forms, can be read elsewhere (NIHRD 2013). As this article is a further analysis of the 2013 Riskesdas, no further ethical review was needed.

Study variables

The main outcome of interest is the person in the household who usually fetches water. This variable was constructed using information obtained from two questions in the 2013 Riskesdas: (1) 'How long does it take to obtain water for drinking?' and (2) 'If the response to the previous question is option 2 to option 4, who usually goes to fetch drinking water for your household?' The first question provides the following options: <6 minutes, 6–30 minutes, 31–60 minutes and >60 minutes. The second question provides the options Adult woman (≥15 years of age), Adult male (≥15 years of age), Female child (<15 years of age) and Male child (<15 years of age). These questions are similar to those in the Indonesia DHS and Indonesia MICS (Statistics Indonesia 2013, 2014). The two questions of water fetching were then constructed into a four-category variable (1 = Adult man, 2 = Adult woman, 3 = Male child and 4 = Female child).

With regard to the explanatory variables, they were selected based on previous literature (Rahut *et al.* 2015; Adams *et al.* 2016; Irianti *et al.* 2016) and were grouped into three categories: spatial variables (region of residence and place of residence), environmental variables (drinking water source and sanitation facility) and socio-demographic variables (education of household head, employment of household head, sex of household head, age of household head, marital status of household head, household size, number of under-5 (U-5) children, and household wealth index). We constructed the household wealth index from household assets and appliances (bicycle, motorcycle, cable TV, air conditioner, water heater, 12 kg or more gas cylinder, refrigerator and car), main material of the floor and main material of the wall. The index was estimated using polychoric principal component analysis (PCA) method (Kolenikov & Angeles 2009).

Statistical analysis

Households with on-premise drinking water sources were excluded from the analysis, taking out 179,567 households from the sample. Then, a further list-wise deletion process led to a final analytic sample of 115,392 households (Dong & Peng 2013). As the outcome variable is a nominal variable, we fitted a multivariable multinomial logit model (MNLM) to examine the relationship between the explanatory variables and the outcome variable (Long & Freese 2014). This regression model has also been used in previous environmental studies (Chunga *et al.* 2017; De 2018). In this paper, the MNLM is written as:

$$ln\Omega_{m|b} = ln\frac{\Pr(y=m|x)}{\Pr(y=b|x} = x\beta_{m|b} \text{ for } m = 1 \text{ to } J \quad (1)$$

where b is the base outcome or known as the reference category (i.e., men as the water fetcher). These J equations can be solved to estimate the probabilities of each category of the outcome:

$$\Pr(y=m|x) = \frac{\exp(x\beta_{m|b})}{\sum_{j=1}^{J}\exp(x\beta_{j|b})} \quad (2)$$

Relative risk ratios (RRRs) were used as the measure of association, and an exponential value of the coefficients. Adjusted McFadden R-square was used to measure goodness-of-fit (Hausman & McFadden 1984). All of the

statistical analyses were performed using Stata version 13.1 (StataCorp 2013).

RESULTS AND DISCUSSION

Sample characteristics

A total of 115,392 households were included in the final analytic sample. Table 1 presents the characteristics of the households in the sample. The role of water fetching is predominantly taken by an adult man (54.83%). However, the role of an adult woman is still substantially high. It was observed that two out of five households (42.3%) rely on women to fetch water. A substantial proportion of household reported children as the primary collector of drinking water, with female children (1.57%) slightly higher than male children (1.31%).

The sampled households primarily reside in the Sumatra region (28.22%), and the least reside in the Maluku region (4.53%). Almost two in three households reported living in rural areas (63.52%) as opposed to living in urban areas (36.48%). One-fifth of the sample was observed to be living in slum areas.

Most of the households (47.42%) rely on unimproved water sources for drinking. The proportion of households that use improved drinking water sources is slightly higher (46.17%), while only 6.41% of the sample reported using piped water for drinking. Regarding sanitation, the majority of sampled households used an improved facility (45.08%), followed by having no facility (41.19%) and unimproved facility (13.73%). Concerning distance and time to the water source, almost half of the sample requires 6–30 minutes to fetch water (48.79), followed by requiring less than 6 minutes (45.93%). Only 5.27% of households take more than 30 minutes to collect water.

The majority of households are headed by a male (85.93%), employed (87.71%), and have an elementary school educational background (32.77%). Most of the household heads are aged 30 to 49 years (53.19%) and are married (84.58%). It was also observed that most of the households (73.19%) do not have any U-5 children. The average number of household members is four members. Lastly, the wealth index has an average of zero as expected from the process of polychoric PCA.

Table 1 | Household characteristics in Indonesia

Variable	Number	%
Primary water fetcher in the household (dependent variable)		
Adult men (≥15 years old)	63,268	54.83
Adult women (≥15 years old)	48,812	42.30
Female children (<15 years old)	1,806	1.57
Male child (<15 years old)	1,506	1.31
Region of residence		
Sumatra	32,562	28.22
Java and Bali	31,346	27.16
Nusatenggara	10,762	9.33
Kalimantan	11,332	9.82
Sulawesi	14,935	12.94
Maluku	5,222	4.53
Papua	9,233	8.00
Place of residence		
Urban area	42,100	36.48
Rural area	73,292	63.52
Reside in a slum area		
No	92,292	79.98
Yes	23,100	20.02
Drinking water source		
Unimproved	54,716	47.42
Improved	53,277	46.17
Piped	7,399	6.41
Sanitation facility		
None/open defecation	47,531	41.19
Unimproved	15,840	13.73
Improved	52,021	45.08
Time required to fetch water		
<6 minutes	53,005	45.93
6–30 minutes	56,304	48.79
31–60 minutes	4,576	3.97
>60 minutes	1,507	1.31
Education of household head		
None	31,499	27.30
Elementary school	37,814	32.77
Junior high school	17,280	14.98
Senior high school	22,240	19.27
College or higher	6,559	5.68
Household head is working		
No	14,183	12.29

(*continued*)

Table 1 | continued

Variable		Number	%
Yes		101,209	87.71
Sex of household head			
Male		99,152	85.93
Female		16,240	14.07
Age of household head			
10–29 years		8,777	7.61
30–49 years		61,378	53.19
50–69 years		37,568	32.56
70+ years		7,669	6.65
Marital status of household head			
Married/cohabiting		97,599	84.58
Never married		2,870	2.49
Divorced/separated/widowed		14,923	12.93
Number of under 5 children			
None		84,453	73.19
One		26,047	22.57
Two or more		4,892	4.24
Variable	Mean (SD)	Min	Max
Number of household members	3.78 (1.65)	1.00	19.00
Household wealth index	0.00 (1.34)	−2.36	3.79

Source: Authors' calculation of the 2013 Riskesdas data.

Regression results

The primary objective of this study was to investigate the correlates of women and children as household water fetcher in Indonesia. The final multivariable multinomial logit model was statistically significant ($LR\,\chi^2_{60} = 22,626.48$; $P < 0.001$) with adjusted McFadden R-squared of 12.30%. Table 2 presents the results of the relationships between the explanatory variables and the outcome variable.

This study observed spatial inequalities in water fetching concerning the region of residence. The Java-Bali region was selected as the reference category as most of the Indonesian people reside in that region. We observed that compared to households residing in the reference region, households residing in Nusatenggara and Papua regions are more likely to rely on women than men to collect water (RRR = 2.5328 and RRR = 1.3194, respectively). Moreover, households located in almost all of the other regions have their children fetch water for drinking (RRR ranges from 1.6257 in Sulawesi region to 5.6679 in Nusatenggara region). The Nusatenggara region consists of East Nusatenggara Province and West Nusatenggara Province, while Papua consists of Papua Province and West Papua Province. These two regions are part of the so-called 'eastern Indonesia' that comprises Kalimantan, Sulawesi, East and West Nusatenggara, Maluku and Papua. These regions have been known to lag behind in terms of economic development in Indonesia (Barlow & Gondowarsito 2009; Resosudarmo & Jotzo 2009; De Silva & Sumarto 2015).

Women and children residing in the Nusatenggara and Papua regions, compared to other regions, are much more prone to bear the responsibility of water collection. These findings concur with the previous study by Nainggolan & Kristanto (2013), where they showed that the proportion of women as primary water collector exceeds that of men in West Nusatenggara, East Nusatenggara and Papua. There are several possible explanations for this disparity. First, households living in the Nusatenggara region are less likely to have access to piped water (Irianti *et al.* 2016). Second, the availability of water in that region is low; in fact, it is the lowest in Indonesia (Radhika *et al.* 2017) owing to the semi-arid climate nature of Nusatenggara (Messakh *et al.* 2018). This lack of resource may hinder the provision of drinking water.

Furthermore, women and children are more likely to take the role of water fetcher in households reported living in rural areas compared to those reported living in urban areas (RRR = 1.4818 and RRR = 1.6842, respectively). This finding is consistent with the findings of previous studies that show rural disadvantage regarding access to improved water sources (Rahut *et al.* 2015; Adams *et al.* 2016; Graham *et al.* 2016; Irianti *et al.* 2016). A study conducted by Hemson (2007) in South Africa also revealed that children bear water fetching responsibilities. However, living in a slum area was not found to determine the water fetcher duty of the household significantly.

The environmental variables in this study were found to significantly influence the probability of women or children being the water carrier. Households with piped or improved water source, compared to those with unimproved sources, were observed to rely more on women than men to obtain water (RRR = 1.5977 and RRR = 1.4908, respectively). This relationship was also found in children, although only households with improved sources were statistically significant (RRR = 1.2082). However, the relationship between

Table 2 | Multinomial logit model estimates for water fetcher ($N = 115,392$)

		Women vs men		Children vs men	
Variable	**Category**	**RRR**		**RRR**	
Spatial					
Region of residence	Java-Bali	Ref.		Ref.	
	Sumatra	1.0107		1.6577	***
	Nusatenggara	2.5328	***	5.6679	***
	Kalimantan	0.7485	***	1.0959	
	Sulawesi	0.9212	***	1.6257	***
	Maluku	0.9768		2.5346	***
	Papua	1.3194	***	5.1659	***
Place of residence	Urban area	Ref.		Ref.	
	Rural area	1.4818	***	1.6842	***
Reside in a slum area	No	Ref.		Ref.	
	Yes	0.9720	*	1.0642	
Environmental					
Drinking water source	Unimproved	Ref.		Ref.	
	Improved	1.4908	***	1.0485	
	Piped	1.5977	***	1.2082	**
Sanitation facility	None/open defecation	Ref.		Ref.	
	Unimproved	0.7890	***	0.6719	***
	Improved	0.7131	***	0.6854	***
Time needed to fetch water	<6 minutes	Ref.		Ref.	
	6–30 minutes	0.6384	***	0.9664	
	31–60 minutes	0.5121	***	1.0201	
	>60 minutes	0.3736	***	0.9098	
Socio-demographic					
Education of household head	None	Ref.		Ref.	
	Elementary school	0.8736	***	0.6902	***
	Junior high school	0.8034	***	0.7415	***
	Senior high school	0.7492	***	0.8385	***
	College or higher	0.6987	***	1.0437	
Household head is working	No	Ref.		Ref.	
	Yes	1.1256	***	0.9727	
Sex of household head	Male	Ref.		Ref.	
	Female	5.2599	***	4.0104	***
Age of household head	10–29 years	Ref.		Ref.	
	30–49 years	1.0395		1.7200	***
	50–69 years	0.9734		1.2319	**
	70+ years	0.9682		1.5559	***
Marital status of household head	Married/cohabiting	Ref.		Ref.	
	Never married	0.5038	***	0.5365	***
	Divorced/separated/widowed	0.5691	***	0.7408	***
Number of household members	1.0507	***	1.3550	***	
Number of under 5 children	None	Ref.		Ref.	
	One	1.0345	*	0.6441	***
	Two or more	1.0188		0.4454	
Wealth index		0.7925	***	0.6162	***

Source: Model conducted using data from Riskesdas 2013.
*p <0.10; **p <0.05; ***p < 0.01.

household sanitation facility and the role of water fetcher differs. Households with better sanitation facilities were found to have a lower probability of having their water fetched by women (RRR = 0.7890 for unimproved vs none; RRR = 0.7131 for improved vs unimproved) or children (RRR = 0.6719 for unimproved vs none; RRR = 0.6854 for improved vs unimproved).

Moreover, the time required to collect water is significantly associated with women as water fetcher in the household. The longer the duration to collect water, the less likely women, as opposed to men, are the primary water collector in the households (RRR varies from 0.3736 to 0.6384). This pattern is similar to the findings of a study done by Graham *et al.* (2016), where they observed a lower proportion of women as the primary collector in six out of 24 sub-Saharan African countries. Concerning children as the water carrier, the water collection time is not a significant factor.

All of the socio-demographic variables were observed to be significantly influencing the probability of women or children being the water carrier. Households headed by more educated persons rely less on women than on men to obtain water (RRR varies from 0.6987 to 0.8736). This relationship was also found in children as water fetcher (RRR varies from 0.6902 to 0.8385). Households in which the household head is employed are more likely to have women as the water carrier (RRR = 1.1256). However, this relationship was not observed in children as the water fetcher.

Households headed by females are more likely to rely on women and children as the primary collector of water (RRR = 5.1599 and RRR = 4.0104, respectively). Research by Boone *et al.* (2011) found that female-headed households in rural areas of Madagascar are more likely to use public taps, meaning that these householders need to travel to collect water. Moreover, female-headed households are more likely to be never married or a single parent (only 23.38% of the female householders in the sample are married or cohabiting). Hence, they are less likely to have a male spouse to help with daily water fetching. Lastly, age and marital status of household head were included only as controls.

Household size significantly influences the probability of water fetcher role. The larger the household, the higher the probability of women or children as the water fetcher (RRR = 0.1057 and RRR = 1.3550, respectively). This finding is also the case in Dar es Salaam, Tanzania, where Smiley (2016) observed that women and children play a pivotal role in water collection. She further explains that men who fetch their own water are mostly single men with no one else to assist such daily chore. Moreover, households with one U-5 child, as compared to none, rely more on women (RRR = 1.0345), but rely less on children (RRR = 0.6441). Furthermore, women living in more affluent households are less likely to take the role of the water carrier as opposed to those living in worse-off households (RRR = 0.7925). This relationship was also observed in the case of children as opposed to men (RRR = 0.6162).

Study limitations

The 2013 Riskesdas data were collected in a cross-sectional survey, which might have confounded the causality among the explanatory variables. Moreover, several important indicators are not collected by Riskesdas. First is the number of hours spent collecting water in a day (Boone *et al.* 2011). The second one is the frequency of trips in a day. Also, it would be interesting to see how these variables affect children's education or mothers' well-being. Hence, these limitations should be kept in mind when interpreting and using the results. Nonetheless, the analysis in the paper still provides useful information for policymakers.

CONCLUSIONS

We employed a large nationally representative survey to analyse the spatial, environmental and socio-demographic correlates of women or children as the water fetcher in Indonesian households. The results have shown the role of water fetcher burdens women and children in disadvantaged households. Providing direct access to an on-premise drinking water source would reduce time in fetching water and thus provide more time for women and children. The time otherwise used for water fetching can be allocated for more productive activities such as labour and childbearing for women. Moreover, the physical and health risks of fetching water would also be reduced. Furthermore, the findings in this article can also be used to inform policymakers. However, more research related to the issue of gender and water fetching is needed to gain more robust evidence.

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