Title: The determinants of migrants' access to piped water in South Africa: The case of metropolitan and non-metropolitan.

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Abstract

Studies on migration and access to water are generally detached from each other. However, there is little study attempting to make connection between the two aspects. There is limited knowledge on the challenges migrants encounter in places of destination regarding access to piped water for consumption and domestic use. Determinants of piped water access and differences across metropolitan and non-metropolitan regions are not fully documented on migration and service delivery (access to water) literature. Therefore, it has come to the attention of this paper to examine the significance between these two aspects, to examine the inequalities of accessing piped water in areas of destination by comparing the spatial areas. However, the study makes use of the 2011 Census data requested from Statistics South Africa. Descriptive statistics (univariate analysis) is used to show the distribution of the variables used. Chi-square analysis (bivariate analysis) was used to test the relationship between dependent and independent variables. Logistic regression (multivariate analysis) was executed to highlight the factors contributing to access piped water inside migrant's dwellings. Key findings indicate that access to piped water inside the dwellings differ by demographic features as per population groups, education level, and level of income. The disparity is also apparent in access to piped water in spatial areas, it differs across metropolitans.

Key words: Migration, Piped water, Metropolitan & Non-metropolitan areas

Introduction and Background

Migration has been largely studied and associated with economic conditions where people are migrating in resolutions of seeking employment, known as labour migration (Collinson et al., 2006; Lurie et al., 2003). However, there is little literature investigating the relationship between migration and access to basic services, safe drinking water in particular. Therefore, this paper aims at identifying the factors that migrants encounter during their migratory process. This paper examines closely the differences that exist among migrants in accessing piped water inside their dwellings across metropolitan and non-metropolitan areas of South Africa. The study tried to answer the general research question: "Are there any existing relationships between accesses to piped water inside the dwellings and migrants in respect of demographic characteristics across metropolitan and non-metropolitan areas?" To compile it, the study has used the data contained in the 2011 Census conducted by Statistics South Africa (StatsSA, 2011).

When looking at migration during the apartheid era in South Africa, it was strongly regulated and organized by the government and profoundly racist in design and execution (Smit, 1998). During this period, several procedures were constituted and executed to control and limit the movement of predominantly Black South Africans (Kok et al., 2003). Consequently, Black South Africans were constrained to live in urban areas without employment and authorization (Smit, 1998). Throughout this era, the marginalization and exploitation of the human rights were not merely on the movements, but also on other social involvements such as the provision of basic services and infrastructure within the population, such as access to safe drinking water, for an instance. According to Hirschowitz, (1997), under the policy of "separate development", majority of South Africans left to fend for themselves about water services. This resulted in an estimated 16 to 19 million people living without formal water supplies (Hirschowitz, 1997). In the post-apartheid, however, the new government has tried to justify the imbalances of the past by eliminating these laws and exploitations and implement new ones that would accommodate everyone (Smith and Hanson, 2003; Mlambo, 2018).

In contrast, the legacy of apartheid still exists in the contemporary South African cities through residential separation and increased level of unequal distribution and access in public services, including access to improved water (Budlender, 1999; Hirschowitz and Orkin, 1997). South Africa has a highly partial socio-economic structure, split into urban and non-urban black and white privileged and oppressed (Hirschowitz, 1997). In South Africa, inequality is based on

denial of access among the vast majority to amenities, standards and services. The population in the country have been denied equal access not only to basic resources such as water and sanitation, but also to the social investments such as education and health (Hirschowitz, 1997). According to Barde (2017), access to piped water has been significantly growing in urban areas of the developing world over the past twenty years. In rural areas (non-metropolitans), however, the situation is different, only 28% of the access to piped water inside the dwellings during 1990-2012. Worldwide, only 29% of rural population have access to piped drinking water on their premises (Barde, 2017). Development in access and quality to water leads not only to an increase for water demanded by dwellings but also to a proportionate decrease in the expenditure and collection time (Ngum, 2011).

Literature review

Migration is the fundamental aspect influencing the increase or decrease of the population size of an area. In the developing world, migration is perceived as the causing factor of increased demand in resources (including water access), and expansion in urban areas (Kamalie, 2017; Collinson et al., 2007; Rachidi, 2014; Posel, 2004). As concerted by Gcabashe (1995), most large cities in South Africa, such as Johannesburg and Cape Town, are overfilled with people in such a way that they are unable to accommodate them appropriately. He further stated that, many problems like sufficient housing, sanitation, insufficient access to water supply, to name a few, are facing migrants from rural areas that are now residing to urban areas (Gcabashe, 1995). These problems result from improper integration of clear majority of migrants, linked with failure of urban economy and urban infrastructure to provide proper provisions of human needs (Gcabashe, 1995; Smith and Hanson, 2003; Nnadozie, 2011).

Because of the demographic segregation in the country, access to improved water services, including piped water inside dwellings among migrants is unevenly distributed. The shortage of local infrastructure such as water, sanitation, and housing to name a few, varies by population groups and spatiality (Hirschowitz and Orkin, 1997; Smith and Hanson, 2003; Nnadozie, 2011). Therefore, the pattern of inequality and relative deprivation is apparent. Hirschowitz and Orkin (1997), on their study, found that nearly all Indian (98%) and White homes (98%), and the vast majority Coloured houses (78%) have taps inside their dwellings, compared with only 27% of Black dwellings. Their findings also showed that among African houses, those in cities are more likely to access their water in taps inside their dwellings (54%) compared with those in nonurban areas (8%). Africans living in the more urban provinces, such

as Western Cape and Gauteng, have more access to services compared with those living in more rural provinces, such as Free State, Northern Cape, or North West (Hirschowitz and Orkin, 1997). Conversely, Nnadozie (2011) argues that the focus of the government welfare services in the post-apartheid era has been pro-poor. Homes of the poor were found to have benefitted more from government services (Nnadozie, 2011). Drawing from the end of apartheid, there has been a dramatic change in access to services by the previously oppressed households (Nnadozie, 2011). Between 1994 to 2005 dwellings with access to piped water increased from 6.6 million to 11 million, a rise of above 69% (Nnadozie, 2011). This implies that about 4 million added connections delivered over this period.

Studies also show the relationship between migratory practice and the infrastructural distribution, including provision and access to safe drinking water among the dwellings. Ngobeni (2014) on his study of an overview of rural-urban migration in South Africa, states that the massive migration of people from rural areas has put the pressure on cities around the country and consequently, cities have witnessed an increase in housing infrastructure backlog. This can also be applicable on the context of this study, that this type of migration can exert pressure and increased demands in accessing water in cities. Rachidi (2014) opines that the demand for fresh drinking water is rising in response to global population and industrialization.

Theoretical framework

Theoretical framework is the structure that can hold or support a theory of a research study (Ngobeni, 2014). In respect of migration, people migrate from one place to the other for countless reasons; many researchers and scholars from different disciplines have developed many theories to try to explain the migratory process and its determinants (Ngobeni, 2014; Lindstrom and Ramirez, 2010; Majikijela, 2015). Migration can be categorized at Micro and Macro level. On micro level, migration theories are based on the decisions made by individuals to migrate, while macro level on the other side focuses on decisions influenced by socio-economic differences such as economic and environmental structures (Majikijela, 2015).

This study, however, is developed to bridge the gap from previous studies on migration and accessibility in basic services, on access to water. Existing studies does not go into depth details in studying the relationship between migration and water access. Therefore, there is no precise theory to be applied in explanation of the affiliation between migration and access to basic services (water). Nonetheless, at the centre of migration theory lies the arguments initiated by

Lee (1966), push-pull factors of migration, that explain the decision to migrate as linked with the place of origin and also the destination (Ngobeni, 2014). Moreover, the study used and reviewed theories such as migration selectivity theory and push-pull model of migration as a starting point to conceptualize a theoretical framework. Selectivity is an important feature of migration process (Lindstrom and Ramirez, 2010). This is because human migration does not go on a specific or defined process (Swart, 2004). This means that people choose how, why, where, and how to migrate. Migration could be either positively or negatively selected. When migrants are of better quality that their previous area, it is regarded as positive. Contrariwise, migration becomes negatively selective when migrants are responding negatively to push factors at the place of origin (Nsengiyumva, 2013). In the context of this study, migration could be positively selective when the migrants from water scarce areas are much likely to access water inside their dwellings with better quality in their areas of destination. Lee (1966) opines that migration is selective due to the single migrant's individualities since people respond differently to 'pull' (positive) and 'push' factors at the place of origin and place of arrival. Research on migration and selectivity uses predictor variables such as gender, age, level of educational, income and employment status, to name a few (Shaw, 1976). This could be used to predict migrant's water accessibility. In the context of this study, the areas of interest are metropolitan and non-metropolitan areas of South Africa where it is assumed that access to service delivery, particularly access to improved water, is still problematic for people and migrants in particular. Nonetheless, it seems that using the migrant characteristics selectivity, one can still apply this theory to establish a relationship between migrant's characteristics and access to piped water across metropolitan and non-metropolitan regions.

Looking on the push-pull model of migration initiated by Lee (1966), migration normally takes place because of the push factors of scarcer opportunities in the socio-economic situation, and because of pull features that occur in more industrialized areas (Thet, 2014). In other words, people mostly encouraged to migrate from one region to the other for various motives, others fascinated by definite socio-economic features in other geographical areas away from their places of origin, and others forced to move from their places of origin to other areas because of the rough situations occurring in their places of origin. Thet (2014) also argues that push factors are factors that compel an individual, due to different motives, to leave that place and go to some other place. This theory is relevant to the context of this study in such a way that migrants could be attracted by improvements and the provision of basic services in other areas than their previous areas of residence.

Data sources and methods

The existing study employed 10% of the data from 2011 Census requested from the Statistics South Africa. The study did not use a recent data, the 2016 Community Survey data, because it does not contain the socio-economic variables such as the income, employment status, and occupation which plays a huge role in shaping this study. Thus, the 2011 Census data is the last population census that has the latest data of all the variables utilized in the full completion of this study as it consists data up to the lowest geographical areas.

A population census is defined as the "total process of collecting, compiling, evaluating, analysing and publishing or otherwise distributing demographic, economic and social data pertaining, at a specified time, to all persons in a country or a well-defined part of the country" (Statistic South Africa, 2011)

The 2011 Census data was conducted by Statistics South Africa (StatsSA) which is known to produce data with high quality with a more reliable data. Methodologies and procedures were developed and tested in a form of mini tests and pilot in 2008 and 2009 respectively. The findings from the tests helped to improve the plans and methods for the final test in 2010. Later, it was expected the replica of how the actual count was to be conducted in 2011, and therefore, the timing had to be the same month as the main census, that is October month (Statistics South Africa, 2011). The findings in this study were computed using the statistical packages applied to the Statistical Package for the Social Sciences (SPSS).

Variables and definition

Independent and dependent variables are used in this study to test a hypothesis connecting migration and access to water. Regarding the independent variables, migratory variables signify the province of previous residence and province of usual residence. Socio-economic variables refer to occupation, employment status, and income. Demographic variables denote to the population groups; level of education; gender difference; and age groups. Water variables refer to water sources and water access. Looking at the dependent variable, it referred to "access to piped water".

Nominal or ordinal variables with more than three categories were computed. For example, dependent variable "Access to piped water" was divided into categories and presented in SPSS as (1) = Piped (tap) inside the dwelling; (2) = Piped (tap) water inside the yard; (3) = Piped (tap) water on community stand; and (4) = No access to piped (tap) water. As for independent

variables, population group became (1) = Black/African; (2) = Coloured; (3) = Indian/Asian; and (4) = White. Income category became: (1) = No income; (2) = Low income; and (3) = High income. Employment status categorised as: (1) = Unemployed; (2) Employed; and (3) = Not economically active. Level of education categorised as: (1) = No schooling; (2) = Primary schooling; (3) = Secondary schooling; and (4) = Tertiary.

Statistical analysis

Univariate, Bivariate, and Multivariate methods were used in this study to analyse the data. The data is summarized in tables. Thus, the relationship between migratory variables, water variables, and socio-economic variables were observed. A multivariate analysis which is the model that combines more than two variables was created. Independent variables were concurrently included in the model. The model helped to ascertain which independent variables were statistically significant with dependent variable (access to piped water). Therefore, Chi-Square statistical test was utilized to test the relationship between the independent and dependent variables. For instance, a $p<0.05$ indicated that the relationship between variables is significant, therefore, the model fits the data.

Findings

Distribution of migrants in respect of gender in 2011

Based on the 2011 Census data, the distribution of migrants according to the province of previous residence shows the gross migration of migrants across the nine provinces of South Africa in 2011 was 20482. Figure1 at the bottom of the paper shows the dispersion of migrants based on their gender in the year 2011. It is apparent from the findings that males are more likely to migrate than females with 63.3% and 31.7% respectively. The findings are consistent with literature that suggests that males are more migratory than their female counterparts from ages 25 to 59 olds (Mlambo, 2018).

Migrant's access to piped water across metropolitans

Table 1 below illustrates the findings on migrant's access to piped (tap) water across metropolitan areas of the country. When looking at access to piped water inside the dwelling/premise, the results show that migrant's in the City of Johannesburg and in City of Tshwane (both in Gauteng Province) have the most access with 36.4% and 20.7% respectively. Followed by City of Cape Town with 17.6%. Since these metropolitans are situated in urban

areas, the findings support the argument that South Africa is rapidly urbanizing as large number of people are migrating to urban areas mainly because of the perceived better living and job opportunities that are ought to be available (Mlambo, 2018) Conversely, other metropolitans like Buffalo City, Nelson Mandela Bay, Mangaung, and eThekwini have small proportions in accessing piped water inside their premises. The primary reason for these disparities might be based on the spatiality, these ones are more rural, and that means there is not much development in infrastructure and service delivery as compared to the ones situated in urban regions. However, the findings also show that in these highly urbanised metropolitans (City of Johannesburg, City of Cape Town, Ekurhuleni, and City of Tshwane) the access to water is the issue as people (migrants in this case) can travel long distances outside their dwellings to access water. In addition, the findings reveal that they also lack access to developed (piped) water. General explanation of this is because that these metropolitans attract high influx of migration, where in-migration surpasses out-migration. Therefore, this makes it difficult for the local government to provide the growing population with adequate and proper service delivery (Gcabashe, 1995). Consequently, migrants tend to lack access to developed water sources or find themselves travelling long distances to get to water points. For instance, the findings show migrants with no access to piped water with 36.0 in City of Tshwane and 31.1% in City of Johannesburg, whereas it is only 1.2% in Mangaung. Migrants accessing tap water in distances more than 500 metres outside their dwellings, the results show it was 25.0% in City of Cape Town and Ekurhuleni, 16.7% in City of Tshwane, whereas that is not the case in Buffalo City with 0.0%.

Chi-square statistics was used to test for the association between access to piped water and independent variables. In this case, the chi-square test was performed between access to piped water and metropolitan areas. The findings show a p-value of 0.000 between the two variables above mentioned. Since the p-value of 0.000 is less than 0.05, the test statistic was significant. This means that there is a relationship between migrant's access to piped water and metropolitan areas they choose to go.

Access to piped water by level of income

When examining figure 2, the findings reveal that more than some half migrants (59.9%) with high income are likely to access piped water inside their houses than those with low or no income (29.2% & 11.3% respectively). In addition, those with high income are less likely not to have access to tap water (16.0%) than those with low and no income (59.9% & 24.5%

correspondingly). The findings prove that migrants with low or no income are more likely to access piped water outside of their premises, travelling long distances to fetch water as compared to those with high income.

The output of chi-square statistic showed the test of 0.000. Therefore, since the p-value of 0.000 is less than the value of 0.05, the test statistic was significant. This means that there is a relationship between migrant's access to piped water inside the dwellings and level of income.

Access to piped water by level of education

It is apparent in figure 3 below that migrants with secondary school have more access in piped water in all categories, from inside the dwellings and are travelling long distances more than 500 metres. This may explain that many of the migrants acquire at least a secondary education and are diverse in their places of destination. However, the findings also show that more than a quarter (32.9%) of migrants with tertiary education have access to piped water inside their dwellings more than those with primary or no formal education (4.1% & 2.5% respectively). The chi-square statistics was 0.000. Therefore, since the p-value of 0.000 is less than the value of 0.05, the test statistic was significant. This shows that the relationship exists between migrant's access to piped water inside the dwelling and the level of education.

Access to piped water by population groups

The findings in Figure 4 below show the relationship between migrant's access to piped water and racial groups. The results show that Whites are much likely to access piped water inside their premises with 49.8%, Indian/Asian and Coloureds with only 6.2% and 5.1% respectively. Findings also show that Black migrants are the only group that likely to have access outside of the dwellings and is the only group with high percentage of not having access to piped water with the proportion of 83.8%, with only 2.1% for Indian/Asian and Coloureds. These results may be influenced by the proportion of population groups in the country, as Black population consists of more than 67%, White more than 21%, Coloured with more than 8.6%, and Indian/Asian with just more than 2.4% of the total population (Statistics South Africa, 2011). The results on chi-square test showed the p-value of 0.000. This means that the test was significant since the p-value is less than the value of 0.05. Therefore, based on these findings we can conclude that there is a significant relationship between migrant's access to piped water inside the premises and population groups.

Aspects contributing towards the access to piped (tap) water across metropolitan areas

Table2 further down shows the results from logistic regression model. The omnibus tests of model coefficients were significant with p-value of 0.000 and -2 log likelihood revealed that the data fits well the model. The column called Exp.(B) shows the odds ratios (OR) for the dependent and independent variables. When looking on metropolitan, the results show that the OR for Male is 1.413. This means that Male migrants in metropolitan areas are more likely to have access to piped water inside the dwelling compared to female migrants. These results, however, indicate that likelihood to access piped water inside the dwelling in metropolitan areas is influenced by gender differences. Therefore, this produces an implication that being male migrant increases the chances of accessing improved water compared to females. This suggests that even in the post-apartheid South Africa, disparities still exist between genders, males being advantageous than their female counterparts. As stated by the South African human rights commissions (SAHRC), women have been marginalised and regarded as unequal as compared to men in terms of social and power relations. Considering the age groups, the OR for Children, Youth, and Elders is 6.968; 2.36; and 1.875 respectively. This means that for every one-unit increase in age (i.e. one additional year of living), the odds of having access to piped water inside the dwelling increases. Looking at the population groups, the data shows that being Black increases the chances of accessing piped water in metropolitans 3.552 times higher than the Whites. This supports the argument made by Ngum (2011) that in an attempt to correct the imbalances of the past (apartheid regime), new policies that promoted equality and human dignity were adopted by the post-apartheid government. This might also be due to the fact that Black population is dominating the numbers in the country, giving them great chances of benefiting in almost all basic services. With regard to level of education, the study included three dummies in the model (Tertiary education is the reference category). The OR for migrants with no formal schooling is 3.585, for primary education is 5.314, and is 2.317 for secondary schooling. This means that migrants in metropolitan with no schooling, basic or secondary education are more likely to have access to piped water inside the dwelling than those with higher education. The findings also indicate that migrants with no income and those with lower income have increased chances of accessing piped water than those with high level of income with 5.051 and 3.876 odds correspondingly. This implies that the government is giving a hand to those groups of people who are disadvantaged than the others. Finally, the findings show the significance in provinces of previous residence. Migrants from the Eastern

Cape, Free State, KwaZulu-Natal, and Limpopo have increased chances of accessing piped water in metropolitan by 2.516, 2.879, 1.608, and 1.606 times higher respectively.

Aspects contributing towards the access to piped (tap) water across non-metropolitan areas

Looking at non-metropolitan areas in Table2 below, there are less factors contributing towards accessing to piped water as compared to metropolitan areas. Sex is one of the important factors influencing the access to piped water. Findings illustrate that being male increases the chances of accessing piped water inside the house by 1.204 times higher than females in non-metropolitan areas. As in the metropolitan areas, this is also the case in the non-metropolitan areas. This implies that females have less access to piped water than their counterparts. Population groups were also significant in the findings. Black, Coloured, and Indian migrants in non-metropolitan areas have increased chances of accessing piped water inside their dwelling 5.842, 2.073, and 3.620 times higher than Whites respectively. Level of education is another factor which influences the likelihood of benefiting the access to piped water inside the dwelling in non-metropolitan areas. Findings clearly indicate that migrants with no schooling, primary schooling, and secondary education maximise the possibilities of accessing piped water inside their dwellings by 3.386, 3.566, and 2.429 times higher, respectively than those with tertiary education. The results also portray the likelihood of accessing piped water inside the dwelling by level of income. Migrants with no income increase their chances of accessing piped water inside their dwellings by 3.643 times higher than those with high income, while those with lower income increases their chances by 2.763 times higher. This means that migrants with no income or with lower income are likely to access piped water inside their premises because, as they do not afford water bills, the government gives them free access unlike those who can afford to pay water. Table 2 further indicate that, being an unemployed migrant is a contributing factor of water access to piped water inside the dwelling. The findings show that being an unemployed migrant increases the chances of accessing piped water inside the dwelling by 1.355 times higher than those who are not economically active. This may be because the government provide free or at lower rate basic services to those who cannot afford access.

Discussion of the results

The aim of this paper was to examine was the relationship between migrant's access to piped water inside the dwellings across the metropolitan and non-metropolitan areas of South Africa. This was investigated using demographic variables such as gender, level of income, level of education, and population groups. However, when looking at the access to piped water across the metropolitans, the study found that migrants in City of Johannesburg, City of Tshwane, Ekurhuleni, and City of Cape Town are more likely to access improved and safe water inside their dwellings. This supports the argument by Barde (2017) that access to piped water has significantly increased in urban areas.

However, even though the South African government (ANC) implemented some policies which enforce access to safe water, such as making water access a human right, there are still shortcomings in water access based on one's demographic characteristics. Evidence from the literature has shown that female headed dwellings are poorer than their male counterparts hence limiting their access to water. This means that water access is more a socio political than an economic issue (Dungumaro, 2007). This study also discovered that the migrant's level of income was identified to be one of the contributing factors towards accessing tap water inside the dwelling. This paper reveals that, the higher the earning/ income of the migrants, the chances of accessing piped water inside the dwelling decreases. However, it would be mistaken to conclude that an income is a predictor of dwelling to access tap water (Ngum, 2017). This is because the findings show that migrants with low income and those with no income, however, do have access to improved water inside their yards and public taps. This implies that the only difference between those with high income and those with low or with no income is the distance in water point (tap), those with high incomes have greater chances of accessing piped water inside their dwellings than the outside as compared to others with low or no income. Furthermore, the access to piped water also depends on the availability of water in a certain area, other than just on the level of income one earns or not. Households in a water scant area with relatively high income would still not be able to access water (Ngum, 2017).

When looking at the level of education, the results show that migrants with at least secondary school and tertiary education have great chances of accessing piped water inside their dwellings than the ones with only primary or with no formal education. Nonetheless, it would be inaccurate to measure the accessibility to piped water based solely on the level of education obtained. However, the differences in education are minimal and are accounted for by the

differences in economic status, those with higher education are more likely to be economically secured and can afford to pay water inside their dwellings in areas that pay for water use. Ngum (2018) also found that a greater proportion of dwellings headed by those with higher education have tap water inside their premises.

Lastly, there are great disparities in accessing piped water inside the dwellings between population groups (Ngum, 2017). Given that, the proportion of the racial groups in South Africa is unevenly distributed, Black population with approximately 67%, White with 21%, Coloured 8.6%, and Indian/Asian 2.4% (Statistics South Africa, 2011), the results in this study also show the disparities in access to piped water inside the dwellings by racial groupings. The study found that half of the White have piped water inside their dwellings, while Black population that is expected to have most access due to their majority, but have the least of access to piped water inside the dwelling.

Conclusion

This paper focused on the assessment of migrant's access to piped water across metropolitan and nonmetropolitan areas of South Africa. It made use of secondary data (2011 Census) using univariate, bivariate, and multivariate methods of analysis to achieve this end. Deducing from the findings, the study concludes that there are great differences in migrant's dwelling access to piped water. The study found that migrants in large metropolitans, especially City of Johannesburg are more likely to access piped water, inside and outside of their dwellings. This is because these metropolitans are much developed than the others. In contrary, vast number of migrants without access to piped water are also found in these metropolitans. This is because these metropolitans are highly urbanised and it is difficult for local government to accommodate all the population with proper and adequate facilities. Lastly, the study also discovered that the access to piped water, especially inside the dwelling, can differ across migrants in terms of the demographic characteristics such as the level of income, level of education, and racial groups.

Recommendations

Given that access to basic services in general in apartheid era was problematic among racial groups, it is recommended that the local government should be firm and adhere to the policies and regulations implemented by the post-apartheid government, that all people in the country should have equal access in basic services including access to safe water. The government should lower the cost of water usage to accommodate all the dwellings and needs to prioritize the previous disadvantaged population groups, especially Blacks as they contain large proportion of the total population of the country. The improvement of water supply as means to reduce poverty should be focused on by the government. As for further research on this topic, this study opens a gap for further investigation on migration and reliability of water supply together with migrant's alternative water sources.

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Table 1: The distribution of access to piped (tap) water and migrants in metropolitan regions in percentage (%)

Access to piped water	CPT	Buffalo	N.M Bay	Mangaung	eThekwini	Ekurhuleni	JHB	Tshwane	Total
inside the dwelling	17.6	1.6	1.6	1.4	8.3	12.2	36.4	20.7	100%
inside the yard	12.8	1.4	0.6	3.6	6.9	17.5	39.4	17.8	100%
less than 200m	19.8	2.4	0.7	3.1	18.1	12.6	29.6	13.6	100%
Between 200m & 500m	10.0	2.3	0.8	0.8	8.5	18.5	40.8	18.5	100%
less than 500m	21.4	1.8	1.8	0.0	17.9	23.2	21.4	12.5	100%
Between 500m & 1km	25.0	0.0	4.2	4.2	12.5	25.0	12.5	16.7	100%
No access to tap water	7.3	4.3	1.8	1.2	11.0	7.3	31.1	36.0	100%
Total	17.1	1.7	1.5	1.7	8.5	12.8	36.4	20.4	100%

Table 2: Aspects contributing towards the access to piped (tap) water across metropolitan areas

Independent variables	Metropolitan areas				Non-metropolitan areas			
	B	Wald	Sig.	Exp.(B)	B	Wald	Sig.	Exp.(B)
Sex								
Male	0.346	16.867	0.000	1.413	0.185	4.556	0.033	1.204
Female@								
Age group		17.041	0.001			2.070	0.558	
Children	1.941	6.220	0.013	6.968	0.717	0.486	0.486	2.048
Youth	0.860	8.273	0.004	2.363	-0.021	0.007	0.931	0.979
Elders	0.629	4.434	0.035	1.875	0.083	0.115	0.734	1.086
Population group		110.846	0.000			146.793	0.000	
Black/African	1.267	77.837	0.000	3.552	1.765	138.548	0.000	5.842
Coloured	-0.084	0.072	0.789	0.919	0.729	6.395	0.011	2.073
Indian/Asian	-0.473	1.692	0.193	0.623	1.287	19.618	0.000	3.620
White@								
Level of education		96.539	,0.000			39.647	0.000	

Independent variables	Metropolitan areas				Non-metropolitan areas			
No Schooling	1.277	27.082	0.000	3.585	1.220	26.366	0.000	3.386
Primary Schooling	1.670	82.538	0.000	5.314	1.271	34.161	0.000	3.566
Secondary schooling	0.840	28.271	0.000	2.317	0.887	19.773	0.000	2.429
Tertiary level@								
Income group		111.128	0.000			70.895	0.000	
No Income	1.620	97.602	0.000	5.051	1.293	61.182	0.000	3.643
Lower Income	1.355	96.079	0.000	3.876	1.016	60.188	0.000	2.763
High Income@								
Employment status		6.182	0.045			4.978	0.083	
Employed	-0.161	1.608	0 .205	0.851	0.077	0.355	0.551	1.080
Unemployed	0.154	1.259	0.262	1.166	0.304	4.631	0.031	1.355
Not economically active@								
Province of usual residence		7.478	0.587			11.211	0.261	
Western Cape	0.405	1.294	0.255	1.499	0.023	0.005	0.943	1.023
Eastern Cape	0.460	1.645	0.200	1.585	0.449	2.278	0.131	1.566
Northern Cape	0.768	1.382	0.240	2.156	0.012	0.001	0.975	1.012
Free State	0.017	0.001	0.969	1.017	-0.012	0.001	0.974	0.988
Kwa-Zulu Natal	0.488	1.899	0.168	1.629	0.088	0.085	0.771	1.092
North West	0.257	0.191	0.662	1.294	-0.068	0.050	0.823	0.934
Gauteng	0.235	0.496	0.481	1.265	0.123	0.174	0.676	1.131
Mpumalanga	0.555	1.224	0.269	1.742	0.215	0.484	0.486	1.240
Limpopo	0.414	1.279	0.258	1.513	0.136	0.205	0.650	1.145
Outside SA@								
Province of Previous Residence		62.294	0.000		14.659	0.101		
Western Cape	0.136	0.402	0.526	1.146	-0.281	1.225	0.268	0.755
Eastern Cape	0.923	28.389	0.000	2.516	0.202	1.383	0.240	1.224
Northern Cape	0.453	1.216	0.270	1.573	0.375	1.398	0.237	1.455
Free State	1.057	17.607	0.000	2.879	-0.479	3.259	0.071	0.619
Kwa-Zulu Natal	0.475	6.564	0.010	1.608	0.084	0.209	0.648	1.087
North West	0.146	0.197	0.657	1.157	-0.038	0.038	0.845	0.963
Gauteng	0.062	0.177	0.674	1.064	-0.151	0.798	0.372	0.860
Mpumalanga	0.396	1.692	0.193	1.485	-0.076	0.144	0.705	0.926
Limpopo	0.474	6.426	0.011	1.606	0.121	0.471	0.493	1.129
Outside SA@								

Independent variables	Metropolitan areas				Non-metropolitan areas			
Constant	-7.025	207.664	0.000	0.001	-5.115	140.311	0.000	0.006

Source: Author's own calculations.

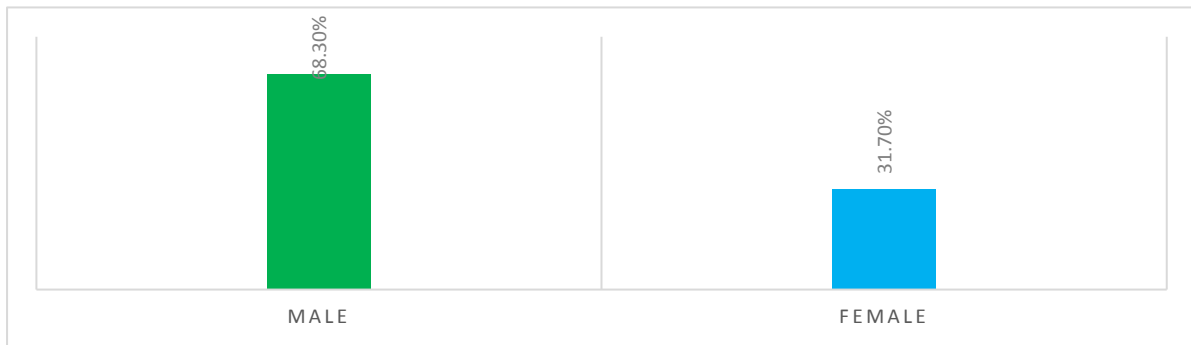**Figure 1: The distribution of migration by sex**

Figure 2: Distribution of access to piped water in respect of level of income
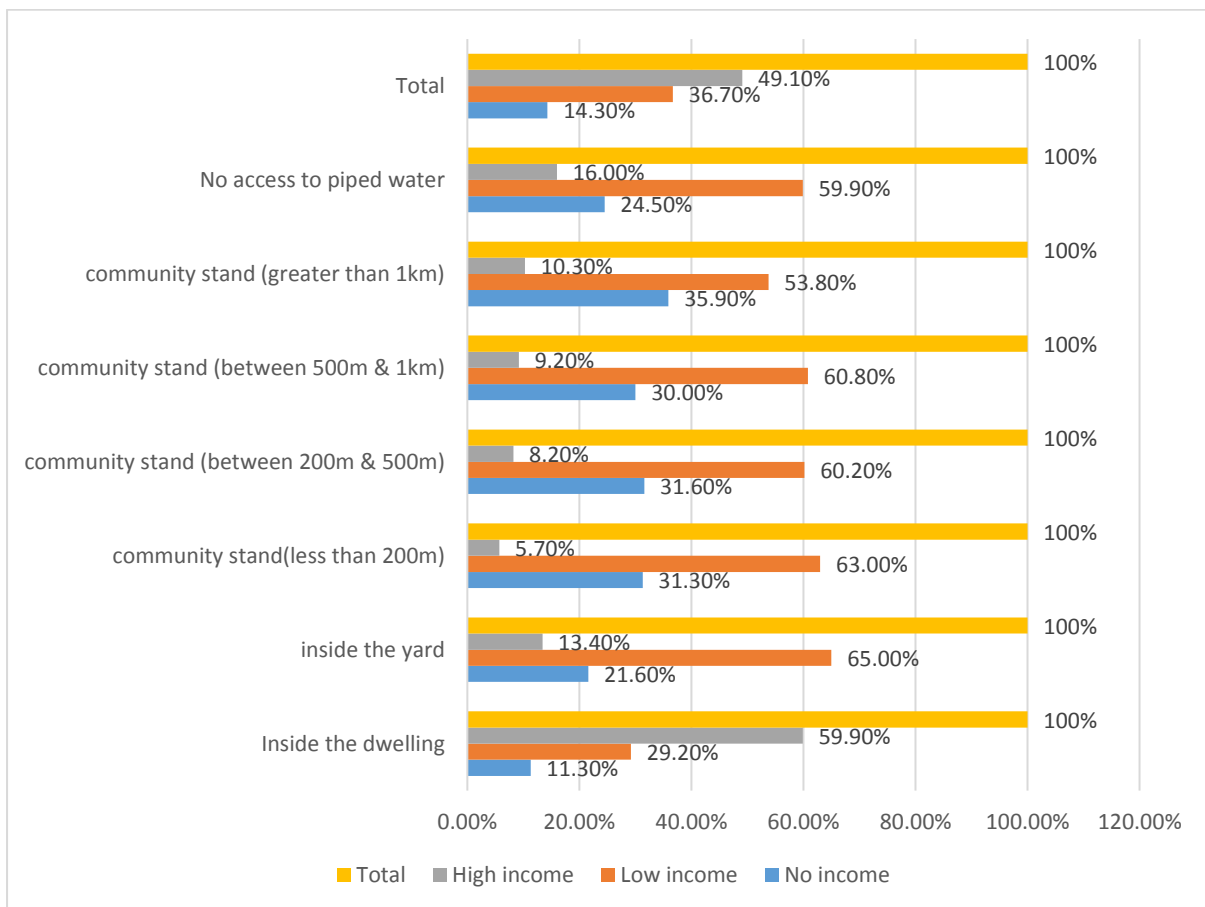
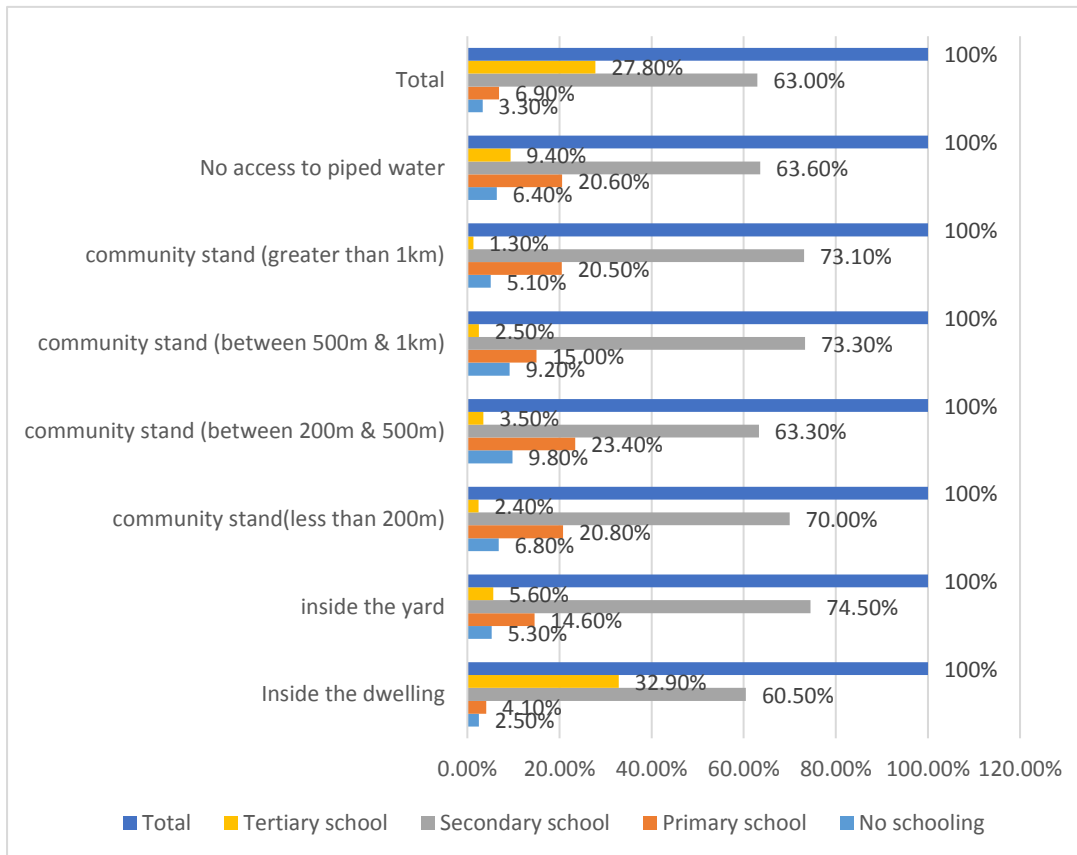*Figure 3: Distribution of access to piped water in respect of level of education*

Figure 4: Distribution of access to piped water in respect of population groups