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Who Carries the Weight of Water? Fetching Water in Rural and Urban Areas and the Implications for Water Security

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ABSTRACT: The global burden of fetching water, particularly its effects on individuals and societies, is largely unknown because comparative analysis of the global data available is incomplete and scarce. To address this information gap, this article presents a synthesis of the data on water-fetching from households in 23 countries. In rural areas of the dataset almost 50% of the population still have to bring water from a source outside of their home or yard. Women generally carry the main responsibility for fetching water; however, in many countries and in particular in urban areas, men also take on a great share of this work. The mean single trip time to collect water ranges from 10 to 65 minutes in urban areas with an average increase or decrease of 2 to 13 minutes in rural areas. Further, up to 60% of children support the collection of wood and water, in some countries spending up to 11.3 hours per week. Water fetching continues to have the greatest impact on women and children in poorer rural areas and is likely to be a substantial barrier to household water security and sustainable development in regions most in need of sustainable development.

KEYWORDS: Water fetching, MICs surveys, global data, time, health impacts

INTRODUCTION

'Water security' is defined in this collection as 'the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable or tolerable level of water-related risks to people, environments and economies'. We argue in this paper that in many regions of the world, continued reliance on the manual labour of fetching water to obtain water for household use is substantial, and compromises water security. Consequently, opportunities for sustainable growth which are commonly expected to occur as a result of 'improved access' to safe drinking water are not likely to occur unless the burden of the work of fetching water is recognised and reduced. Whilst there are data to support that men contribute to this work in some regions and in urban areas, global regions most in need of sustainable growth and economic development, such as rural areas of sub-Saharan Africa, most commonly rely on women to obtain and carry household water from a source located away from their homes (UNICEF and WHO, 2012). Water fetching therefore remains a significant barrier to household water security and sustainable development, particularly for rural women in middle- and low-income regions.

Improving access to safe drinking water was a key target for Millennium Development Goal 7 (MDG 7) (Moe and Rheingans, 2006). Whilst the global MDG target of halving the proportion of people without improved drinking water was reported as met in 2010, some regions did not achieve the target and regional inequalities persist (UNICEF and WHO, 2015). Some 663 million people still lacked access

to improved drinking water sources in 2015 (UNICEF and WHO, 2015) and most 'unsafe' drinking water sources are likely to be located away from a person's home or 'off-plot' at shared public access or supply points. Importantly, even improved or 'safe' water sources are frequently located off-plot, highlighting that many people must continue to travel or walk some distance to access and bring home water for drinking and general household use (Pickering and Davis, 2012; Evans et al., 2013). Off premises or 'off-plot' access has been recognised as an important issue by the WHO/UNICEF Joint Monitoring Programme (JMP), which has incorporated the location of water source and water-fetching times into their 'ladder' for household drinking water services, to improve future monitoring of inequalities in access (WHO, 2017).

For many people, off-plot access means that the final steps of the water supply chain require manual labour to transfer water into containers from a publicly shared source, and carry water-filled containers to their house for storage at home, which will influence the quantity and quality of water available to household members (Jagals, 2006; Geere et al., 2010a; Baguma, et al., 2013). Therefore, when water is obtained by water-fetching, 'the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production' at the household level is dependent on the ability of household members to negotiate access to off-plot sources (Wutich, 2009; Stevenson et al., 2012; Diouf et al., 2014), carry sufficient quantities of water home (Geere et al., 2010a) and safely store it (Jagals, 2006).

Despite this crucial role in household water provision, the working conditions of carrying water and impact on the carrier have received little attention to date. Yet, with the 2013 Resolution of the International Conference of Labour Statisticians to recognise fetching water and other unpaid and informal service and production of goods as work, moving away from a sole focus on formal employment (ICLS, 2013) member states will be able to report water-fetching in the Labour Force Surveys. This would open up possibilities to look deeper into the working conditions of this female-dominated link in the water provision service chain.

The detrimental health impacts of regular water carrying are being increasingly recognised and have been investigated in small-scale studies (Geere et al., 2010a; Evans et al., 2013; Geere, 2015). The risks to personal safety that may occur in many areas have also been recognised (House et al., 2014). Any detrimental impact of water-fetching may be superimposed on other personal or household factors which limit capacity to access and carry water and exacerbate inequalities in water security and livelihoods. For example, older adults, orphans, people living with long-term conditions, disability or facing social stigma may be less able to access and carry water, and therefore particularly vulnerable to household water insecurity (Wrisdale et al., in press).

Comparison and analysis of reliable data on fetching water derived from multi-country surveys or datasets are limited, and mainly focus on countries of sub-Saharan Africa (Thompson, et al., 2000; Pickering and Davis, 2012; WHO, 2017). This article summarises descriptive data derived from a subset of 29 Multiple Indicator Cluster surveys (MICs) reported from 2010 to 2015, which included information on access to water and the work of carrying water. We focus on location of the water source, household member responsible for fetching water and time spent fetching water and use the data to illustrate and consider the implications of these specific factors for household water security. More complex analyses of relationships between water-fetching and health, utilising all MICs surveys containing relevant data and reported from 2010 to 2015, will be published elsewhere. This report answers the following questions

- What proportion of household respondents report their access to their main water supply as being from off-plot sources comparing different countries and regions?
- Who is typically responsible for water collection within households?
- How much time is spent fetching water in different countries and regions?

We then discuss the implications of water-fetching on household water security and opportunities for sustainable growth, highlighting water-fetching as a substantial challenge to both and to achievement of many of the Sustainable Development Goals (SDGs). We highlight the recently proposed JMP ladder for drinking water services, which incorporates location of water source and trip times for fetching water (WHO, 2017), and indices such as 'Percentage of population using safely managed drinking water services at home' as appropriate to monitor progress toward SDG 6 and to flag areas and regions vulnerable to household water insecurity between now and 2030.

BACKGROUND

Time spent fetching water and fuel reduces the time that can be devoted to generating livelihoods or in remunerated work, whether in the formal or informal economy. Poor households rely heavily on the time its members have for formal and informal work. As a result, time poverty due to the need for fetching water, firewood and other domestic chores cause trade-offs putting food security, child nutrition, health and education at risk (Kes and Swaminathan, 2006).

According to the JMP (UNICEF and WHO, 2012) about three quarters of households in sub-Saharan Africa bring water from a source located away from their home, with women and girls bearing the main responsibility for collecting water in 71% of the households. A recent JMP report highlights that in 61 DHS and MICs surveys, 73.5% of households reported women as responsible for collecting water, and in 53 out of 73 countries, over half of households without water on premises rely on women to collect water (WHO, 2017). In addition, the likelihood of a woman being the responsible person has been reported to increase as more time is needed per trip (Sorenson et al., 2011). In South Africa, in poor rural households, women who fetch water and fuelwood spend 25% less time in paid employment (Valodia and Devey, 2005).

The mean time needed to fetch water in sub-Saharan Africa is about 30 minutes per trip (UNICEF and WHO, 2012), but depending on the persons in a household and water carrying method, multiple trips per day may be required, substantially increasing the total time spent per day (Hemson, 2007; Geere et al., 2010a; Sorenson et al., 2011). Tanzanian time use data suggest that water-related infrastructure investments could free up time spent on water collection to the equivalent of, if converted into paid employment, more than half a million new full-time jobs for women (Fontana and Natali, 2008). Hutton et al. (2007) estimated that 4 billion working days would be saved by meeting the MDG target on water, equivalent of USD 15,330 million per year of global economic benefits.

Carrying water appears to have direct detrimental impacts on the physical health of the carrier (Geere, 2015), and his or her ability to participate in domestic, formal and informal work (Schatz and Gilbert, 2014). Both children and adults link persisting pain or movement problems with fetching water (Lloyd et al., 2010; Geere et al., 2010a, b) and the task may be an important factor in pain and disability linked to spinal musculoskeletal disorders and cervical compression syndromes (Evans et al., 2013).

In addition, water insecurity contributes to psychosocial and emotional distress (Wutich, 2009; Stevenson et al., 2012; Diouf et al., 2014). Stress can influence general health, disability related to musculoskeletal disorders and work performance or satisfaction. Incidents and fear of physical and sexual violence are widely reported by women and children in relation to water-fetching (Sorenson et al., 2011; House et al., 2014).

The effects of fetching water on women’s health and abilities to work are likely to be more pronounced in low- and middle-income countries where a greater proportion of people are engaged in physically demanding, informal or poorly regulated work environments (Hoy et al., 2014). Furthermore, since economic, political and social inequalities are reflected in the access to drinking water (UNICEF and WHO, 2015), it is likely that marginalised groups suffer disproportionally from the negative economic and health impacts of fetching water.

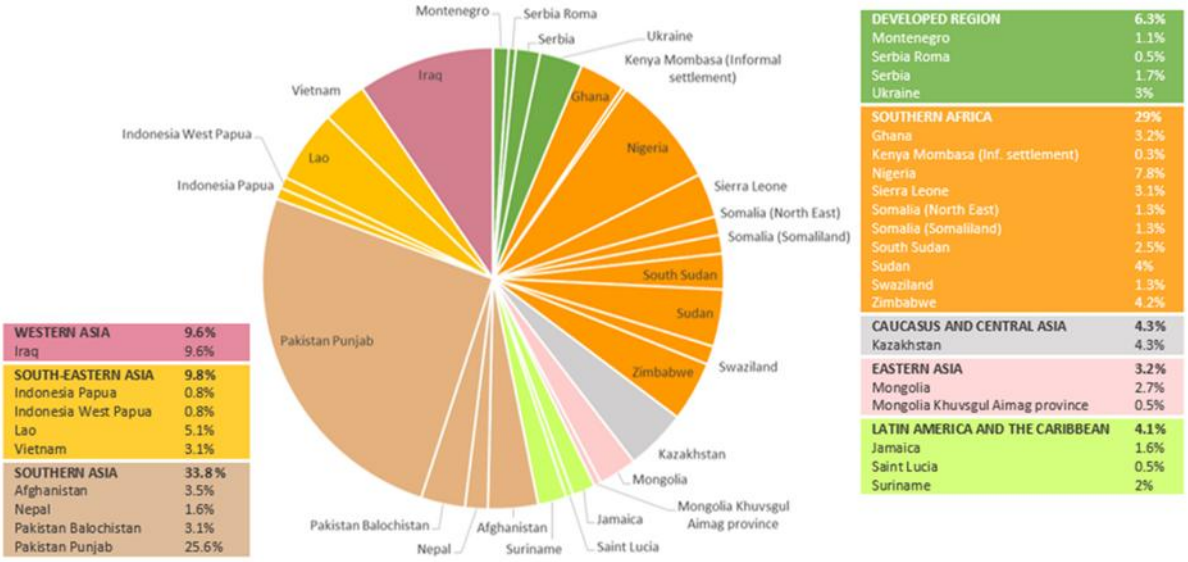
Reducing the time, distance and impact of water-fetching has a double effect: on the practical side, it can improve the quality and quantity of water supply, and on the strategic side, it has been demonstrated to have "an impact on gender/power relations both at the household and community levels and has also contributed towards greater gender equity in terms of women's decision-making and participation in local water management" (Mishra Panda, 2007). To develop effective processes and strategies for improving household water security, we must estimate the global burden of work involved in fetching water, and understand who is doing it.

METHODS

Datasets derived from 29 MICs[1] conducted in 23 countries were purposively selected as a subset of those reported and available through UNICEF in a five-year time span (2010-April 2015). The sample was chosen to ensure representation of countries classified in the UN MDG categories of 'developed countries' (n4) and 'developing' countries (n25), which include regions of sub-Saharan Africa (n10), as well as other regions (n15). The distribution of extracted survey responses per country and MDG region (UNICEF and WHO, 2015) is visualised in Figure 1.

Of these 29 surveys 20 were national surveys and 9 were limited to either a region of a country (8) or to a specific ethnic group within a country (1). A Table of the MICs questions derived for the analysis of this article can be found in Annex 1.

Figure 1. Multiple Cluster Indicator surveys (MICs); % households per region and survey.



The datasets of MICs were downloaded using the Statistical Package for the Social Sciences (SPSSv22) software and data files recording household-level variables related to access to water, women's health, and information on child health for each individual country or regional survey and were merged and prepared for analysis. All surveys were then merged for comparison.

In the household survey of the MICs the question WS3 'what is the location of the water source?' with response options 'house', 'yard', or 'elsewhere', is only asked of respondents without piped water to their house, yard, or neighbour (determined in question WS1). Therefore, variables WS1 and WS3

[1] The complete MICs survey tools can be accessed at http://mics.unicef.org/tools.

were merged to create a new variable, so that wherever possible any household without WS3 responses had their WS1 response re-categorised to indicate at-house, in yard, or 'elsewhere' location of water source. Respondents who had not answered WS3 but for WS1 reported their main drinking water source as a public standpipe, kiosk, tanker truck, cart with small tank/drum, filter plant, bottled or sachet water, or reverse osmosis and in Sudan and South Sudan as a 'water yard/hand pump' were deemed as getting their water from 'elsewhere' as these sources are unlikely to be accessed from within the house or yard. Other sources (protected/unprotected well or spring, rainwater, surface water or 'other') which could be accessed either on or off-plot were designated as 'missing'. However, most of these were wells or springs, many likely located outside of the house or yard to be situated 'elsewhere' or 'off-plot'.

In the original surveys of MICs, only respondents who did not report their main drinking water source as piped to their house, yard, or neighbour in question WS1 were asked about the location of their water source (question WS3) and only those responding 'elsewhere' to WS3 were asked about the person responsible for collecting water. As a result, because of the way in which the surveys are administered, the number of respondents to this question is reduced.

The mean time to get water and return home in minutes (question WS4) was asked of household respondents who reported obtaining their main drinking water from 'elsewhere' (i.e. neither in the house nor yard). In households with children aged 5-17 years, respondents were asked whether the child had fetched water or collected wood for household use in the previous week (question CL8), and the number of hours spent fetching water or firewood in the previous week (question CL9). IBM SPSS statistics v22 were used to establish statistical significance of mean difference in time taken to get water and return, and mean difference in hours spent fetching water or firewood, comparing urban versus rural households in the different surveys.[2]

RESULTS

Altogether 371,635 household surveys were completed in the 29 MICs, with 152,073 (41%) completed in urban areas and 219,562 (59%) completed in rural areas. Further, 6943 (1.9%) surveys were classified as missing mainly due to the uncertainty about the location of wells, springs, rainwater collection, surface water and 'other' sources of water. In all surveys, except Kenya Mombasa Informal Settlement (2.5%), Sudan (19.1%) and South Sudan (39.6%), the percent of answers with unknown location amounts to less than 1.0%. As a consequence, the number of households having to manually bring drinking water is most probably underestimated in areas where wells, springs, rainwater and surface water are common water sources.

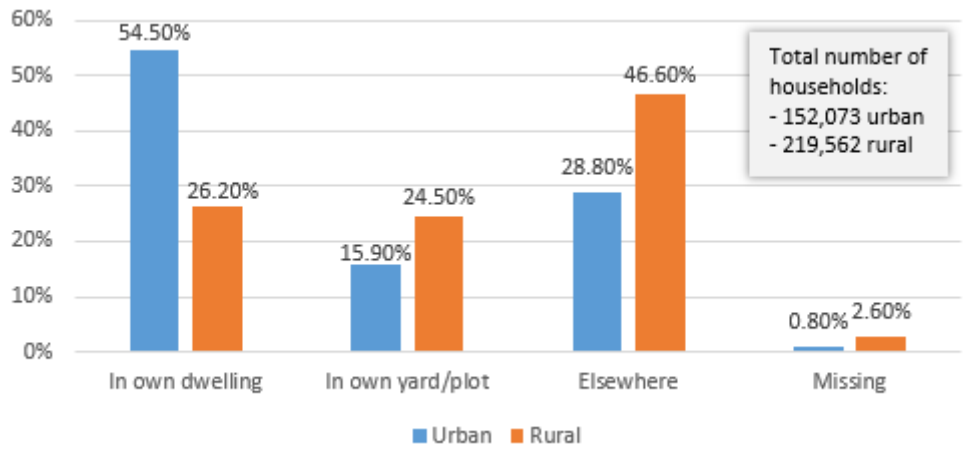
Location of main drinking water source

Of the 371,635 households, a greater proportion of urban households compared to rural households had a water supply within their house, while a smaller proportion of urban households reported a drinking water source in their yard (Figure 2). Consequently, of the urban dwellers, only a smaller share of those without water in their homes, can access it in their yard; those in the larger share (28.8%) have to look for it elsewhere.

In all surveys a greater percentage of urban compared to rural households reported having their main drinking water supply in their house. However, there was no such consistent trend regarding the proportions of urban versus rural households accessing drinking water in their yards. The combined findings overall will be influenced by the large proportion of data from Pakistan Punjab (Figure 1).

[2] The assumption of equal variances was assessed using Levene's test, to reduce the risk of a type I error. If Levene's test gave $p>0.05$, homogeneity of variance assumption was assumed; if Levene's test gave $p< 0.05$, equal variances are not assumed.

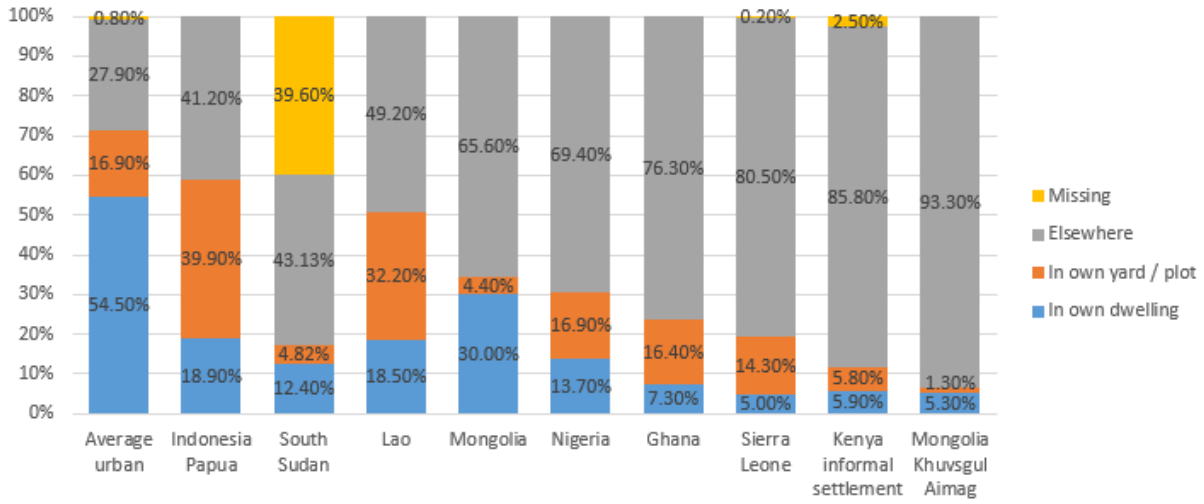
Figure 2. Location of water source urban versus rural.



In most surveys, proportionately fewer households in urban areas obtain their drinking water from 'elsewhere' compared to rural households. The exceptions are for Serbia, Pakistan Punjab and most noticeably in South Sudan. The South Sudan findings may be due to the greater proportion of rural data which had to be categorised as missing for the analysis due to the main water source being categorised as a spring or well, which could be located within the yard or elsewhere (see Figure 3). However, in some surveys (Indonesia West Papua, Lao PDR, Pakistan Punjab, Montenegro, and Serbia) the difference between percentage of urban versus rural households obtaining water from elsewhere is very small (Annex 2). In urban areas of countries of developed regions it is likely that a substantial proportion of water sourced from 'elsewhere' is bottled water, which may not require a household member to physically carry a container from a shared water source. For example, of households in urban areas of Montenegro obtaining water from elsewhere, 61.3% obtained their water from a protected spring and 35.4% had bottled water, compared to rural households where water was obtained from a greater range of sources with 46.9% using a protected spring and 30.5% using bottled water. In Serbia 80.8% of urban households obtaining water from elsewhere used bottled water, compared to 57.2% in rural areas.

Because fetching water from off-plot sources is generally accepted to be more common in rural areas, and a potentially neglected issue in urban areas, we compared location of water source in urban areas of different surveys, to highlight the extent to which water-fetching can be required in urban areas. Comparing the location of the main drinking water source in urban areas only, eight surveys (Ghana, Indonesia Papua, Kenya informal settlement, Lao, Mongolia Khuvsgul Aimag, Mongolia, Nigeria, and Sierra Leone), indicated that the largest proportion of urban households obtained their drinking water from elsewhere (i.e. outside of their own house or yard), with six of the surveys having the majority (>50%) of urban households obtaining their water from 'elsewhere' (Figure 3). In these surveys the proportion of urban households obtaining drinking water outside of their home or yard ranged from 41 to 93% of surveyed households (Figure 3).

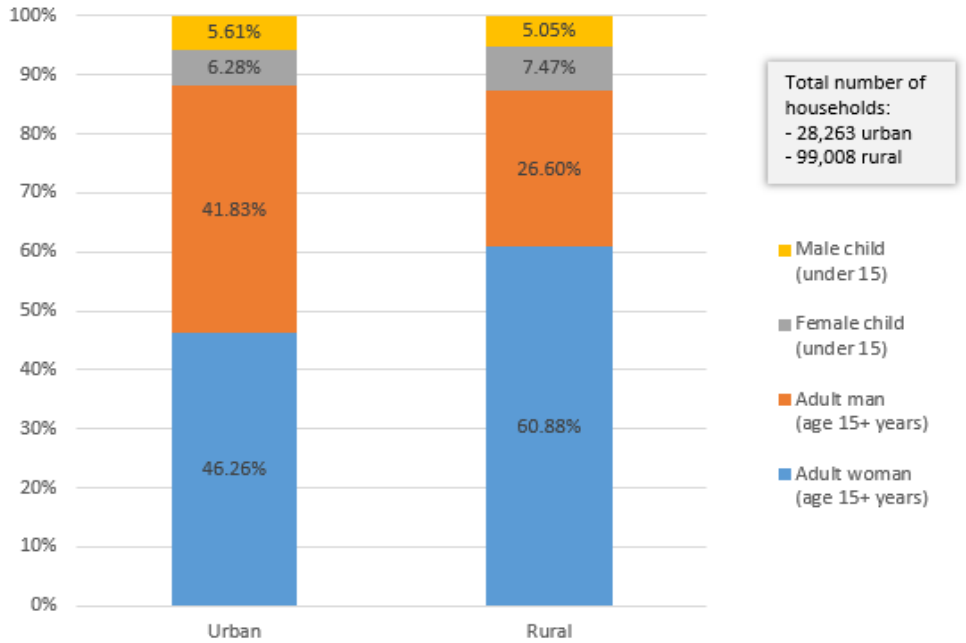
Figure 3. Surveys in which biggest proportion of urban households obtain water from elsewhere.



Person responsible for collecting water

From all surveys and in both the urban and rural areas of 127,271 households that provided information on the main person responsible for collecting water, the greatest proportion of households identified an adult woman as the main person responsible. In urban areas however, the proportion of households who identified men as the main person carrying water is almost equal to the proportion of households identifying a woman as the main person carrying water. In rural areas approximately twice as many households identify women as main carriers of water than men (Figure 4).

Figure 4. Person responsible for collecting water in percent, urban and rural areas.



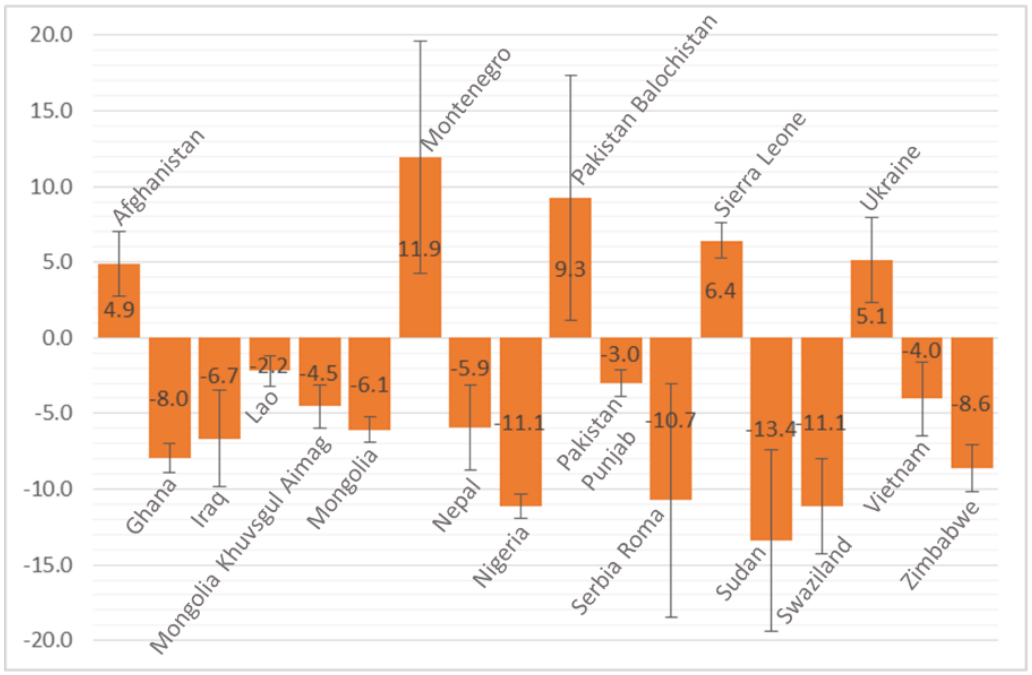
In all surveys adults were most often identified as the main person responsible for collecting water; however, the proportion of households reporting a woman or a man as that person varied between surveys, and in some regions differed between rural and urban areas. In 15 surveys (Ghana, Indonesia Papua, Lao PDR, Nepal, Nigeria, Sierra Leone, Serbia Roma, Somalia (North East), Somalia (Somaliland), Sudan, South Sudan, Suriname, Swaziland, Vietnam, and Zimbabwe) proportionately more households surveyed identified a woman as responsible in both urban and rural areas; in nine surveys (Iraq, Jamaica, Kazakhstan, Mongolia Khuvsgul Aimag, Mongolia, Montenegro, Saint Lucia, Serbia, and Ukraine) proportionately more households identified a man as responsible for collecting water in both rural and urban areas; and in four surveys (Pakistan Baluchistan, Pakistan Punjab, Indonesia West Papua, and Afghanistan) proportionately more households identified a man as responsible in urban areas and a woman in rural areas. The Mombasa informal settlement includes only urban households, and more households reported men as responsible for collecting water (Figure 5, Annex 5).

Figure 5. Person responsible for fetching water.

Time to fetch water

The mean time taken for urban households to get water from an off-plot water source (i.e. 'elsewhere') and return home ranged from 10 minutes in Lao PDR to 65 minutes in Somaliland (Annex 3). Significant differences in urban versus rural mean time to collect water and return occur in 18 of the 28 surveys with urban and rural households. Significant mean time difference between urban and rural water collection time within each survey ranges from 2-13 minutes and can be either increased or decreased in urban areas (Figure 6; Annexes 3 and 4). In Indonesia Papua, Indonesia West Papua, Jamaica, Kazakhstan, St Lucia, Serbia, Somalia (NE), Somalia (Somaliland), South Sudan and Suriname no significant difference was found.

Figure 6. Mean difference in minutes between rural and urban areas to get water and come back.



Notes: Only surveys with statistically significant difference. Negative value indicates more time taken in rural compared to urban areas.

Children and water collection

In 23 MIC surveys, children between 5 – 17 years of age were asked if they had worked to collect water or firewood in the previous week and in 22 surveys responses of children in rural versus urban households could be compared. Children who had worked fetching water or firewood in the previous week were asked how many hours they had spent working at that task. Disproportionately, children in rural rather than urban areas had spent time collecting firewood or water in the previous week. In urban areas the proportion of children engaged in this work ranged from 1% in Serbia to 60% in Mongolia Khuvsgul Aimag.

The mean number of hours spent collecting water or firewood in the previous week ranged from 1 (St Lucia) to 11.3 hours (Somalia NE). In St Lucia, Serbia Roma and Serbia the number of children reporting hours spent fetching water or firewood was small. There were significant differences in the mean number of hours spent fetching water or firewood in the previous week between children from urban and rural households in all survey responses except Jamaica, Montenegro, Saint Lucia, Serbia, Suriname, Ukraine and Vietnam. The significant mean differences in hours spent in the previous week ranged from 0.4 hours or 20 minutes in Sierra Leone (greater in rural areas) to 4.2 hours in Serbia Roma (greater in urban areas).

DISCUSSION

Location of main drinking water source

Within MICs surveys, information about the location of water source is only asked of households reporting access to their main source of drinking water from public standpipes or other non-piped sources. However, within the MICs surveys included in this study, there was a large proportion of

missing data in some areas. For example, with South Sudan and Sudan, types of water source commonly reported (well or spring) did not also indicate whether the source was on or off plot. If we had treated all such indeterminate data as off-plot rather than 'missing' data, we would have larger proportions of households accessing water 'elsewhere' and therefore likely to be engaged in the work of fetching water. Even with this potential underestimation, our findings are consistent with the 2015 update of progress on sanitation and drinking water (UNICEF and WHO, 2015) which highlights that despite important improvements in the last 15 years, rural-urban disparities persist. Our findings also highlight the importance of obtaining information about the on-plot or off-plot location of springs, wells and rainwater sources in household surveys to more accurately indicate the burden of work in fetching water.

While in most global regions urban coverage of piped water on premises remains higher than in rural areas (UNICEF and WHO, 2015), our findings highlight that coverage within urban areas may still be poor in developing regions, particularly in informal settlements. Informal settlements are a very specific type of urban space that generally does not have access to basic services because the settlement is 'illegal'. Although this makes it difficult to compare the situation of informal settlements with other urban areas that would include both informal and formal urban areas, our analysis indicates very clearly that there are stark differences even within cities. This finding is particularly important when considering the challenges of maintaining public health in urban areas of developing countries, which can be affected by high rates of rural-urban migration (Bieker et al., 2010), protracted armed conflict (ICRC, 2015), and epidemics of infectious diseases (Brainard et al., 2015).

Person responsible for collecting water

For both urban and rural areas the greatest proportion of households identified an adult woman as the main person responsible for collecting water and in all individual surveys an adult was most often identified as the main person responsible for collecting water. However, the gender of the person responsible for collecting water in most households varies between both countries and regions.

In 15 surveys, including all of those from sub-Saharan Africa except the informal settlement of Mombasa, Kenya, water collection is more commonly reported as a woman's responsibility in both rural and urban areas. Surveys from the remaining 14 developed and developing regions had proportionately more households indicating a man as the main person responsible for collecting water in urban areas, and in rural areas of just four of these, proportionately more households identified a woman as responsible for collecting water. Thus, contrary to many reports (Ferguson, 1986; Crow, 2001; Buor, 2004; Sultana, 2009; Baguma et al., 2013), our findings indicate that in many regions, the majority of households do not report collecting water is a woman's responsibility.

There are several possible explanations for our findings. Traditional cultural and religious practices may determine who is tasked with fetching water at locations away from home, and traditional practices may change over time, or with migration or urbanisation. Rural-urban migration for employment may mean that in urban areas there are more households comprising only men, or that 'traditional' gender roles for household chores typical of rural areas are not observed by younger generations living in urban areas. Increasing access to vehicles or other equipment to bring home more water more easily may also be a factor, particularly where men are more likely to have learned the skills required to drive vehicles or operate equipment. An increase in informal water vending may lead men to take responsibility for obtaining water if they control or manage household monetary transactions. In areas of armed conflict, men may replace or escort women during water collection for safety reasons, and therefore be seen as the ultimate person responsible for water collection. Alternatively, it is possible that the image of the female water carrier is simply not true in many parts of the world, and was extrapolated from observations in sub-Saharan Africa.

However, in sub-Saharan African countries water collection is most often a responsibility of women, and in rural areas of other regions (e.g. Afghanistan and Suriname), women play an important role in accessing and securing household water. In these regions, the inclusion of women's perspectives is likely to be particularly important to voice community needs for household water security against the competing demands of other groups (Baguma et al., 2013). This is especially so, since case studies from Panama, Philippines, and Senegal indicate that as service provision is formalised and institutionalised men tend to take the lead, making skills training and affirmative actions in employment and water management intrinsic components of policies to include women in formal water work (Reyes, 2014). Since research has shown that women tend to prioritise investments in drinking water more than men and that equal participation in water and sanitation increase efficiency and sustainability (WSP and IRC, 2000; Chattopadhyay and Duflo, 2004), promoting gender equality in water management can also be a way to lift the water issue on the political agenda and to catalyse lasting improvements in access to water and sanitation services.

Time to get water and come back

Combining all surveys, the mean time taken to get water and come back is 28 minutes. Statistically significant differences were found in urban versus rural mean time to collect water and return in 19 surveys. However, the actual mean time differences are not large (ranging from 2 to 13 minutes) and indicate that once water must be sourced from out of the home or yard, return trip water collection times are similar in rural and urban areas. The data cannot demonstrate whether this is due to similar distances to off-plot water sources in rural and urban areas, or other factors. For example, it is possible that crowding and queueing times may be longer in urban areas, even if actual distances to water points are reduced. It is probable that people in rural areas also need to collect firewood or perform other types of informal reproductive or manual labouring work that takes up their time and energy. Particularly if combined with poorer health, limited access to health services and poverty, as is often the case in low-income households of rural areas and some urban areas, fetching water may exacerbate water insecurity and be a barrier to sustainable development. These differences are likely to cement existing inequalities or poverty and increase the risk of them being transferred across generations.

The data are also limited in that they indicate only the time taken for one trip for water collection. The surveys do not account for the number of trips required to obtain sufficient water for household needs or differences which create barriers to access for vulnerable people. Household needs are likely to vary greatly according to the number of people in the household, activities performed in the household, and the health of household members. Barriers to access can be due to environmental factors affecting safety or physical exertion required for water collection (Geere et al., 2010a; Geere, 2015; ICRC, 2015) and in many regions create particular challenges for people with disability (Groce et al., 2011). The number and timing of trips for water collection may also be influenced by the reliability of water supplies. A strategy which has been reported in regions where household water supplies are unreliable, is to collect as much water as possible over many trips for storage at home to cover periods when a public service has broken down (Geere, 2015). These differences in household needs and service reliability may create substantial inequalities in access to safe drinking water which are not reflected by the mean time taken for one trip for water collection (Geere, 2015).

Children and water collection

In all of the 22 surveys with rural-urban comparisons, proportionately more children in rural areas had spent time collecting firewood or water (Annex 6). There were statistically significant differences in the mean number of hours spent fetching water or firewood in the previous week between children from urban and rural households in 15 surveys.

The marked differences in time spent fetching water and firewood between countries may influence the impact which this activity has on childhood growth, health and development. The data cannot indicate how well matched the work of water-fetching is to a child's capacity to safely perform the task, which may vary greatly depending on the child's age, health, and circumstances (Geere et al., 2010a). In some regions, it may take up important opportunities to spend time on other activities, such as completing school work or doing sports activities, and expose children to environmental hazards, physical jeopardy, or physical strain and pain (Hemson, 2007; Geere et al., 2010b). Alternatively, it may be seen as a valuable use of time which makes life better through participation in physical activity and household tasks, or through remuneration (Geere et al., 2010b). Nevertheless, given their greater vulnerability and reduced physical strength compared to adults, it is hard to understand how reliance on children as a labour force to obtain sufficient water for household needs and development can be deemed secure, safe or sustainable.

Monitoring and evaluation of access to water and fetching water

MIC surveys provide a valuable source of basic information about access to water and time per trip in fetching water in many countries. However, it is clear that more detailed information is needed to understand the true impact of the work of fetching water on household resources and individuals and to understand which regions, communities and households face water insecurity. In particular, the following information would provide more insight into the impact of this work:

- Usual number of trips in fetching water per day or week, to estimate total time required for work on fetching water.
- Measured distance to water source or time taken for water-fetching, as self-reported travel time for fetching water may be influenced by recall and has been shown to be an inaccurate indicator of distance to water source (Ho et al., 2014).
- Method of carrying water, as access to equipment which would reduce the strain of carrying water is likely to be affected by poverty and gender (Geere et al., 2010a).
- Health and disability status of individuals in the household and of those who carry water, as this may influence capacity to obtain sufficient water for household needs and effect quantities of water required to maintain household health (Geere, 2015).
- Safety of individuals engaged in fetching water from off-plot sources, which can indicate quality of work and highlight risks related to the working environment.

Disaggregation by social categories, such as ethnicity, race, capabilities, and economic quintile, would enable a better understanding of how different social and cultural groups are affected. This would greatly support efforts to develop differentiated strategies focused on the most marginalised groups in society, in line with the intent of SDG 7 and the Human Rights to Water and Sanitation. Issues related to the working conditions of carrying water could also be strengthened or integrated in the MICs, but considering the recognition of water-fetching as work by the International Conference of Labour Statisticians, the Labour Force Surveys could also provide a suitable framework to look at aspects such as method of fetching, health and safety issues and use of time. In such a case harmonisation of methods to enable comparability will be key.

New approaches to data collection are needed to supplement the information gathered in MIC surveys if we are to better understand the impact of fetching water on water security and sustainable development. Improved data collection could also reduce the overall burden of work due to carrying water, by facilitating improved levels of water service provision and maintenance. Mobile devices and networks have revolutionised communication globally, particularly in sub-Saharan Africa. Researchers have begun to explore their potential to improve monitoring, evaluation and maintenance of water

services, and to leverage improved access to water. For example, mobile devices have been used to support operational management of water distribution in Colombia, monitor data on water level in The Netherlands, advise farmers in Ethiopia and provide urban flood warnings to citizens in Dhaka, Bangladesh (Jonoski et al., 2012) and also to monitor WaSH services in some areas (Tomlinson et al., 2009; Kumpel et al., 2015; Van-Ess et al., 2015).

Mobile devices and networks may provide ways to improve water service provider and user communications for better information-sharing and strengthened partnerships. They may also enhance local capacity to identify and voice community needs for household water security against competing demands of other groups, particularly by engaging water carriers in service monitoring. Improved service monitoring could substantially mitigate detrimental effects of carrying water, by improving reliability and maintenance of water supply systems, and through better communication, enabling households to choose appropriate coping strategies during service disruptions.

Finally, if we are to meet the SDGs and reduce inequalities, estimating the scale of global work on fetching water, and the proportion of households accessing water off-plot to identify who has what he or she needs will be crucial; thus, the importance given to the development of indicators for the 17 goals. With better information and understanding of the constraints under which different groups live we can move forward to SDG 5 on gender, SDG 6 on water and SDG 8 on decent work and economic growth by reducing the global need for fetching water. In particular, proposed changes to monitoring and reporting incorporated in the JMP's 'ladder' for household drinking water (WHO, 2017) which will identify the 'Percentage of population using safely managed drinking water services at home' are appropriate and important strategies to monitor the extent of water-fetching, progress toward SDGs and to flag areas and regions vulnerable to household water insecurity because of location of source of water between now and 2030.

LIMITATIONS

The data represented in figures with combined information from all surveys included in this study were not weighted, and will be influenced by differences in proportional representation of surveys within this dataset. The summary figures are used to indicate the unadjusted data from the surveys included in this report and cannot be generalised to indicate a global picture. However, individual MICs surveys are conducted to a rigorous standard and provide data representative of the country or region of the survey indicated by the survey title, such that it is appropriate for comparisons between surveys to be made.

CONCLUSIONS

The synthesis of MICs data demonstrates that, even if the MDG target on access to safe drinking water has been met, large populations globally still have to physically bring water to their homes. In most countries, this responsibility is predominantly carried by women, particularly in rural areas, yet in urban areas men also take on a substantial share of the burden. The detrimental health and security implications that arise from this informal water provision work highlight an often overlooked dimension related to the definition of 'access to safe drinking water' and one which is a substantial barrier to household water security, sustainable development and achievement of the SDGs. Our findings support the implementation of the JMP's drinking water services ladder and use of 'Percentage of population using safely managed drinking water services at home' as appropriate indicators to monitor progress toward SDGs and to flag areas and regions with substantial numbers of households vulnerable to water insecurity between now and 2030.

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ANNEXES

Annex 1. MICs questions used for the analysis

WS1. What is the main source of drinking water for members of your household?	Piped water	
	Piped into dwelling 11	11⇨WS6
	Piped into compound, yard or plot 12	12⇨WS6
	Piped to neighbour 13	13⇨WS6
	Public tap/standpipe 14	14⇨WS3
	Tube Well, Borehole 21	21⇨WS3
	Dug well	
	Protected well 31	31⇨WS3
	Unprotected well 32	32⇨WS3
	Water from spring	
	Protected spring 41	41⇨WS3
	Unprotected spring 42	42⇨WS3
	Rainwater collection 51	51⇨WS3
	Tanker-truck 61	61⇨WS3
	Cart with small tank/drum 71	71⇨WS3
	Surface water (river, stream, dam, lake, pond, canal, irrigation channel) 81	81⇨WS3
	Bottled water 91	
	Other (*specify*) _____ 96	96⇨WS3
WS3. Where is that water source located?	In own dwelling 1	1⇨WS6
	In own yard/plot 2	2⇨WS6
	Elsewhere 3	
WS4. How long does it take to go there, get water, and come back?	Number of minutes ..... __ __ __	
	Don't know 998	
WS5. Who usually goes to this source to collect the water for your household? *Probe:* Is this person under age 15? What sex?	Adult woman (age 15+ years) 1	
	Adult man (age 15+ years) 2	
	Female child (under 15) 3	
	Male child (under 15) 4	
	Don't know 8	
CL8. Since last (day of the week), did (name) fetch water or collect firewood for household use?	Yes 1	
	No 2	2⇨ CL10
CL9. In total, how many hours did (name) spend on fetching water or collecting firewood for household use, since last (day of the week)?	Number of hours ..... __ __	

Annex 2. Location of main drinking water source rural vs. urban

Country				Location of the water source: In own dwelling	In own yard / plot	Elsewhere	Missing	Total
UN MDG Developed Region								
Montenegro	Area	Urban	Count	2287	19	210	1	2517
			% within area	90.9	0.8	8.3	0.0	100.0
		Rural	Count	1149	260	126	0	1535
			% within area	74.9	16.9	8.2	0.0	100.0
	Total		Count	3436	279	336	1	4052
			% within area	84.8	6.9	8.3	0.0	100.0
Serbia Roma	Area	Urban	Count	892	167	75	0	1134
			% within area	78.7	14.7	6.6	0.0	100.0
		Rural	Count	303	158	145	3	609
			% within area	49.8	25.9	23.8	0.5	100.0
	Total		Count	1195	325	220	3	1743
			% within area	68.6	18.6	12.6	0.2	100.0
Serbia	Area	Urban	Count	3023	43	636	0	3702
			% within area	81.7	1.2	17.2	0.0	100.0
		Rural	Count	1900	232	353	4	2489
			% within area	76.3	9.3	14.2	0.2	100.0
	Total		Count	4923	275	989	4	6191
			% within area	79.5	4.4	16.0	0.1	100.0
Ukraine	Area	Urban	Count	5879	795	666	4	7344
			% within area	80.1	10.8	9.1	0.1	100.0
		Rural	Count	1123	2401	453	0	3977
			% within area	28.2	60.4	11.4	0.0	100.0
	Total		Count	7002	3196	1119	4	11321
			% within area	61.8	28.2	9.9	0.0	100.0
UN MDG Developing Region sub-Saharan Africa								
Ghana	Area	Urban	Count	332	744	3469		4545
			% within area	7.3	16.4	76.3		100.0
		Rural	Count	59	206	7115		7380
			% within area	0.8	2.8	96.4		100.0
	Total		Count	391	950	10584		11925
			% within area	3.3	8.0	88.8		100.0
Kenya Mombasa Informal	Area	Urban	Count	60	59	872	25	1016
			% within area	5.9	5.8	85.8	2.5	100.0
	Total		Count	60	59	872	25	1016
			% within area	5.9	5.8	85.8	2.5	100.0
Sierra Leone	Area	Urban	Count	193	552	3103	8	3856
			% within area	5.0	14.3	80.5	0.2	100.0
		Rural	Count	99	392	7022	25	7538
			% within area	1.3	5.2	93.2	0.3	100.0
	Total		Count	292	944	10125	33	11394
			% within area	2.6	8.3	88.9	0.3	100.0
Somalia (North East)	Area	Urban	Count	1213	967	899	18	3097
			% within area	39.2	31.2	29.0	0.6	100.0
		Rural	Count	137	384	1136	23	1680
			% within area	8.2	22.9	67.6	1.4	100.0
	Total		Count	1350	1351	2035	41	4777
			% within area	28.3	28.3	42.6	0.9	100.0

Somalia (Somaliland)	Area	Urban	Count	1016	580	796	1	2393
			% within area	42.5	24.2	33.3	0.0	100.0
		Rural	Count	277	447	1684	7	2415
			% within area	11.5	18.5	69.7	0.3	100.0
	Total		Count	1293	1027	2480	8	4808
			% within area	26.9	21.4	51.6	0.2	100.0
South Sudan	Area	Urban	Count	41	45	1603	731	2420
			% within area	1.7	1.9	66.2	30.2	100.0
		Rural	Count	26	24	3922	2977	6949
			% within area	0.4	0.3	56.4	42.8	100.0
	Total		Count	67	69	5525	3708	9369
			% within area	0.7	0.7	59.0	39.6	100.0
Sudan	Area	Urban	Count	736	1552	1948	243	4479
			% within area	16.4	34.7	43.5	5.4	100.0
		Rural	Count	367	1680	5679	2573	10299
			% within area	3.6	16.3	55.1	25.0	100.0
	Total		Count	1103	3232	7627	2816	14778
			% within area	7.5	21.9	51.6	19.1	100.0
Swaziland	Area	Urban	Count	770	871	453	1	2095
			% within area	36.8	41.6	21.6	0.0	100.0
		Rural	Count	219	654	1864	2	2739
			% within area	8.0	23.9	68.1	0.1	100.0
	Total		Count	989	1525	2317	3	4834
			% within area	20.5	31.5	47.9	0.1	100.0
Zimbabwe	Area	Urban	Count	2170	1545	1414	5	5134
			% within area	42.3	30.1	27.5	0.1	100.0
		Rural	Count	267	1767	8504	14	10552
			% within area	2.5	16.7	80.6	0.1	100.0
	Total		Count	2437	3312	9918	19	15686
			% within area	15.5	21.1	63.2	0.1	100.0
Other								
Afghanistan	Area	Urban	Count	792	1657	1096	0	3545
			% within area	22.3	46.7	30.9	0.0	100.0
		Rural	Count	1155	1867	6542	7	9571
			within area	12.1	19.5	68.4	0.1	100.0
	Total		Count	1947	3524	7638	7	13116
			% within area	14.8	26.9	58.2	0.1	100.0
Indonesia Papua	Area	Urban	Count	194	410	423	0	1027
			% within area	18.9	39.9	41.2	0.0	100.0
		Rural	Count	114	588	1135	2	1839
			% within area	6.2	32.0	61.7	0.1	100.0
	Total		Count	308	998	1558	2	2866
			% within area	10.7	34.8	54.4	0.1	100.0
Indonesia West Papua	Area	Urban	Count	221	380	237	2	840
			% within area	26.3	45.2	28.2	0.2	100.0
		Rural	Count	279	1143	548	6	1976
			% within area	14.1	57.8	27.7	0.3	100.0
	Total		Count	500	1523	785	8	2816
			% within area	17.8	54.1	27.9	0.3	100.0
Iraq	Area	Urban	Count	14091	1288	6027	0	21406

			% within area	65.8	6.0	28.2	0.0	100.0
		Rural	Count	6217	3441	4636	1	14295
			% within area	43.5	24.1	32.4	0.0	100.0
	Total		Count	20308	4729	10663	1	35701
			% within area	56.9	13.2	29.9	0.0	100.0
Jamaica	Area	Urban	Count	2358	768	491	3	3620
			% within area	65.1	21.2	13.6	0.1	100.0
		Rural	Count	922	781	637	0	2340
			% within area	39.4	33.4	27.2	0.0	100.0
	Total		Count	3280	1549	1128	3	5960
			% within area	55.0	26.0	18.9	0.1	100.0
Kazakhstan	Area	Urban	Count	8043	536	1050		9629
			% within area	83.5	5.6	10.9		100.0
		Rural	Count	1532	2202	2437		6171
			% within area	24.8	35.7	39.5		100.0
	Total		Count	9575	2738	3487		15800
			% within area	60.6	17.3	22.1		100.0
Lao PDR	Area	Urban	Count	876	1525	2328	1	4730
			within area	18.5	32.2	49.2	0.0	100.0
		Rural	Count	1324	5834	6952	3	14113
			% within area	9.4	41.3	49.3	0.0	100.0
	Total		Count	2200	7359	9280	4	18843
			% within area	11.7	39.1	49.2	0.0	100.0
Mongolia Khuvsgul Aimag	Area	Urban	Count	24	6	419		449
			% within area	5.3	1.3	93.3		100.0
		Rural	Count	4	22	1507		1533
			% within area	0.3	1.4	98.3		100.0
	Total		Count	28	28	1926		1982
			% within area	1.4	1.4	97.2		100.0
Mongolia	Area	Urban	Count	1429	208	3123	0	4760
			% within area	30.0	4.4	65.6	0.0	100.0
		Rural	Count	157	294	4877	4	5332
			% within area	2.9	5.5	91.5	0.1	100.0
	Total		Count	1586	502	8000	4	10092
			% within area	15.7	5.0	79.3	0.0	100.0
Nepal	Area	Urban	Count	151	632	437	8	1228
			% within area	12.3	51.5	35.6	0.7	100.0
		Rural	Count	106	1227	3326	12	4671
			% within area	2.3	26.3	71.2	0.3	100.0
	Total		Count	257	1859	3763	20	5899
			% within area	4.4	31.5	63.8	0.3	100.0
Nigeria	Area	Urban	Count	996	1223	5031	1	7251
			% within area	13.7	16.9	69.4	0.0	100.0
		Rural	Count	1604	2509	17701	12	21826
			% within area	7.3	11.5	81.1	0.1	100.0
	Total		Count	2600	3732	22732	13	29077
			% within area	8.9	12.8	78.2	0.0	100.0
Pakistan Balochistan	Area	Urban	Count	2045	275	302	4	2626
			% within area	77.9	10.5	11.5	0.2	100.0
		Rural	Count	2684	1742	4508	52	8986
			% within area	29.9	19.4	50.2	0.6	100.0
	Total		Count	4729	2017	4810	56	11612
			% within area	40.7	17.4	41.4	0.5	100.0

Pakistan Punjab	Area	Urban	Count	27538	5041	5683	113	38375
			% within area	71.8	13.1	14.8	0.3	100.0
		Rural	Count	32526	16866	7450	21	56863
			% within area	57.2	29.7	13.1	0.0	100.0
	Total		Count	60064	21907	13133	134	95238
			% within area	63.1	23.0	13.8	0.1	100.0
Saint Lucia	Area	Urban	Count	404	73	201	0	678
			% within area	59.6	10.8	29.6	0.0	100.0
		Rural	Count	590	123	325	2	1040
			% within area	56.7	11.8	31.3	0.2	100.0
	Total		Count	994	196	526	2	1718
			% within area	57.9	11.4	30.6	0.1	100.0
Suriname	Area	Urban	Count	2280	721	171	4	3176
			% within area	71.8	22.7	5.4	0.1	100.0
		Rural	Count	1206	2035	978	12	4231
			% within area	28.5	48.1	23.1	0.3	100.0
	Total		Count	3486	2756	1149	16	7407
			% within area	47.1	37.2	15.5	0.2	100.0
Vietnam	Area	Urban	Count	2795	1493	708	5	5001
			% within area	55.9	29.9	14.2	0.1	100.0
		Rural	Count	1235	4611	764	3	6613
			% within area	18.7	69.7	11.6	0.0	100.0
	Total		Count	4030	6104	1472	8	11614
			% within area	34.7	52.6	12.7	0.1	100.0
Total	Area	Urban	Count	82849	24175	43871	1178	152073
			% within area	54.5	15.9	28.8	0.8	100.0
		Rural	Count	57581	53890	102326	5765	219562
			% within area	26.2	24.5	46.6	2.6	100.0
	Total		Count	140430	78065	146197	6943	371635
			% within area	37.8	21.0	39.3	1.9	100.0

ANNEX 3. TIME TO GET WATER AND RETURN (IN MINUTES)

Country		Area	N	Mean	Std. Deviation	Std. Error Mean
Afghanistan	Time (in minutes) to get water and return	Urban	911	28.12	31.119	1.031
		Rural	6262	23.25	26.050	.329
Ghana	Time (in minutes) to get water and return	Urban	2185	20.36	18.846	.403
		Rural	6974	28.32	22.066	.264
Indonesia Papua	Time (in minutes) to get water and return	Urban	140	20.44	19.504	1.648
		Rural	1096	18.80	17.547	.530
Indonesia West Papua	Time (in minutes) to get water and return	Urban	130	18.05	12.045	1.056
		Rural	484	19.15	16.486	.749
Iraq	Time (in minutes) to get water and return	Urban	740	26.71	38.612	1.419
		Rural	2603	33.38	39.286	.770
Jamaica	Time (in minutes) to get water and return	Urban	123	21.16	24.117	2.175
		Rural	469	23.68	27.102	1.251
Kazakhstan	Time (in minutes) to get water and return	Urban	756	18.77	18.086	.658
		Rural	2319	19.47	15.883	.330
Kenya Mombasa Informal	Time (in minutes) to get	Urban	805	12.65	20.317	.716

	water and return	Rural	0[a]	.	.	.
Lao PDR	Time (in minutes) to get water and return	Urban	417	10.12	10.278	.503
		Rural	6472	12.31	13.341	.166
Mongolia Khuvsgul Aimag	Time (in minutes) to get water and return	Urban	419	15.11	10.547	.515
		Rural	1504	19.65	19.043	.491
Mongolia	Time (in minutes) to get water and return	Urban	3110	19.08	13.180	.236
		Rural	4852	25.16	25.551	.367
Montenegro	Time (in minutes) to get water and return	Urban	117	38.97	26.200	2.422
		Rural	83	27.04	28.217	3.097
Nepal	Time (in minutes) to get water and return	Urban	439	21.76	28.140	1.343
		Rural	3315	27.69	30.202	.525
Nigeria	Time (in minutes) to get water and return	Urban	4599	19.36	19.508	.288
		Rural	17296	30.49	36.347	.276
Pakistan Baluchistan	Time (in minutes) to get water and return	Urban	207	50.76	58.271	4.050
		Rural	3751	41.51	38.414	.627
Pakistan Punjab	Time (in minutes) to get water and return	Urban	4140	23.56	19.698	.306
		Rural	6364	26.52	26.023	.326
Saint Lucia	Time (in minutes) to get water and return	Urban	26	14.62	13.526	2.653
		Rural	35	21.57	21.360	3.611
Serbia Roma	Time (in minutes) to get water and return	Urban	17	13.35	6.557	1.590
		Rural	98	24.08	35.185	3.554
Serbia	Time (in minutes) to get water and return	Urban	109	47.84	47.596	4.559
		Rural	136	42.07	54.465	4.670
Sierra Leone	Time (in minutes) to get water and return	Urban	2622	23.80	29.552	.577
		Rural	6749	17.39	14.346	.175
Somalia (North East)	Time (in minutes) to get water and return	Urban	746	53.36	60.642	2.220
		Rural	1088	58.18	76.209	2.310
Somalia (Somaliland)	Time (in minutes) to get water and return	Urban	424	65.44	79.154	3.844
		Rural	1564	62.66	77.086	1.949
South Sudan	Time (in minutes) to get water and return	Urban	2105	38.47	58.513	1.275
		Rural	6721	38.74	47.860	.584
Sudan	Time (in minutes) to get water and return	Urban	625	38.94	71.042	2.842
		Rural	5382	52.34	82.683	1.127
Suriname	Time (in minutes) to get water and return	Urban	27	37.59	44.938	8.648
		Rural	776	20.29	23.097	.829
Swaziland	Time (in minutes) to get water and return	Urban	286	24.02	23.851	1.410
		Rural	1794	35.14	31.530	.744
Ukraine	Time (in minutes) to get water and return	Urban	275	21.07	21.169	1.277
		Rural	430	15.94	13.502	.651
Vietnam	Time (in minutes) to get water and return	Urban	87	10.86	9.196	.986
		Rural	572	14.90	17.927	.750
Zimbabwe	Time (in minutes) to get water and return	Urban	1268	20.91	25.869	.726
		Rural	8429	29.55	27.831	.303

[a] Rural value cannot be computed for Kenya Mombasa Informal settlement

ANNEX 4. TIME TO GET WATER AND RETURN (IN MINUTES)

Country		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Afghanistan	Yes	42.093	.000	5.132	7171	.000	4.867	.948	3.008	6.727
	No			4.497	1103.331	.000	4.867	1.082	2.744	6.991
Ghana	Yes	80.607	.000	-15.206	9157	.000	-7.956	.523	-8.982	-6.931
	No			-16.506	4219.265	.000	-7.956	.482	-8.902	-7.011
Indonesia	Yes	4.955	.026	1.027	1234	.304	1.639	1.596	-1.491	4.770
Papua	No			.947	169.000	.345	1.639	1.731	-1.779	5.057
Indonesia	Yes	3.672	.056	-.712	612	.477	-1.101	1.546	-4.138	1.937
West Papua	No			-.850	273.015	.396	-1.101	1.295	-3.650	1.449
Iraq	Yes	4.507	.034	-4.085	3341	.000	-6.661	1.630	-9.858	-3.464
	No			-4.125	1208.274	.000	-6.661	1.615	-9.829	-3.493
Jamaica	Yes	2.021	.156	-.937	590	.349	-2.515	2.686	-7.790	2.759
	No			-1.003	210.191	.317	-2.515	2.509	-7.461	2.430
Kazakhstan	Yes	.200	.654	-1.020	3073	.308	-.703	.689	-2.054	.648
	No			-.955	1158.525	.340	-.703	.736	-2.146	.741
Lao PDR	Yes	19.152	.000	-3.292	6887	.001	-2.191	.666	-3.496	-.886
	No			-4.135	510.832	.000	-2.191	.530	-3.233	-1.150
Mongolia	Yes	37.859	.000	-4.680	1921	.000	-4.537	.969	-6.438	-2.636
Khuvsgul A.	No			-6.374	1238.062	.000	-4.537	.712	-5.933	-3.140
Mongolia	Yes	275.984	.000	-12.268	7960	.000	-6.082	.496	-7.053	-5.110
	No			-13.937	7655.915	.000	-6.082	.436	-6.937	-5.226
Montenegro	Yes	.141	.708	3.075	198	.002	11.938	3.882	4.282	19.594
	No			3.036	168.439	.003	11.938	3.932	4.176	19.700
Nepal	Yes	17.381	.000	-3.898	3752	.000	-5.934	1.522	-8.918	-2.949
	No			-4.115	580.045	.000	-5.934	1.442	-8.765	-3.102
Nigeria	Yes	422.187	.000	-20.012	21893	.000	-11.129	.556	-12.219	-10.039
	No			-27.898	13863.816	.000	-11.129	.399	-11.911	-10.347
Pakistan	Yes	29.770	.000	3.265	3956	.001	9.253	2.834	3.697	14.809
Baluchistan	No			2.258	215.992	.025	9.253	4.098	1.175	17.331
Pakistan	Yes	106.759	.000	-6.246	10502	.000	-2.960	.474	-3.889	-2.031
Punjab	No			-6.617	10265.354	.000	-2.960	.447	-3.837	-2.083
Saint Lucia	Yes	1.157	.286	-1.456	59	.151	-6.956	4.777	-16.515	2.603
	No			-1.553	57.735	.126	-6.956	4.480	-15.925	2.013
Serbia Roma	Yes	5.681	.019	-1.249	113	.214	-10.729	8.589	-27.745	6.288
	No			-2.755	112.412	.007	-10.729	3.894	-18.443	-3.014
Serbia	Yes	.271	.603	.872	243	.384	5.778	6.624	-7.270	18.826
	No			.885	241.154	.377	5.778	6.526	-7.078	18.634
Sierra Leone	Yes	316.227	.000	14.065	9369	.000	6.413	.456	5.519	7.306
	No			10.635	3112.758	.000	6.413	.603	5.230	7.595
Somalia	Yes	1.820	.178	-1.445	1832	.149	-4.830	3.342	-11.383	1.724
(North East)	No			-1.507	1791.931	.132	-4.830	3.204	-11.114	1.455
Somalia	Yes	3.956	.047	.654	1986	.513	2.775	4.245	-5.550	11.100
(Somaliland)	No			.644	656.740	.520	2.775	4.310	-5.688	11.238
South Sudan	Yes	.082	.774	-.215	8824	.829	-.272	1.264	-2.750	2.205

	No			-.194	3036.353	.846	-.272	1.403	-3.022	2.478
Sudan	Yes	11.650	.001	-3.888	6005	.000	-13.399	3.446	-20.155	-6.643
	No			-4.383	833.362	.000	-13.399	3.057	-19.400	-7.399
Suriname	Yes	29.540	.000	3.664	801	.000	17.300	4.722	8.032	26.569
	No			1.991	26.480	.057	17.300	8.688	-.542	35.143
Swaziland	Yes	14.906	.000	-5.710	2078	.000	-11.121	1.948	-14.941	-7.301
	No			-6.974	460.241	.000	-11.121	1.595	-14.255	-7.987
Ukraine	Yes	28.865	.000	3.923	703	.000	5.121	1.306	2.558	7.685
	No			3.574	417.098	.000	5.121	1.433	2.304	7.938
Vietnam	Yes	5.335	.021	-2.058	657	.040	-4.035	1.961	-7.885	-.184
	No			-3.258	203.900	.001	-4.035	1.238	-6.477	-1.593
Zimbabwe	Yes	25.469	.000	-10.394	9695	.000	-8.636	.831	-10.264	-7.007
	No			-10.970	1738.695	.000	-8.636	.787	-10.180	-7.092

a. No statistics are computed for one or more split files; yes = Equal variances assumed; no = Equal variances not assumed.

ANNEX 5. PERSON COLLECTING WATER – URBAN VERSUS RURAL.

				Person collecting water				
Country				Adult woman (age > 15)	Adult man (age > 15)	Female child (under 15)	Male child (under 15)	Total
UN MDG Developed Region								
Montenegro	Area	Urban	Count	21	97			118
			% within area	17.8	82.2			100.0
		Rural	Count	32	57			89
			% within area	36.0	64.0			100.0
	Total		Count	53	154			207
			% within area	25.6	74.4			100.0
Serbia Roma	Area	Urban	Count	9	7	0	1	17
			% within area	52.9	41.2	0.0	5.9	100.0
		Rural	Count	57	35	2	0	94
			% within area	60.6	37.2	2.1	0.0	100.0
	Total		Count	66	42	2	1	111
			% within area	59.5	37.8	1.8	0.9	100.0
Serbia	Area	Urban	Count	17	87	0		104
			% within area	16.3	83.7	0.0		100.0
		Rural	Count	26	106	2		134
			% within area	19.4	79.1	1.5		100.0
	Total		Count	43	193	2		238
			% within area	18.1	81.1	0.8		100.0
Ukraine	Area	Urban	Count	81	192		2	275
			% within area	29.5	69.8		0.7	100.0
		Rural	Count	187	232		0	419
			% within area	44.6	55.4		0.0	100.0
	Total		Count	268	424		2	694
			% within area	38.6	61.1		0.3	100.0
UN MDG Developing Region Sub-Saharan Africa								
Ghana	Area	Urban	Count	1422	433	227	107	2189
			% within area	65.0	19.8	10.4	4.9	100.0
		Rural	Count	5274	860	561	279	6974

			% within area	75.6	12.3	8.0	4.0	100.0
	Total		Count	6696	1293	788	386	9163
			% within area	73.1	14.1	8.6	4.2	100.0
Kenya Mombassa Informal	Area	Urban	Count	358	437	9	4	808
			% within area	44.3	54.1	1.1	0.5	100.0
	Total		Count	358	437	9	4	808
			% within area	44.3	54.1	1.1	0.5	100.0
Nigeria	Area	Urban	Count	2320	1595	463	296	4674
			% within area	49.6	34.1	9.9	6.3	100.0
		Rural	Count	8823	5729	1711	1233	17496
			% within area	50.4	32.7	9.8	7.0	100.0
	Total		Count	11143	7324	2174	1529	22170
			% within area	50.3	33.0	9.8	6.9	100.0
Sierra Leone	Area	Urban	Count	1521	719	280	156	2676
			% within area	56.8	26.9	10.5	5.8	100.0
		Rural	Count	4529	961	936	511	6937
			% within area	65.3	13.9	13.5	7.4	100.0
	Total		Count	6050	1680	1216	667	9613
			% within area	62.9	17.5	12.6	6.9	100.0
Somalia (North East)	Area	Urban	Count	466	196	63	37	762
			% within area	61.2	25.7	8.3	4.9	100.0
		Rural	Count	713	236	97	51	1097
			% within area	65.0	21.5	8.8	4.6	100.0
	Total		Count	1179	432	160	88	1859
			% within area	63.4	23.2	8.6	4.7	100.0
Somalia (Somaliland)	Area	Urban	Count	251	192	28	13	484
			% within area	51.9	39.7	5.8	2.7	100.0
		Rural	Count	1062	445	97	43	1647
			% within area	64.5	27.0	5.9	2.6	100.0
	Total		Count	1313	637	125	56	2131
			% within area	61.6	29.9	5.9	2.6	100.0
South Sudan	Area	Urban	Count	1744	154	192	17	2107
			% within area	82.8	7.3	9.1	0.8	100.0
		Rural	Count	5753	300	617	51	6721
			% within area	85.6	4.5	9.2	0.8	100.0
	Total		Count	7497	454	809	68	8828
			% within area	84.9	5.1	9.2	0.8	100.0
Sudan	Area	Urban	Count	318	213	68	63	662
			% within area	48.0	32.2	10.3	9.5	100.0
		Rural	Count	2812	1410	751	552	5525
			% within area	50.9	25.5	13.6	10.0	100.0
	Total		Count	3130	1623	819	615	6187
			% within area	50.6	26.2	13.2	9.9	100.0
Swaziland	Area	Urban	Count	160	114	6	7	287
			% within area	55.7	39.7	2.1	2.4	100.0
		Rural	Count	1265	345	112	66	1788
			% within area	70.7	19.3	6.3	3.7	100.0
	Total		Count	1425	459	118	73	2075
			% within area	68.7	22.1	5.7	3.5	100.0
Zimbabwe	Area	Urban	Count	959	291	28	9	1287
			% within area	74.5	22.6	2.2	0.7	100.0
		Rural	Count	6859	1202	265	108	8434
			% within area	81.3	14.3	3.1	1.3	100.0

	Total		Count	7818	1493	293	117	9721
			% within area	80.4	15.4	3.0	1.2	100.0
Other								
Afghanistan	Area	Urban	Count	129	488	106	218	941
			% within area	13.7	51.9	11.3	23.2	100.0
		Rural	Count	2922	1864	754	893	6433
			% within area	45.4	29.0	11.7	13.9	100.0
	Total		Count	3051	2352	860	1111	7374
			% within area	41.4	31.9	11.7	15.1	100.0
Indonesia Papua	Area	Urban	Count	75	59	6	2	142
			% within area	52.8	41.5	4.2	1.4	100.0
		Rural	Count	694	261	95	55	1105
			% within area	62.8	23.6	8.6	5.0	100.0
	Total		Count	769	320	101	57	1247
			% within area	61.7	25.7	8.1	4.6	100.0
Indonesia West Papua	Area	Urban	Count	61	64	0	4	129
			% within area	47.3	49.6	0.0	3.1	100.0
		Rural	Count	271	210	10	5	496
			% within area	54.6	42.3	2.0	1.0	100.0
	Total		Count	332	274	10	9	625
			% within area	53.1	43.8	1.6	1.4	100.0
Iraq	Area	Urban	Count	230	499	10	43	782
			% within area	29.4	63.8	1.3	5.5	100.0
		Rural	Count	1136	1497	30	41	2704
			% within area	42.0	55.4	1.1	1.5	100.0
	Total		Count	1366	1996	40	84	3486
			% within area	39.2	57.3	1.1	2.4	100.0
Jamaica	Area	Urban	Count	41	82	3	6	132
			% within area	31.1	62.1	2.3	4.5	100.0
		Rural	Count	159	304	10	10	483
			% within area	32.9	62.9	2.1	2.1	100.0
	Total		Count	200	386	13	16	615
			% within area	32.5	62.8	2.1	2.6	100.0
Kazakhstan	Area	Urban	Count	194	556	1	9	760
			% within area	25.5	73.2	0.1	1.2	100.0
		Rural	Count	651	1616	14	47	2328
			% within area	28.0	69.4	0.6	2.0	100.0
	Total		Count	845	2172	15	56	3088
			% within area	27.4	70.3	0.5	1.8	100.0
Lao PDR	Area	Urban	Count	290	91	20	21	422
			% within area	68.7	21.6	4.7	5.0	100.0
		Rural	Count	4804	970	585	185	6544
			% within area	73.4	14.8	8.9	2.8	100.0
	Total		Count	5094	1061	605	206	6966
			% within area	73.1	15.2	8.7	3.0	100.0
Mongolia KA	Area	Urban	Count	163	192	28	35	418
			% within area	39.0	45.9	6.7	8.4	100.0
		Rural	Count	536	823	74	71	1504
			% within area	35.6	54.7	4.9	4.7	100.0
	Total		Count	699	1015	102	106	1922
			% within area	36.4	52.8	5.3	5.5	100.0
Mongolia	Area	Urban	Count	997	1709	116	295	3117
			% within area	32.0	54.8	3.7	9.5	100.0

		Rural	Count	1549	2830	152	330	4861
			% within area	31.9	58.2	3.1	6.8	100.0
	Total		Count	2546	4539	268	625	7978
			% within area	31.9	56.9	3.4	7.8	100.0
Nepal	Area	Urban	Count	382	24	23	10	439
			% within area	87.0	5.5	5.2	2.3	100.0
		Rural	Count	3035	137	110	36	3318
			% within area	91.5	4.1	3.3	1.1	100.0
	Total		Count	3417	161	133	46	3757
			% within area	91.0	4.3	3.5	1.2	100.0
Pakistan Balochistan	Area	Urban	Count	78	138	6	11	233
			% within area	33.5	59.2	2.6	4.7	100.0
		Rural	Count	2461	1347	198	176	4182
			% within area	58.8	32.2	4.7	4.2	100.0
	Total		Count	2539	1485	204	187	4415
			% within area	57.5	33.6	4.6	4.2	100.0
Pakistan Punjab	Area	Urban	Count	699	3145	90	216	4150
			% within area	16.8	75.8	2.2	5.2	100.0
		Rural	Count	3591	2257	192	241	6281
			% within area	57.2	35.9	3.1	3.8	100.0
	Total		Count	4290	5402	282	457	10431
			% within area	41.1	51.8	2.7	4.4	100.0
Saint Lucia	Area	Urban	Count	12	17		0	29
			% within area	41.4	58.6		0.0	100.0
		Rural	Count	6	31		1	38
			% within area	15.8	81.6		2.6	100.0
	Total		Count	18	48		1	67
			% within area	26.9	71.6		1.5	100.0
Suriname	Area	Urban	Count	19	9	2	2	32
			% within area	59.4	28.1	6.3	6.3	100.0
		Rural	Count	678	105	12	4	799
			% within area	84.9	13.1	1.5	0.5	100.0
	Total		Count	697	114	14	6	831
			% within area	83.9	13.7	1.7	0.7	100.0
Vietnam	Area	Urban	Count	63	22	1	1	87
			% within area	72.4	25.3	1.1	1.1	100.0
		Rural	Count	390	168	13	6	577
			% within area	67.6	29.1	2.3	1.0	100.0
	Total		Count	453	190	14	7	664
			% within area	68.2	28.6	2.1	1.1	100.0
Total	Area	Urban	Count	13080	11822	1776	1585	28263
			% within area	46.3	41.8	6.3	5.6	100.0
		Rural	Count	60275	26338	7400	4995	99008
			% within area	60.9	26.6	7.5	5.0	100.0
	Total		Count	73355	38160	9176	6580	127271
			% within area	57.6	30.0	7.2	5.2	100.0

ANNEX 6. MEAN HOURS SPENT FETCHING WATER OR FIREWOOD IN PREVIOUS WEEK (CHILDREN AGED 5-17)

Country		Area	N	Mean	Std. Deviation	Std. Error Mean
Afghanistan	Hours to fetch water or collect firewood	Urban	1242	6.71	6.527	.185
		Rural	8107	9.27	7.784	.086
Indonesia Papua	Hours to fetch water or collect firewood	Urban	353	2.84	3.637	.194
		Rural	1385	5.39	4.094	.110
Indonesia West Papua	Hours to fetch water or collect firewood	Urban	190	2.82	3.114	.226
		Rural	937	3.68	4.302	.141
Iraq	Hours to fetch water or collect firewood	Urban	1087	3.99	4.120	.125
		Rural	1789	6.53	5.178	.122
Jamaica	Hours to fetch water or collect firewood	Urban	197	1.57	2.832	.202
		Rural	283	1.20	1.345	.080
Mongolia Khuvsgul Aimag	Hours to fetch water or collect firewood	Urban	226	7.37	7.315	.487
		Rural	929	10.10	9.705	.318
Mongolia	Hours to fetch water or collect firewood	Urban	1678	5.88	5.876	.143
		Rural	2587	8.69	9.088	.179
Montenegro	Hours to fetch water or collect firewood	Urban	138	1.58	3.189	.272
		Rural	159	2.10	2.361	.187
Nepal	Hours to fetch water or collect firewood	Urban	720	5.52	5.571	.208
		Rural	4579	7.82	6.609	.098
Nigeria	Hours to fetch water or collect firewood	Urban	5890	4.05	4.416	.058
		Rural	23516	5.00	5.383	.035
Pakistan Balochistan	Hours to fetch water or collect firewood	Urban	537	7.63	7.635	.329
		Rural	4609	6.77	7.216	.106
Pakistan Punjab	Hours to fetch water or collect firewood	Urban	1483	4.56	4.337	.113
		Rural	7652	5.94	5.278	.060
Saint Lucia	Hours to fetch water or collect firewood	Urban	22	1.09	2.022	.431
		Rural	38	.74	.828	.134
Serbia Roma	Hours to fetch water or collect firewood	Urban	20	8.60	7.910	1.769
		Rural	23	4.39	3.751	.782
Serbia	Hours to fetch water or collect firewood	Urban	13	1.85	1.772	.492
		Rural	27	2.56	3.080	.593
Sierra Leone	Hours to fetch water or collect firewood	Urban	3516	3.83	4.647	.078
		Rural	8815	4.19	4.881	.052
Somalia (North East)	Hours to fetch water or collect firewood	Urban	1580	11.34	10.505	.264
		Rural	1390	12.37	11.063	.297
Somalia (Somaliland)	Hours to fetch water or collect firewood	Urban	785	11.03	9.853	.352
		Rural	1802	12.46	10.721	.253
Suriname	Hours to fetch water or collect firewood	Urban	115	1.46	2.433	.227
		Rural	826	1.77	3.210	.112
Swaziland	Hours to fetch water or collect firewood	Urban	352	2.05	1.914	.102
		Rural	3025	2.91	2.584	.047
Ukraine	Hours to fetch water or collect firewood	Urban	59	2.14	1.727	.225
		Rural	229	2.69	2.558	.169
Vietnam	Hours to fetch water or collect firewood	Urban	101	7.28	7.765	.773
		Rural	821	7.09	6.199	.216