To what extent does socio-economic status still affect household access to water and sanitation services in South Africa?

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Abstract

Despite notable progress in the provision of water services and sanitation (WSS) in South Africa, considerable gaps remain. It is publically acknowledged that South Africa has recently met is Millennium Development Goal of halving water and sanitation backlogs. However, significant deficits remain, especially in the case of sanitation. These shortfalls are unevenly distributed across provinces and can be tracked by socio-economic status. This paper seeks to examine and identify those socio-economic factors that may affect poor WSS provision in South Africa. Using the 2011 South African General Household Survey (GHS), socio-economic indicators and access to WSS were analysed. The results of the descriptive statistics and multivariate analysis indicate that access to WSS is largely determined by province, race and geographical location. It appears that higher quality levels of sanitation are less accessible relative to piped water access. Identifying these socio-economic factors affecting WSS provides obvious policy direction and better-targeted water infrastructural development.

1. Introduction

In 2000, 189 countries, including South Africa, adopted the eight Millennium Development Goals (MDG) (Choffnes and Mack, 2009). By 2002 the provision of a safe and high quality level of drinking water supply and sanitation (WSS), captured by MDG 7 had been recognized by the Committee on Economic, Social and Cultural Rights as a basic human right (IIED, 2008). To fulfill this right UN resolution 64/292 has since called, upon States and international organisations to provide financial resources, capacity-building and technology transfer to help countries, in particular developing countries, to provide safe, clean, accessible and affordable drinking water and sanitation for all (UN, 2013). In the same year is was reported over 1.1billion people were without access to improved drinking water and a further 2.6 billion without access to improved sanitation where 90% of affected people live in Asia and Africa (Hutton, 2008; Choffnes and Mack, 2009). These statistics are virtually unchanged after ten years (Choge and McCornick, 2010). 2005-2015 was declared the ‘Water for Life’ decade as water will affect all the millennium goals in some way including, inter alia, poverty alleviation (goal 1), gender equality (goal 3) as well as within its own environmental sustainability (goal 7) (Hutton, 2008). Part of MGD goal 7, target 10, is to “halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation” (Hutton and Bartram, 2008:13). However, more recent reporting by the WHO Joint Monitoring Programme (JMP) revealed that the target of halving the populations without access to adequate and safe drinking water by 2015 (from 1990 levels) is expected to be met in every region except sub-Saharan Africa. Furthermore, the proportion of people without access to basic sanitation will not be halved by 2015 (WHO, 2012). This immediately raises a call for research on drinking water and sanitation in equal importance, as only an integrated approach will minimise health impacts.

Providing safe and reliable WSS is a huge and costly undertaking and largely the domain of developing countries. From a 1990 baseline, using over 90 developing countries, Hutton and Bartram (2008) estimate that the average per-capita spending requirement for developing countries is US$120 over a 10-year period (2005 to 2015) . In terms of the costs due to a lack of WSS, the economic cost of poor sanitation alone for the African continent has been estimated at around $30bn (African Business, 2012). The World Health Organization estimates this to be around $23.5 billion for Sub-Saharan Africa or 5% of GDP (Choge and McCornick, 2010). Furthermore it is estimated that for every $1 spent on sanitation, an average return of $9 of benefits follow such as gains from children staying in school and general health benefits, particularly from a reduced incidence of diarrhea (World Bank, 2011 in Tissington, 2011).

Given this high cost, donor and recipient governments need to understand the socioeconomic characteristics of households most in need of better WSS to sharpen the focus of water policy both in terms of allocating water-based resources, infrastructure provision and ultimately, water pricing. In South Africa, there is little recent work on identifying the socio-economic characteristics of households that access piped water and even less on the equivalent analysis for sanitation. To fill these gaps this research is focused on identifying those socioeconomic variables that are most associated with having (1) access to piped water and (2) access to a flush toilet. This could provide invaluable insight for policy makers in terms of identifying and prioritising the most WSS impoverished households. Furthermore comparing access to piped water and flush toilets enables useful progress indicators of one against the other.

Section 2 below gives a brief background to South African WSS targets, the challenges faced by the government and progress made since 1994. This section is concluded by a review of the specific relevant economics literature on socio-economic predictors of water access and sanitation. Section 3 details the chosen methodology of investigation and econometric specification followed by results in section 4 and a concluding discussion in section 5.

2. Literature review

Historically for South Africa, clean piped water and a flush toilet were associated with white privilege; the majority of black South Africans only having access to dry toilets (Eales, 2011). In 1994, South Africa faced a huge WSS backlog and borne from the overall Reconstruction and Development Programme and Bill of Rights, the South African government drew up the White Paper on Water Supply and Sanitation Policy (Tissington, 2011). Since then it has made a clear commitment to ensuring a free basic water supply for all by 2013/14 (defined as 25 litres per person per day of acceptable quality at a minimum flow of 10 litres per minute, no more than 200m from the home, available at least 350 days and uninterrupted for less than 48 consecutive hours per supply incident) (Okonkwo, 2010; StatsSA, 2011). In 1995 a National Sanitation Task Team was set up to coordinate the relevant national departments to coordinate a recovery of the national sanitation backlog (Tissington, 2011).

Being ahead of the international curve, in 1997 South Africa declared basic water and sanitation a human right under the auspices of the Water Services Act (1997), consistent with the Bill of Rights (StatsSA, 2011) but in 2005 it was estimated that about 6 million South Africans still lacked access to basic level of service (Cullis, 2005). Achieving the 2013/14 targets was always going to be difficult in a country not known for its abundance of water. In addition to basic human rights and dignity issues surrounding WSS, failure to secure safe and reliable WSS can exasperate the effects of climate change, population growth, cause excessive migration and force people to use unclean water sources, placing undue burden on health services and water collectors (typically women) and increasing the chance of death, especially for children under the age of 5 (Lewin et al, 2000; Dungamaro , 2007; Choge and McCormick, 2010).

For sanitation, after publishing the National Sanitation Policy in 1996 (much like the 1994 Water Supply and Sanitation Policy), the 2001 White paper on the Basic Household Sanitation was followed by a series of initiatives including, inter alia the 2003 Water Services Framework and the National Sanitation Strategy tasked with recovering the backlog of sanitation provision by 2010. In 2009 the Department of Water Affairs (DWA) passed the Free Basic Implemetation Strategy that was given the mandate to guide the 169 Water Service Authorities across the country in fulfilling national policy as laid down by the 2001 white paper (Tissington, 2011).

Water and sanitation improvement targets form part of MDG goal 7 in the context of environmental sustainability. Goal 7c is to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation (National Planning Commission, 2013). For South Africa, the safe drinking water aspect was achieved in 2005 but the drive for sanitation is more pressing where, “the goal of eliminating the full sanitation backlog by 2014 may seem too ambitious” (National Planning Commission, 2010: 94).

The statistics are crucial but the human dimension of poor WSS is staggering considering the social loss of personal hygiene, disease protection and dignity (City of Cape Town, 2008). The failure of service delivery was no better highlighted than in the 2011 Local Government election period which saw the placement of un-enclosed and very undignified public toilets being built in Khayelitsha, Cape Town and in Rammulotsi in the Moqhaka municipality in the Free State (DWA, 2012). Between 2007 and mid 2010 it was found that over 30% of the time, service delivery protests was due to a water supply or sanitation issues (Tissington, 2011). It seems that the poorest and the most vulnerable groups have to wait the longest for any significant change (Eales, 2011),

Whilst interesting, relevant and necessary, achieving MDGs is no panacea. This paper is not intended to test the feasibility of WSS based on any MDG but rather to better understand the socio-economic characteristics of households that that do not access piped water and a flush toilet. For a given population, piped water and flush toilets for all would arguably be the end point in terms of infrastructural improvement and reversing Apartheid-era neglect with maintenance the only concern. Given this development gap, examining water supply and sanitation under these criteria would continue to inform policy and also reveal the dual progress of WSS.

There is a growing body of literature that is making stronger links to the lack of access to safe WSS having devastating effects on labour force participation, education, cooking and food provision and equity of women, especially in rural areas (Choffnes and Mack, 2009). Within the context of the developing world, including South Africa the risk of diarrhea, cholera, bilharzia, trachoma, intestinal worms and hookworms especially amongst children due to poor water provision can be deadly (Choffnes and Mack, 2009; Okonkwo, 2010; Hoque and Worku, 2005).

Much of recent theoretical and empirical water poverty research over the last decade has focused on developing a water poverty index comprising of variables representing access, use, capacity, resources and environment distilled into one neat number yet there with no firmly agreed upon definition (Komnenic et al, 2009). The more comprehensive water poverty indices take account of the socio-economic variables, such as income, that help to identify water impoverished areas and guide policy; notable examples include Sullivan, (2002); Lawrence et al (2002) and Cullis, (2005).

There is broad agreement that household income is a powerful predictor of domestic water quality (Sullivan, 2002). This directly links to poverty where female headed households tend to be the poorest and thereby exposed to reduced water quality and/or poor sanitation (Kimenyi and Mbaku, 1995). It is important to note that water poverty does not necessarily arise due to poor access but rather the income poor cannot afford to get connected.

Previous research examining associated socioeconomic variables on WSS in the South African context is thin. Dungamaro (2007) found that dwelling type, income source (salaries/wages or remittances), household size and to a lesser extent gender of head of household were all good predictors of domestic water quality. Dungamaro (2007) largely confirmed the findings of Sullivan (2002) in that low income households in poor quality dwellings shared by many (exaccerbating poverty) are far more likely to have unsafe drinking water.

StatsSA (2011) published a comprehensive report covering the progress of WSS provision between 2002-2010. Whilst some MDG targets had been met, it is still publically acknowledged by the DWA that much work needs to be done. Indeed whilst 40.7% of households (4484) had access to piped water inside their homes in 2002, this had only risen to 41.5% (5943) by 2010 and the number of households using boreholes as their main source of drinking water had risen from 146 to 180 (1.3%) (StatsSA, 2011). In addition, using 2012 data it was estimated that South Africa had improved drinking water quality use by 95% whereas use of improved sanitation facilities were lower at an increase of 74% (WHO, 2014).

The StatsSA (2011) report also identified significant socio-economic variables using logistic regressions with safe/unsafe water access as the binary dependent variable. This analysis was conducted using data from the 2010 GHS. Safe was defined by anything other than a river, dam, well or stream. All piped water and boreholes (private or communal) are classed as a safe source (StatsSA, 2011). With some regional variation, access to safe water is strongly associated with home ownership and access to basic services (sanitation and refuse removal) whereas it is negatively associated with having four or less rooms, a monthly expenditure of R1800 or less and the head of household being 35 years old or less. In 2010, the Western Cape had the highest access to safe water (92.1%) and the Eastern Cape had the lowest access (45.0%) (StatSA, 2011). No regressions were run for sanitation services.

Whilst the few aforementioned studies identified the socio-economic variables associated with safe/unsafe water, there is even less independent research in the South African sanitation context. Kirigi and Kainyu (2000) using 1995 data gathered from a survey of nearly 4000 households in city, township, farm and rural locations gathered socio-economic data including details of toilet ownership. It was generally found that household size, location, health insurance coverage, income, age, education (formal and health education), racial group and employment status had a significant impact upon the probability of toilet ownership (Kirigi and Kainyu, 2000).

The analysis presented below builds on previous work, extends and updates it. There is little literature that focuses on the socio-economic background of water poor households and even less over the last 10 years where it is hoped that much improvement in water facilities has occurred. The analysis below compares piped and non-piped drinking water rather than the more typical safe and unsafe distinction. According to StatsSA, safe water includes piped water in the dwelling, on-site or off-site and also from a borehole source (StatsSA, 2012). However boreholes are susceptible to contamination (Samie et al, 2011; Esterhuizen et al, 2012) and so for this reason the socio-economic variables associated with households that have piped or non-piped water were identified. The non-piped water sources therefore include boreholes, dams, wells, springs, rivers and streams.

For sanitation the basic provision for adequate sanitation refers to a ventilated pit latrine (VIP) if it is constructed and maintained properly (Tissington, 2011; StatsSA, 2012). As part of the drive to achieve basic sanitation targets many pit latrines have been upgraded to the ventilated version as such remains a cost-effective way of rolling out basic sanitation provision (Tissington, 2011). Whilst this is certainly laudable it is arguable to say that universal access to a waterborne conventional flush toilet connected to a bulk sewer or septic tank system is an important threshold of development in terms of dignity and disease protection. Such a sanitation system requires 6-13 litres per flush and needs a reliable uninterrupted water supply (Tissington, 2011). For this reason the analysis below identifies the socio-economic variables associated with households that have flush or non-flush toilets.

3. Data and Methods

The data was drawn from the 2011 General Household Survey (GHS). The GHS was initiated in 2002 by Statistics South Africa (Stats SA) as an annual cross-sectional survey to determine the level of development in South Africa.

The survey questions were designed to capture information on service delivery and living conditions in South Africa and cover a range of broad areas such as education, health, labour market participation and household access to services and facilities (Stats SA 2011). The GHS 2011 aimed to survey a representative sample of the population by using a two-stage stratified sampling design whereby the first stage of stratification was by province and the second stage by urban and non-urban location within each province. The response rate was 94.2% and a total of 25 653 households were successfully interviewed. The target population consisted of all private households in South Africa and is therefore only representative of non-institutionalised and non-military persons or households (Stats SA 2011). All members of the households who were present at the time of the interview were asked to provide individual level data but only one person was asked for household-level information (typically the person identified as the household decision maker or household head).

There are a range of questions regarding the socio-economic status of the household. These included questions regarding a household's geographical location (urban/rural), dwelling type, household size and access to electricity as well as information on the household head which includes educational attainment, gender and race. There are also a number of questions pertaining to water access, quality and municipal service provision as well as sanitation. With regards to sanitation, the GHS enquires about whether or not households share a toilet facility and where that facility is situated relative to their dwelling. In addition to these, there is information pertaining to household income and asset ownership however these were not used in the analysis given that the variables for race, gender and geographical location of the household serve as a sufficient proxy for socio-economic status.

4. Results

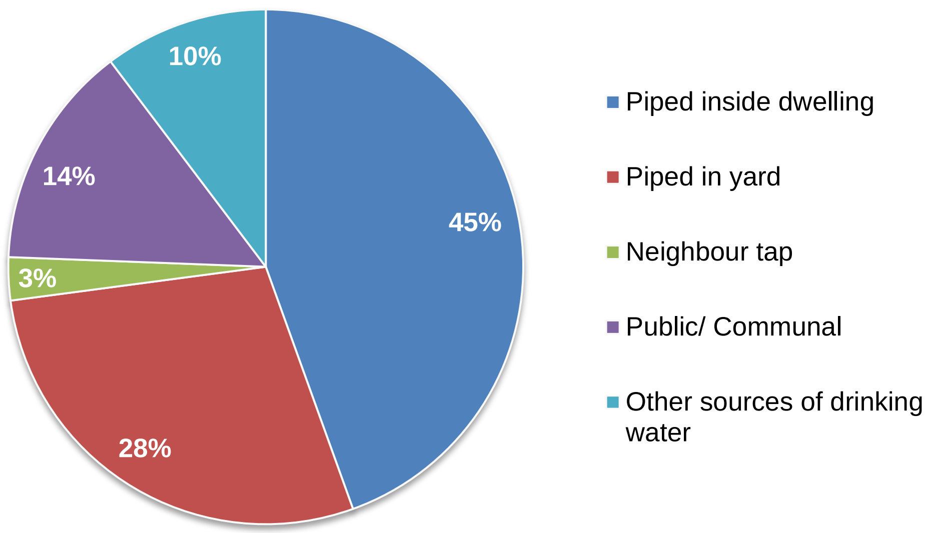
4.1. Descriptive Statistics

The question in the GHS pertaining to piped water asks for households to identify their main source of drinking water. Responses include piped water inside the dwelling, piped water in the yard, a neighbour's tap, a communal or public tap, boreholes, rain water tank, flowing or stagnant water amongst others. For the purposes of this analysis, a dummy variable representing access to piped water was created. The variable is binary and equal to 1 if a household identified having access to piped water inside their dwelling, in their yard, their neighbour's tap or a communal/public tap and is equal to 0 for all other water sources.

In addition, a dummy variable representing household access to a flushing toilet was created such that it equals 1 if a household has a flush toilet connected to a public sewerage system or septic tank and 0 if a household use a chemical toilet, pit latrine, bucket or no toilet.

In South Africa, 90 percent of households have access to piped water whilst two-thirds have access to flush toilets.[1] With regards to water services, almost three quarters of the total population have a tap water source either in their dwelling or in their yard whilst just less than 20 percent share a piped water source (Figure 1).

Figure 1: Main source of drinking water for households in South Africa



Source: GHS 2011, own calculations. Notes: Data have been weighted to be nationally representative.

[1] Significant at the 5% level with respect to the categories for no piped water and no flush toilet respectively.

Of all those households with access to piped water, just over two-thirds have access to a flush toilet (Table 2). This is indicative of the need to address access to sanitation more thoroughly as it appears that piped water access has improved over time whilst a third of South African households are still without proper sanitation.

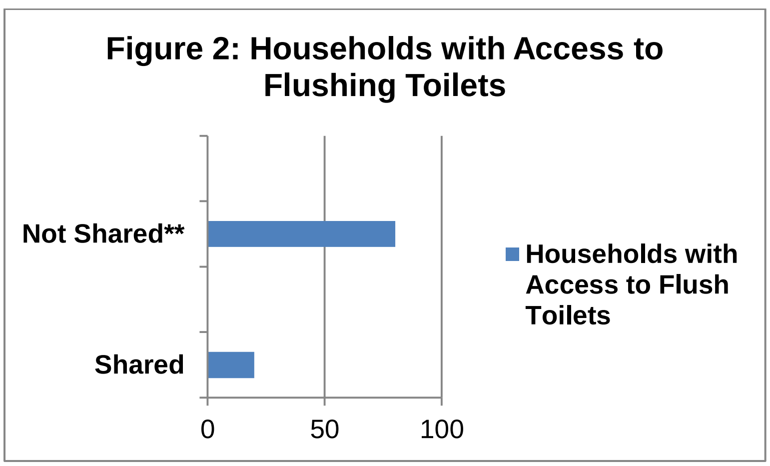
Table 2: Cross tabulation showing access to both piped water and flush toilet

	Piped Water	No Piped Water
No Flush Toilet	31.9 (0.4)	91.2 (0.8)
Flush Toilet	68.1** (0.4)	8.8** (0.8)
Total	100.0	100.0

Source: GHS 2011, own calculations.

*Notes: Data have been weighted to be nationally representative. Standard errors are in parentheses. ** significantly different at the 5% level compared to the 'no piped water'.*

Figure 2 indicates the ease of access and the extent to which households share sanitation amenities with other households. These figures specifically illustrate the situation for households who are identified as having access to a flushing toilet. Results show that 80 percent of households have their own toilet facility whilst 20 percent share a facility with other households.



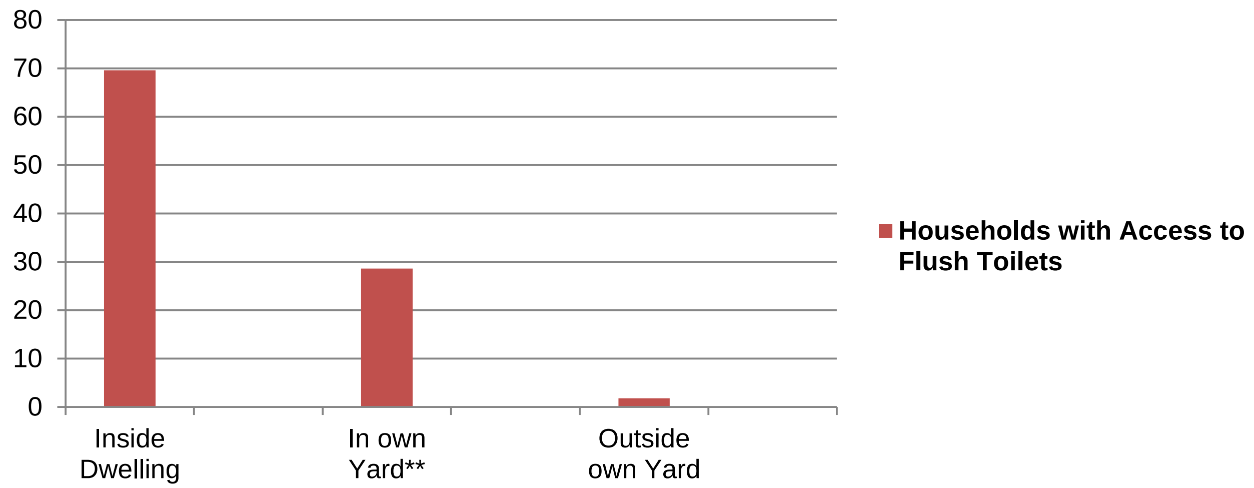
Source: GHS 2011, own calculations.

Notes: Data have been weighted to be nationally representative. Standard errors are in parentheses.

*** significantly different at the 5% level compared to the 'shared' category.*

More than two thirds of these households with access to flush toilets have a toilet inside their dwelling whilst just under third have a facility outside the dwelling but within their yard (Figure 3). A very small percentage of households have been identified as having to access such a facility outside of their own yard (1.8%).

Figure 3: Households with Access to Flushing Toilets



Source: GHS 2011, own calculations. Notes: Data have been weighted to be nationally representative. Standard errors are in parentheses.

*** significantly different at the 5% level compared to the 'outside yard' category.*

A number of socioeconomic status indicators in relation to household access to either piped water or a flushing toilet were analysed (Table 4). As expected, households who live in formal housing (brick house, flat, cluster home, garden cottage etc.) are significantly more likely to have access to both piped water and proper sanitation facilities. However, the distribution of sanitation facilities has been less inclusive as compared to piped water. Just fewer than 72 percent of households classified as living in formal housing access a flushing toilet whereas close to 95 percent access piped water. Similarly, living in an urban area significantly increases the chances of households having proper sanitation and piped water. There is also significant variation by province especially for sanitation. Notably, relative to say the Western Cape, over half the country (Limpopo, Mpumalanga, KwaZulu-Natal, the North-West and the Eastern Cape) perform poorly, especially in the case o fhousehold access to appropriate (flush) sanitation.

It is important to note that for the African subset of the population[2] access to piped water is comparable within 10 percentage points to other race groups but only half of African headed

[2] as determined by the race identified by the household head.

households have appropriate flush sanitation facilities. This is in stark contrast to White, Coloured and Indian households where almost all have access to a flushing toilet. Similarly, looking at gender, only half of female-headed households compared to two-thirds of male-headed households have flushing toilets. Thus, race and gender of the household head serve as good proxies for socio-economic status.

Table 4: Household socio-economic indicators

	Piped	Not Piped	Total	Flush	No Flush	Total
Formal Housing	93.4** (0.2)	6.6 (0.2)	**100**	71.5** (0.4)	28.5 (0.4)	**100**
Informal Housing	76.4** (0.7)	23.6 (0.7)	**100**	27.1** (0.8)	72.9 (0.8)	**100**
Urban Area	98.9** (0.1)	1.1 (0.1)	**100**	87.9** (0.3)	12.1 (0.3)	**100**
Rural Area	71.8** (0.5)	28.2 (0.5)	**100**	11.2** (0.5)	88.8 (0.5)	**100**
African	87.4** (0.3)	12.6 (0.3)	**100**	51.4** (0.4)	48.6 (0.4)	**100**
Coloured	99.0** (0.2)	1.0 (0.2)	**100**	94.7** (0.5)	5.3 (0.5)	**100**
Indian	99.7** (0.2)	0.3 (0.2)	**100**	98.5** (0.5)	1.5 (0.5)	**100**
White	96.0** (0.6)	4.0 (0.6)	**100**	99.9** (0.1)	0.1 (0.1)	**100**
HH head is Male	91.2** (0.3)	8.8 (0.3)	**100**	67.1** (0.5)	32.9 (0.5)	**100**
HH head is Female	87.2** (0.4)	12.8 (0.4)	**100**	53.9** (0.6)	46.1 (0.6)	**100**
Connected to Electricity Mains	92.4** (0.2)	7.6 (0.2)	**100**	67.7** (0.4)	32.3 (0.4)	**100**
Not Connected to Electricity Mains	74.8** (0.8)	25.2 (0.8)	**100**	30.0** (0.9)	70.0 (0.9)	**100**
WC	99.5** (0.1)	0.5 (0.1)	**100**	96.1** (0.4)	3.9 (0.4)	**100**
EC	75.2** (0.9)	24.8 (0.9)	**100**	45.9** (1.1)	54.1 (1.1)	**100**
NC	96.2** (0.5)	3.8 (0.5)	**100**	74.5** (1.3)	25.5 (1.3)	**100**
FS	96.9** (0.4)	3.1 (0.4)	**100**	75.7** (1.1)	24.3 (1.1)	**100**
KZN	83.4** (0.6)	16.6 (0.6)	**100**	46.4** (0.9)	53.6 (0.9)	**100**
NW	91.2** (0.7)	8.8 (0.7)	**100**	49.3 (1.2)	50.7 (1.2)	**100**
G	97.8** (0.3)	2.2 (0.3)	**100**	88.5** (0.6)	11.5 (0.6)	**100**
M	87.4** (0.9)	12.6 (0.9)	**100**	40.0** (1.2)	60.0 (1.2)	**100**
L	82.1** (0.8)	17.9 (0.8)	**100**	18.6** (0.9)	81.4 (0.9)	**100**

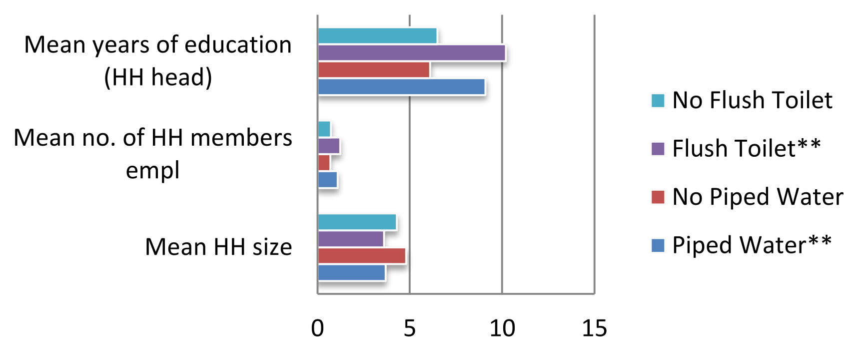
Source: GHS 2011, own calculations.

Notes: Data have been weighted to be nationally representative. Standard errors are in parentheses.

*** significantly different at the 5% level compared to the ‘not piped’ or ‘no flush’ category respectively.*

In additional, the average impact of educational attainment and number of employed household members is a little higher in the case of sanitation compared to piped water (Figure 4). This potentially signals that household socio-economic status is more important in the case of sanitation.

Figure 4: Effects on piped water and flush toilets



Source: GHS 2011, own calculations.

Notes: Data have been weighted to be nationally representative.

*** significantly different at the 5% level compared to the 'not piped' or 'no flush' category respectively.*

4.2 Multivariate Analysis

The multivariate analysis aims to determine whether certain socio-economic indicators affect household access to piped water and to a flushing toilet. In both cases, since the dependent variable is binary, a probit model was used:

$$Y = \beta' X + \varepsilon \quad \text{(i)}$$

4.2.1. Access to Piped Water

In this case, Y represents a dummy variable for piped water (as mentioned above) and X is a vector of household level socio-economic indicators which includes dwelling type, household size, gender, race and educational attainment of the household head, the number of household members employed, electricity connection and geographical (urban/rural) location. Given that 68 percent of households with piped water were identified as having a flushing toilet (Table 2), the dummy variable for flush toilet was used as an additional explanatory variable.

The probit model was estimated three times, varying the explanatory variables each time so as to ensure the robustness of the results. The first probit (I) simply estimates the probability of accessing piped water if a household has a flush toilet. The second (II) includes the additional household level indicators mentioned above and the third (III) excludes the variable for flush toilets.

The marginal effects of the probit estimations are presented in Table 5 below. Most of the variables appear to have the expected signs and significance however in most cases the marginal effects are negligible. In the first estimation (I) having a flush toilet only increases the probability of having piped water by 23 percent, however upon the inclusion of the additional household level explanatory variables this effect is reduced to five percent. The most notable socio-economic driver of access to piped water is location in an urban area, raising the likelihood of access by 15 percent. The coefficients in the second and third model estimations are very similar, however the removal of the variable for flush toilets increases the size of the coefficient on the urban dummy variable to 22 percent.

4.2.2. Access to Flushing Toilet

With reference to the same equation (i), the equivalent probit analysis was conducted for flush toilets. The dependent variable is now equal to 1 if a household has a flush toilet (connected to the public sewerage system or to a septic tank). The explanatory variables are identical to those included in the piped water analysis, the only exception being that the piped water dummy variable is incorporated into the analysis of access to flush toilets.

Once again the marginal effects of the probit estimations are presented in Table 5. In the first estimation (I), the probability of accessing a flush toilet increases by 60 percent if a household has piped water. This suggests that households with piped water typically have the infrastructure required to have a flushing toilet. Upon inclusion of the other household level variables (II), the coefficient on piped water falls to 24 percent but still remains a significantly positive determinant of household access to flush toilets. The explanatory variables all have the expected signs and significance. The most prominent factors appears to be whether a household is based in an urban area or is considered to dwell in formal housing as this raises the likelihood of accessing flush-toilet sanitation by over 70 percent and 30 percent respectively. African households are between 20 and 30 percent less likely to have access to a flushing toilet compared to each of the other race groups. Excluding piped water in the final model (III), results in no major changes to the marginal effects.

Table 5: Household socio-economic drivers of access to piped water and flushing toilet

	I	II	III	I	II	III
Dependent Variable;	**Piped Water**			**Flush Toilets**		
Independent Variables						
Flush Toilet	0.23*** (0.01)	0.05*** (0.01)	-	-	-	-
Piped Water	-	-	-	0.59*** (0.01)	0.24*** (0.04)	-
HH size	-	-0.00*** (0.00)	-0.00*** (0.00)	-	-0.01*** (0.00)	-0.01*** (0.00)
Number of HH members employed	-	0.00 (0.00)	0.00 (0.00)	-	0.05*** (0.01)	0.05*** (0.01)
Connected to Electricity mains	-	0.05*** (0.01)	0.06*** (0.01)	-	0.20*** (0.02)	0.21*** (0.02)
Urban	-	0.15*** (0.01)	0.22*** (0.01)	-	0.71*** (0.01)	0.73*** (0.01)
Coloured	-	0.01*** (0.00)	0.02*** (0.00)	-	0.22*** (0.01)	0.22*** (0.01)
Indian	-	0.02 (0.01)	0.03*** (0.01)	-	0.22*** (0.02)	0.22*** (0.02)
White	-	-0.10*** (0.02)	-0.06*** (0.01)	-	0.36*** (0.01)	0.35*** (0.01)
Male	-	-0.00 (0.00)	0.00 (0.00)	-	0.03*** (0.01)	0.03*** (0.01)
Educ attainment HH head (years)	-	0.00* (0.00)	0.00*** (0.00)	-	0.01*** (0.00)	0.01*** (0.00)
Formal Housing	-	0.03*** (0.00)	0.04*** (0.00)	-	0.32*** (0.02)	0.32*** (0.02)

Source: GHS 2011, own calculations.

*Notes: Data have been weighted to be nationally representative. The marginal effects of the probit estimations are presented. Standard errors are in parentheses. Figures marked with *** are significant at the 1% level, ** 5% and * at the 10% level.*

Results suggest that poverty issues drive household access to flush toilets more so than piped water. Given that Africans appear to be the worst affected population group, the probit model (III) is re-estimated for African households only (Table 6). The size and significance of the coefficients in the case of both the piped water and flush toilet do not change when the model is estimated for African households specifically demonstrating that the results in Table 5 is essentially driven by African households. The 2011 GHS data shows that for Africans, a far higher proportion (58%) of households live in rural areas compared to urban areas. Whereas the opposite is true for other race groups.

Table 6: African household socio-economic drivers of access to piped water and flushing toilet

Dependent Variables:	**Piped Water**	**Flushing Toilet**
Independent Variables		
HH size	-0.00* (0.00)	-0.02* (0.00)
Number of HH members employed	0.00 (0.00)	0.06* (0.01)
Connected to Electricity mains	0.06* (0.01)	0.24* (0.02)
Urban	0.23* (0.01)	0.72* (0.01)
Male	0.00 (0.00)	0.04* (0.01)
Educ attainment HH head (years)	0.00* (0.00)	0.02* (0.00)
Formal Housing	0.04* (0.00)	0.35* (0.02

Source: GHS 2011, own calculations.

*Notes: Data have been weighted to be nationally representative. The sample consists only of African households. The marginal effects of the probit estimations are presented. Standard errors are in parentheses. Figures marked with *** are significant at the 1% level, ** 5% and * at the 10% level.*

5. Discussion

Being able to access piped drinking water and a flushing toilet is unfortunately taken for granted by many. In reality this is a luxury which many households in South Africa do not experience even after more than 20 years of democracy in Africa's largest economy. Inadequate provision of WSS is at best undignified but is potentially costly in terms of lost productivity and a health sector burden. Whilst of course there has been considerable progress since 1994 in achieving WSS development, consistent with previous studies, results show that progress in the domain of piped drinking water is more advanced than sanitation. As such the socio-economic variables examined here are not driving the incidence of household access to piped water relative to the access to flush sanitation.

Relative to piped water access having use of a flush toilet is more dependent upon many of the socio-economic variables since they act as poverty signals including household size, the number of people employed in the household, connection to the electricity mains, geographical location (urban/rural), gender of the household head, educational attainment of the household head and dwelling type. A plausible explanation could be that piped water relative to flush sanitation has been largely addressed as a supply-side issue, with government expanding infrastructure to accommodate households country-wide. However, the same practice does not seem to have been applied to flush sanitation services indicating that poorer households are significantly worse off. This could be indicative of a lack of infrastructure and service delivery in poor rural areas. Such a premise is supported by the National Planning Commission which identifies that the rural municipalities have little of the technical expertise to manage the whole supply chain of WSS projects from source to tap. Such infrastructure is a prerequisite for flush toilets which will also require additional technical support over the more basic VIP latrines.

An important aspect of water provision and motivations for improvement is health. The social health dimension of better access to quality drinking water and sanitation facilities was not enabled by the data. The only waterborne disease that is reported on in the GHS is that of very recent diarrhea problems. The sample reporting these issues is too small to make useful inferences regards piped water or flush toilet ownership. This remains an interesting area for future research as adequate volumes of water and sanitation facilities are needed to support a basic level of hygiene. Increasing the quality of water access and sanitation is arguably a necessary condition for associated incremental health improvements although perhaps not sufficient. Health education may be needed to ensure appropriate behavioural changes.

Identifying and understanding the importance of the different household socio-economic characteristics remains an important part of WSS-based policy design. Despite progress, the calls for service delivery in WSS continue to get louder as expectations grow and the disparity of provision by geography, race group or otherwise, widens. This paper serves to highlight those important socio-economic factors that identify water impoverished households, especially in the domain of sanitation. Policy makers would be well advised to focus attention in this area and ensure the level of technical ability is in place in areas of WSS scarcity. Whilst beyond the scope of this paper it is acknowledged that providing universal WSS has to be achieved within the limits of environmental capacities. Flush toilets are water intensive and alternative technologies may be more appropriate as environmental constraints get tighter.

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