Findings from a survey of private households in Lagos, Nigeria

Briefing Paper

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RIGSS

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Executive Summary

Groundwater reserves can play a critical role in achieving safe and reliable water supplies across Africa, and borehole ownership has increased in many places, particularly in Nigeria. While private boreholes offer convenient and secure water supply, risks of contamination, over-abstraction and natural or societal shocks threaten to undermine the resilience of this supply. The current study aimed to explore attitudes and behaviours across a demographically representative sample of 539 Lagos residents (drawn from an online survey panel) in relation to groundwater supplies and borehole development.

Key headline findings from the survey are:

- The majority of survey respondents (87%) use either their own private borehole, or access one shared with neighbours, at least once a week.
- Most of those with their own private borehole make this available to neighbours and typically no charge is levied for this.
- Perhaps surprisingly, given high levels of access to borehole supplies, one in six (17%) of respondents used water from an open well at home on at least a weekly basis.
- Regular users of private boreholes are more likely drink this water, compared to those regularly using boreholes shared with neighbours. Water from community boreholes is least likely to be used for drinking purposes.
- Water delivered by tanker or cart, and water accessed by an open well, was typically used for the purposes of sanitation. Few survey respondents used these water sources for drinking water.
- It is widely observed that boreholes are now commonplace in Lagos. Borehole developers are largely trusted, but there is awareness of the not inconsiderable cost and maintenance involved in borehole ownership.
- Overall, respondents felt personal borehole access resulted in clean, reliable (perpetual) and convenient water supply.
- A substantial proportion of respondents perceived no risks from borehole ownership. Of the risks mentioned, most related to cost, maintenance, or risks of contamination; a few also risks from environmental changes or earthquakes.
- Borehole attitudes are largely very positive (more so than attitudes to public water supply), with little variation in attitudes between different types of respondents.
- Most worry about where their drinking water comes from. Those who own a borehole have fewer water-related worries (e.g., how to get enough water each week for their family); and are less likely to treat their water before drinking it.
- Respondents explicitly endorsed the view that water is plentiful and only a minority were concerned about over-abstraction.
- Most express some concern about future environmental and economic risks to water availability and quality. The strongest predictor of these future concerns is worry about climate change.

Introduction and background

Access to safe and reliable water supplies is a key goal for households and governments across Africa. Groundwater reserves can play a critical role in achieving this, and their use has been encouraged and enabled by both governments and non-governmental organisations.

In many parts of Africa, access to groundwater is achieved through actions taken by private individuals and households. The ability to install a private borehole is now within the financial reach of many, and this can often be carried out by contractors on a short timescale and with basic equipment.

Although private access to groundwater provides households with the convenience and security of their own water supply, risks of contamination and over-abstraction threaten to undermine the resilience of this supply. A rapidly rising trend for privately-developed wells and boreholes raises additional concerns about the vulnerability of water supplies to natural or man-made environmental shocks.

The potential scale of the situation is particularly marked in Nigeria where the use of boreholes has increased substantially since 1999 (from 10% of the population to 38% in 2015), with most other forms of water supply, notably piped tap water, falling.

Although we know that many households in Nigeria are now using groundwater supplies, almost nothing is known about how decisions are made by people concerning the way in which they are used and the uses to which they are put. Yet, the choices being made now by households will have long-lasting effects.

In order to better inform our understanding of individuals' perceptions, choices and behaviour in relation to groundwater supplies, we carried out a survey questionnaire of over 500 members of the public in Lagos, Nigeria, in April and May 2017. This survey forms part of the wider project *Resilience In Groundwater Supply Systems* (RIGSS), an interdisciplinary collaboration between academics from the UK and Nigeria working in the fields of economic geography, psychology, hydrogeology and journalism studies.

We report here some of the initial findings from this research. We provide detail on the circumstances, perceptions and concerns of the sample as a whole, and also focus upon the way in which these differ depending on people's access to groundwater supplies. As well as drawing summary conclusions regarding household groundwater use, we highlight remaining gaps in knowledge and offer some suggestions for future research.

Section 1 Methods and Sample Characteristics

The questionnaire was designed by the RIGSS research team and was intended to assess respondents' circumstances, as well as their subjective attitudes and perceptions with respect to water use.

The survey was administered online using survey panels; these are individuals who have previously signed up to participate in online surveys, usually for small cash incentives. The questionnaire was structured using mostly closed-ended items, with several open-ended questions also used where spontaneous responses were sought.

Survey respondents were asked to answer questions relating to their use and attitudes towards a range of water supplies, with a particular emphasis placed on groundwater use. Respondents were also asked about their environmental risk perceptions and for demographic information. The questions asked can be grouped into the following broad categories:

Use of and attitudes towards water supplies (general)

i. Availability of different water sources (e.g. sachet water, piped supplies) and their utilisation
ii. Drinking water preferences and treatment approaches used
iii. Attitudes towards wider availability and resilience of water
iv. Rights (e.g. to use at will) and responsibilities (e.g. to take care of supply)

Use of and attitudes towards groundwater supplies

i. Beliefs about feasibility and ability to secure groundwater access
ii. Access to private and shared groundwater sources
iii. Physical characteristics of boreholes used by respondents (e.g. age, depth)
iv. Perceptions of private groundwater supplies (e.g. reliability, quality)
v. Perceived benefits and risks from household ownership of boreholes

Environmental risk perceptions

i. Perceived risks to present and future water supplies (e.g. costs, access, quality)
ii. Perceived future risks to water supply from political and economic factors
iii. Perceived future risks to water supply from climate change and natural disasters
iv. Climate change risk perceptions

Demographic variables

i. Age, gender
ii. Household type and tenure; household size
iii. Location within Lagos
iv. Income

Margins of error, reporting of findings and sampling

The final survey sample comprised 539 individuals. Descriptive statistics are accurate to within +/- 4% for a 50% finding and to within +/- 2.5% for a 90% finding (95% confidence intervals). This means for example that a finding such that '50% of respondents stated X' has a 95% probability of representing the 'true' value in the population as being between 46% and 54%. This is based on a sample size of 539 and a population estimate for Lagos of 14 million, and assumes that the respondents are randomly sampled from the wider population. Given that the survey is completed online, however, caution should be exercised as to its alignment with the general population of Lagos, particularly in terms of income and associated factors (e.g. household ownership, location). For those findings for which the sample is subdivided (e.g. the perceptions of private vs. shared borehole users) the margins of error will be larger than those referred to above.

Within the report, results may not always sum to 100. This may be due to use of multiple response categories, exclusion of 'don't know' answers, or rounding.

The survey was only made available to individuals living in the State or city of Lagos. Quota sampling was utilised in order to obtain as representative a sample as possible in terms of age and gender.

Section 2 Survey Findings

2.1 Respondent characteristics

The survey sample was broadly representative in terms of age and gender, although was skewed towards younger and male respondents. Across the full sample, 368 were male (68% of the sample) and 168 were female (31% of the sample); three respondents did not specify.

The median age range of respondents was 25-34; a more complete age breakdown is shown in Fig 1.

Respondents provided information about annual personal income. The distribution of income bands across the respondent sample is shown in Fig 2.

Fig. 1 Respondents' age

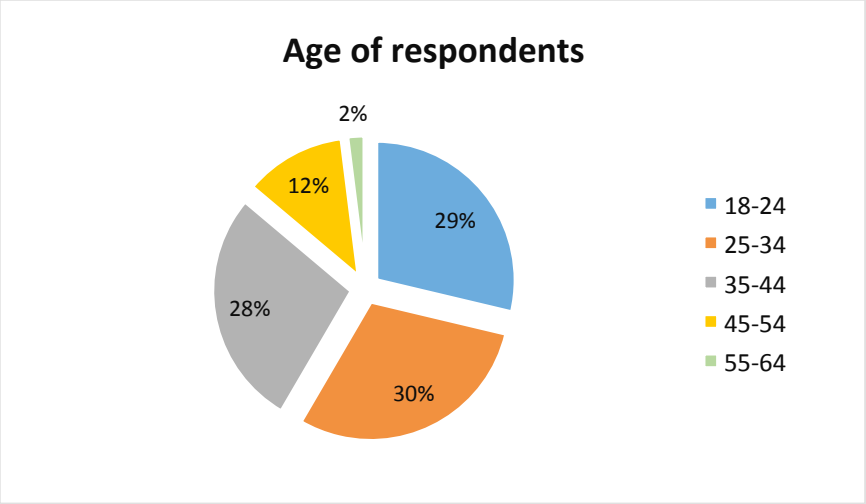
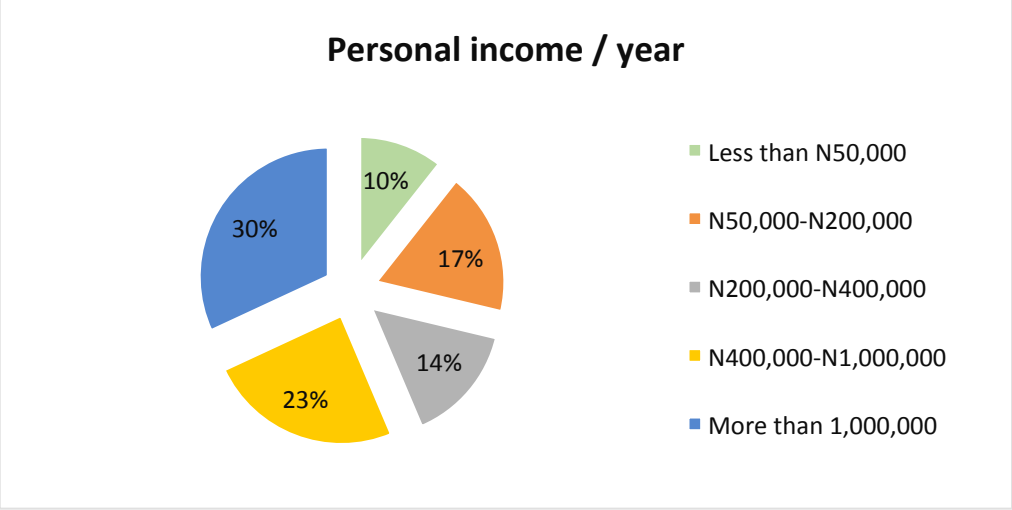
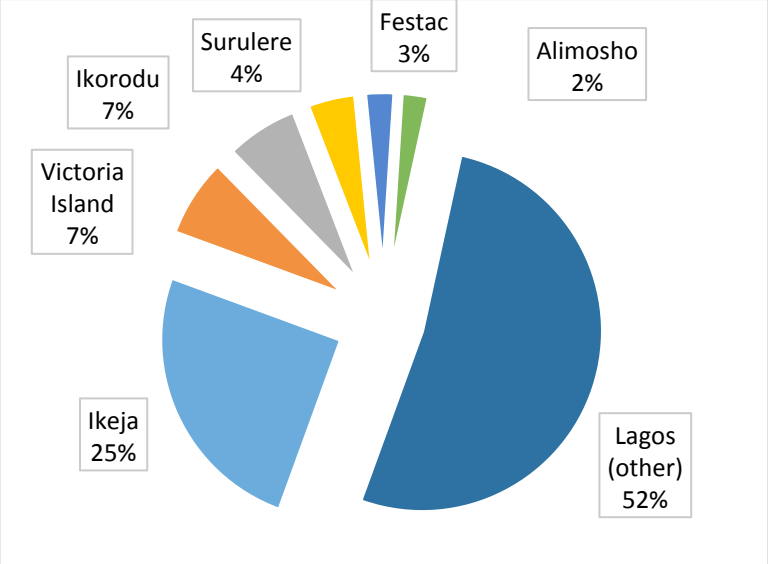


Fig. 2 Respondents' income



Respondents were additionally asked about where in Lagos they lived, having the option to state either 'Ikeja', 'Victoria Island' or another part of Lagos (in which case they provided further information). A breakdown of the more common parts of Lagos within which respondents resided is shown in Fig 3.

Fig. 3 Respondents' location



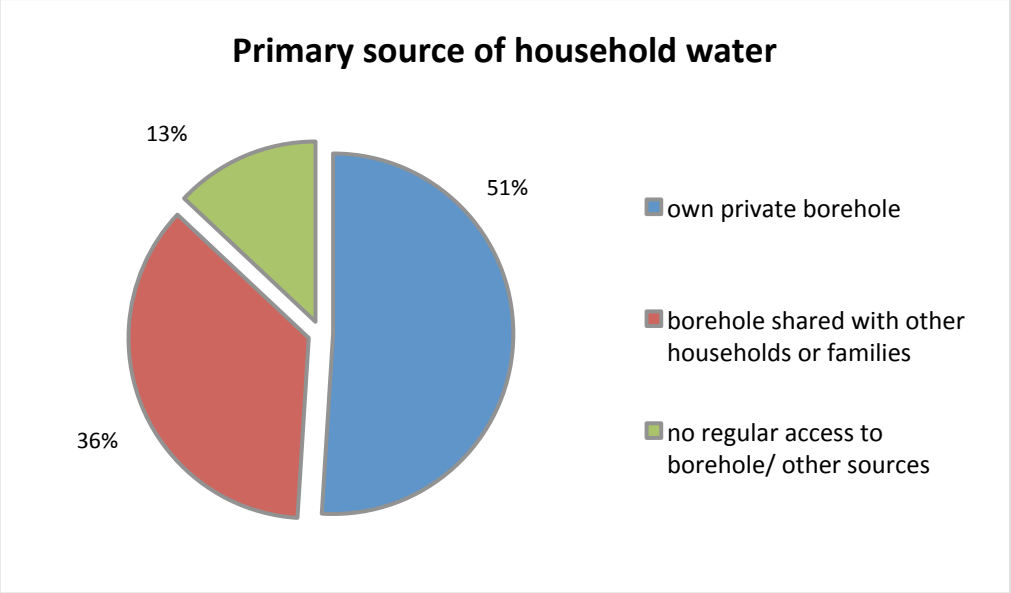
2.2 *Primary water sources and attitudes towards these*

Those completing the survey were asked which of the following sources of water constituted their *primary* source of water: their own private borehole; a borehole shared with other households or families; or, alternatively that they did not have regular access to water from a borehole, or mainly use other sources.

Across the sample, around half (51%) of survey respondents – 277 of the sample of 539 – reported that their main source of water was their own private borehole (Fig. 4). A little over a third (36%) reported that their main water source was a borehole shared with others, with 13% reporting that they did not have regular access to a borehole or mainly used other sources[1].

[1] It should be noted that these figures vary with respect to others given subsequently in this report. For example, whereas Fig.1 shows that half the survey sample reports that their *main* source of water is their own private borehole, elsewhere we note that three-quarters use a private borehole on at least a monthly basis. This likely reflects that some households have access to their own borehole, but do not use it as their primary water source. For example, and as we discuss further below, many of those with access to their own borehole do not typically use this to provide drinking water.

Fig. 4 Primary source of household water



Of the demographic factors measured (age, gender, income, home ownership, home type, household size), only home ownership and home type (house with garden/land) are significantly associated with private borehole ownership. We find no association between income, gender, age, or household size and borehole ownership. Regression analysis (Table 1) shows that home ownership is the strongest predictor of borehole ownership.

Those who own their own home are over five times more likely to have their own borehole.

Table 1. Predictors of private borehole ownership

	B	S.E.	Sig.	Exp(B)
Income	.066	.078	.400	1.068
Home ownership	**1.640**	**.226**	**.000**	**5.153**
Age	-.053	.099	.590	.948
Gender	-.101	.217	.640	.904
Live in apartment/flat	-.056	.369	.880	.946
Live in house without land	-.645	.541	.233	.525
Live in house with garden/land	.316	.367	.389	1.371
Live in house on private estate	.195	.444	.660	1.216
Live in other	-.473	.870	.586	.623
No. of people in household	.010	.019	.590	1.011
Constant	*-.782*	*.637*	*.220*	*.458*

2.2.1 Private boreholes: groundwater access and perceptions of supply

For those survey respondents reporting that their *primary* source of water was their own private borehole, a further series of detailed questions were asked concerning the commission and use of this, as well as perceptions of the supply.

In terms of how they had found a contractor to install their borehole, this was most typically done through word of mouth: 80% of those with private boreholes reported that people they knew told them about the contractor used to carry out the work. Relatively small proportions of people (less than 10%) chose their contractor through seeing their advertisement, or having asked several contractors to quote for the work.

The majority of private borehole owners reported that the drilling contractor used was officially certified (39% of this subsample) and/or that an independent professional supervised the drilling of the borehole (43% of the subsample). A majority were mechanically drilled (67% reported this was how the borehole was installed, excluding 'don't know' responses); the remaining boreholes were reported to have been manually drilled. An electrical pump was the principal means by which water was drawn from these boreholes: over three-quarters (83%, excluding 'don't know' responses) of those whose primary water source was their own private borehole used this approach. A further 20% used a diesel pump to do so, whereas far fewer used a hand, foot or solar-powered pump.

The median age of private boreholes was between 5 and 6 years, with a small proportion (14%, excluding 'don't know' responses) being over 10 years of age. The typical depth of private boreholes was between 100 feet and 200 feet (30 metres to 60 metres).

Our data suggest that whereas people's access to their own private borehole is commonplace, nevertheless this water source is often made available to others. Close to four in five (79%) of those whose primary water supply is their own private borehole make this available to neighbours; around a fifth (19%) make the supply available to others in the community. Most do not charge for access to their own private supply (90% said they did not do so) although others did so at times.

Most of those with their own private borehole make this available to neighbours and typically no charge is levied for this.

There was very strong agreement among private borehole owners that the siting and physical condition can affect the quality of the water provided (see Fig. 5). A majority (67%) also were of the view that they had responsibility for the quality of the water that comes from the borehole; very few felt that the quality of water from their borehole was the responsibility of the government (see Fig. 6). The vast majority of those with their own private borehole agreed that they could rely on both the quality and supply of water from this (see Fig 7).

Figure 5. Perceptions of siting and condition of borehole (private)

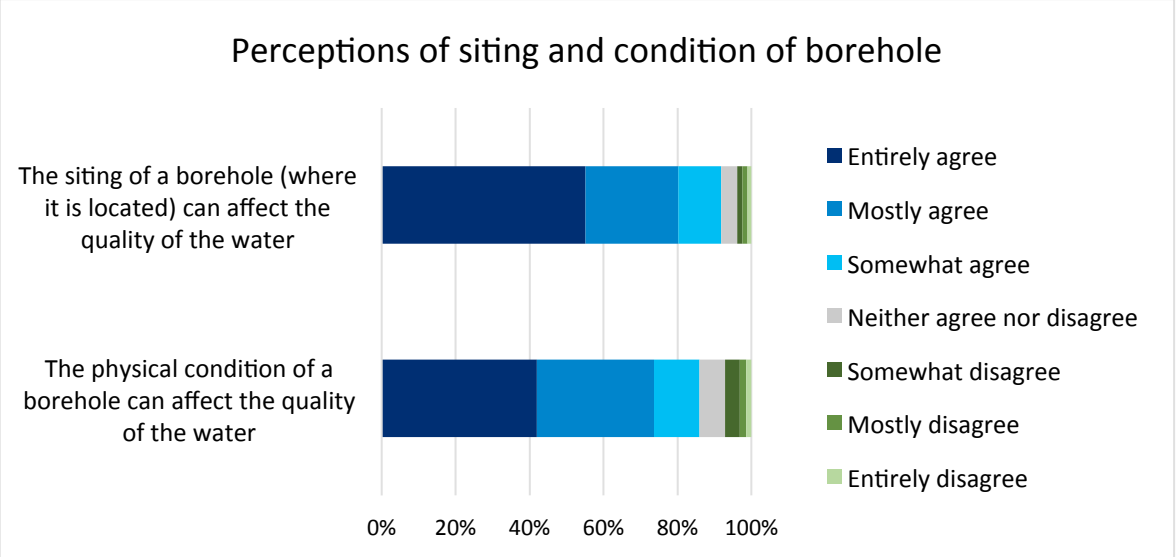


Figure 6. Perceptions of responsibility for water quality (private borehole)

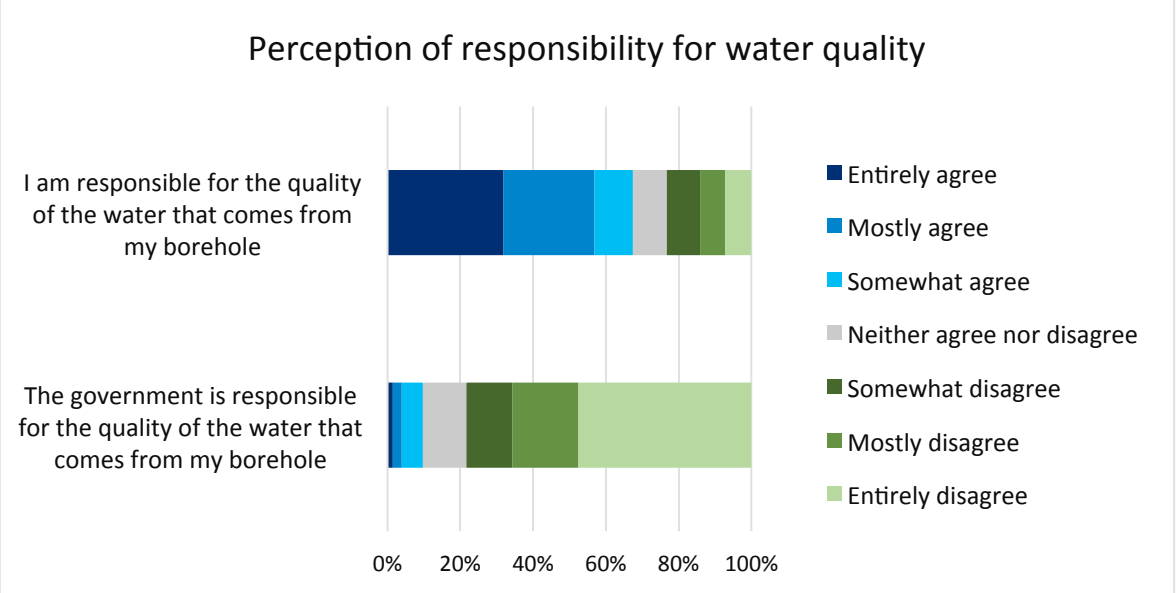
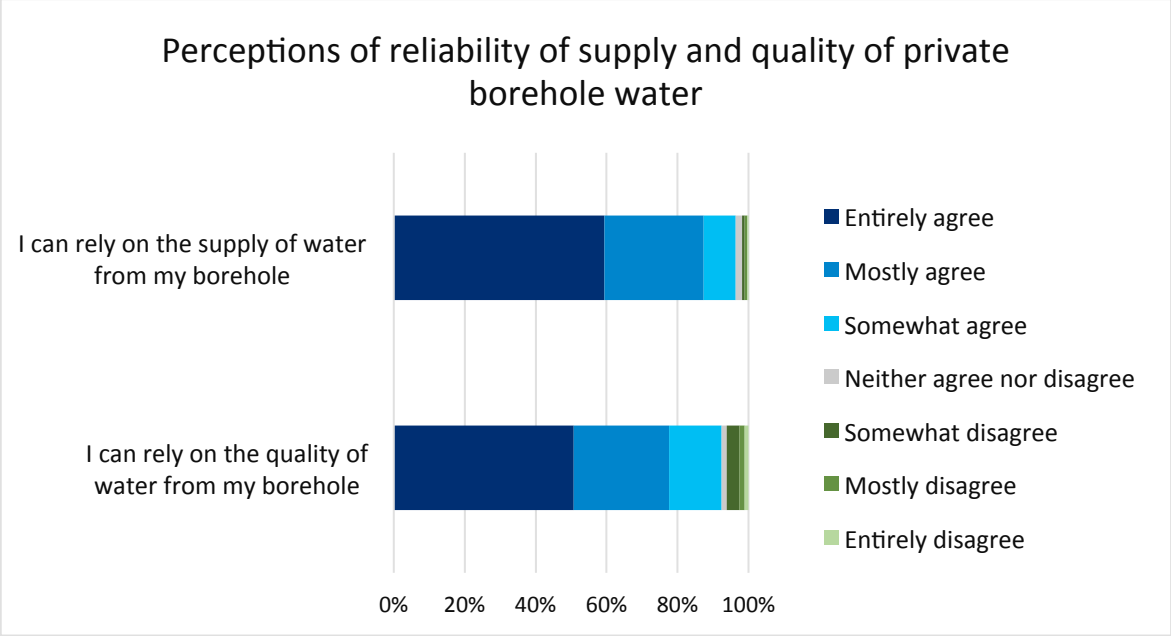


Figure 7. Perceptions of reliability of supply and quality of private borehole water



Those whose primary source of water is their own private borehole consider this to be reliable in terms of quality and supply.

2.2.2 Shared boreholes: groundwater access and perceptions of supply

Those who reported that their main source of water was a borehole shared with neighbours or other households, were asked a similar range of questions to those considered above, though were not asked about the approach used to commission the borehole.

As in the case of private borehole owners, a majority of shared borehole users reported that this borehole had been mechanically drilled (69% of respondents from this subsample, excluding 'don't know' responses), with the remaining respondents indicating this was manually drilled.

An electrical pump was the principal means by which water was drawn from these boreholes: close to nine in ten (91%, excluding 'don't know' responses) of those whose primary water source was a shared borehole used this approach. A smaller proportion used a diesel pump to do so, with few using a hand, foot or solar-powered pump.

As in the case of private boreholes, the median age of shared boreholes was between 5 and 6 years, with a small proportion (26%, excluding 'don't know' responses) being over 10 years of age. The typical depth of private boreholes was between 100 feet and 200 feet (30 metres to 60 metres).

As was found to be the case for private borehole owners, among those whose main source of water is a shared borehole, there was very strong agreement that the siting and physical condition can affect the quality of the water provided (see Fig. 8). A little over half of this sub-sample (57%) were of the view that the owner of the borehole had responsibility for the quality of its water; very few felt that the quality of water from their borehole was the responsibility of the government (see Fig.

9). The vast majority of those using a shared borehole agreed that they could rely on both the quality and supply of water from this (see Fig. 10).

Among those using a borehole shared with neighbours and other households, almost all (98%) stated that, if circumstances allowed, they would like to install a private borehole on their own property.

Figure 8. Perceptions of siting and condition of borehole (shared)

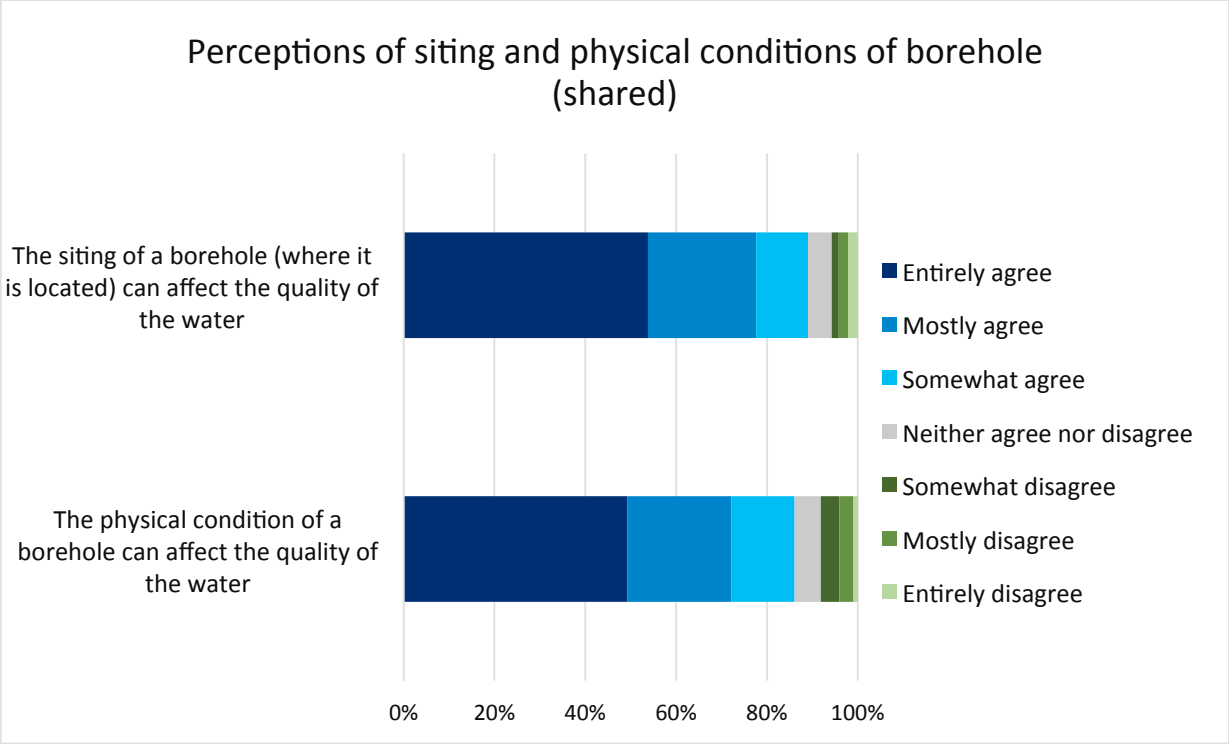


Figure 9. Perceptions of responsibility for water quality (shared borehole)

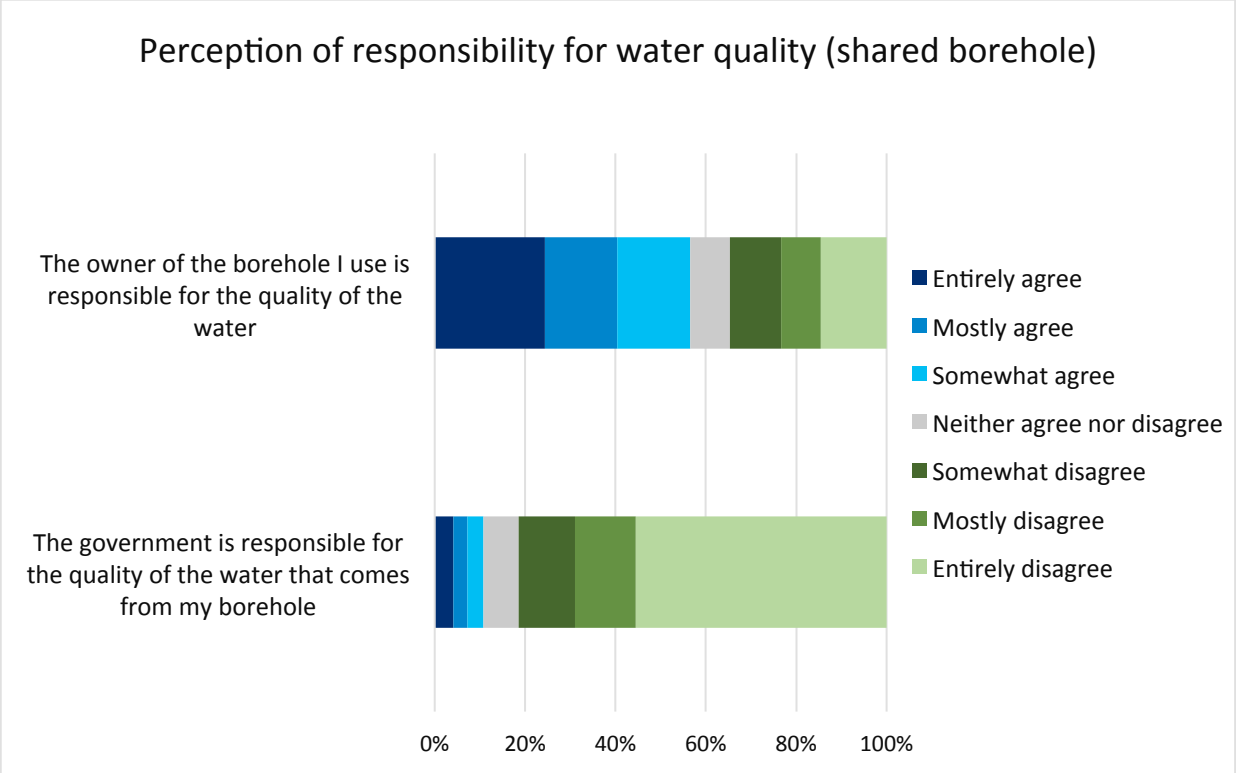
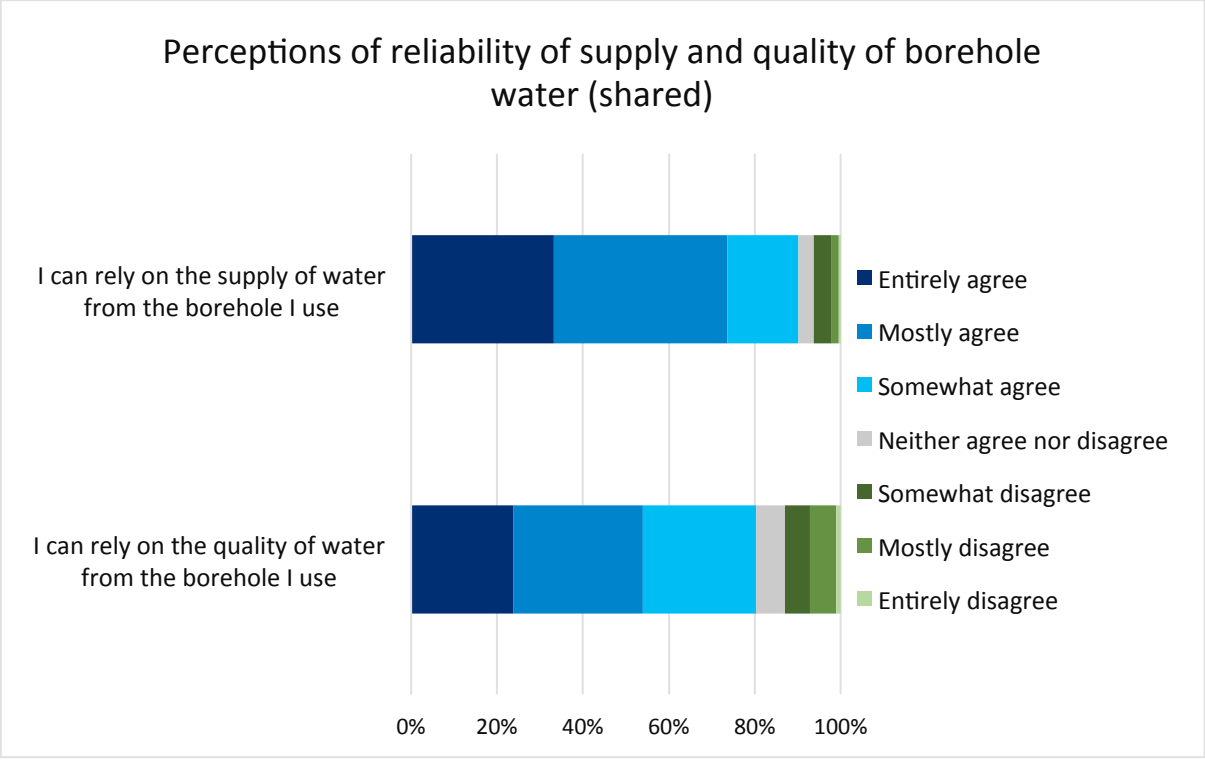


Figure 10. Perceptions of reliability of supply and quality of shared borehole water



2.2.3 Perceptions of those without regular borehole access

A minority of the overall sample (69 respondents, or 13% of the sample) stated that they did not have regular access to their own borehole, or to a shared borehole.

This sub-sample was asked a smaller range of follow-up questions than those reported above. In the case of their perceptions of the relevance of the physical condition and siting of a borehole, and responsibility for water quality, these largely mirrored the findings obtained for those who did have access to private or shared boreholes.

Among those who did not have regular access to borehole water, a majority (90%) stated that they would like to install a borehole if circumstances allowed; 9% stated that they would not like to do so.

2.3 Frequency and nature of use of different water supplies

Irrespective of their primary water source, all survey respondents were asked about the frequency with which they used a range of water supplies. In order to understand in more detail the ways in which these were utilised, we also asked further questions about a range of possible purposes to which water sources were put.

2.3.1 Types of water supplies used

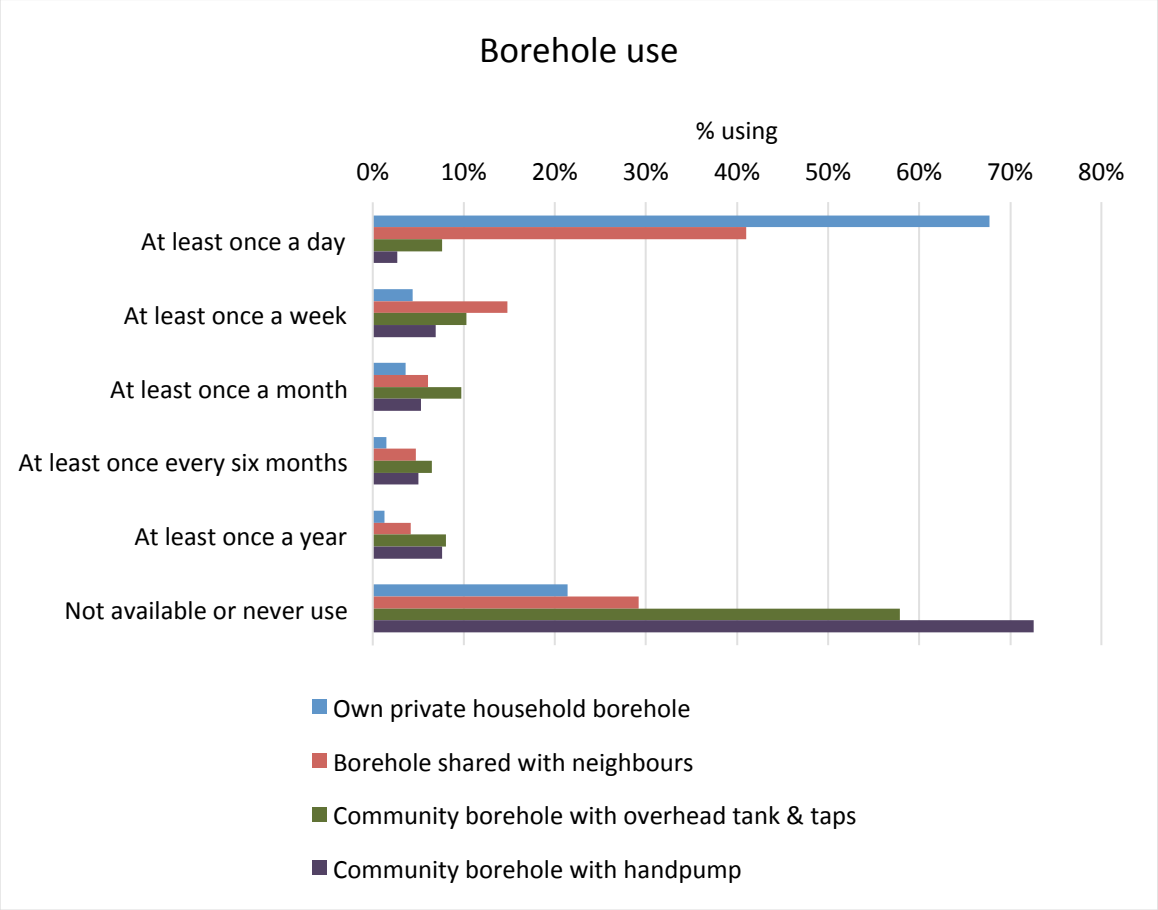
As indicated from section 2.2, we again find that private and shared borehole use is very common among the survey sample. Around two-thirds (68%) of respondents reported making use of their own private household borehole on a daily basis; two-fifths (41%) make daily use of a borehole shared with neighbours – either as well as, or instead of their private household supply (see Fig. 11). Further analysis of cross-tabulated data indicates that private and/or shared borehole use is very common across the survey sample.

The majority of survey respondents (87%) use either their own private borehole, or access one shared with neighbours, at least once a week.

Not shown in Fig. 11, although revealed through further analysis of the survey data, is the proportion of those without access to either of these water sources. Despite access to private and shared household boreholes being commonplace, we also note that some of those responding (7%) have no access to either of these sources, even on an occasional basis.

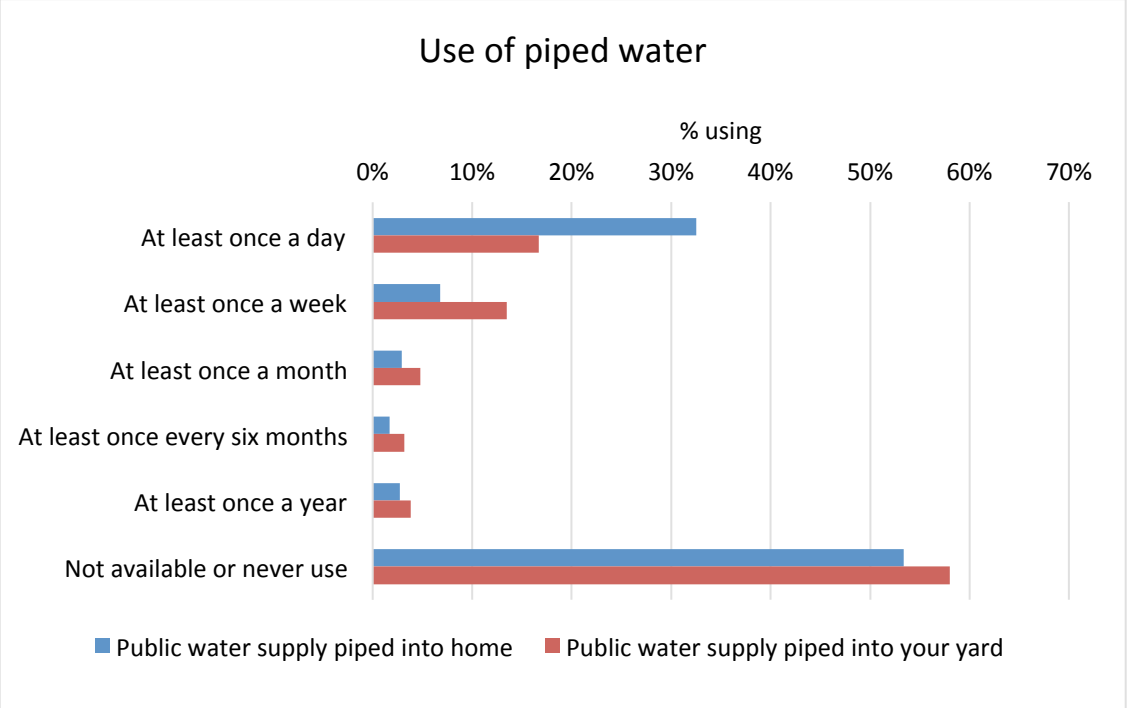
Although less commonly accessed, a significant minority of respondents nevertheless did make use of community borehole supplies. Around a quarter (27%) stated that they used a community borehole with tank/taps at least once a month; 15% of survey respondents reported use of a community borehole with hand-pump on a monthly basis or more often.

Figure 11. Borehole use



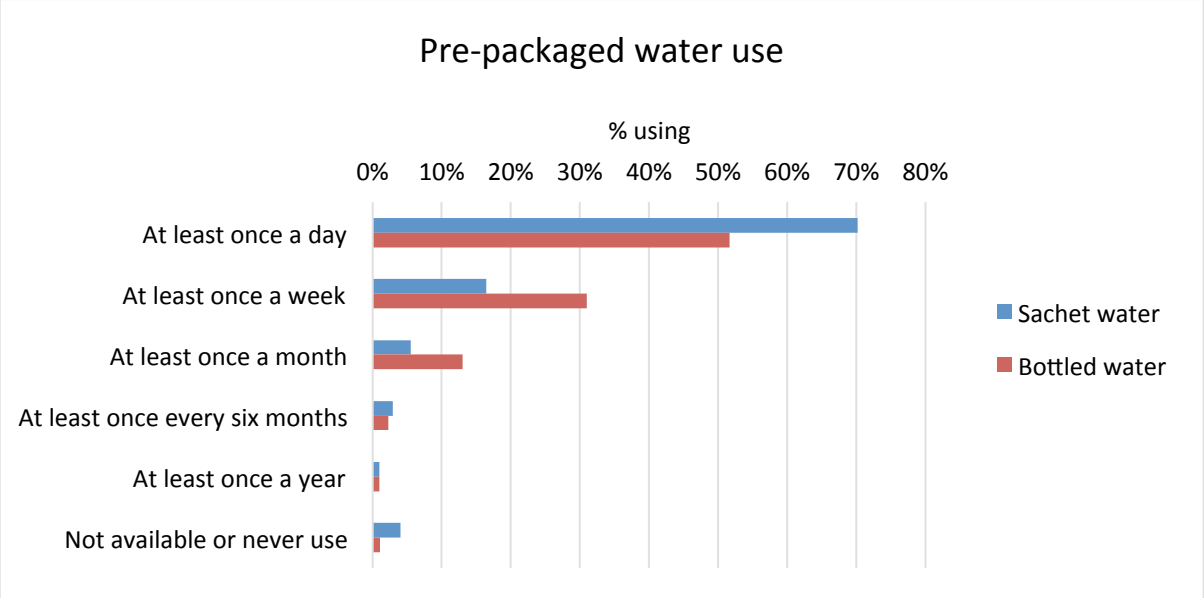
Access to a piped water supply was less common that water obtained through private or shared boreholes (Fig. 12). Nevertheless, in this survey sample at least, around a third of respondents (33%) indicated that they used a public water supply piped into their home on a daily basis. Around one in six respondents (17%) indicated that they made use of a public water supply piped into their yard. It should be noted however that for the most part these represent the same individuals (most of those completing the survey had access to both forms of piped water supply, or neither).

Figure 12. Piped water use



We observe a very high frequency of use of pre-packaged drinking water in the form of sachet and bottled water (Fig. 13). Further analysis of survey data indicates that almost all survey respondents (95%) use sachet water and/or bottled water at least once a week.

Figure 13. Pre-packaged water use



The survey also asked about frequency of use of a range of other, less common, water sources. A public tap or standpipe was used on a weekly basis or more by a quarter (25%) of respondents. Smaller proportions of people accessed water delivered by tanker (8% did so on a weekly basis or more often) or delivered by cart (11% on a weekly basis or more).

Perhaps surprisingly, given high levels of access to borehole supplies, one in six (17%) of respondents used water from an open well at home on at least a weekly basis.

2.3.2 Functions of different water supplies

In cases where survey respondents indicated regular use of any type of water supply – using a source once a month or more – they were also asked the uses to which they put this. Here we consider these water uses in a way that encompasses less frequent uses than those assessed above; that is, we report findings for all those accessing each type of water on an at least monthly basis.

Private household boreholes

We find that water from private and shared boreholes is put to a wide variety of uses. Among the 408 respondents (76% of the sample) who access their own private borehole on a monthly basis or more, the most common uses of this water were for cooking, flushing/cleaning toilets, bathing, and for cleaning dishes as well as clothes. Over 80% of those regularly accessing their own private borehole used their water for these purposes. By contrast, private boreholes were used to provide drinking water for a little over half (58%) of those using them on a regular basis.

Boreholes shared with neighbours

A smaller proportion of the survey sample regularly accessed a borehole shared with neighbours; 332 respondents (62% of the full sample) did so on at least a monthly basis. In common with the uses of private boreholes, this water was typically used for cooking, flushing/cleaning toilets, bathing, and for cleaning dishes as well as clothes. In contrast to private borehole water, these were slightly less common practices, however: between two-thirds (66%) and three-quarters (75%) of those regularly using shared boreholes used water for these purposes. It is notable also that these respondents were also far less likely to use these to provide drinking water: only 30% of those use shared boreholes regularly used this for drinking water.

Community boreholes

A smaller proportion of the overall survey sample regularly used community boreholes. 147 respondents (27% of the full sample) used a community borehole with overhead tank on at least a monthly basis; 79 respondents (15% of full sample) used a community borehole with handpump on a monthly basis or more.

Cleaning and sanitation were among the more common uses to which this water is put. Between half and two-thirds of regular users of community boreholes (with overhead tanks) make use of this water for cleaning clothes and dishes, bathing, and cleaning/flushing toilets. By contrast, less than

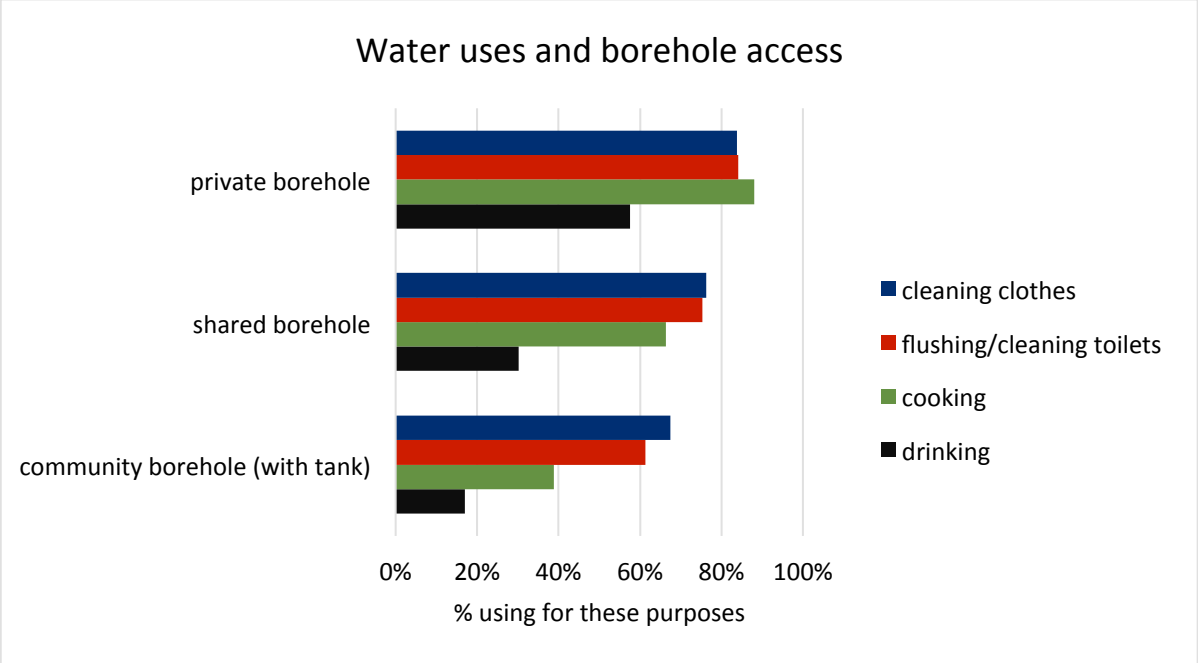
half (39%) of those regularly using this water supply use this for cooking; fewer still – 17% - use this water for drinking.

The more common uses of water from community boreholes (with handpumps) are for bathing and cleaning clothes; over half of regular users put the water to this purpose. By contrast, only around a third (33%) use this water for cooking, and only 14% use this water for drinking.

Regular users of private boreholes are more likely drink this water, compared to those regularly using boreholes shared with neighbours. Water from community boreholes is least likely to be used for drinking purposes.

Fig. 14 shows some typical uses of water supplies from private, shared and community boreholes.

Figure 14. Water uses and borehole access



Piped water supplies

Survey respondents were also asked about the availability and frequency of use of piped water supplies. A large minority of the overall sample (223 respondents, 41% of the sample) regularly accessed water piped directly into their home (many of these also had access to water piped into their yard). In common with the uses to which private borehole water supplies are put, the most common uses of piped water supplies were for cooking, flushing/cleaning toilets, bathing, and for cleaning dishes as well as clothes. Around 80% of those regularly accessing water piped into their home use their water for these purposes. By contrast, only around a third (35%) of those with regular access to piped water in the home use this for drinking purposes.

Water delivered by tanker or cart

Although a less common means of obtaining water among the survey sample, 85 respondents (16% of the sample) had water delivered by tanker on a monthly basis or more; a slightly higher proportion (109 respondents, 20% of the sample) had water regularly delivered by cart.

The main uses for this water were for purposes of sanitation: flushing/cleaning toilets, bathing, and for cleaning dishes and clothes. Around two-thirds of those regularly using tanker-supplied water and/or cart-supplied water used it for these purposes. Slightly over half those regularly using water supplied by tanker or cart used this for cooking. It was rare for this water to be used for drinking purposes: only around one in ten (11%) of those regularly receiving water supplied by cart used this for drinking; around one in five (22%) of those using tanker-supplied water used this for drinking.

Open well water

Perhaps surprisingly, given the high level of access to borehole supplies across the sample, many respondents also accessed water from an open well on a monthly basis or more: 150 respondents (28% of the sample) accessed water in this way. The main use to which this water was put was for sanitation: two-thirds (67%) of those regularly accessing well water used this for flushing/cleaning toilets, with a similar proportion using this water for cleaning clothes. Around 50% of those regularly accessing well water used this for cleaning dishes or for personal washing. By contrast, the use of open well water for cooking purposes was less common: only 17% of those using this supply regularly did so for cooking. Fewer still – only around 5% – used this water supply for drinking water.

Water delivered by tanker or cart, and water accessed by an open well, was typically used for the purposes of sanitation. Few survey respondents used these water sources for drinking water.

Bottled water and sachet water

Unsurprisingly, the primary use to which sachet and bottled water was put was for drinking purposes. Of the 493 respondents who used sachet water once a month or more, 480 of these (97%) used this as drinking water. However, 28% of sachet water users also used this for cooking.

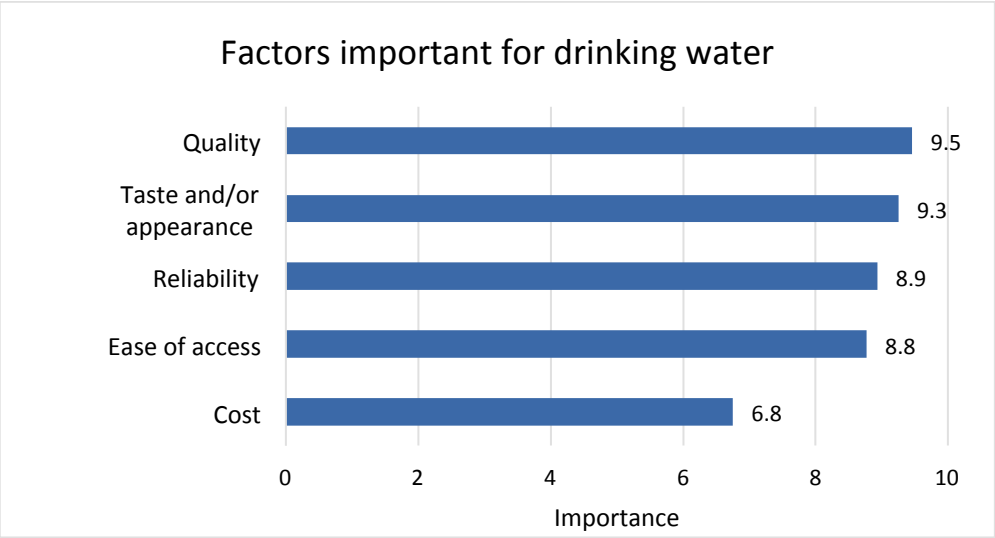
Likewise, whilst all regular bottled water users (the majority of our sample: 513 respondents) reported this water was for drinking, 17% of bottled water users also used this for cooking purposes.

Other uses for water as discussed above (e.g. cleaning and flushing toilets) were rare for those using sachet and bottled water.

2.3.3 Factors influencing choice of drinking water

Respondents considered several factors in their choice of drinking water. Quality, taste/appearance, reliability and ease of access were all rated as very important (around 9 on a 10-point scale; Fig. 15). Cost was rated as somewhat less important, at 6.8 on the importance scale.

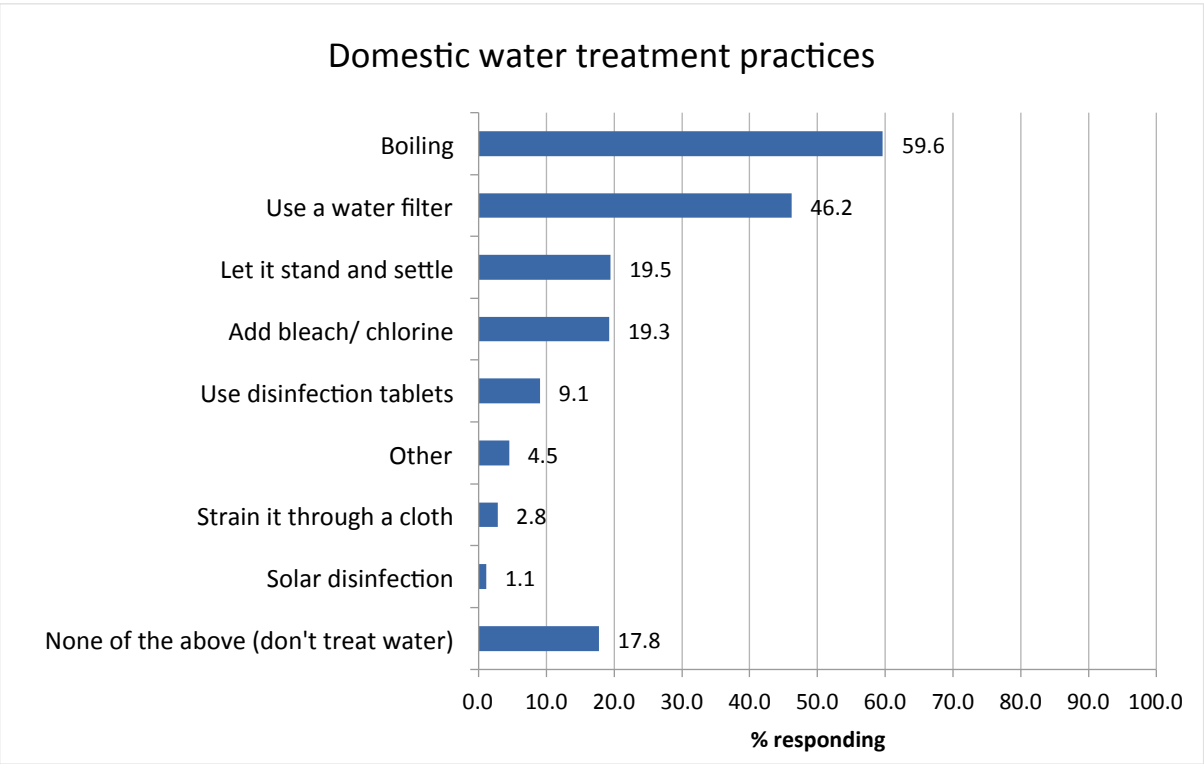
Figure 15. Factors important in drinking water



2.3.4 Practices for treating drinking water

Boiling was the most common practice for treating water, used by three in five respondents (Fig. 16). Just under half the sample used a water filter, while one in five let water stand and settle or added bleach/chlorine to treat it. Notably, nearly one in five (17.8%) do not treat their water at all.

Figure 16. Domestic water treatment practices



Comparing those with versus those without their own boreholes, we see some differences in water treatment practices. Specifically, those *without* their own boreholes are significantly more likely than those with one, to boil their water (65% versus 55%; p=.02) and to let it stand (25% versus 14%; p=.001).

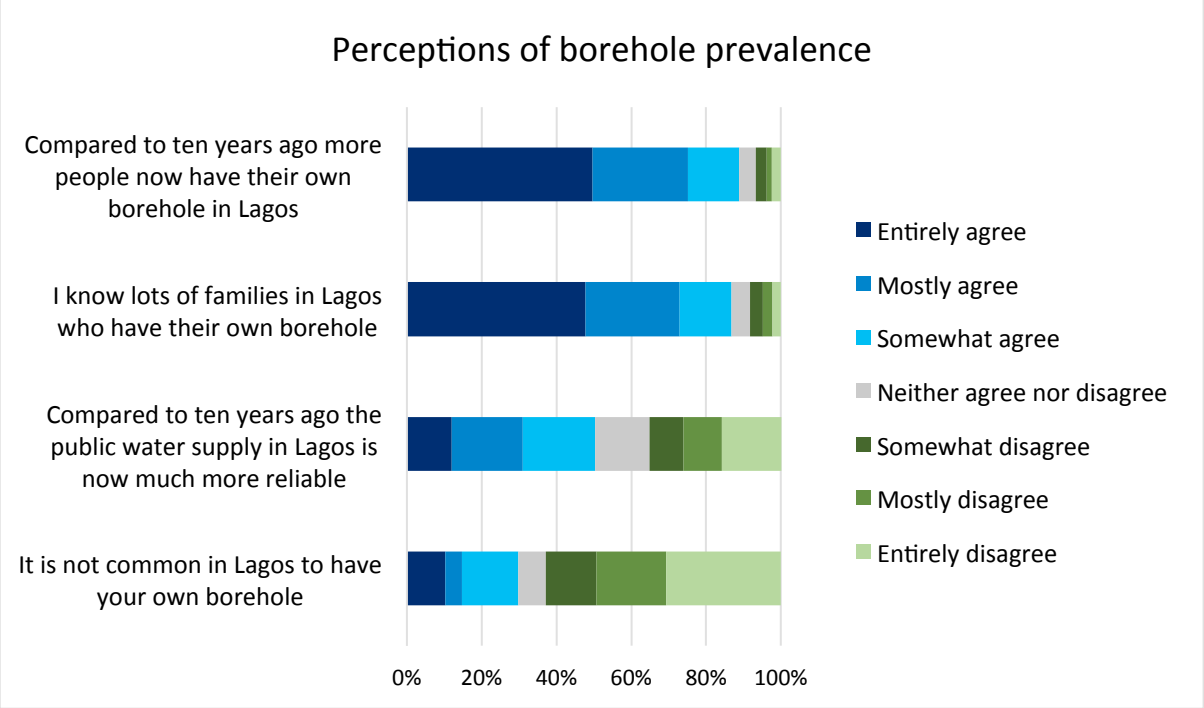
2.4 General attitudes towards boreholes and other water sources

Both closed and open-ended questions reveal positive attitudes towards borehole access and use amongst the survey participants, and less positive views about other water sources.

2.4.1 Perceived borehole prevalence and ability to access water supplies

Most respondents (89%) agreed that more people have their own boreholes now than did ten years ago (Fig. 17); similarly, 87% agreed that they know lots of families in Lagos with their own borehole and 64% *disagreed* that it is uncommon in Lagos to have your own borehole. In contrast, only half the sample (50%) agreed that the public water supply is more reliable now than it was ten years ago.

Figure 17. Perceptions of borehole prevalence



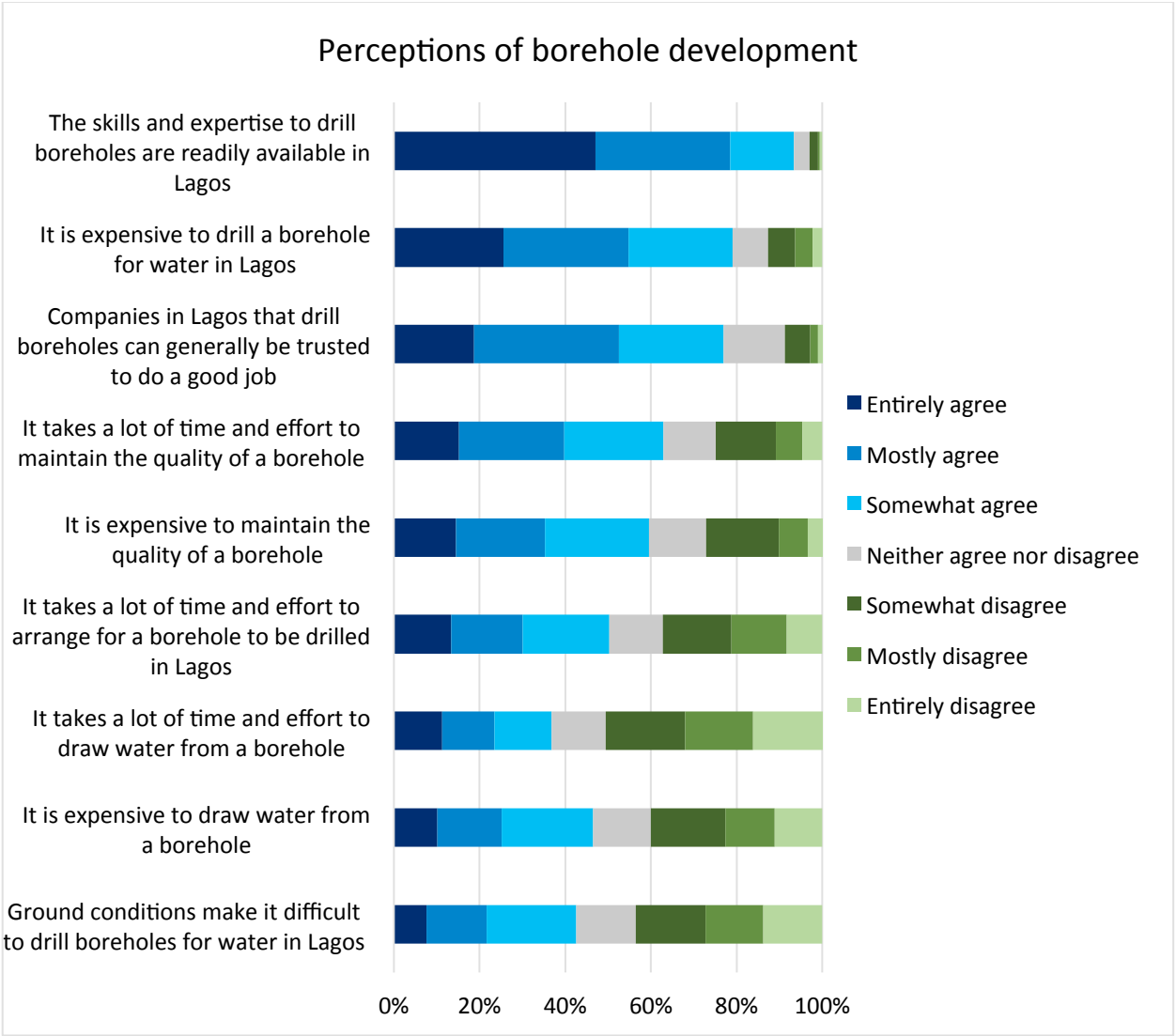
Most respondents (83%) agreed that 'the skills and expertise to drill boreholes are readily available in Lagos' (Fig. 18); and most (77%) felt borehole developers could be trusted. On the other hand, we found that many respondents felt there were considerable costs and effort involved with looking after boreholes:

- 79% agreed that 'It is expensive to drill a borehole for water in Lagos'
- 63% agreed that 'It takes a lot of time and effort to maintain the quality of a borehole'

- 60% agreed that 'It is expensive to maintain the quality of a borehole'
- Half the overall sample (50%) agreed that 'It takes a lot of time and effort to arrange for a borehole to be drilled in Lagos'
- 43% agreed that 'Ground conditions make it difficult to drill boreholes for water in Lagos'
- 47% agreed that 'It is expensive to draw water from a borehole'
- Only 37% felt 'It takes a lot of time and effort to draw water from a borehole'

It is widely observed that boreholes are now commonplace in Lagos. Borehole developers are largely trusted, but there is awareness of the not inconsiderable cost and maintenance involved in borehole ownership.

Figure 18. Perceptions of borehole development



2.4.2 Risks and benefits of groundwater use

Almost all respondents (95% total agreement) agreed that 'access to private a borehole helps families cope with possible water shortages in the future' (Fig. 19), and nine out of ten (90%) agreed that most people would prefer their own private borehole. This compares to 62% who agreed that most people would prefer to be connected to the public water supply and only 33% who agreed most would prefer to buy water from private vendors.

There was not widespread agreement, however, that groundwater supplies were resilient to risks of contamination: under half the sample (46%) agreed that 'there is little risk that underground water in Lagos will become contaminated'. Similarly, around half (51%) the sample agreed that is 'little risk that the public water supply in Lagos is contaminated'.

Attitudes to boreholes are largely very positive. There is little variation in borehole attitudes between different types of respondents.

Of the few significant predictors of borehole attitudes (Table 2), we see that older people are more likely to agree that 'given the choice, most people in Lagos would prefer to have their own private borehole for water supplies'. Home owners, those with higher incomes, and younger people from smaller households were more likely to agree that 'given the choice, most people in Lagos would prefer to be connected to the public water supply'. Those on higher incomes are also more likely to agree that 'Given the choice, most people in Lagos would prefer to buy their water from private vendors'.

Figure 19. Attitudes to boreholes and other water sources

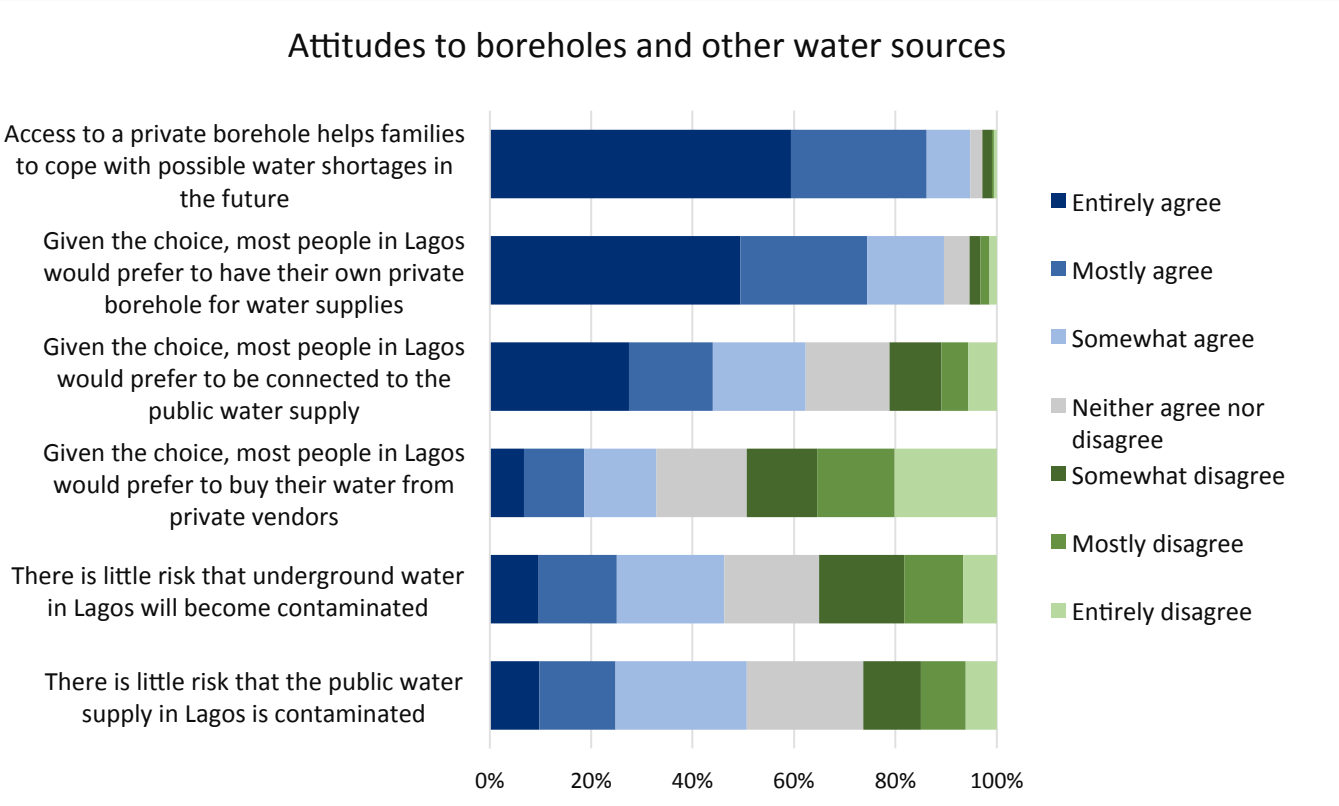


Table 2. Predictors of borehole attitudes

	Access to a private borehole helps families to cope with possible water shortages in the future			There is little risk that underground water in Lagos will become contaminated			There is little risk that the public water supply in Lagos is contaminated		
	Beta	t		Beta	t		Beta	t	
(Constant)		-6.07	***		-8.62	***		-9.37	***
Home ownership	-0.02	-0.32		-0.01	-0.24		0.02	0.46	
Income	-0.01	-0.27		-0.05	-0.96		-0.02	-0.42	
Age	-0.06	-1.21		-0.03	-0.66		-0.04	-0.84	
Gender	0.02	0.52		0.02	0.49		0.03	0.62	
Borehole ownership	0.01	0.24		0.04	0.72		-0.09	-1.81	(*)
Household size	0.03	0.54		0.08	1.72	(*)	0.08	1.83	(*)
Climate change concern	-0.05	1.11		-0.08	-1.75	(*)	-0.03	-0.55	

	Given the choice, most people in Lagos would prefer to have their own private borehole for water supplies			Given the choice, most people in Lagos would prefer to be connected to the public water supply			Given the choice, most people in Lagos would prefer to buy their water from private vendors		
	Beta	t		Beta	t		Beta	t	
(Constant)		5.65	***		5.38	***		7.42	***
Home ownership	-0.06	-1.26		0.11	2.26	*	-0.06	-1.18	
Income	0.02	0.45		0.10	2.18	*	0.14	3.01	**
Age	0.11	2.35	*	-0.10	-2.24	*	0.07	1.38	
Gender	-0.07	-1.52		0.03	0.73		0.01	0.12	
Borehole ownership	0.02	0.33		0.06	1.27		0.04	0.76	
Household size	-0.05	-1.14		-0.10	-2.23	*	0.00	-0.05	
Climate change concern	0.08	1.86	(*)	0.12	2.72	**	0.06	1.43	

(*) p<.01, * p<.05, ** p<.01, *** p<.001

Two open-ended questions elicited participants' views of the risks and benefits of household ownership of boreholes. In terms of benefits, responses reflected a sense of water '*independence*', '*control*' and security of supply, as well as assured water quality and cost-effectiveness.

Overall, respondents felt personal borehole access would mean **cheap, clean, reliable (perpetual) and convenient water supply**, implying health and economic benefits. For example, responses included:

> *'They will have access to water any time they like and they are in charge of the water quality control.'*
>
> *'There will not be any shortage of water'*
>
> *'It is safer because you know the source'*
>
> *'Easy accessibility to water. Less worry about water borne disease'*
>
> *'Freedom, pay once, can make money from it'*
>
> *'For most, they will live healthier'.*

In terms of risks, a substantial proportion of respondents indicated **no risks** from borehole ownership (e.g., '*I don't see any risk at all'*).

Of the risks mentioned, most related to **cost, maintenance, or risks of contamination**; a few also risks from environmental changes or earthquakes. Examples include:

> *'Maintenance'*
>
> *'High cost of chemicals for treating the water for good quality. Climate effect resulting in low groundwater'*
>
> *'Earthquakes may occur in future'*

A small number of responses indicated risks from availability of supply (e.g., *'Not enough water underground to go round for individual borehole'*).

2.4.2 Resilience of and responsibility for water

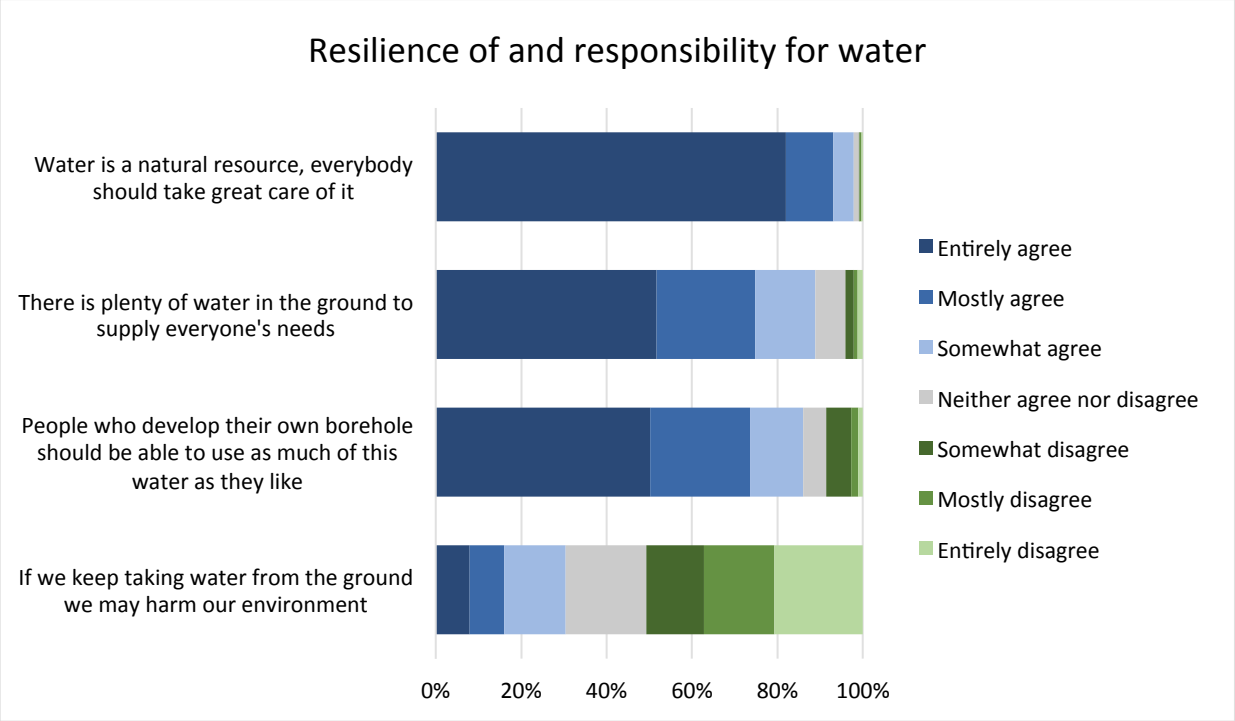
Respondents were asked for their views concerning the resilience of water supplies, as well as perceived responsibility for taking care of this resource.

Our findings point to an almost unanimous view that water is a common good that 'everybody should take great care of' (98% total agreement); however, there was also a common view that water is abundant (89% agreeing 'there is plenty of water in the ground to supply everyone's needs'); see Figure 20.

Furthermore, most agreed (86%) that 'People who develop their own borehole should be able to use as much of this water as they like', while only 31% agreed 'If we keep taking water from the ground we may harm our environment'.

Respondents explicitly endorsed the view that water is plentiful and only a minority were concerned about over-abstraction.

Figure 20. Perceived resilience of and responsibility for water



Comparing responses across different types of people (Table 3), we see that climate change concern positively predicts belief that 'If we keep taking water from the ground we may harm our environment' and negatively predicts the view 'People who develop their own borehole should be able to use as much of this water as they like'. This suggests an underlying environmental concern that underpins global and local issues. Men and young people are more likely to agree that 'There is plenty of water in the ground to supply everyone's needs'; while young people are also more likely to agree that 'Water is a natural resource, everybody should take great care of it'.

Table 3. Predictors of resilience and responsibility attitudes

	Water is a natural resource, everybody should take great care of it			**If we keep taking water from the ground we may harm our environment**			**People who develop their own borehole should be able to use as much of this water as they like**			**There is plenty of water in the ground to supply everyone's needs**		
	Beta	t		Beta	t		Beta	t		Beta	t	
(Constant)		-6.60	***		-9.02	***	-0.33	-5.57	***		-4.40	***
Home ownership	-0.08	-1.59		0.02	0.42		-0.14	0.62		-0.00	-0.00	
Income	0.05	0.96		-0.04	-0.83		-0.05	-0.89		-0.00	0.06	
Age	-0.13	-2.71	**	0.08	1.72	(*)	-0.06	-1.16		-0.10	-2.15	*
Gender	-0.00	0.01		-0.00	0.02		-0.13	-1.47		-0.10	-2.18	*
Borehole ownership	0.10	2.10	*	-0.05	-1.01		-0.14	0.78		0.03	0.65	
Household size	0.08	1.75	(*)	-0.02	-0.36		-0.01	-1.23		-0.00	0.03	
Climate change concern	-0.04	0.85		-0.14	3.12	***	-0.06	-2.70	**	-0.01	0.29	

(*) p<.01, * p<.05, ** p<.01, *** p<.001

2.4.3 Concerns about current water availability

Most respondents worried about where their drinking water comes from (85% total agreement; Figure 21), while half had immediate concerns about sufficient water for their family each week (50% agreement). Slightly fewer stated they had little choice over how they get their water (43% agreement), suggesting most have some degree of choice about their water source.

Looking at what might predict these attitudes (Table 4), we see climate change concern is a significant predictor of worries about where drinking water comes from, having enough water each week, and having any choice about where to get water. That is, those more worried about climate change are also more worried about these more immediate concerns. Home ownership and income are also negative predictors of worry about having enough water each week. Women are less worried than men about where their water comes from. Borehole ownership negatively predicts two of these concerns: having enough water each week, and worrying where their water comes from.

Consistent with the positive attitudes towards boreholes expressed earlier in the survey, it seems owning a borehole mitigates general water-related worries.

Figure 21. Concerns about current water availability and quality

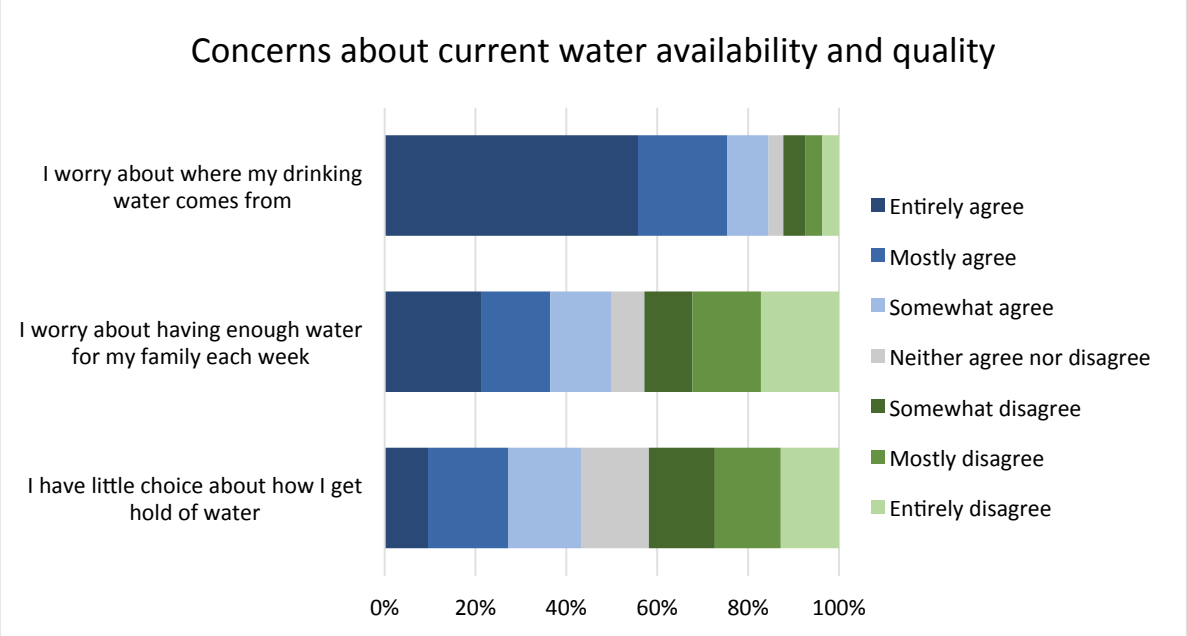


Table 4. Predictors of concerns about water availability and quality

	I worry about having enough water for my family each week			I worry about where my drinking water comes from			I have little choice about how I get hold of water		
	Beta	t		Beta	t		Beta	t	
(Constant)		-3.87	***		-2.79	**		-7.97	***
Home ownership	-0.11	-2.33	*	-0.04	-0.71		0.05	0.91	
Income	-0.15	-3.34	***	-0.00	0.05		-0.05	-0.97	
Age	0.08	1.67	(*)	0.04	0.78		0.03	0.57	
Gender	-0.07	-1.56		-0.09	-2.01	*	0.00	0.02	
Borehole ownership	-0.10	-2.01	*	-0.10	-2.01	*	-0.07	-1.47	
Household size	0.03	0.77		0.02	0.46		0.03	0.67	
Climate change concern	-0.13	2.91	***	-0.15	3.39	***	-0.10	2.15	*

(*) p<.01, * p<.05, ** p<.01, *** p<.001

2.4.4 Concerns and perceived risks about future water supplies

When asked about possible changes that could affect water supplies in future years, most respondents were concerned about changes to the quality of the water they used (71% worried about this to some extent; Fig. 22). In relation to natural hazards, 73% also expressed at least some worry that change in climate could affect water supplies, while 63 % similarly worried about natural disasters affecting them. Changes to cost of accessing water were a worry for 61%. More general changes in the economy were a concern for a little over half the sample (54%), while only 38% were worried about political changes affecting water supply.

Most are concerned about risks to future water supplies. The strongest predictor of these future concerns is worry about climate change.

As shown in Table 5, those who express more worry about climate change are more likely to be concerned about all future risks to water (from political, economic, environmental and other changes). In addition, borehole owners are significantly more likely to express concern about changes to the cost of accessing water. Those on higher incomes are more likely to be concerned about political changes, economic changes, climate change and natural disasters affecting water supply; while younger people express more concern about political changes affecting water supply. Household size, gender and home ownership are not significant predictors of these future risks to water supply.

Figure 22. Concerns about future risks to water

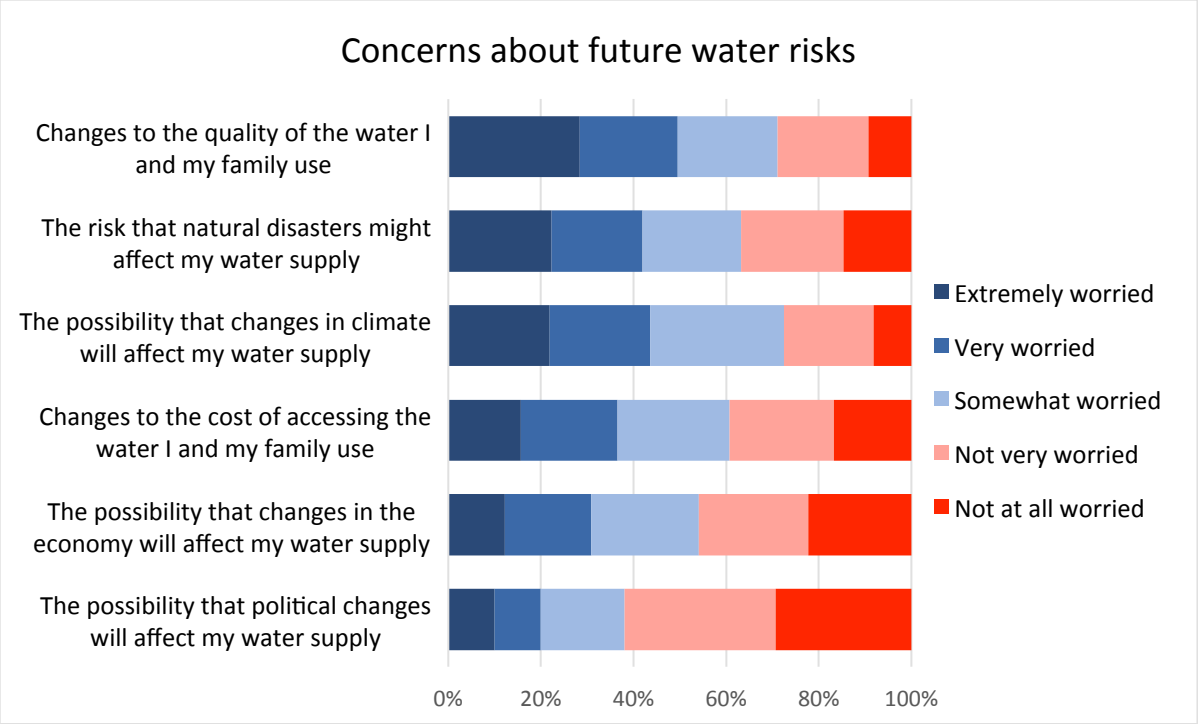


Table 5. Predictors of concerns about future risks to water

	Changes to the cost of accessing the water I and my family use			Changes to the quality of the water I and my family use			The possibility that changes in climate will affect my water supply		
	Beta	**t**		**Beta**	**t**		**Beta**	**t**	
(Constant)		6.39	***		3.68	***		3.94	***
Home ownership	0.06	1.20		0.08	1.87	(*)	0.03	0.71	
Income	0.08	1.80	(*)	0.04	1.04		0.08	2.00	*
Age	-0.05	-1.12		-0.06	-1.39		-0.01	-0.32	
Gender	-0.03	-0.61		0.06	1.37		0.02	0.55	
Borehole ownership	0.14	3.15	***	0.04	0.94		0.02	0.47	
Household size	-0.03	-0.66		0.00	0.05		-0.02	-0.55	
Climate change concern	0.34	8.14	***	0.44	10.82	***	0.54	14.06	***

	The possibility that political changes will affect my water supply			The possibility that changes in the economy will affect my water supply			The risk that natural disasters might affect my water supply		
	Beta	**t**		**Beta**	**t**		**Beta**	**t**	
(Constant)		9.34	***		5.63	***		4.76	***
Home ownership	-0.01	-0.25		0.04	0.86		-0.04	-0.98	
Income	0.11	2.50	**	0.16	3.68	***	0.12	3.03	**
Age	-0.13	-2.93	***	-0.07	-1.67	(*)	0.00	0.11	
Gender	-0.01	-0.20		0.00	-0.05		-0.05	-1.25	
Borehole ownership	0.07	1.48		0.08	1.83	(*)	-0.05	-1.13	
Household size	-0.01	-0.23		0.01	0.32		-0.04	-0.93	
Climate change concern	0.34	8.04	***	0.40	9.97	***	0.50	12.90	***

(*) p<.01, * p<.05, ** p<.01, *** p<.001

Section 3 Conclusions

The use of boreholes to access groundwater supplies is becoming ever more commonplace in Nigeria. Our research surveyed 539 residents of Lagos, Nigeria, and found that the majority were able to access either private or shared boreholes to obtain water.

We must be cautious about extrapolating our findings to those of the population of Lagos more generally. We were able to obtain the views of people from a range of ages, and in different parts of the city; however, our respondents likely had higher incomes than average, and our methodology of necessity excludes those without internet access. Nevertheless, our findings enable us to draw some general conclusions and to point to areas for potential future research.

First, our data suggests that not only is access to groundwater widespread, but that people generally have very positive views towards this as a water source. Those using boreholes see them as reliable and safe sources of water, and put this water to a full range of purposes. For those with their own private supply in particular, this water source is viewed favourably and used freely: those with their own borehole are more likely to drink this water and use it for cooking, as well as for sanitation purposes.

Whether or not people have access to private boreholes, attitudes towards them are overwhelmingly positive. Across the sample as a whole, groundwater supplies are seen as abundant, and private boreholes are viewed as providing an effectively unlimited and safe water supply. Most of those who are unable to access groundwater themselves would like to be able to do so. For those who do have access to their own private borehole, this appears to be associated with a lower degree of worry about being able to source water.

These findings suggest that the momentum towards extensive installation and use of private boreholes is likely to continue. Although this can enable the security of supply that survey respondents commend, a note of caution might be sounded in that our findings point to a collective enthusiasm for unlimited and ever-expanding extraction of groundwater.

It is beyond the scope of this report to comment upon the physical and social conditions that might enable or impede this trend. We can consider only upon people's attitudes towards and opinions of water supplies; an appraisal of the hydrogeology and regulatory environment in Lagos (and beyond) is not appropriate here. This said, we draw attention to the need to take into account the prevailing nature of public opinion we describe where considering future policy, regulations and communications in relation to groundwater supplies. In circumstances where there are legitimate concerns about the safety or resilience of groundwater and the installation of private boreholes, it should be recognised that these may not be shared by those actively using these supplies (or those who would like to do so). This said, there are indications that households do have concerns about future risks to water supplies – in particular, with respect to the potential impacts of natural disasters and/or climate change.

We have offered some preliminary analyses of factors that may underpin perceptions and use of water in Lagos. There is the potential for these to be further developed, in order to more completely model the influences upon people's water use practices. This can be undertaken using the data obtained as part of the present survey research.

Additional research might examine further the social nature of water use practices, which we have only been able to address briefly in the present research. It will be of value to understand better the

ways in which water is used and shared collectively by people (e.g. within families or neighbourhoods) or, alternatively, treated as a private and restricted resource (e.g. within estate communities). It will also be of value to understand whether there is a tendency for water from private boreholes to be used more liberally (i.e. at higher volumes) and treated as safer (in particular, used for drinking water without treatment) as appears to be the case from our findings.

Finally, and as we acknowledge above, the present survey is limited in its ability to understand the choices and access to water of more vulnerable groups – such as those in informal housing or on low incomes. Even among our sample, there is a notable minority of people who do not have any access to groundwater, despite the ever-increasing availability of this resource among the wider population. Future research might more directly address the prospects for access of those with lesser means, and whether these are advanced or hindered by the growing trend for using private groundwater supplies.