Changes in household access to water in countries of the former Soviet Union

Bayard Roberts1, Andrew Stickley1,2,3, Alexander Gasparishvili4, Christian Haerpfer5, Martin McKee1

1European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, 15-17 Tavistock Place, London WC1H 9SH, UK
2Stockholm Centre on Health of Societies in Transition (SCOHOST), Södertörn University, Huddinge, Sweden
3Department of Global Health Policy, Graduate School of Medicine, University of Tokyo, Japan
4The Center for Sociological Studies, Lomonosov Moscow State University, Russia
5Department of Politics and International Relations, School of Social Science, University of Aberdeen, UK

Address correspondence to Bayard Roberts, E-mail: bayard.roberts@lshtm.ac.uk

ABSTRACT

Background  Evidence from the Early 2000s quantified limited coverage of household water supplies in countries of the former Soviet Union. The study objectives were to measure changes in access to piped household water in seven of these countries between 2001 and 2010 and examine how these varied by household economic status.

Methods  Cross-sectional household sample surveys were conducted in 2010 in Armenia, Belarus, Georgia, Kazakhstan, Moldova, Russia and Ukraine. Data on household piped water were compared with a related 2001 study and descriptive, regression and relative risk analyses applied.

Results  Increases in access to piped water in the home between 2001 and 2010 were recorded in urban and rural areas of all countries, except Kazakhstan. Access remains lower in rural areas. The relative risk of urban households not having piped water in 2010 compared with 2001 diminished by one-third for households with a bad/very bad economic situation [rate ratio (RR): 0.66] and by half for wealthier households (RR: 0.48). In rural areas, the declines were 15% for households with a bad/very bad economic situation (RR: 0.85) and 30% for wealthier households (RR: 0.69).

Conclusions  Despite encouraging increases in access to piped water, there remain significant gaps for rural and poorer households.

Keywords  determinants, former Soviet Union, water

Background

Access to clean water is essential for individual and population health, most notably in reducing the burden of infectious diarrhoeal disease. Globally, around 2.4 million deaths annually (4.2% of all deaths) and 6.6% of the global burden of disease are attributable to poor drinking water, sanitation and hygiene. Access to water is also vital in ensuring dignity and improving quality of life. Hygiene, sanitation, water supply and quality interventions have all shown substantial reductions in diarrhoeal disease prevalence. Perhaps, the most notable of these interventions is the provision of piped water to households which has shown reductions of up to 63% in diarrheal disease prevalence. However, it was estimated that as many as 884 million people did not have access to improved drinking water in 2008. The failures in meeting ‘basic water requirements’ is most evident in the poorer regions of the world such as sub-Saharan Africa and parts of South Asia. However, even in the more developed regions where there is a good
provision of fresh water—such as in Europe—differences in access are encountered both between and within countries. More specifically, it has been shown that a distinct East–West divide exists in terms of the availability of safe drinking water—with the countries in East having a much lower level of access to public water supplies.

The roots of this East–West continental water divide can be found in the attempts to ameliorate the desperate living conditions that had been suffered by much of the population in the Soviet Union prior to the Second World War. Against a backdrop of ongoing industrialization and increasing urbanization a large-scale house-building programme took place from the Late-1950s onwards that resulted in, on average, over two million properties being built annually. While this housing expansion was accompanied by increased access to essential services, such as piped water, ‘Khrushchev’s slums’ (as these early properties came to be known) and the properties that followed them had many deficiencies with regards to their water supply. This was not only because Soviet planning placed an emphasis on quantity rather than quality, but also due to increasing under-investment in the housing sector. In many of the smaller towns and settlements this meant that water was obtained from a pump, while over 60% of individual housing units in larger urban areas had no running water. Interruptions to water supply were also commonplace. In rural areas that had historically been disadvantaged the situation was even worse, as many of them still had extremely limited access to water when the Soviet Union broke apart in 1991.

The subsequent situation has not been favourable to an expansion of access. In many countries, important elements of the state apparatus have been dismantled, leading to shortages of basic goods and services. Economic crises have reduced funds that could have been invested in basic infrastructure for water and sanitation. Some countries face the additional challenge of reaching highly dispersed rural populations and some have faced major political instability and even armed conflicts. In these circumstances, there have been reports indicating that the water supply and sanitation in the region is in crisis.

Our previous research showed that many people still lacked access to household water supplies even in 2001 in a number of countries in the region, particularly in rural areas. It also documented substantial economic differences in access. Understanding the relation between economic status and how it might now be impacting on access to water in this context may be important as research from other parts of the world has highlighted how limited economic resources can be a crucial factor in this respect.

The objectives of this paper are to measure changes in access to piped household water in seven countries of the former Soviet Union between 2001 and 2010 and examine how these changes varied by household economic status. This paper uses data from the Living standards, Lifestyles and Health (LLH) project from 2001 (www.llh.at) and its related follow-up study in 2010, the Health in Times of Transition (HITT) study (www.hitt-cis.net). The 2001 LLH study consisted of household surveys in Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia and Ukraine. The 2010 HITT study included household surveys conducted by the same research teams in the same countries. However, the civil disturbance that occurred in Kyrgyzstan in 2010 meant that the survey there has had to be postponed until 2011, so the results are not yet available for inclusion here.

**Methods**

The LLH and HITT studies used standardized questionnaires to allow direct comparisons between countries (and between the two studies) on demographic characteristics, social, economic and lifestyle characteristics and a range of self-reported health conditions. Except in Russia and Belarus (where all interviews were conducted in Russian), respondents were given the choice of answering in Russian or a national language.

Both studies used a cross-sectional design and multi-stage random sampling with stratification by region and rural/urban settlement type was used. Within each primary sampling unit (about 50–200 per country), households were selected by random route procedures (except in Armenia in the 2001 LLH study which used random sampling from a household list). Within each of the selected households, one eligible person (aged ≥18 years) was chosen (based on nearest coming or last birthday). If after three visits (on different days and times) there was no one at home, the next household on the route was selected. Some pre-specified quota control was used in Belarus, Kazakhstan, Moldova and Ukraine (a combination of region, area, gender, age and/or education level).

Face-to-face interviews were conducted by trained field-workers in the respondents’ homes. In the LLH surveys, response rates varied from 71% to 88% among the countries included. In the HITT surveys, they were somewhat lower from 47.3% in Kazakhstan to 83% in Moldova. In the LLH study, there were approximately 2000 interviews completed in each country with the exception of Russia (4000) and Ukraine (2400) to reflect their larger and diverse populations. In the HITT study, there were 1800 respondents in...
each country, except in Russia (3000) and Ukraine (2200) to reflect their larger and more regionally diverse populations, and in Georgia (2200) where a booster survey of 400 additional interviews was undertaken in November 2010 to ensure a more representative sample.

All persons gave their informed consent prior to their inclusion in the study. The research was approved by the ethics committee of the London School of Hygiene and Tropical Medicine and was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

The outcome of interest in this paper was whether the respondent’s household had piped water, with response options of: inside the house/apartment; only outside the house/apartment or no piped water (with water collected from a well, stand pipe, etc.). The main independent variable of interest was household economic status which asked respondents how they rated their current household economic situation (with response options of very good, good, average, bad and very bad). Our previous research has found that this is a more valid measure of the economic situation of a household than measures of income, given the extensive use of barter in some parts of this region.

Data analysis
We firstly described the respondents’ characteristics from the 2010 HITT study (Table 1), and then compared access to piped water between the 2001 LLH study and 2010 HITT study for each of the study countries (Table 2). Existing data on the proportion of the population living in urban areas and proportion of households with access to piped water were also presented to compare with the new 2010 data (Table 3), using data supplied by the World Health Organisation and the Joint Monitoring Programme for Water Supply and Sanitation17,18 (similar external data at the time of the 2001 study are provided in the earlier paper15).

We then explored the influence of household economic status on household access to piped water and how this varied between 2001 and 2010. This was firstly done descriptively to show percentage changes over the 10 year period by the three abridged categories of self-reported economic sub-group (Fig. 1). Logistic regression analysis was then used to measure the probability (expressed as odds ratios) of not having access to piped water for the ‘average’ and ‘good or very good’ economic sub-groups when compared with the reference group of ‘bad or very bad’, with separate models run for the 2001 and 2010 data (Table 4). Prevalence RRs were then calculated using the Greenland method to observe changes in the relative risk of not having piped water in 2010 compared with 2001 by the three abridged household economic sub-groups of ‘bad or very bad’, ‘average’ and ‘good or very good’ (Table 5).19 The regression and relative risk analyses were undertaken for all the countries combined to show regional patterns and to ensure sufficient statistical power for all the sub-groups and adjusted for the variable of country to control for any national-level influences. All data were disaggregated by urban/rural living location, given the major differences in access to water between urban and rural areas in the region. Statistical significance was set at $P < 0.05$.

Results
Table 1 shows the respondents’ characteristics from the 2010 HITT study. The proportion of respondents living in urban areas ranged from 77% in Armenia to 38% in Moldova. These findings are consistent with those from official data sources (Table 2). The range of respondents who felt their households were in a bad/very bad economic situation varied from 7% in Kazakhstan to 44% in Georgia. The findings show substantial increases in access to piped water inside the household between 2001 and 2010 (Table 3). In urban areas, the access increased in all the study countries, from a 4 percentage point increase in Russia (from 89% to 93%) to 13 percentage point increases in Georgia (from 81% to 94%) and Moldova (from 73% to 86%). The improvements in access to piped water within the household were even greater in rural areas, with increases of 43 percentage points in Armenia (from 26% to 69%), 29 percentage points in Belarus (from 35% to 64%), 26 percentage points in Ukraine (from 30% to 56%), 25 percentage points in Moldova (from 5% to 30%) and 23
percentage points in Russia (from 44% to 67%). This is mirrored by declines in the proportions of households with no access to piped water. The exception to this general trend is in Kazakhstan where there appeared to be no significant changes in patterns of access to piped water over the study period in either rural or urban areas. Throughout all the countries of the region, there remain marked differences in access to piped water in the household between urban and rural areas, most notably in Georgia, Kazakhstan and Moldova. Despite the improvements over the decade, access to piped water in the home in rural areas still remains low in all the countries (ranging from 29% in Kazakhstan to 69% in Armenia).

The overall reductions between 2001 and 2010 in households with no piped water inside the home are greater for the average or good/very good economic sub-group when compared with bad/very bad sub-group in rural areas (Fig. 1). Household economic situation predictably showed a strong association with access to piped water in the home in the multivariate logistic regression analysis using both the 2001 and the 2010 data, with households in both urban and rural areas with an average or good/very good economic situation being much less likely not to have a piped water supply than those with a bad/very bad economic situation. This relationship between household economic situation and piped water in the home was more marked in 2010 than 2001 (Table 4).

The findings on the relative risk of not having piped water to the home in 2010 compared with 2001 for the three economic sub-groups are shown in Table 5. The relative risk of not having piped water in the home reduced among all economic sub-groups, but the poorer groups benefited less than the richer groups during the 10 year period. In urban areas, the relative risk of households with a bad/very bad economic situation not having piped water in the home reduced by

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Sample characteristics for type of settlement and economic situation for 2001 survey (n = 18,427) and 2010 survey (n = 16,200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living location</td>
<td>Urban</td>
</tr>
<tr>
<td>Armenia 2001</td>
<td>1220 (61.0)</td>
</tr>
<tr>
<td>2010</td>
<td>1393 (77.4)</td>
</tr>
<tr>
<td>Belarus 2001</td>
<td>1372 (68.6)</td>
</tr>
<tr>
<td>2010</td>
<td>1323 (73.5)</td>
</tr>
<tr>
<td>Georgia 2001</td>
<td>1152 (57.0)</td>
</tr>
<tr>
<td>2010</td>
<td>1051 (47.8)</td>
</tr>
<tr>
<td>Kazakhstan 2001</td>
<td>970 (52.4)</td>
</tr>
<tr>
<td>2010</td>
<td>1000 (55.6)</td>
</tr>
<tr>
<td>Moldova 2001</td>
<td>839 (42.0)</td>
</tr>
<tr>
<td>2010</td>
<td>687 (38.2)</td>
</tr>
<tr>
<td>Russia 2001</td>
<td>2914 (72.7)</td>
</tr>
<tr>
<td>2010</td>
<td>2179 (72.6)</td>
</tr>
<tr>
<td>Ukraine 2001</td>
<td>1630 (67.9)</td>
</tr>
<tr>
<td>2010</td>
<td>1396 (69.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Official data sources for living location and access to piped water in the home (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living location</td>
<td>Piped water in the home</td>
</tr>
<tr>
<td>Armenia</td>
<td>2005</td>
</tr>
<tr>
<td>2005</td>
<td>72 28</td>
</tr>
<tr>
<td>Belarus</td>
<td>2005</td>
</tr>
<tr>
<td>Georgia</td>
<td>2005</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>2005</td>
</tr>
<tr>
<td>Moldova</td>
<td>2005</td>
</tr>
<tr>
<td>Russia</td>
<td>2005</td>
</tr>
</tbody>
</table>

*Living location source: WHO European Health for All Database (http://data.euro.who.int/)
one-third (RR: 0.66 [95% CI 0.58; 0.76]) and for households with a good/very good economic situation it reduced by half (RR: 0.48 [95% CI 0.36; 0.65]) (although these differences between economic groups were not statistically significant at P < 0.05). In rural areas, there was a decline of 15% in the relative risk of not having piped water in the home for households with a bad/very bad economic situation (RR: 0.85 [95% CI 0.82; 0.89]) which is significantly different from the 30% decline for households with an average (RR: 0.72 [95% CI 0.69; 0.75]) or good/very good economic situation (RR: 0.69 [95% CI 0.62; 0.75]).

Discussion

Main findings of this study

This study indicates significant increases in access to water in urban areas and, even more so, in rural areas
throughout the region between 2001 and 2010. The sole exception to this general pattern was seen in Kazakhstan. The worsening situation there may be due to the deteriorating financial conditions that have come in the wake of social, economic and political transition there (World Health Organization, 2009).

The substantial divide between urban and rural areas in the region remains, with high proportions of households in rural areas without access to water within the household. Nearly half of rural households in Moldova still rely on another source of water (such as a well or standpipe) and around 20% or more of rural households in the other study countries still relying on another source of water. There remains a substantial need to expand piped water into these rural houses. The exception to this pattern is Armenia where household access to piped water in the home appears to have substantially improved. This may have resulted from the introduction of performance management in the wake of reforms introduced in 2001 that were aimed at reviving the disintegrating water supply system.20 It could also linked to the fact that many households in Armenia have individually laid private pipes from the mains network to the inside of the house.18

The study also provides evidence of a widening gap between rich and poor in urban areas and, even more so, in rural areas, despite overall improvements. This may reflect a situation in which better-off households take action to connect their homes to a water system, in the absence of investment in public infrastructure programmes. It may also result from the fact that obtaining water incurs more costs proportionally for those who are poorer and have to spend more time travelling further to get it16—thus exacerbating already existing inequity. Although beyond the scope of this study, it is relevant to note the disproportionate impact on the poor of rising costs of water as a result of the privatization of water services throughout much of the region.14,21 This risks poorer households, particularly in rural areas, being left even further behind.

**What is already known on this topic**

There is limited published evidence on the factors influencing access to household water supply in the region. Studies have highlighted ongoing challenges in water supply in Armenia, Belarus, Russia, Ukraine and Kazakhstan.8,20,22,23 Our previous research showed a lack of access to household water supplies in the study region in 2001, particularly in rural areas and poorer households.15 This reflects evidence globally on challenge of providing clean water in rural areas (although the urban-rural gaps are decreasing and narrower in the study region than in Asia and Sub-Saharan Africa)5) and also economic inequalities in access to adequate water supply.5,16

**What this study adds**

The study provides new data on changes to access to piped water supply over a 10 year period in seven countries using a standardized questionnaire. The findings provide valuable evidence that improvements in access to piped water have taken place in the study region but that significant gaps remain, particularly for rural and poorer households.

**Limitations**

First, we could not explore the quality of the household water supply, and the quality of piped water is clearly integral to fully understanding the impact of water supply on health.24,25 Evidence from the study region has shown the variation in the level of domestic water supply quality and

<table>
<thead>
<tr>
<th>Economic category</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Bad/very bad</td>
<td>886 (20.5)</td>
<td>229 (13.5)</td>
</tr>
<tr>
<td>Average</td>
<td>648 (13.0)</td>
<td>400 (7.7)</td>
</tr>
<tr>
<td>Good/very good</td>
<td>79 (9.7)</td>
<td>83 (4.2)</td>
</tr>
</tbody>
</table>

RR, rate ratio.

% is of those within each economic category who did not have household access to piped water (separate for urban and rural location).

RR of not having piped water inside the house in 2010 compared with 2001.
the impact this has had upon diarrheal disease.8 Other reports have also expressed concern about the quality of water supplies in the region.8,14,20,27 Second, the main focus of the LLH and HITT surveys was not on water and so the information obtained on these issues was limited and so validation of responses could not conducted. Third, the sample size was relatively small which prevented detection of significant differences between sub-groups within individual countries (rather than all the countries combined). Fourth, a few small regions were excluded from both studies due to geographical inaccessibility, the socio-political situation and military actions. These regions were in Georgia (3% of the population), Moldova (5% of the population) and the Russian Federation (2% of the population). Similarly, nomadic populations, such as the reindeer herders of the arctic, were also not included. Access to water in these regions and populations may be much worse than in the surveyed population. Lastly, consistent with survey experience in this region generally, response rates were lower in 2010 than in 2001. This could potentially introduce biases into the study if certain locations (e.g. rural/urban) or populations (e.g. demographic or social-economic groupings) were over or under-represented. However, no locations were systematically under- or over-represented in the 2010 surveys. There is evidence from other studies that non-responders are more likely to be at either end of the income spectrum, although with a greater proportion among the poor. However, it is not easy to predict the impact of non-response on the observed rates and we were not able to detect any obvious biases associated with the population characteristics and these broadly matched those from other comparable studies, including findings on access to piped water (Table 2).

Conclusions

There have been encouraging improvements in access to piped water in the countries examined, but significant gaps remain, particularly for rural and poorer households. There is a need for sustained investment in basic infrastructure for piped water in the region that ensures poorer and rural populations also benefit.

Acknowledgements

We are grateful to all members of the HITT Project study teams who participated in the co-ordination and organization of data collection for this working paper. We are also grateful to Prof. Sandy Cairncross for his advice on the study and comments on the draft manuscript.

Funding

The HITT Project was funded by the European Union’s 7th Framework Program, project HEALTH-F2-2009-223344. The European Commission cannot accept any responsibility for any information provided or views expressed.

References


