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Water accessibility and women's participation along the rural-urban gradient: A study in Lake Victoria Region, Kenya

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Small towns and cities in Sub-Saharan Africa are emerging as hotspots of population growth. This paper considers the case of the small but rapidly growing town of Bondo in the Lake Victoria region of Kenya, and its surrounding peri-urban and rural settlements. The study objectives are to examine: a) alternative indicators of households' accessibility to improved water sources along the urban-rural gradient; b) households' water collection and storage practices; and c) women's involvement in community-level efforts to improve water-service provision. Data were collected through interviews of 307 women from urban, peri-urban and rural settlements in 2011. By studying different kinds of settlements in the same geographical region, the paper shows how each kind has its own unique characteristics and development needs. Results show that peri-urban settlements are not just an intermediate space between the rural and the urban; instead, these settlements pose very different kinds of challenges than those of their rural and urban counterparts. Despite efforts by donor and government agencies to promote participation among women, study results indicate that women participate only marginally, with lowest participation observed among women from peri-urban areas. Innovative ways that agencies can engage more women to improve water service are discussed.

Keywords: Water accessibility, urbanization, Sub-Saharan Africa, gender, secondary urban centers, Kenya.

INTRODUCTION

Global demographic predictions indicate that small cities and towns with population under 500,000 will be hot spots of urban population growth in the near future (Cohen, 2006). Yet, until quite recently, most donor and government efforts, as well as academic research, focused on large metropolitan areas, and small cities and towns received little attention (Cohen, 2006). This is particularly so in the case of Sub-Saharan Africa, where the pace of urbanization is the fastest globally and providing basic services to rapidly growing small towns remains a daunting challenge. It is projected that unless investments in water supply accelerate, Sub-Saharan Africa will not meet the target set by the Millennium

Development Goal to halve the proportion of households without access to clean water (UNDP, 2006). As a recent UN habitat report observes, meeting this target in "large urban areas, and small towns or large villages (and anything in between) will require different approaches and governance systems, from the point of technical choices, appropriate institutional arrangements, capacity-building and sustainable financing mechanisms" (Alabaster and Osinde, 2007).

To delve deeper into the question of why different approaches are needed for different kinds of settlements (rural, urban and peri-urban), and how these approaches should be structured.

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This study examines water accessibility in the small but rapidly growing town of Bondo, in the Lake Victoria Region of Kenya. A significant point of departure from previous studies is that we not only consider water accessibility in the town of Bondo, but also in its surrounding peri-urban and rural settlements. Along this urban-rural gradient, we examine: a) households' accessibility to improved water sources; b) water collection and storage practices followed by households; and c) women's involvement in community-level efforts to improve water-service provision and sustainability.

Bruggen et al. (2009) have identified the main causes of urban water-supply problems in Sub-Saharan Africa as population growth, lack of infrastructure and limited water resources. In Kenya, where less than half of the population of 40 million has access to piped water (KNBS, 2009), scarcity of water resources is the factor most often cited as hindering rapid improvement of access to safe water. -Eighty percent of Kenya is classified as either arid or semi-arid (UN-WWAP, 2008). Rainfall distribution is highly variable throughout the year and seasonal rainfall has become less reliable in recent years (UN-WWAP, 2008). The country's population has continued to grow rapidly. If current population trends continue, by 2020 the country will have 56.5 million people, and per capita water availability will be 359 m³/yr, about 20 percent of the per capita availability in 1969 (UN-WWAP, 2008).

Within Kenya, the Lake Victoria region has been identified as a hot spot for rapid urbanization (Odada et al., 2009). In recent decades, many small towns have sprung up along the Lake's shores and in its catchment basin (UN-Habitat, 2008; Odada et al., 2009). The dominant drivers of urbanization are rural-to-urban migration and the expansion of urban areas through annexations. In some cases, such as that of our study town, Bondo, the transformation and reclassification of rural markets into small urban administrative centers has emerged as a significant driver of urbanization. This kind of development, which follows from administrative decisions rather than an organic process of growth makes the challenge of basic service provision in secondary urban centres even more severe, as we show in this paper.

Kenya produced its first water master plan in 1974, with a clear aspiration to provide piped water to all Kenyans by 2000 (GoK, 1999). Unfortunately, from the 1970s through the 90s, the country's water sector was beset by a range of problems, including lack of clear goals, limited financing relative to growing needs and conflicts amongst different ministries over water policies. Water problems exploded as infrastructure became severely dilapidated or virtually collapsed in some cases due to lack of maintenance. In 2000, Kenya began developing a new policy framework, which became the 2002 Water Act. The Act called for increased participation by the private sector, NGOs, and local communities, to accelerate water

supply and ensure sustainability (MWI, 2007). It emphasized the involvement of marginalized groups, particularly women from low-income settlements, in town-level forums so that their needs could be taken into account in planning for water distribution. Specifically, the Act required that women constitute at least 30% of the network of water-kiosk managers (MWI, 2007). This emphasis on women was predicated on the assumption that women have a larger stake in a well-functioning and sustained water supply because they are the ones who bear the burden of collecting water (MWI, 2007). In this paper, we examine the nature and extent to which women are currently involved in various water-related initiatives and how involvement varies along the rural-urban gradient.

METHODS

Description of the study area

Bondo is located about ten kilometres from Lake Victoria and has a population of about 39,000 (KNBS, 2009). Bondo was established in the early 1920s as a small market centre. Its population growth was constrained by limited government investments in infrastructure, which made the town unattractive to people migrating from rural to urban areas. The designation of Bondo Town as a district headquarters in 1993 began to change the town's fortunes, with government posting district administrators and providing some infrastructure. The town's population is expected to increase exponentially in the coming decade, as Kenya's decentralized government system takes effect in 2013. Bondo has already attracted a public University, Jaramongi Oginga Odinga University of Science and Technology. The town's projected population growth to 54,000 by 2015 will probably be surpassed by thousands of people.

Bondo's water provider is Siaya-Bondo Water Supply Company (SIBO), appointed by the Lake Victoria South Water Service Board (UN-Habitat-Bondo, 2008). SIBO draws water from the Yala River about 6 km north of the town. The town has limited water infrastructure, but in recent years several international organizations have stepped in to boost the company's capacity to increase water supply. These include the UN-Habitat, which funds the Lake Victoria Water and Sanitation Initiative (LVWATSAN). The initiative targets 15 towns on the shores of Lake Victoria in Kenya, Uganda, and Tanzania with the goal of ensuring that the poor enjoy sustained provision of safe water (UN-Habitat, 2008). The initiative is particularly keen to involve stakeholders, mainly those from low-income households, using "Multi-Stakeholder Forums" (MSF). The initiative spearheaded the formation of the Bondo Multi-Stakeholder Forum (UN-Habitat-Bondo, 2008). While the notion of MSF appeals to donors, there has been only limited research on how

Table 1. Socio-demographic characteristics of the sampled women according to settlement type.

Variable	Type of settlement		
	Urban (n=106)	Peri-urban (n = 83)	Rural (n = 118)
Female head of household (%)	17	16.9	37.3
Education level (%)	None	5.7	2.4
	Primary	50.9	65.2
	Secondary education	38.7	25.3
	Post-secondary education	4.7	7.2
	Under 20	12.3	13.3
Age (%)	21 – 29	47.2	42.2
	30 – 39	22.6	26.5
	40 – 49	8.5	7.2
	50 and older	9.4	10.8
	Relies on support from husband or children	49.1	61.4
Sources of income (%)	Agriculture oriented	6.6	3.6
	Small business oriented	34.9	26.5
	Formal employment	9.4	8.4

Source: Survey data.

MSFs work and how they impact participation by the urban poor.

Data collection and sampling

The study used face-to-face interviews with women heads-of-households to examine improvements in water service provision along the rural-to-urban gradient of Bondo Town. A gradient approach was considered more informative in uncovering varied patterns of water access and vulnerability than typical assessments of progress, which look at *urban* water accessibility. Bondo is composed of five major residential settlements which were organized from previous sub-locations as administrative units: Bondo Township, Bar Kowino West, Bar Kowino East, Nyawita, and Ajigo. We interviewed women only, because the study aimed to better understand the perspectives of women on the town-level efforts aimed to increase water service coverage.

The study used stratified random sampling to select households. Residential areas to be surveyed were categorized into three groups: urban (Bondo Township sub-location), peri-urban (Nyawita) and rural (Bar Kowino East, Bar Kowino West and Ajigo). The total number of households in the selected residential areas was 1499, out of which a stratified random sample of 307 households was selected. The sample consisted of 107 of the 527 households in the urban settlement, 78 of the 378 in the peri-urban settlement, and 122 of the 594 in the rural settlements. The selected households represented about 20% of the households in each residential

area. An enumeration map was used to identify the households from the sampled areas. A sample size of 307 was considered sufficiently large to capture households of diverse socio-demographic profile in the study area.

Interview procedure

Interviews were conducted with the help of a research assistant who was familiar with Bondo Town and two staff members of a community-based organization. Interview topics included the household demographic, educational, and socio-economic characteristics; sources of water; water storage and treatment methods; participation in water treatment and sanitation training; and attendance at water meetings.

RESULTS

Socio-demographic characteristics

Table 1 presents the socio-demographic characteristics of the women interviewed.

Female heads of households: Nearly one-quarter (24.8%) of the women interviewed were also heads of their households (Table 1). In rural settlements, nearly twice as many of the sampled households were headed by women as in urban and peri-urban settlements. These women were either single or widowed. Female-headed

households tend to be more vulnerable to lack of water access than other households, because collecting water adds another burden to the household chores that the women have to attend to (Were et al., 2006).

Education. The level of educational attainment is low in general in Bondo, with the majority of women having primary or no education. Rural settlements have the highest proportion of women without any education (15.3%), while peri-urban settlements have the lowest (5.7%). The proportion of women with secondary or post-secondary education is higher in peri-urban and urban areas than in rural areas. Women's literacy level has been shown to affect their access to information related to development issues (Akbar et al., 2007) and their participation in community management of water (Were et al., 2006). In the absence of clearly defined and enforced pro-poor efforts, interventions to increase access to water are likely to marginalize women with little or no education.

Age. The rural areas of Bondo Town are home to a higher proportion of older women than are the peri-urban and urban areas (Table 1). In both the peri-urban and urban areas, the proportion of women aged over 50 years is less than 20%. This age structure has consequences for water-intervention implementation. Younger women are more open to change than their elders and more likely to adopt improved water-access methods, particularly point-of-use water storage and treatment methods (Makutsa et al., 2001).

Sources of income. Formal employment seems to be the privilege of only a few women in the households surveyed, with 3.4% of rural, 8.4% of peri-urban, and 9.4% of urban women relying on this source of income. Where women have a limited budget with which to buy basic necessities, they are unlikely to spend it to purchase clean water, and will likely rely on cheaper unimproved sources (Kremer et al., 2011). A relatively higher proportion of women in the peri-urban and urban areas of Bondo depend on children or spouses for financial support than do women in rural neighborhoods. In rural areas in Bondo, more than 50% of the women rely on agricultural activities for income, which are seasonal and highly climate dependent.

Access to improved water sources

We used the United Nations (UN) definition of improved water sources to evaluate water accessibility in Bondo. The World Health Organization and the United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation (2000) defines improved water sources as including household connections to piped water, public stand pipes, bore holes with hand

pumps, protected dug wells, and collected spring water or rainwater. Unprotected wells and springs and water supplied by vendors or tanker trucks are considered unimproved sources.

According to the survey, 51% of sampled households had access to an improved water source (Figure 1). This finding is consistent with that of UN-Habitat for Bondo (2008). Urban and peri-urban settlements had much better service coverage (68.9 and 67.5%) than rural settlements (11.9%). Most survey respondents had complaints about public stand pipes as sources of drinking water, including overcrowding, high costs, and low reliability (Figure 2). Public stand pipes are vulnerable to all sorts of abuse, ranging from vandalism to people re-selling the water, which is a frequent occurrence. Though considered improved sources, stand pipes and piped-water connections are unreliable and negatively affect the management and sustainability of service provision: when urban residents perceive improved sources to be less reliable or more expensive than unimproved sources, they are less likely to cooperate with institutions to improve outcomes in service provision (Kremer et al., 2011).

Due to problems with piped water and stand pipes, the majority of respondents relied on a "mix" of water sources. The strategy of relying on a mix of water sources is driven by both livelihood needs and as a response to the lack of reliability of improved sources due to poor management practices. Accordingly, when access to safe water is evaluated in terms of both primary and alternative water sources (a source used when primary water source is unavailable), it drops from 50 to 21% of households. Households may turn to vended water, rainwater collection, or ponds when water from improved sources is unavailable. All three of these alternatives, considered "unimproved" sources, are not only unsafe, but also insufficient. For instance, during the rainy season, a majority of households harvest rainwater. Although roof top water harvesting is important for households, it is intermittent, and most households interviewed lack facilities to store rainwater for use during the dry season.¹ Only one household in the sample had invested in water tanks sufficient to store enough rainwater to cover dry spells.

A Kruska-Wallis test was conducted to assess whether the level of importance households attached to alternative sources of water differed based on settlement type. The two predominant alternative sources mentioned by survey respondents were vendors and ponds. Participants were asked to rank them according to a Likert scale, on which 1 = unimportant, 2 = slightly important, 3 = somewhat important, 4 = moderately important, and 5 = very important.

Results of the Kruska-Wallis test showed significant

¹This survey was conducted during the rainy season; a survey conducted during the dry season might find fewer households harvesting rainwater

Figure 1. Percentage of households' access to improved water source.

Figure 2. Respondents' complaints about public stand pipes as sources of drinking water, including overcrowding, high costs, and low reliability.

differences in the level of importance households attached to vendors as alternative sources of water, with $\chi^2 = 156.90$ ($df = 2$, $p < 0.001$). Households in urban settlements were found to have a relatively higher preference for vended water. The mean ranks for urban, peri-urban, and rural households were as follows: $4.7 \pm .79$, 4.14 ± 1.58 , and 2.00 ± 1.37 . The Kruska-Wallis test also revealed statistically significant differences among the settlements in the level of importance households attach to ponds as alternative sources of water, with $\chi^2 = 195.03$ ($df = 2$, $p < 0.001$). Households in rural settlements attached a relatively high importance to

ponds as an alternative source of water. The mean values for urban, peri-urban, and rural households were as follows: 1.43 ± 1.05 , 2.07 ± 1.65 , and 4.43 ± 1.19 .

Vended water is an important alternative water source

Some authors have pointed out that water vendors are prevalent where utility services are poor (Whittington et al., 1989; Kijellen and McGranahan, 2006). The 2009 national census revealed that mobile water providers are becoming a prominent feature in Kenya's towns and cities (KNBS, 2009). Water vendors get water from various sources and the sale price depends on whether the source is a public stand pipe or a pond. Households prefer vended water because they can negotiate terms of payment, something they can't do for water from utilities or public standpipes.

A plethora of mobile water-service providers were observed in Bondo. Water vending is a lucrative business and some women mentioned selling water as an important source of income. Households reported that vendors are reliable and convenient, and save them time and effort that they would otherwise have to devote to water collection.

Water vendors are an alternative source of water even for households with piped water. However, water vendors are not considered to be an improved source (WHO, 2008; UN-Habitat, 2011). Various studies have reported mixed experiences of urban households with vended water (Kiellen and McGranahan, 2006). Our study found that some households perceive water from vendors to be convenient, reasonably priced, and reliable compared to water service from the utility. Householders find vendors convenient because vendors free them from having to spend time collecting water. However, some householders worry about the quality of water provided by vendors. Utilities suspect vendors of vandalizing infrastructure to obtain water to resell. Serious conflicts between vendors and utility staff sometimes occur. The negative view of vendors leads to water rationing by utilities, particularly when they perceive heavy losses to be due to vendors siphoning water from utility infrastructure. Rationing can create a vicious circle in which households, particularly in low-income settlements, begin to perceive utility service as poor and therefore prefer to purchase water from vendors.

Time spent on water collection

Households were asked how long it takes to walk to the water source and back. The majority of residents surveyed (61.2%) spent 30 min or less (Table 2), but 14% spent more than an hour to collect water. Along the urban-rural gradient, peri-urban and rural settlements

Table 2. Time to water source, methods of improving water quality and storing water, Bondo town, Kenya (percentages).

Variable		Settlement type		
		Urban n = 106	Peri-Urban n = 83	Rural n = 118
Time it takes to walk to water and back	Less than 30 min or water on household premises	9.4	9.6	6
	About 30 min	65.1	73.5	28.2
	30 min to 1 h	13.2	3.6	11.1
	One hour or more	12.3	13.3	54.7
Do you treat drinking water?	Yes	86.8	88	89
Predominant method for treatment	Boiling	25	59.7	53
	Adding Water Guard	75	40.3	47
	Water pot	58.5	61.4	72
	Bucket	3.8	8.4	5.9
Method of water storage	Plastic tank – <i>Sky plast</i>	12.3	8.4	10.2
	Plastic jerry can	23.5	20.5	11.9
	Bottled water	1.9	1.2	0

Source: Survey data.

Table 3. Intra-household division of labor, Bondo Town, Kenya.

Variable		Residential area		
		Urban n = 106	Peri-urban n = 83	Rural n=118
Who collects water? (Proportion of times mentioned)	Women alone	66	86.7	36.4
	Women or children	13.2	6	33.1
	Women or husbands	1.9	0	1.7
	Women or vendors	8.5	1.2	1.7
	Husband	0.9	3.6	4.2
	Children or grandchildren	4.7	2.4	11.9
	Vendors	1.9	0	5.1
	Other	2.8	0	5.8

Source: Survey data.

suffered most in terms of the amount of time spent collecting water. A larger proportion of households in rural settlements, 55% of households surveyed spent more than an hour to collect water, while only 13% of households in peri-urban settlements and 12% of households in urban settlements spent more than one hour. This time spent on water collection represents a significant burden as it consumes time that households could invest in more productive socio-economic activities.

Water collection: Intra-household division of labor

Given that several sampled households spend considerable time in collecting water, it is worth

examining how this burden is distributed within the household. Table 3 shows the pattern of intra-household division of labor in water collection along the urban-rural gradient. As the table shows, women living in peri-urban are most disadvantaged because in these areas, relatively fewer options exist for water collection. Results point to a more diverse set of options for women from urban and rural settlements, namely, children and water vendors. However, the motivation behind this strategy may be different among the two settlements. In the urban settlements, relying on water vendors may be a time-saving strategy for women who are involved in a variety of small-business enterprises. It is not clear why women in rural settlements choose to purchase water from water vendors.

Household water treatment and storage methods

Water storage and treatment practices at the household level are somewhat neglected - but critical - intervention points along the chain from water collection to water consumption (Bartlett, 2003; Carpenter, 2003). The survey asked women about the practices they follow to make water safe for drinking, and how drinking water is stored in the households. Preferences for various methods differed along the urban-rural gradient, as shown in Table 2.

Water treatment was found to be a widespread practice among the sampled households. Of the 307 households surveyed, 87.9% reported treating drinking water in some way. The wide spread practice of treating water in the households reflects increased awareness of the dangers of drinking unclean water. This finding counters that of a government report (GoK, 2006) that described water treatment by households in this region to be much less prevalent. Urban dwellers seem to have high preference chemical treatment methods (used by 75% of the urban households sampled), while rural dwellers preferred to boil water (72% of households sampled). This difference may be due to greater availability of various chemicals in the urban area. The majority of the peri-urban dwellers sampled did not rely on chemicals, but boiled water. Peri-urban residents may be doubly disadvantaged in this respect. Unlike rural dwellers, they do not live close to wood resources, and so have to pay for most of the wood they use for boiling water. Unlike urban dwellers, they lack access to water-treatment chemicals, because most shops that sell these chemicals are located in the urban core.

A Kruska-Wallis test was conducted to assess whether the level of importance households attached to different methods of water treatment differed based on settlement type. The two predominant methods mentioned by respondents during the survey were boiling water and treating with chemicals. Participants were asked to rank their preferences according to the five-point Likert scale described above. Results of the Kruska-Wallis test showed significant differences in the level of importance households attach to boiling of water as a method of making water safe for drinking, $\chi^2 = 54.21$ (df = 2), $p < 0.001$. Households from both peri-urban and rural settlements had a relatively higher preference for boiling water. The mean values for urban, peri-urban, and rural households were as follows: 1.73 ± 1.43 , 2.90 ± 1.84 , and 3.52 ± 1.75 . The test also revealed statistically significant differences among settlements in the level of importance households attach to the use of chemicals as a method of water treatment, $\chi^2 = 29.72$ (df = 2), $p < 0.001$. Households in peri-urban and rural settlements had the lowest regard for use of chemical methods of water treatment. The mean values for the urban, peri-urban, and rural households were as follows: 4.13 ± 1.62 , 3.23 ± 1.84 , and 2.78 ± 1.79 .

Some studies have reported use of the Moringatree seeds and leaves to purify water in the Lake Victoria region (Alekal, 2005). Although the tree is grown by communities in the Lake Victoria region, its use in water disinfection does not seem to be popular in Bondo Township. It may be used more often as the cost of chemicals rises. The Moringa tree is reported to have strong nutritional and health benefits, and to improve water quality (Lea, 2010). However, using Moringa to purify water is laborious, because its seeds and leaves have to be crushed and then processed into a coagulant (Alekal, 2005; Lea, 2010). If entrepreneurs recognized the business opportunity that processing Moringa for water purification represents, Moringa could become a popular method to improve water quality and livelihoods in the near future.

The majority of sampled households (65%) reported using earthen pots for water storage. Use of pots is most prevalent in rural settlements, where close to three-quarters of the sample reported using this method. Earthen pots have limited storage capacity but are relatively less expensive than other options. Pots usually allow suspended particulate matter to settle to the bottom, and facilitate water cooling. However, they have wide mouths and do not close as tightly as jerry cans, thus putting their contents at risk of recontamination. A study in Ethiopia found that diarrheal prevalence amongst small boys was associated with drinking water obtained by dipping cups into open containers, while water source and amount consumed were not significant risk factors (Teklemariam et al., 2000). A study in a refugee camp in Malawi found a 69% reduction in fecal coliform levels in water and a 31% reduction in cases of diarrhea when water stored in containers was covered (Roberts et al., 2001).

It is important to note that most household treatment methods work hand-in-hand with proper water storage to eliminate microbiological contamination. For example, use of chlorine or a Water Guard works well with water storage methods where the container remains tightly closed to maintain required levels of disinfectant concentration (Ogutu et al., 2001). Chlorine levels decline quickly (especially if pots are uncovered), which lowers efficiency in eliminating microbiological contaminants (Ogutu et al., 2001). More research is needed to ascertain the relative effectiveness of different treatment and storage options, taken together, in eliminating microbiological contamination. Although efforts have been made in most parts of Lake Victoria to provide households with improved pots for water storage, which increases the efficiency of chlorine water-disinfection, the adoption rate as we found in our survey remains low.

Household participation in water interventions

Household participation in water interventions has been

Figure 3. Women's participation in various water-related interventions along the rural-to-urban gradient.

recognized as an important factor in improving health outcomes and sustainability (Sarah and Katz, 2004). Women's participation was first articulated as one of the six principles of the Dublin Statement for sustainable management of water resources in developing nations (ICWE, 1992). The Dublin Statement recognizes role of women in the provision, management, and safeguarding of water, and calls for policies that address women-specific needs, especially the need to empower women to participate at all levels in water-resources programs, including decision-making and project implementation. Kenya's National Water Services Strategy specified that the number of female operators at public/communal outlets was to exceed 30% by 2009 (MWI, 2007). Community-level participation in water interventions takes the form of multi-stakeholder forums (MSFs), which are also described as "peoples' parliaments." These are intended to be long-term forums for involving stakeholders in town- or city-wide issues, and to provide for long-term democratic governance of water developments. Several donor agencies, including the UN-Habitat, have emphasized women's participation in town-level MSFs for water service provision in the Lake Victoria region (UN-Habitat, 2008).

In this study, women were asked questions to elicit information about the extent to which they were involved in various water-related interventions: did they belong to a water group (formal or informal)? Had they attended a water meeting during the last six months? Had they participated in water-treatment training? And had they

participated in hand-washing training? Figure 3 summarizes findings on women's participation in these activities along the rural-to-urban gradient.

We found very low levels of participation in water interventions, despite all the attention to women's participation in these activities. Only 2.3% of the 307 households interviewed belong to a water group, and only 4.2% had attended a water meeting during the six months prior to the survey. More had participated in some kind of training, 13.4% in water-treatment training and 9.1% in hand-washing training. The number of households belonging to a water group decreased along the rural-to-urban gradient; in fact, none of the urban households were involved in a water group (Figure 3). Similarly, participation in household water treatment and safe storage training was lowest in the urban settlements (9.3%), followed by the peri-urban settlements (15.4%). Interestingly, around a quarter of sampled women from rural settlements had participated in such training. Participation in hand-washing training was also highest among rural women (16.7%). However, participation of rural women in water meetings was found to be much lower (2.6%) than for urban (5.6%) and peri-urban women (6.4%). The relatively higher proportion of women from peri-urban and urban settlements who had attended water meetings may be a result of more access to information about the meetings and greater proximity to the meeting venues. The interviews revealed that the local government representative, the chief, calls and chairs most of the water meetings. Announcements about

Figure 4. The main actors involved in efforts to improve household access to safe water

upcoming water meetings were made during *barazas* at the chief's office, also located in urban areas. The local administration could consider alternative strategies, such as rotating venues, for the meetings.

The lack of informal women's groups in the urban core is rather surprising. One reason for this may be that most of the public investment to improve access to safe water is concentrated in the urban core. Thus, there may be limited incentives for women living in the core to self-organize into informal groups to find solutions to water problems. However, in the rural settlements where service deprivation is most severe, the motivation for women to self-organize and find ways to cope with water shortages is higher. This suggestion is consistent with studies on rural water supply and conservation in Kenya that have found informal arrangements in which women form support groups to cope with uncertainty in water supply (Were et al., 2006; Wawire and Nafukho, 2009; Nyangena, 2008). An explanation for the higher proportion of rural women participating in water-treatment, safe-storage and hand-washing training may be the involvement of non-governmental organizations and private agencies in these kinds of interventions (Figure 4). These entities tend to focus on peri-urban and rural settlements where deprivation is most severe and the risks from water-borne diarrheal diseases are high. Thus, it is not surprising that a higher proportion of women in these areas than in urban settlements reported participation in training related to hand-washing, water

treatment, or safe storage. However, we found the proportion of women who reported participating in these trainings to be much lower than what we expected from our reading of the literature.

Interview respondents were asked the name of the agency responsible for organizing the various activities aimed at improving service and/or health outcomes. Figure 4 summarizes the main actors involved in efforts to improve household access to safe water. Women reported that state agencies played a prominent role in organizing hand-washing campaigns. Responses indicate that NGOs and private agencies play the dominant role in organizing water-treatment and safe-storage training, but only a small role in bringing women together in meetings to talk about other water issues. Community-based organizations (CBOs) appear to play marginal role in water-treatment, safe-storage, and hand-washing training, and no role at all in organizing meetings (Figure 4). This is surprising because CBOs are assumed to provide opportunities at the grass-roots level to talk about water issues (Were et al., 2006).

DISCUSSION

We examined water accessibility, collection, and storage practices, as well as women's participation in community-level initiatives along the rural-urban gradient of Bondo, a small town in the Lake Victoria region of Kenya. Small

towns and cities, also referred to as secondary urban centers, have emerged as hotspots of population growth. In these rapidly growing areas, there is a strong dynamic relationship between the emerging urban core and its hinterland. The traditional dichotomy of settlements as either rural or urban, which continues to dominate much policy work, may not be very helpful in this rapidly changing demographic and socio-economic context. As a recent UN Habitat report points out, "the vast majority, and indeed the areas of greatest need fall somewhere in between" (Alabaster and Osinde, 2007).

This space in between, often referred to as "peri-urban," continues to be an ambiguous category. Although recent research has emphasized the need for studying peri-urban settlements, there has been limited systematic investigation of how development indicators, specifically those related to water accessibility and management, vary across rural, urban, and peri-urban settlements. By studying these different kinds of settlements in the same geographical region, we were able to discover each kind of settlement's unique characteristics and development needs. Our study suggests that peri-urban settlements are not just an intermediate space between the urban and the rural. Peri-urban settlements pose different kinds of challenges from those of their rural and urban counterparts.

For several indicators related to water-collection and treatment activities, we found that women in peri-urban areas bear a *greater* burden than their counterparts in rural and urban settlements, so the lack of policy attention to peri-urban settlements is particularly serious. For instance, we found that although peri-urban women have better access to improved water sources than rural women, they face the greater burden in terms of collection activities because they are more likely than either urban or rural women to be the sole collectors of water in their households. Rural women share the burden of collection with children while urban women tend to rely more on vendors. Similarly, peri-urban women bear more of the burden of water treatment than their urban or rural counterparts. Unlike women in urban settlements, who have ready access to relatively inexpensive chemical options, women in peri-urban areas depend mainly on boiling to make water safe for consumption. Women living in rural areas also report boiling as the predominant method of water treatment, but in these areas firewood is more readily and cheaply available than in peri-urban areas. Peri-urban women must invest time not only in collecting water, but also in collecting firewood to boil the water. This does not bode well for the future in terms of environmental consequences: as peri-urban populations increase, so will the demand and competition for firewood for boiling water and cooking.

In most policy literature, water accessibility is measured in terms of availability of an improved source within a certain distance. But often, even if an improved source is available, water supply can be unreliable and/or

inadequate, so households depend on a mix of sources. This study contributes to our understanding of water accessibility by demonstrating what happens when alternative indicators are factored into the evaluation of accessibility. When we evaluated access to safe water in terms of both primary and alternative water sources, the level of access dropped from 50 to 21% of households in our study. This suggests that an examination of both primary and alternative water sources may be important to understand the incidence of water borne diseases.

Further, our study suggests that it is not just the source of water that determines its safety, but also storage and handling practices. We found treatment of water to be a more widespread practice than reported in previous studies. However, storage practices were found to be seriously deficient, particularly in rural and peri-urban areas, where the common practice of storage in open containers exposes households to the risk of recontamination. An approach to improving health outcomes that emphasizes hygiene practices such as hand washing *and* household water treatment *and* safe storage is likely to yield better outcomes than an approach that focuses on only one of these factors. Obviously, training hygiene, water treatment, and water storage requires more resources than training in just one of these components. Therefore, agencies may wish to pool their resources to facilitate comprehensive training, rather than conduct more limited training by themselves.

Finally, our findings suggest that a reevaluation of efforts to decentralize urban water service provision in Kenya is necessary. CBOs have not performed as well as expected, perhaps because they lack capacity, and because they receive little or no support from the government to provide their communities with training in hygiene or water treatment. Most CBOs are unregistered, and consequently not recognized by government agencies, NGOs, or other donor agencies. More case studies of secondary towns would improve our understanding of the possibilities and limitations of CBOs. These organizations represent an unexploited opportunity for accelerating improved water-service coverage. They are well placed to reach marginalized communities that are unlikely to be served by government or private agencies. Because resources will always be limited, governments, NGOs, and private agencies may find it prudent to empower CBOs by training trainers and providing the resources required to facilitate such training.

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