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Urbanisation and Access to Improved Water Sources: Evidence from Least Developed Countries

Sylvia Szabo, Sabu Padmadas, and Jane Falkingham
University of Southampton

Abstract

The pace of urbanisation in the 21st century has been phenomenal especially in lower middle and low income countries. This trend is mostly explained by an unprecedented increase in semi-skilled and un-skilled migration from rural areas to urban areas and cities, putting enormous strain on natural resources, and increasing social, economic and health inequalities. Based on regression analysis of socio-economic and demographic data from 19 Demographic and Health Surveys, this study highlights the need for differentiated strategies and interventions to sustaining the provision of improved water sources in urban areas of resource-poor countries. The findings draw recommendations for policy considerations in the context of the new Sustainable Development Goals agenda, highlighting sustainable population level strategies for improving access to safe drinking water in rapidly growing urban areas in poor countries.

Introduction

In 2010, the United Nations General Assembly and the United Nations Human Rights Council passed resolutions, which recognized that access to improved water sources (IWS) and sanitation are basic human rights (WHO, 2012). Yet, it is evident that a substantial number of households in resource poor settings do not have proper access to IWS. The water challenges are multidimensional, and not restricted to poor countries but other arid and semi-arid regions, including in the Middle East and North African countries where changes in both socioeconomic conditions and climate threat aggravate water scarcity (Jemmali and Sullivan, 2014, Elseouda and Matthews, 2013, Droogers et al., 2012).

Least developed countries (LDCs) are particularly disadvantaged due to high rates of poverty, weak physical infrastructure, cycles of natural disasters and climate change, as is the case in Bangladesh (Faisal and Parveen, 2004, Parvin and Ahsan, 2013). A number of targeted global initiatives already exist which address specifically the future water and energy needs in urban areas and cities of the LDCs (WHO, 2012, Kjellstrom et al., 2008, UNESCO, 2014). Despite these initiatives, a number of LDCs, including Zambia and Democratic Republic of the Congo (DRC), are still off track in terms of meeting their Millennium Development Goals (MDG) water targets (WHO and UNICEF, 2014).

Poor access to water and sanitation has far reaching consequences on human health especially in deprived regions and congested slums (Champion and Hugo, 2004, Fotso, 2006, Martine et al., 2008, Van de Poel, O'Donnell and Van Doorslaer, 2007). For example, many urban settings in Africa and Asia are highly vulnerable to air, water and food borne disease outbreaks such as respiratory illnesses, cholera, multidrug resistant tuberculosis and diarrhoea (Garenne, 2010, Khatun et al., 2012) . Approximately two-fifth of households have limited access to IWS because of poor access to public water supply outlets, long waiting time and difficulties in transporting water (UN, 2013). Moreover, rapid unruly urbanisation, unequal development and environmental threats linked to climate change exacerbate the disease risks and inequalities in health outcomes between the rich and the poor (WHO-UNICEF, 2003-2010). This survey paper presents the findings from analysis of key socioeconomic and demographic factors influencing the access to IWS in urban areas of LDCs.

Urban challenges in developing countries

Urbanisation is a complex and dynamic process and as such caution is needed when trying to assess its broader impact. There is evidence to suggest the urban-rural divide is becoming increasingly irrelevant because of the changes in the nature and scope of urbanisation, which can lead to greater intra-urban inequalities

(Champion and Hugo, 2004, Fotso, 2006, Van de Poel, O'Donnell and Van Doorslaer, 2007). Rural-urban boundaries are often becoming fluid in an increasingly interconnected world where many people reside in rural areas and work in the cities. In sub-Saharan Africa, rural-urban linkages continue to persist through circular and return migration caused by both structural and economic reasons as well as migrants' identity and attachment patterns (Falkingham, Chepngeno-Langat and Evandrou, 2012). In addition, although traditionally poverty has been considered to be largely a rural phenomenon, currently urban poverty has become a significant developmental challenge. In less developed or developing regions, more than 862 million people live in slums most of whom are located in sub-Saharan Africa and Eastern and South Asia (UNHABITAT, 2012).

Although urban growth is often perceived as a direct result of an increase in the overall population size and was found to be the main contributor to urban growth (Montgomery, 2004), evidence also suggests that the reasons behind rapid urbanisation are complex and can also involve natural increase in urban populations, rural-urban migration and reclassification (Montgomery, 2004, Szabo, 2016). For example, the United Nations reports that in the first half of the 21st century urban growth in China is expected to be the only cause of the increase in urban populations, while in India two thirds of the increase in urban populations are to be accounted for by urban growth and the remaining one third by an overall population growth (UN, 2014b). On the other hand, in sub-Saharan Africa natural increase has become the primary contributor to urbanisation (Falkingham, Chepngeno-Langat and Evandrou, 2012).

Most of the projected urban growth occurs in the developing world. With regards to the LDCs, Dhaka in Bangladesh is already on the list of megacities; while Kinshasa of the Democratic Republic of Congo is expected to be on the list by 2025 with a projected population of 14.5 million. This situation is a reason for concern, as urban poverty in these two countries is already alarming. In addition, urban poverty is associated with child labour and as such it deprives children of their right to education (Amin, Quayes and Rives, 2004). Hampering the development of human capital in the poorest countries is likely to have a dramatic impact on economic progress, not least because of barriers to technological advancement required for providing universal water access. Because of the high population density in urban areas, the risks of disease spread in urban environments are particularly severe. Combined with poor health systems, lack of universal health coverage, and high proportion of out of pocket expenditure on health, mortality rates in the least developed settings continue to be worryingly high. Addressing the structural and household barriers to accessing IWS is therefore critically important in planning and sustainable health interventions in urban regions of LDCs.

Data and methods

The dataset used in this study consists of the combined data from 19 Demographic and Health Surveys (DHS). Selected DHS datasets include waves five & six of standard DHS surveys conducted between 2000 and 2010. Out of the 19 LDCs, 15 countries are geographically located in Africa, and the remaining four are in Asia. The complete list of countries, including the number of observations by country and survey dates are provided in Table 1.

A total of 55,778 urban households were interviewed, using the standard methodology of two-stage stratified sampling and data collection instruments. The enumeration areas are selected in the first stage allocating clusters or primary sampling units in rural and urban areas based on probability proportional to the size of the unit. During this stage, a complete household listing is undertaken in all selected enumeration units, which forms the sampling frame for selecting a systematic sample of households for the second stage. Only urban areas are included in the sample.

Table 1: Distribution of households with access to improved and unimproved water supply in urban areas in selected LDCs

Country	Year of survey	Number of households	% access to improved water supply
Bangladesh	2007	3,821	99.5
Benin	2006	7,228	82.2
Burundi	2010	1,673	85.0
Congo Democratic Republic	2007	3,697	71.8
Ethiopia	2011	5,112	94.5
Liberia	2007	2,606	81.8
Lesotho	2009	2,141	91.2
Mali	2006	4,139	78.9
Maldives	2009	944	98.7
Malawi	2010	2,909	92.6
Nepal	2011	3,148	93.4
Rwanda	2010	2,009	89.6
Sierra Leone	2008	2,956	83.4
Senegal	2010-11	2,963	93.6
Sao Tome and Principe	2008-09	1,394	99.5
Timor Leste	2009-10	2,745	88.4
Tanzania	2010	2,209	80.0
Uganda	2006	1,390	89.4
Zambia	2007	2,694	82.5

Note: Maldives graduated from its LEDC status in 2008. However, the country was retained in the analysis since it was classified as LEDC at the time of data collection.

Based on the UN definition, IWS are classified into: piped water into dwelling, piped water to yard or plot, public tap or standpipe, tube well or borehole, protected dug well. On the other hand, the unimproved sources are water from unprotected well, spring and rainwater, surface water, lake, pond, stream and canal (WHO-UNICEF, 2003-2010). Of the selected 19 countries, the access to IWS is ranging between 99.5% in Sao Tome and Principe and Bangladesh to 71.8% in DRC. The study considered key socio-economic characteristics, such as household size, gender of household head, distance from a water source and variables approximating wealth (electricity, wall material) as explanatory variables. It should be acknowledged as a limitation that not all variables are available at the level of each individual survey, which restricts the number of potential confounding factors. For example, variables quantifying ownership of agricultural land or defining which household member collects water are not available across all datasets.

Logistic regression was used to investigate the association between socioeconomic and demographic factors with access to IWS as dependent variable. The following equation was estimated to examine the association between household's access to IWS and selected socio-economic characteristics:

$$logit(Y_i) = \beta_0 + \beta_1 X_i\, \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{3i} + \ldots + \varepsilon_i \quad \text{where, i=1,2…n}$$

Where, Y_i denotes household access to IWS with a values 0 or 1 (0 = doesn't have access, 1 = has access), β_0 is a constant, X_{1i} indicates time to fetch water, β_1 is the coefficient that measures the direction and magnitude of the relationship with Y_i. X_{2i}, X_{3i}, X_{4i},…denotes household level socio-economic characteristics (e.g. education and gender of household head) $\beta_2, \beta_3, \beta_4$ ...denote the adjacent coefficients to the corresponding variables and ε_i is the error term. Model selection was conducted using a standard stepwise routine. Model fit was assessed by widely used statistical tests, such as Wald test and log likelihood test.

Results

Table 2 presents the results from logistic regression analysis. The results of Model 1 show that household socioeconomic and demographic characteristics are significantly associated with access to IWS in the LDCs. Distance to water source is a significant predictor of access to IWS. Controlling for other factors in the model, the odds of access to IWS for households which take more than 15 minutes to collect water are 0.62 times the odds for households which take 5 minutes or less (p<0.01). Interestingly, gender of the household head is a strong predictor of access to IWS: female-headed households are significantly more likely to have had access to IWS than male-headed households. This is an expected outcome as in many

developing countries where females are involved in collecting and managing water at the household level (Crow & Sultana, 2002; Willetts et al., 2010).

Furthermore, education, a proxy for both human capital and wealth (Goujon and Lutz, 2004, Lutz, Goujon and Wils, 2008), has been found positively associated with access to IWS (OR=1.04, p<0.01). Poorer households (as approximated by wall material and access to electricity) are disadvantaged in terms of access to IWS when compared to their richer counterparts. In particular, a strong and significant positive association is noted between access to electricity and access to IWS (OR=2.31, p<0.01). We evaluated these results by looking at selected individual countries, which are currently off track in terms of meeting their MDG water target (WHO and UNICEF, 2014). Overall, the results for Zambia and DRC (Model 2 and Model 3) confirmed the direction of associations, with the exception of household size, which showed a differentiated effect. In the case of Zambia, *ceteris paribus*, the gender variable was found to be insignificant.

Table 2: Factors associated with access to IWS in urban areas of the least developed countries

Independent variables	Model 1 (all LDCs)	Model 2 (Zambia)	Model 3 (DRC)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Time to fetch water			
between 6 and 15 minutes	0.80 (0.74; 0.86)***	0.62 (0.48; 0.80)***	0.57 (0.45; 0.73)***
more than 15 minutes	0.62 (0.58; 0.67)***	0.41 (0.31; 0.55)***	0.50 (0.41; 0.62)***
baseline: up to 5 minutes	1	1	1
Education of HH members	1.04 (1.03; 1.05)***	1.05 (1.00; 1.10)*	1.12 (1.08; 1.16)***
Female head of household	1.18 (1.11; 1.26)***	1.02 (0.80; 1.31)	1.22 (0.99; 1.50)*
Household size			
4-6	0.94 (0.87; 1.00)*	1.04 (0.80; 1.36)	1.11 (0.88; 1.39)
more than 6	0.80 [0.75; 0.87)***	0.75 [0.56; 1.00)*	1.27 [1.00; 1.61)**
baseline: 1-3	1	1	1
Household wall material (finished)	1.27 (1.20; 1.35)***	1.29 (0.97; 1.72)*	
Access to electricity	2.31 (2.17; 2.46)***	2.97 (2.23; 3.95)***	6.26 (4.82; 8.12)***
Constant	3.39 (3.11; 3.69)***	2.70 (1.76; 4.14)***	1.39 (1.01; 1.91)**
Number of observations	41,618	2,523	3,496
Log pseudo-likelihood	-16,620	-1,106	-1,635

*Note: * p≤0.1, ** p≤0.05, *** p≤0.01; Confidence Intervals (CIs) are shown in parentheses.*

Discussion and policy implications

The pace of urbanisation in the 21st century has been phenomenal especially in lower middle and low income countries. This trend is mostly explained by unprecedented increase in semi-skilled and un-skilled migration from rural areas to urban areas and cities, putting enormous strain on natural resources, and increasing social, economic and health inequalities. Our findings show that as rapid urbanisation unfolds, socioeconomic and demographic factors play an important role in determining access to IWS. Tackling water related problems in resource poor urban settings require innovative solutions addressing household barriers along with participatory urban governance and gender considerations (Dawoud, 2005, Stoler et al., 2012).

The findings highlight important policy implications which should be considered in the context of the newly endorsed SDG agenda. First, given often poor infrastructure in the least developed countries, national and local authorities ought to prioritise investments in urban infrastructure and incorporate urban planning policies in cross-sectoral strategies. In this context establishing a specific goal on building resilient infrastructure, the emphasis on participatory urban planning and reduction of intra-urban inequalities in the SDG agenda is a welcome addition (UN, 2014a, United Nations, 2015, Szabo et al., 2015). Importantly, urban planners will increasingly need to consider innovative solutions in order to tackle the consequences of climate change and predicted continued growth of urban areas (UN, 2012). Second, urban dimensions are likely to play in conjunction with other factors at different levels of analysis. In particular, household human capital is a crucial factor, which is confirmed by its role as a stimulator of innovation. Investments in education are therefore vital, and should consider gender contexts and gaps within countries and communities. Educational programmes should involve vocational training, including on resilience building amongst children and youth. In order to ensure progress tracking, related indicators should be incorporated into the proposed SDG indicator framework.

Third, gender specific initiatives should account for differentiated roles of male and female heads of households as related to water provision. As confirmed by previous research (Crow and Sultana, 2002), women are often at the forefront of domestic water and fuel collection. Hence, data on access to safe drinking water need to be disaggregated by sex, as well as age and geographical location. Finally, given considerable diversity of urban areas and the significant effect of household poverty on water

access, policy measures ought to prioritize most vulnerable households and communities, such as the elderly urban dwellers. An effective strategy is only possible when developed in close collaboration with concerned stakeholders.

Sylvia Szabo is Visiting Academic at the University of Southampton

Sabu Padmadas is Professor of Demography and Global Health and Co-Director of GHP3 (Centre for Global Health, Population, Poverty & Policy) at the University of Southampton

Professor Jane Falkingham is Dean of the Faculty of Social, Human and Mathematical Sciences, Professor of Demography and International Social Policy, and Director of ESRC Centre for Population Change at the University of Southampton

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