Guatemala

Water Supply, Sanitation and Hygiene (WASH) Poverty Diagnostic

Annexes

Annexes: Poverty Diagnostic for Water Supply, Sanitation, and Hygiene (WASH)

This document summarises the analysis performed on the socio-economic profiles, poverty trends, consumption and human opportunities of Guatemalan households. Data come from the LHMS/ENCOVI survey, years 2000-2014, and are weighted to make the analysis representative at the national level.
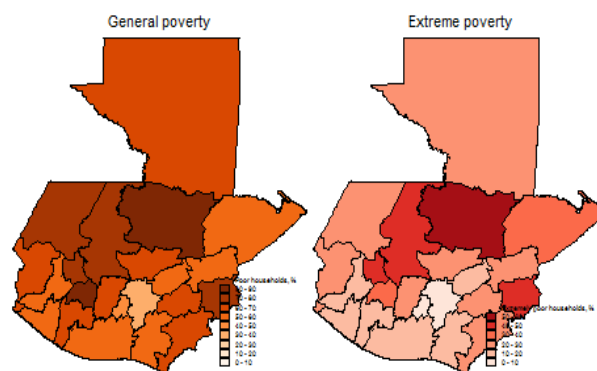

General and extreme poverty by administrative post

Source: own calculations using ENCOVI survey data, year 2014

Summary

Poverty and inequality

A staggering 59 percent of the Guatemalan population currently lives in general poverty, and almost a quarter of the population lives in extreme poverty. These numbers are particularly worrisome as they represent a marked increase with respect to their value in 2000. Both general and extreme poverty are much more prevalent in rural areas, but urban areas saw a much more marked increase in poverty over time: extreme urban poverty in particular is now four times as high as it was in 2000.

The distribution of general and extreme poverty across districts is quite similar, with particularly high concentrations in Alta Verapaz, Solola, Totonicapan, Quiche, Huehuetenango and Chiquimula, and lower levels in Guatemala, Sacatepequez and Escuintla. The Gini index for the country is 0.39: inequality is higher in urban (0.38) than in rural areas (0.32), and is highest in Zacapa and Quetzaltenango districts (0.42) and lowest in Escuintla (0.28).

General and extreme poverty head-counts by area - percentages						
	2000			2014		
	Urban	Rural	National	Urban	Rural	National
General poverty	27.13	74.49	56.20	42.15	76.10	59.28
Extreme poverty	2.811	23.80	15.70	11.23	35.26	23.36

Source: own calculations using ENCOVI survey data, years 2000, 2014

2.2 Improved access to water

91 percent of the Guatemalan population have access to improved water. Overall, between 2000 and 2014, access to improved water increased by around 2 percentage points. The changes over time are mainly due to an increase by almost 8 percentage points in water piped directly to premises, and a reduction in access to other, still improved, yet lower quality sources. As a result, currently more than three quarters of the population have access to piped water. At the same time, the usage of surface water dropped by more than a third with respect to its 2000 level. Improved access to water is more prevalent in urban (95 percent) than in urban areas (87 percent): the difference is even sharper when it comes to access to piped water (89 vs. 64 percent) and especially use of surface water (1.5 vs. 9.3 percent).

Access to water by year - percentages		
	2000	2014
Piped to premises	68.65	76.27
Piped to neighobour/public	3.99	1.53
Tubewell/borehole	14.56	11.41
Rainwater	0.57	2.21
Truck or barrel	0.44	0.47
Surface water	7.28	5.05
Other unimproved	4.52	3.07

Source: own calculations using ENCOVI survey data, years 2000, 2014

Among Guatemalan districts, Solola, Escuintla Suchitepequez and Sacatepequez are the ones with highest access to improved water (96-98 percent), Alta Verapaz, Chiquimula, Santa Rosa and Peten the lowest (80-87 percent). Alta Verapaz, which is by far the location with the lowest access (80.7 percent), is however the district that experienced the highest increase in access to improved water over time, moving by 18 percentage points from 63 percent in 2000.

2.3 Improved sanitation

Only 58 percent of the Guatemalan population have access to improved sanitation. This however represents a sizeable increase from very low levels in 2000, when more than half of the population lacked access to improved sanitation. At the same time, while more than 5 percent still perform open defecation, the percentage has dropped by more than 60 percent since 2000. Almost 43 percent of the population currently have a flush toilet.

Sanitation access by year - percentages		
	2000	2014
Flush to sewer	30.31	42.94
Flush to septic tank	3.18	7.76
Pour flush/composting toilet/other improved	10.76	7.61
Open defecation	13.18	5.02
Ambiguous	42.57	36.67

Source: own calculations using ENCOVI survey data, years 2000, 2014

Access to sanitation is significantly better in urban than in rural areas: 83 percent of the urban population have access to improved sanitation, 72 percent have a flush toilet and 1.7 percent does open defecation; the corresponding figures for rural areas are 29, 24 and 9 percent, respectively.

The percentage of population with access to improved sanitation varies widely by district: if on the one hand some locations like Sacatepequez and Guatemala have shares as high as 90 percent, others like Totonicapan and Peten barely reach 30 percent. In Alta Verapaz, roughly one in five individuals has access to improved sanitation.

Socio-economic profiles

While 96 and 79 percent of the non-poor have access to improved water and sanitation, respectively, the figures are 88 and 45 percent for the poor, and drop to 83 and 19 for the extremely poor.

The most pronounced differences in improved access to water along socio-economic lines are due to age, education, employment sector, ethnicity and migrant status of the household head. When the household head is young (13-24 years old), improved access to water is 5-7 percentage points lower than for other age groups. The same applies when the household head has not completed primary education, and when they are employed in the primary sector. When the household head is an indigenous language speaker or when they have migrated to a new municipality in the last 5 years, the household's access to improved water is 4 percentage points lower than when they do not speak an indigenous language or have not changed municipality.

With the exception of age, the same socio-economic categories account for the main differences in access to improved sanitation as well, although in this case the gaps are much more pronounced. Households whose head migrated or did not complete primary education have respectively 20 and 30 percentage points lower access to improved sanitation than non-migrants or those with at least primary education, whereas primary sector workers and indigenous language speakers are less than half as likely to access improved sanitation as their respective counterparts.

Education, employment sector and ethnicity also appear to be strong predictors of general and extreme poverty, whereas poverty headcounts are higher for non-migrants than for migrants.

Perhaps counterintuitively, households headed by women appear to have a better access to both improved water and sanitation, as well as a lower likelihood of being poor.

As regards the bottom 40 percent of the income distribution, it is predominantly composed of households living in rural areas, whose head is a male, aged 25-44, has not completed primary education, is a wage earner and is employed in the primary sector.

Consumption model

Simple regression analysis of household consumption on WASH variables and a set of covariates shows a positive, statistically significant and robust correlation between consumption and access to improved water and sanitation. When the household has access to improved water, their consumption increases by 19 percent; when they have access to improved sanitation, by 33-37 percent (depending on the actual specification used). Households that have access to both improved water and sanitation have 33 percent higher consumption. Other variables that are significantly positively correlated with consumption are gender (female) of the household head, living in an urban area, education, and being employed, non-wage earner. Age of the household head does not seem to matter much in determining household consumption, whereas households with higher dependency ratios (the ratio of the number of household members younger than 15 and older than 65 on the number of household members aged 15-65) are correlated with 20 percent lower consumption.

Human Opportunity Index (HOI)

Children 0-16

The HOI for access to improved water in Guatemala was 85 in 2000 and increased to 89 in 2014. At the same time, the HOI for access to piped water improved from 66 in 2000 to 72 in 2014. The HOI for access to improved sanitation experienced a more marked increase, almost doubling from 38 in 2000 to 75 in 2014. The HOI for access to any sanitation services and not using open defecation also improved substantially in the time span considered, from 84 to 93. In all cases, the increase in the HOI is driven by both an increase in coverage and a decrease in inequality as measured by the dissimilarity index, although the reduction in inequality is much more substantial for access to improved sanitation.

Changes in the HOI for water were due almost entirely to a scale effect, with only a moderate improvement in inequality (increase in equalisation). Composition effects, due to shifts in the group size circumstances, were also positive, and particularly significant for access to piped water, where they accounted for more than a fifth of the overall change over time. Patterns are very similar for sanitation, although again, the equalisation effect is twice as strong as the scale effect for access to improved sanitation.

The HOI for water is highest in Solola district (98) and lowest in Chiquimula (75). Spatial differences are incredibly more pronounced for sanitation, where the HOI ranges from 86 in Sacatepequez to just 4 in Alta Verapaz.

Inequality of opportunity for water and sanitation services is mainly attributable to wealth distribution and urban or rural location inequality, which account for around 75 percent of the dissimilarity index for both access to improved water and sanitation. The household head characteristic that matters the most in explaining access to water and sanitation services is education.

Human Opportunity Index: Children 0-16 years			
Opportunity	HOI	Coverage	Dissimilarity
Improved water			
2000	85.26	85.50	0.28
2014	89.53	89.69	0.17
Piped water			
2000	66.17	67.92	2.58
2014	72.14	73.32	1.61
Improved sanitation			
2000	17.62	34.12	48.36
2014	35.1	46.88	25.12
Non-open defecation			
2000	83.82	84.50	0.80
2014	93.42	93.54	0.14

Own calculations using ENCOVI survey data, years 2000, 2014.

Children 0-59 months

The HOI trends for younger children are very similar to those relating to the broader sample of children. The HOI for access to improved water changed from 83 in 2000 to 89 in 2014, the HOI for access to piped water from 64 in 2000 to 72 in 2014. The HOI for access to improved sanitation more than doubled, but remains very low at 36 in 2014. The HOI for not using open defecation improved from 82 to 93. Again, in all cases both coverage and inequality improve, and the reduction in inequality is particularly pronounced for access to improved sanitation.

Human Opportunity Index: Children 0-59 months			
Opportunity	HOI	Coverage	Dissimilarity
Improved water			
2000	83.00	83.29	0.35
2014	88.51	88.7	0.22
Piped water			
2000	63.68	65.64	3.00
2014	71.68	72.89	1.66
Improved sanitation			
2000	15.93	31.56	49.53
2014	35.59	47.05	24.37
Non-open defecation			
2000	82.00	82.77	0.93
2014	92.62	92.75	0.14

Own calculations using ENCOVI survey data, years 2000, 2014.

Changes in the HOI for water were mainly due to a scale effect, although both equalisation and composition effects were now more relevant than for the broader sample of children. The same applies for sanitation, with again the exception of access to improved sanitation, where the equalisation effect accounts for 60 percent of the change.

The HOI rankings across districts are also very similar to the broader sample case: the HOI for water is highest in Solola (97) and lowest in Alta Verapaz (71), for sanitation it is highest in Sacatepequez (86) and lowest in Alta Verapaz (7).

Inequality of opportunity for water and sanitation services is overwhelmingly driven by inequality in the wealth distribution and urban or rural location, which account for around 80 percent of the dissimilarity index. The most important characteristic of the household head is again education.

4

Measurement and Data Issues in Guatemala

Actual Population Size

The population figures used in this report and in official statistics are projections, not actuals. The last Population and Housing Census dates from 2002 so some caution is needed when looking at per capita figures. It is expected that birth and death rates will have changed in the 14 years since the last census: certainly there is evidence of changes in migration patterns. Obviously, any errors in the population projections could affect the analysis of per capita GDP, and, if there are variations in the growth of different population groups, this could affect poverty measures as well, although there is no data to indicate that this particular problem exists.

Poverty Measurement

The data for the poverty measures come from the National Living Standards Measurement Study surveys (Encuesta Nacional de Condiciones de Vida or ENCOVI) for 2000, 2006, and 2014. There are also data for a 2011 round of the survey but there are some methodological concerns about these data in terms of comparability. The government is currently reviewing this issue and since this review may lead to revisions of the 2011 indicators, we have chosen to use only data from the 2000, 2006, and 2014 survey rounds in the present report.

Guatemala uses a consumption-based monetary measure of poverty. This per capita measure covers: the consumption of purchased and non-purchased food (own production, gifts, and donations); (ii) transport and communications; (iii) consumer goods; (iv) household services and legal costs; (v) utilities, education, and health; and (vi) the annual use value of housing and durable goods. The poverty lines used reflect the costs of a minimum level of calories (extreme poverty line) and the cost of obtaining both food and other basic necessities (overall poverty line). We use this official measure of welfare throughout the report.

However, the exception is when the focus of the analysis is on benchmarking Guatemala's situation in comparison with other countries (as is in done in this chapter). In such cases, we use an income-based measure of poverty and an international overall poverty line of US$4 and an international extreme poverty line of US$2.5 per person per day in 2005 PPP terms. While there has been an update to the 2011 PPP for the US$1.25 line, there are no updates for the US$2.5 and US$4 lines. For this reason, the report continues to use the 2005 PPP and the global extreme poverty line of US$1.25 in 2005 PPP.

Urban and Rural Definitions

A new urban/rural classification was introduced in the 2002 Census by Guatemala's National Statistics Institute (Instituto Nacional de Estadística, INE). The share of the urban population increased from 38.6 percent in 2000 to 48.1 percent in 2006. However, only 2.9 percentage points of this increase were due to migration and population growth; the remaining 6.6 percentage point increase was due to changes in the urban/rural classification (World Bank, 2009). This dramatic increase in the share of urban areas in the sample explains why extreme poverty decreased between 2000 and 2006, even though both urban and rural extreme poverty increased.

The more recent evolution of poverty between 2006 and 2014 has not been affected by changes in the urban/rural classification. When the rural-urban definition is important for our analysis, the discussion will be restricted to changes between 2006 and 2014 only.

Poverty and Inequality

Inequality in Guatemala is high, but has fallen much faster than in either Central America or Latin America as a whole. As measured by the Gini coefficient, inequality of income in Guatemala was 49 percent in 2014, higher than in most LAC and Central American countries, all aspirational peers, and all structural peers except for Honduras (Figures below). Guatemala's inequality ranked in the 91st percentile worldwide (WDI, 2015). However, while there was no appreciable change between 2000 and 2006, the next eight years saw a very substantial decline in the Gini, which fell from 0.55 to 0.49 percent. This sharp fall in inequality occurred in both urban and rural areas, with urban inequality falling from 0.55 to 0.48 and rural inequality falling from 0.50 to 0.46.[1] As already indicated, these reductions in income inequality have mainly been due to a fall in the incomes of the rich rather than to a rise in the incomes of the poor.[2] And despite this convergence in the income distribution, the total share of income held by those in the bottom deciles remains extremely low. The richest one percent of the income distribution controls 13 percent of total income.
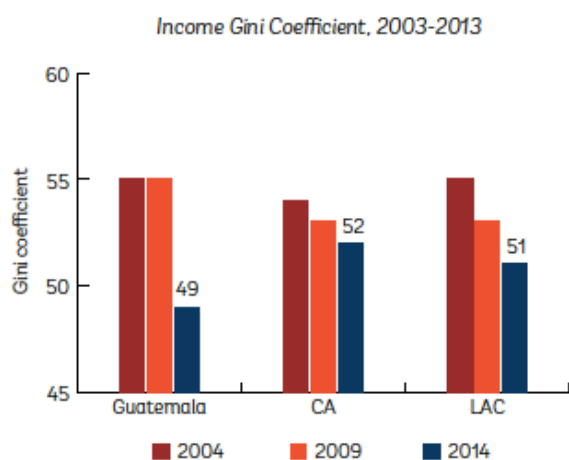
Income Gini Coefficient, 2003-2013

Source: SEDLAC harmonized database (SEDLAS and the World Bank), June 2015.
Note: The Gini coefficients, based on income, for each country are as close to the indicated years as possible. For Guatemala the data points are 2000, 2006, and 2014.

The Rate of decrease in Income inequality was higher in Guatemala than in Central America or in LAC
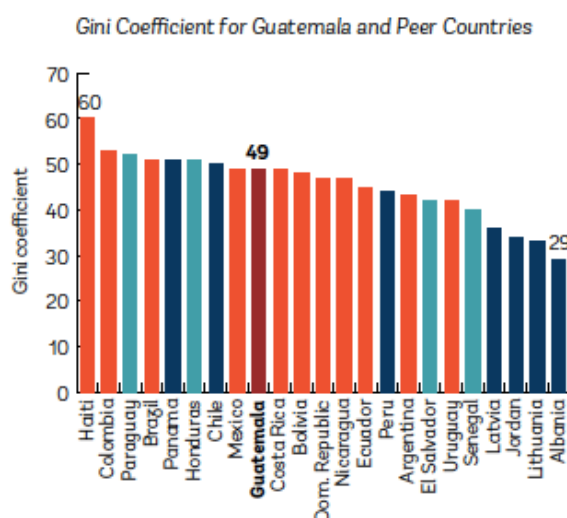
Gini Coefficient for Guatemala and Peer Countries

Source: SEDLAC harmonized database (SEDLAS and the World Bank), June 2015.
Note: The Gini coefficients, based on income, for each country are as close to the indicated years as possible. For Guatemala the data points are 2000, 2006, and 2014.

Inequality continues to be higher in Guatemala than in its peer Countries

Poor and non-poor households have significantly different characteristics in terms of their household structure and employment status (Table below). The poor are more likely than the non-poor to live in male-headed households; in fact, overall and extreme poverty rates among female-headed households are lower than the

---

[1] As might be expected, a consumption-based Gini shows much lower levels of inequality but the trend in the consumption-based Gini is similar to that seen with income. The decline in inequality between 2006 and 2014 is even more dramatic in consumption terms. The decline in both urban and rural inequality can be seen in both income and consumption terms.

[2] One hypothesis about the change in the Gini that cannot be ignored is that there may have been a deterioration in the quality of data at the top end of the distribution over time. There is always some degree of under-reporting: studies of top earner databases from tax records in other countries have shown that the Gini is often under-estimated as a result of non-responses from households at the top end of the distribution. The concern is not so much that this phenomenon exists but that these non-responses may be increasing. Given the very sharp rise in crime and violence in Guatemala, particularly in the cities, it is quite plausible that households are not willing to provide information on their wealth to surveys. In Mexico the non-response rate in some areas of the country has increased to 25 percent in recent years and non-response is correlated to education levels, suggesting that it is correlated to income as well. No assessment has yet been carried out of the increase in non-responses in the latest round of the ENCOVI in Guatemala or of its implications, so until that happens, a degree of skepticism about the magnitude of the fall in the Gini might be warranted.

corresponding national figures and, in terms of overall poverty, the rates have fallen.[3] Having a younger head of household is also correlated with greater poverty, with all other characteristics held constant. The poor and extreme poor tend to belong to larger households than the non-poor. Households in extreme poverty have 6.8 members on average while non-poor households have an average of three fewer members. Having a head of household who is indigenous but not one of the four large Mayan groups is linked to a significantly greater risk of poverty, as is living in the North and having less education.

Characteristics of poor and non-poor households (2014)

	Extreme Poor	Moderate Poor	Non-poor	Bottom 40 percent	Top 60 percent
Household Characteristics					
Age of head	45.5	45.1	47.1	45.2	47.1
Female-headed household (percent)	12.9	19.5	25.5	17.3	25.7
Single earner without children	2.3	4.4	14.8	3.7	14.9
Single earner with children	44	45	33.8	44.7	33.6
Two or more adult earners with children	52.8	48.5	45.8	49.9	45.8
Head indigenous	65.5	43.1	21.2	50.5	20.9
Rural	75.7	56.5	29.3	62.6	29.2
Proportion age 0-14	44.9	36.8	22.7	39.4	22.6
Proportion age 15-64	51.3	56.9	67.9	55.2	68
Proportion age 65+	4.9	6.4	9.8	5.9	9.9
Education of household head (years)	2	3.3	6.7	2.9	6.8
Dependency ratio on employed persons	35.7	39.5	50.1	38.3	50.2
Monthly per capita income	468	739	2102	650	2121
Monthly per capita consumption	363	660	1755	565	1768
Household size	6.8	5.3	3.8	5.8	3.8
Total households	*544,458*	*1,084,735*	*1,722,837*	*1,653,516*	*1,698,514*
Labor force (percent)					
Salaried	57.7	60.7	61.7	59.6	61.7
Self-employed	24.1	24.3	23.6	24.3	23.6
Employer	0.4	1	4.6	0.8	4.7
Unpaid worker	17	12.2	7.6	13.9	7.5
Unemployed	0.9	1.7	2.5	1.4	2.6
Informality (percent)					
Formal (with social security)	3.1	11.1	29.6	8.3	29.8
Informal (without social security)	96.9	88.9	70.4	91.7	70.2
Employment sector (percent)					
Agriculture, hunting	61.5	41.3	14	48.5	13.6
Manufacturing	9.8	12.2	13.9	11.4	13.9
Construction	5.2	7.9	5.3	7	5.2
Wholesale, retail trade	12.8	20.6	32.2	17.7	32.5

Source: Calculations based on the 2014 ENCOVI.

---

[3] World Bank (2009).

Areas with a greater concentration of indigenous people tend to be poorer, but many of the ethnic groups are spread across departments with varying degrees of poverty: this is particularly true for the non-indigenous and the Mam (Figure 1.10). The Mam had the highest poverty rate in 2000 at 90 percent, and live in both departments with high poverty levels and in others with much lower levels. By 2014, the Q´eqchi had overtaken the Mam, having the highest poverty and extreme poverty rates (87 and 56 percent respectively) and representing 22 percent of the extreme poor. In contrast the Kaqchiquel have the lowest poverty rate among the indigenous groups despite this rate having increased in both 2006 and 2014 (Figure 1.11). As noted earlier, the Mam have the highest chronic poverty rate, and none of the indigenous groups have fewer chronically poor households than the non-indigenous.

Department-level Poverty Rates and Share of Population by Ethnicity, 2014
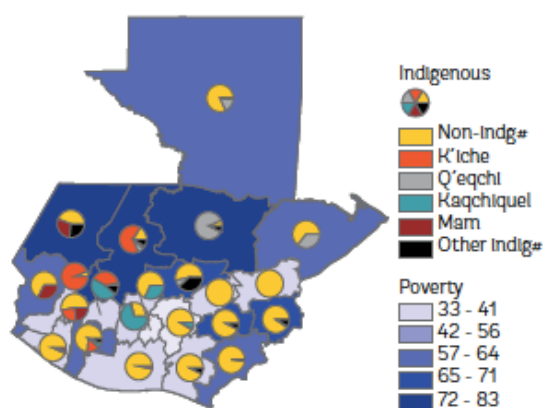
Indigenous
- Non-Indg#
- K'Iche
- Q'eqchi
- Kaqchiquel
- Mam
- Other Indig#

Poverty
- 33 - 41
- 42 - 56
- 57 - 64
- 65 - 71
- 72 - 83

Source: Calculations based on the 2014 ENCOVI
Note: Based on official consumption measure of poverty and national poverty lines.

Ethnic Dispersion and Poverty Are Linked

Poverty Rates by Indigenous/Non-indigenous, 2000-2014

- Overall Pov. 2000
- Overall Pov. 2006
- Overall Pov. 2014
- Ext. Pov. 2000
- Ext. Pov. 2006
- Ext. Pov. 2014

Source: Calculations based on the 2000, 2006, and 2014 ENCOVI
Note: Based on official consumption measure of poverty and national poverty lines.

The Indigenous Are Much More Likely to Be Poor than the Non-indigenous

Poverty is highest in rural areas, but there has been a striking increase in urban poverty. In 2006, rural poverty was more than two times the level of urban poverty overall (71 percent compared to 30 percent) and for extreme poverty, the ratio was 4.8.[4] Both rural and urban poverty rose by 2014, and rural poverty remains much higher than in urban areas. The depth and severity of poverty levels are also worse in rural areas, although there has been some convergence in the second half of the decade as these indicators declined in rural areas while remaining unchanged in urban areas.[5] However, the increase in urban poverty between 2006 and 2014 was much greater (41 percent) than in rural areas (8 percent). This does not appear to have been due to rural-urban migration: a Huppi-Ravaillion decomposition shows that the poverty increases within each area are responsible for the changes. Movements between rural and urban areas are actually poverty-reducing, albeit on a very small scale.[6] The rise in urban poverty has narrowed the urban-rural gap and shifted the concentration of the poor quite dramatically. In 2000, 7 percent of all people in extreme poverty lived in urban areas, while by 2014 this had increased to 24 percent (Figure 1.8). While some of the change between 2000 and

---

[4] A new urban/rural classification was introduced in the 2002 Census by Guatemala's National Statistics Institute (*Instituto Nacional de Estadística*, INE). The share of the urban population increased from 38.6 percent in 2000 to 48.1 percent in 2006. However, only 2.9 percentage points of this increase were due to migration and population growth; the remaining 6.6 percentage point increase was due to changes in the urban/rural classification (World Bank, 2009). When the rural-urban definition is important for our analysis, the discussion will be restricted to changes between 2006 and 2014 only.

[5] Changes in the definition of rural and urban areas between 2000 and 2006 make earlier comparisons suspect: see Annex.

[6] Huppi-Ravallion decompositions look at intra-area and across areas changes in poverty. The within-area increase in poverty was 8 percentage points, but the across-area movements mitigated this effect, resulting in a 7.6 percentage point rise in overall poverty. For extreme poverty, the within-area increase in poverty was 4.1 percentage points, while movements from rural to urban areas led to a small decline in poverty for an overall rate of 3.7.

2006 can be attributed to a post-census reclassification of rural areas, this explains only a portion of the observed change and does not affect differences between 2006 and 2014. The larger change has been in terms of overall poverty. In eight years, the share of the poor living in urban areas has gone up from 28 percent to 57 percent. The regional change in the concentration of the poor is also quite striking.

Country Comparators

To benchmark Guatemala's performance, this report uses six comparable groups of peers: Central American countries, Latin American peers, lower-middle-income countries, world average, structural peers, and aspirational peers. The structural peers were selected using the "Find your friends" tool. The group of structural peers includes countries that provide appropriate benchmarks for answering SCD-relevant questions such as whether or not certain conditions, policies, or economic performances in Guatemala are adequate. The criteria and filters for selection were the following: (i) lower-middle-income countries; (ii) population between 5 million and 25 million people; (iii) Agriculture, value added (% of GDP) less than 20 percent; and (iv) small island states were excluded. The use of these criteria resulted in the following set of countries: Bolivia, El Salvador, Honduras, Nicaragua, Paraguay, and Senegal.

Under aspirational peers, we want to aggregate countries that may be used as good examples of development for Guatemala and that Guatemala may emulate. Thus, we set the following criteria for the period 2001 - 2013: (i) lower middle income and upper middle-income countries; (ii) GDP per capita growth higher than 3 percent; (iii) inflation below 5 percent; (iv) maternal mortality ratio (per 100,000 live births) less than 100; and (v) population below 35 million. Countries that are "natural intensive", landlocked, or islands were excluded. This classification delivers the following group of countries:

Structural Peers for Guatemala

Country	Nominal GDP per capita (US $), 2013	Population (millions), 2014	agriculture, value added (% of GDP), 2001-13
Guatemala	**3,512**	**15.9**	**13.0**
Bolivia	2,700	11.2	14.0
El Salvador	3,875	6.4	11.1
Honduras	2,323	8.3	13.4
Nicaragua	1,840	6.2	18.1
Paraguay	4,170	6.9	19.3
Senegal	1,073	14.5	16.3

Source: Find my Friends Tool 2014.

Aspirational Peers for Guatemala

Country	Nominal GDP per capita (US $), 2013	Population (millions), 2014	GDP per capita growth (%), 2001-13	Inflation (%), 2001-13	Maternal mortality ratio, latest data point
Guatemala	**3,512**	**15.9**	**0.9**	**6.3**	**140**
Albania	4,610	2.8	5.4	2.9	21
Chile	15,776	17.7	3.3	3.1	22
Jordan	5,174	6.7	3.1	4.3	50
Latvia	15,205	2.0	5.5	4.7	13
Lithuania	16,003	3.0	5.9	3.0	11
Panama	10,839	3.8	5.3	3.2	85
Peru	6,674	31.4	4.1	2.6	89

Source: Find my Friends Tool 2014.

Rates of Stunting and GDP per country, circa 2013.
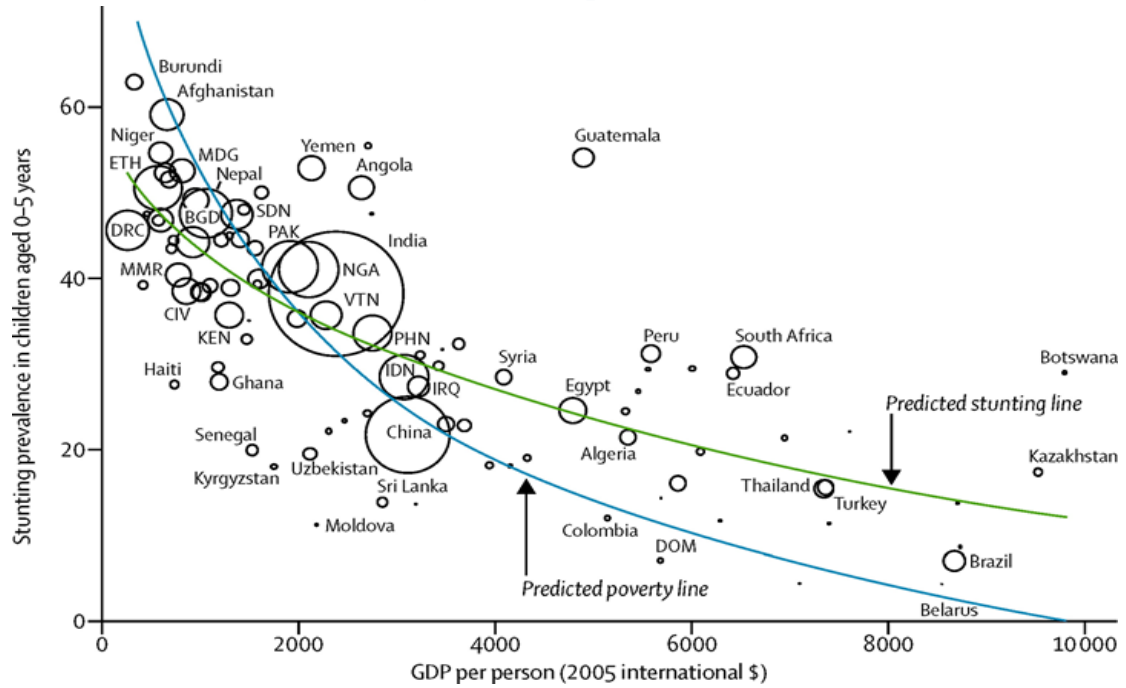
Source: Estimates based on World Bank Data, 2015.

One in four children is stunted from malnutrition, limiting their physical and mental growth and locking them in poverty.

Guatemala 48%
Niger 51%
Yemen 58%
India 48%
Afghanistan 59%
Laos 48%
Burundi 58%
Timor-Leste 58%
Madagascar 50%

Stunting in children under 5, 2007-2015
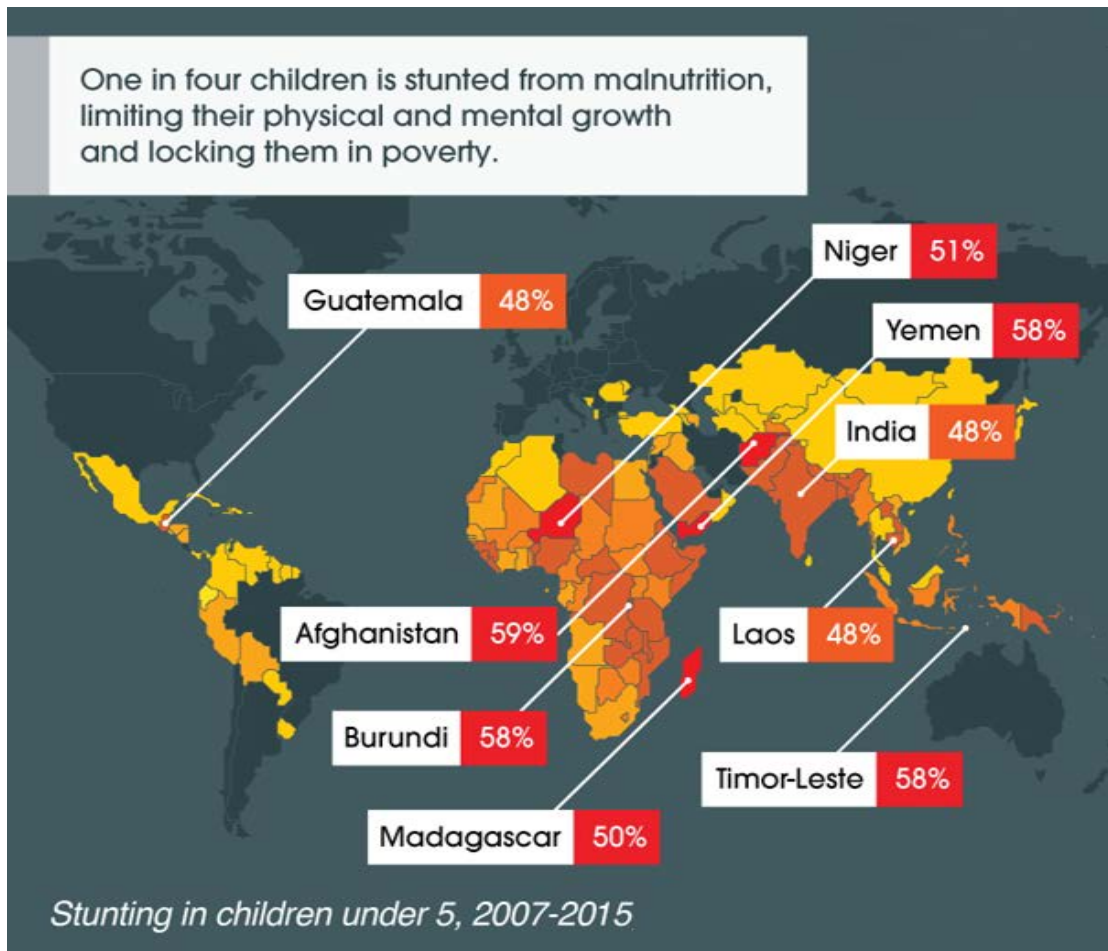
Source: UN, 2015; World Bank, WDI. 2015.

Snapshot of Water and Sanitation Infrastructure and Nutrition in Indigenous Areas of Guatemala

Data and Sampling Description

This snapshot uses data from a survey collected to evaluate an early stimulation intervention from October 2016 to January 2017 in four departments: Huehuetenango, San Marcos, Quiche and Totonicapán. From a list of more than 100 communities, each of them was randomly selected to a treatment arm and within each community, 20 eligible families were randomly selected to our sample. Our sample consists of about 2,000 families with children under 24 months of age. The dataset contains information on basic demographic characteristics, WASH infrastructure and child health and nutritional outcomes.

General Descriptive Statistics

The majority of indigenous families in this sample obtained their water from a pipe located outside of the household (65%) and most purified the water by boiling it (89%). The most common sanitation service reported was latrine (65%), followed by toilet (21%). Fourteen percent of the families did not have any type of sanitation service. A few differences in water access and sanitation services were found across departments. Specifically, families from Huehuetenango had the easiest access to water as 82% reported having water piped inside or outside their household, while families in Quiche were less likely to have sanitation services (19% reported none).

In terms of household and family characteristics, the majority of the houses had dirt floors (65%) and consisted of 2 rooms. In general, families were composed of 5 members of which 3 were children and the head of the household was mostly men (88%). The average number of years of education for the head of the household was 4. Across departments, San Marcos had the highest number of years of education with an average of 6. Regarding family income, the average monthly income per household was 999 GTQ. Using family income and number of family members, a Purchase Power Parity (PPP) index was calculated to identify households in which each member had more than $1.25 USD to spend daily—the majority of the families fell at or below the line (77%) and are thus considered to be poor based on this index. Of all the departments, Huehuetenango had the highest percentage of families at or under the PPP poverty line (84%). The number of children who had had diarrhea in the last two weeks was high (39%) and the percentage was higher in Huehuetenango (50%). On average, the closest health center was 37 minutes away from home.

Approximately 46% of the respondents preferred Spanish only, while 54% preferred an indigenous language or a combination of Spanish and an indigenous language. Huehuetenango had the highest percentage of respondents who spoke Mam or a combination of Mam and Spanish (70%), while Quiche had the highest percentage of respondents who spoke Quiche or a combination of Quiche and Spanish (62%). The majority of respondents in Totonicapán (62%) and San Marcos (73%) preferred Spanish. We conducted additional comparisons across the three language groups, which are not included in the descriptive statistics table (see appendix). Respondents who preferred an indigenous language or a combination of an indigenous language and Spanish had a higher percentage of houses with dirt floors (76%). Additionally, respondents who preferred Mam or a combination of Mam and Spanish had a higher percentage of child diarrhea (51%).

Water and Sanitation Infrastructure

To consider the potential synergies between sanitation infrastructure and water source and our indicators, we compared the percentage of some indicators per type of sanitation and water source. The charts below depict the percentage of houses with dirt floors, PPP-based poverty, children with extreme stunting, and underweight children by sanitation infrastructure and water source. Compared to families who had a toilet, those without

sanitation infrastructure had a higher percentage of homes with dirt floor (86%), were poor (88%), had children with extreme stunting (40%), and underweight (21%). When considering our outcomes by water source, compared to piped water, families who obtained water from other sources had a higher percentage of homes with dirt floors (81%), were poor (82%), had children with extreme stunting (39%), and underweight (20%).
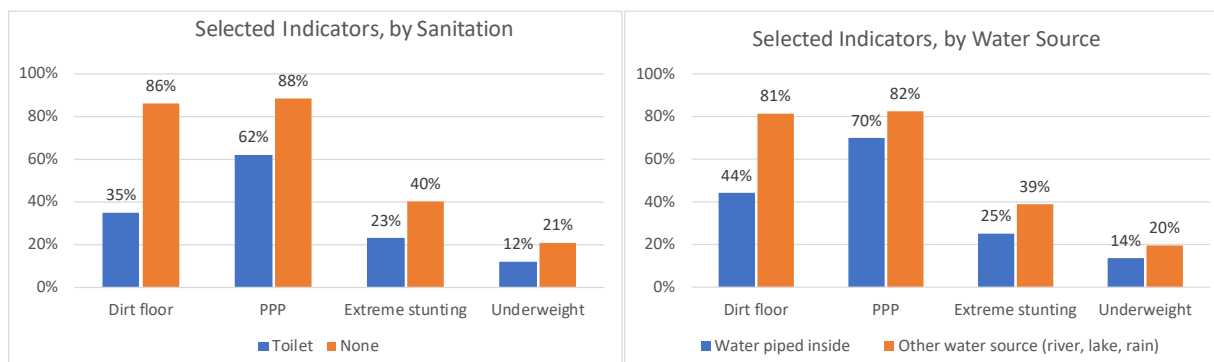
Anthropometric Measures

Following the World Health Organization (WHO) guidelines, stunting or growth retardation is defined as -2 S.D. of the WHO Child Growth standard median for height-for-age and it reflects chronic malnutrition. We constructed an additional measure, extreme stunting, defined as -3 S.D. of the WHO Child Growth standard median for height-for-age and it measures extreme chronic malnutrition because it is the result of long-term effects of nutritional deprivation (cumulative effects of undernutrition) or recurrent infections. Underweight children are those with a weigh-for-age below -2 S.D. of the WHO Child Growth standard median.

The following charts show statistics for our anthropometric indicators. Sixty eight percent of the children in our overall sample were stunted, 32% are extremely stunted and 15% are underweight. These results are similar for the departments of San Marcos, Huehuetenango and Quiche, but much higher for Totonicapán, as it can be observed in the bar chart. We also observed a disturbing trend for these indicators: as age increases, the percentage of stunted, extremely stunted and underweight children increases. We further examined Pearson correlations of age in months with each anthropometric indicator to confirm these findings. We observed that all correlations were statistically significant at the 1-percent level. While these findings are troublesome, they also indicate that policy makers could intervene as early as possible to prevent cumulative negative effects of nutrition deprivation that might impact children mortality, delayed mental development, poor cognitive capacity and school performance.
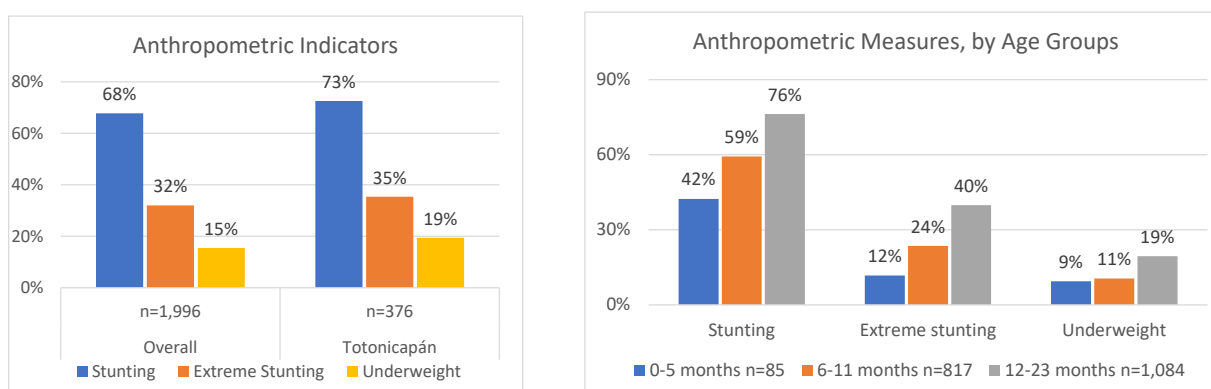
Are these associations significant? Results from Pearson Correlations

Our descriptive statistics show differences in anthropometric measures and basic demographic characteristics for those with different type of sanitation in their households. In general, we observed worst indicators for households with no sanitation. Our correlation analysis showed a positive and statistically significant correlation between no sanitation and extreme stunting and underweight. At the same time, we found better indicators for those with toilet. Our correlation analysis confirmed these findings and showed a negative and significant correlations for toilet with stunting, extreme stunting and underweight. A similar pattern was found for those with water infrastructure in the home (negative correlation with stunting and extreme stunting) and those without it (e.g. water is obtained from river, creek, rain, lake; positive correlation with extreme stunting and underweight).

Pearson correlations

	No sanitation	Latrine	Toilet	Other water source	Water piped outside the residence	Water piped inside the residence
Stunting	0.01	0.07 ***	-0.09 ***	0.03	0.02	-0.06 **
Extreme Stunting	0.08 ***	0.03	-0.10 ***	0.05 *	-0.01	-0.06 **
Underweight	0.07 **	-0.01	-0.05 *	0.04 *	-0.02	-0.02
Diarrhea	-0.02	-0.01	0.03	0.00	0.00	0.02

*Note: ***p ≤ .001**p ≤ .01; *p ≤ .05.*

Descriptive Statistics by Department

	Huehuetenango	Totonicapán	San Marcos	Quiché	Overall
	(n=284)	*(n=378)*	*(n=292)*	*(n=1,078)*	*(n=2,032)*
Water Source					
Piped inside residence	15.2%	19.4%	10.7%	12.1%	13.7%
Piped outside residence	67.1%	57.8%	66.0%	67.2%	65.3%
Communal tap/well	3.5%	13.8%	10.0%	11.2%	10.5%
Other water source	14.1%	9.0%	13.4%	9.5%	10.6%
Water Purification Method					
Boiling	93.3%	89.4%	88.3%	88.2%	89.2%
Other (chlorine, filter, buy purified)	4.9%	8.5%	10.0%	9.6%	8.8%
None	1.8%	2.1%	1.7%	2.2%	2.0%
Sanitation Service					
Toilet	30.0%	13.5%	18.9%	22.0%	21.1%
Latrine	62.9%	77.2%	71.5%	59.2%	64.8%
None	7.1%	9.3%	9.6%	18.8%	14.1%
House Flooring					
Material (concrete, tile, etc)	36.4%	37.7%	37.8%	33.0%	35.0%
Dirt	63.6%	62.3%	62.2%	67.0%	65.0%
Head of Household Gender					
Male	85.2%	90.2%	89.4%	86.9%	87.6%
Female	14.8%	9.8%	10.6%	13.1%	12.4%
Purchasing Power Parity					
Above daily $1.25 line	15.9%	20.3%	24.2%	25.4%	23.0%
At or below daily $1.25 line	84.1%	79.7%	75.8%	74.6%	77.0%
Child Diarrhea					
No	50.0%	61.9%	62.3%	63.3%	61.0%
Yes	50.0%	38.1%	37.7%	36.7%	39.0%
Mother Preferred Language					
Spanish Only	29.9%	61.6%	73.3%	38.2%	46.5%
Quiche and Spanish	0.0%	38.4%	0.0%	61.8%	39.9%
Mam and Spanish	70.1%	0.0%	26.7%	0.0%	13.6%
Household Rooms	1.82 (.98)	1.86 (1.06)	1.63 (.99)	1.79 (1.07)	1.78 (1.05)
Household Members	4.76 (1.51)	5.46 (2.21)	5.30 (1.86)	5.25 (2.15)	5.23 (2.05)
Children in Household	2.15 (1.20)	2.90 (1.74)	2.48 (1.46)	2.79 (1.64)	2.68 (1.60)
***HH Years of Education**	5.06 (3.42)	3.96 (3.10)	6.46 (4.08)	3.73 (3.23)	4.32 (3.50)
Monthly Income in GTQ	841 (911)	967 (620)	1,119 (1333)	1,020 (650)	999 (805)
Health Center Distance (min)	34.42 (22.82)	37.84 (25.21)	39.24 (27.69)	36.91 (25.78)	37.05 (25.60)

*Notes: *HH=Head of Household. Percentages shown for categorical variables; means and standard deviations shown for continuous variables.*

Sector-based Data, Graphs and Maps

Education and Literacy

Guatemala's substantial increases in education levels have exceeded those of its peers. Between 1970 and 2010, Guatemala's rate of increase in years of schooling outstripped most of its peers, with only Bolivia, El Salvador, and Brazil having improved faster.

Guatemala's level of education is well below its peers but has been rising fast

Average years of schooling and change

Source: EDSTATS.

Some progress has been made on closing the large gaps in schooling

Change in the attainment ratio between groups over time, 2000 to 2014
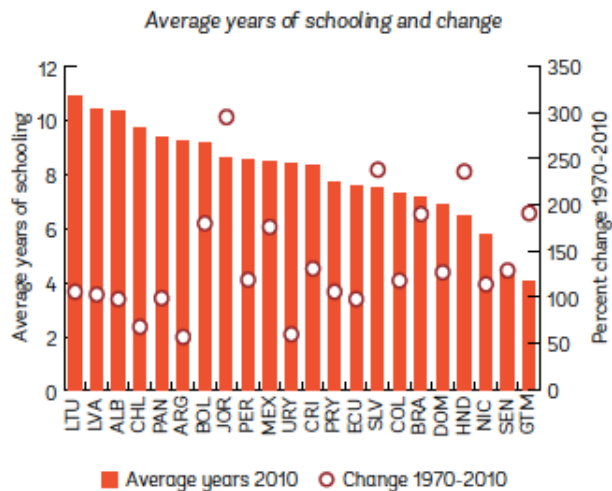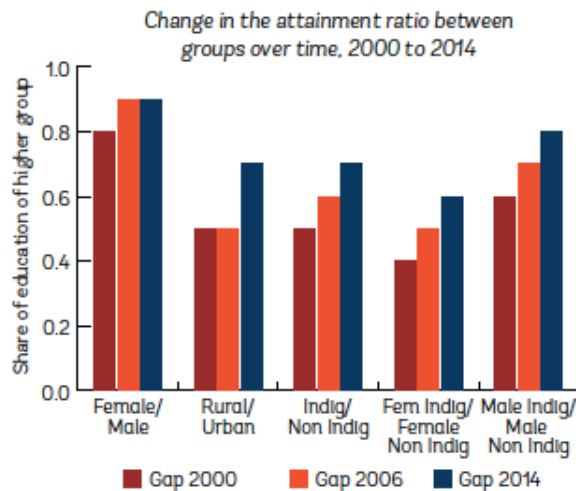
Source: Calculations based on the 2000, 2006, and 2014 ENCOVI
Note: The share of the groups with the lower level is divided by the share of the group with the higher level.

Primary school enrolment became almost universal in 2009 (99 percent) but shows signs of reversal and, by 2014, had fallen to 82 percent, which was even lower than it had been in 2000 (Figure 1.17). To the contrary, between 2000 and 2006, the schooling gap due to ethnicity in Guatemala went from around 3.5 years to less than a half year, a significant achievement[7].

---

[7] Ferreira et al., (2013).

15

Years of Schooling, 2014
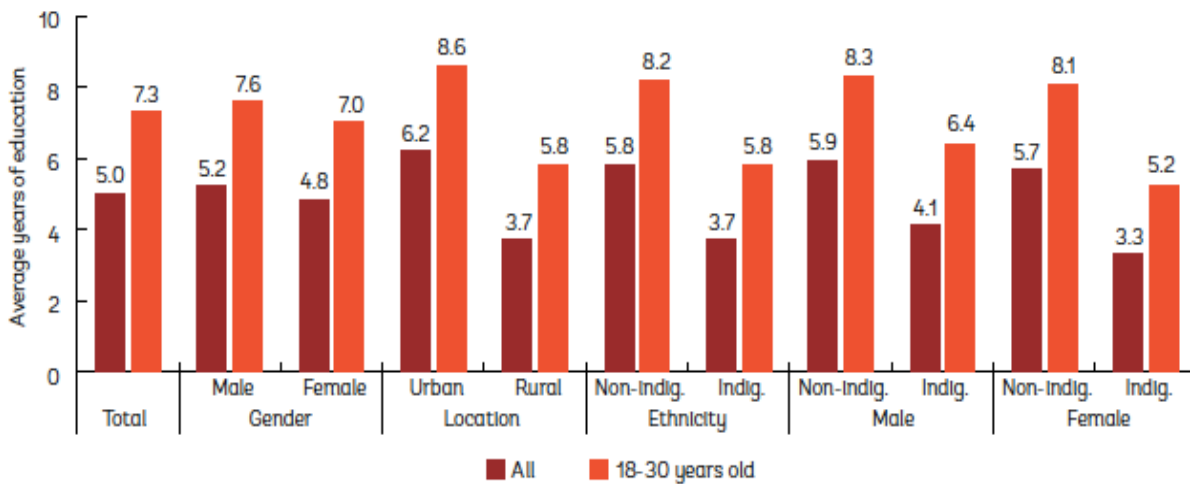
Source: Calculations based on the 2014 ENCOVI.

Education Levels in Guatemala Remain Low and Unequal

Literacy rates improved nationally from 69 percent in 2000 to 81 percent in 2014, however, this varies geographically, by poverty level and ethnicity. In 2014, 87 percent of people living in urban areas were literate in contrast to only 75 percent in rural areas. Similarly, 90 percent of all non-poor people were literate whereas only 75 percent of poor people and 68 percent of those living in extreme poverty were literate. The contrast in education and literacy between ethnic groups is notable. While 87 percent of non-indigenous people were literate, this contrasts with only 72 percent of indigenous people. In 2014, the Q'eqchi had the lowest literacy rates in any language at just under 67 percent (Figure 1.18). However, they have the highest literacy rates in a Mayan language.[8] The Kakchikel have the highest literacy rate of any indigenous group at 78 percent, which remains below the national average.

---

[8] The sample size of the survey data used in this analysis is adequate at best for looking at these groups. The other groups are too small to be able to be examined separately. There are some concerns about the adequacy of the sample even for the larger groups.

Primary Enrolment Became Almost Universal But Shows Signs of Reversal

Literacy Rates in Both Spanish and Mayan Languages Vary by Groups

Net Enrollment Rates, 2000-2014

Pre-primary   Primary
Lower secondary   Upper secondary

Literacy by Language and Ethnicity, 2014
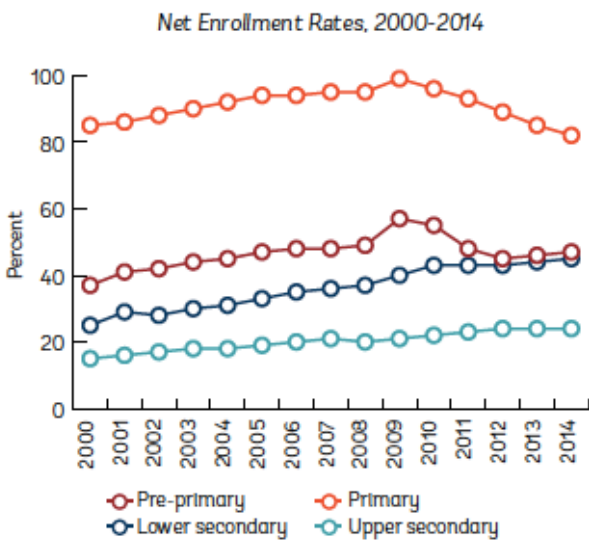
Spanish   Mayan

Source: UNESCO, 2014a and Ministry of Education, 2015.
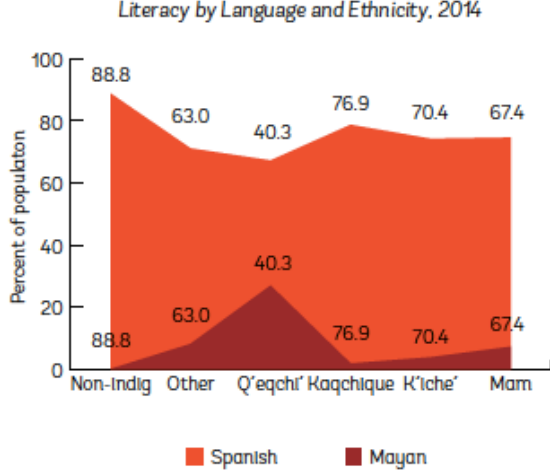
Further concerns exist regarding the levels of educational attainment at the secondary level. The share of children aged 15 to 19 years old who have not completed the nine years of schooling mandated in the 1985 Constitution is high (figure 1.19)[9] and only Nicaragua, among Guatemala's peer countries, has a lower secondary school completion rate. In Guatemala, the drop-off in enrollment is fairly steep: there is almost universal enrollment in the first grade of primary school, yet only half of the enrolled children finish their first year of secondary school. Gross enrollment in secondary school is 65 percent, the lowest in the Central American region, and the net rate of 47 percent is well below both the LAC and Central American averages. Critically, the educational gaps after the primary level begin to divide along ethnic, geographic, and gender lines. By the age of 18 the enrollment gap between indigenous and non-indigenous youths is close to 15 percentage points, and there is a 20 percentage point difference between the share of rural girls who complete 9th grade and the share of urban boys who do so (Figure 1.20).

---

[9] There is a discrepancy between the survey data (from the 2014 ENCOVI) and the administrative data concerning the rate of completion of nine years of schooling. The survey indicates that two out of three children do not complete this level, while the administrative data indicate that only 55 percent do not. It is not clear what is driving the discrepancy. However, neither figure suggests that Guatemala has been able to fulfill its Constitutional obligation regarding education.

Guatemala has low levels of educational attainment compared to the rest of Central America

Grade Attainment by 15-19 year-olds in Central America

Percent of age group (y-axis) vs *Years of schooling successfully completed* (x-axis)

○ Panama 2013 ○ Costa Rica 2014 ○ El Salvador 2013
○ Honduras 2013 ○ Nicaragua 2009 ○ Guatemala 2014
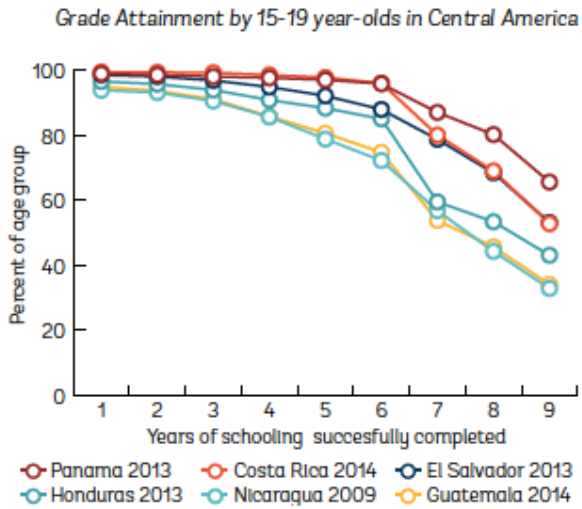
Source: World Bank (2015) and calculations based on the 2014 ENCOVI.

Levels of completion are much lower in rural areas, especially for girls

Years of Schooling Completed by Gender and Location in Guatemala, 2014

Percentage (y-axis) vs *Years of schooling successfully completed* (x-axis)

○ Rural-Girls ○ Urban-Girls ○ Rural-Boys ○ Urban-Boys

Source: World Bank (2015) and calculations based on the 2014 ENCOVI.

Percentage of Heads of Households without eductation

Alta Verapaz***
Huehuetenango***
Solola
Izabal*
San Marcos***
Jutiapa**
Santa Rosa
Peten**
Quetzaltenango*
El Progreso**
Guatemala

■ 2014 ■ 2000

Note: Significance of difference between 2000 and 2014 percentages.
p<0.05, ** p<0.01, *** p<0.001. Source: ENCOVI, 2000 and 2014

18

Profiles of Access to and Quality of WASH

Socioeconomic Characteristics	Coverage rates of WASH services				
	Unimproved water	Improved Water*	Improved Sanitation**	Open Defecation	Piped water
Gender					
Female-headed households	17.0%	11.8%	43.7%	8.5%	71.2%
Age Group					
15-24	27.9%	19.7%	16.5%	19.1%	52.4%
25-44	12.2%	21.4%	20.0%	8.3%	66.4%
45-64	12.1%	20.3%	15.9%	6.8%	67.6%
65 and older	29.7%	17.7%	12.6%	10.1%	52.6%
Labor status					
Wage earners	13.5%	20.2%	32.0%	8.0%	66.3%
Non-waged/unemployed	38.0%	15.7%	22.5%	15.1%	46.3%
Subsistance Agriculture	35.6%	18.1%	20.0%	15.8%	46.1%
Dependency Ratio					
Less than 2	7.6%	20.0%	29.0%	8.0%	72.5%
More than 2	19.2%	23.1%	19.5%	11.4%	57.4%
Household characteristics					
Dirt floors	26.2%	18.2%	14.7%	13.4%	55.6%
Witout electricity	25.1%	30.4%	9.9%	15.9%	44.5%
Overcrowding	16.3%	22.8%	24.3%	9.7%	60.9%

* Excluding piped water

**Excluding open defecation

Source: ENCOVI, 2014/2015
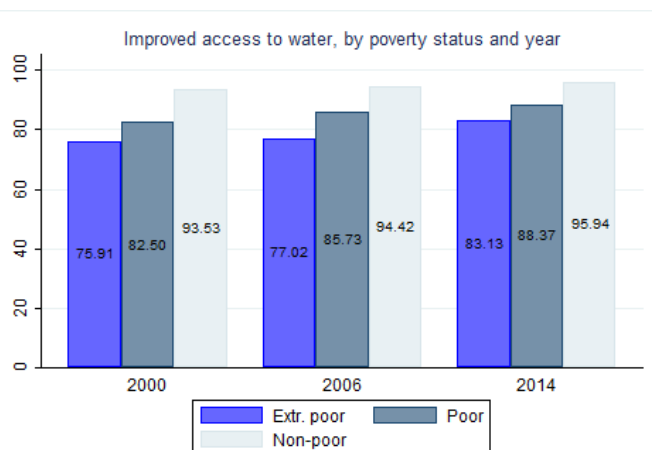
Improved access to water, by poverty status and year

Source: own calculations using ENCOVI survey data, years 2000, 2006, 2014

Change in access to water services
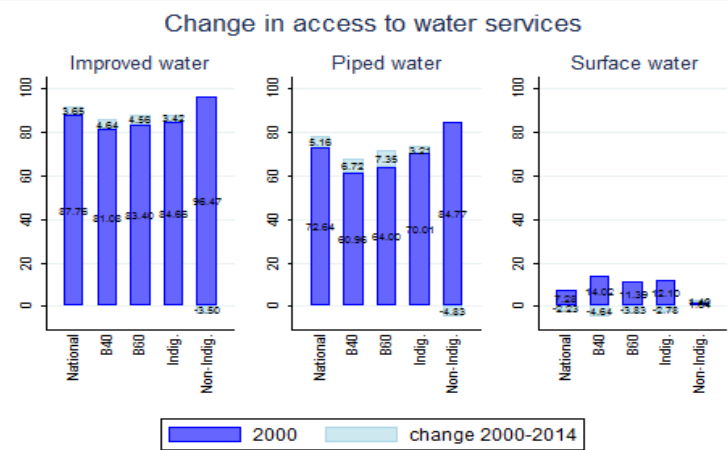
Source: own calculations using ENCOVI survey data, years 2000, 2014

Aggregate statistics mask some of the inequities and trends in the sector.

Access to piped water trend, by poverty status

Source: own calculations using ENCOVI survey data, years 2000, 2006, 2014

Use of surface water trend, by poverty status

Source: own calculations using ENCOVI survey data, years 2000, 2006, 2014

Access to improved sanitation, by poverty status

Source: own calculations using ENCOVI survey data, years 2000, 2006,

Change in access to sanitation services

Source: own calculations using ENCOVI survey data, years 2000, 2014.

Trends in access rates of different sources of water supply
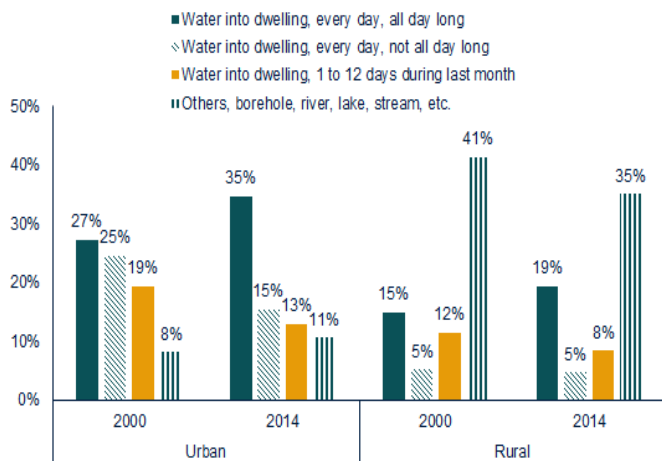
Ratio of piped water service coverage B40/T60
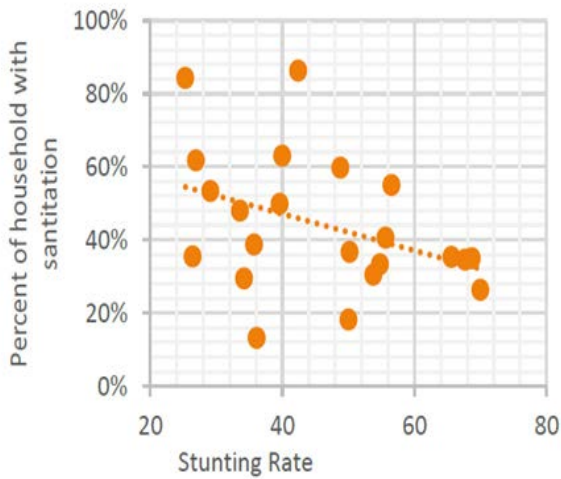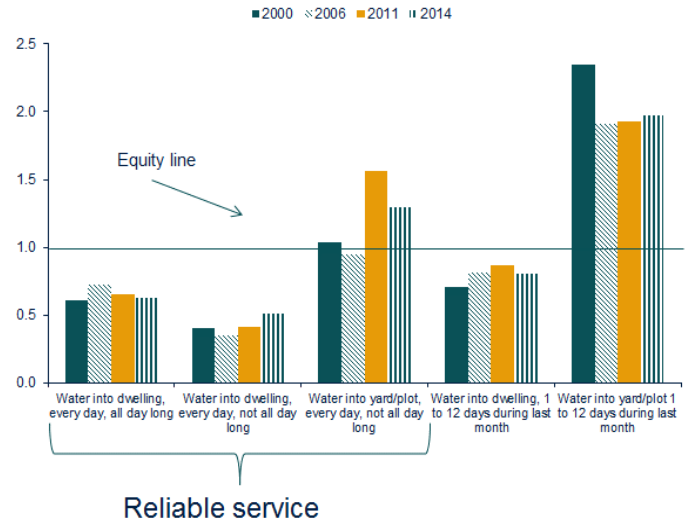
% Change (yearly) in Mortality due to Malnutrition per 100,000 inhabs.
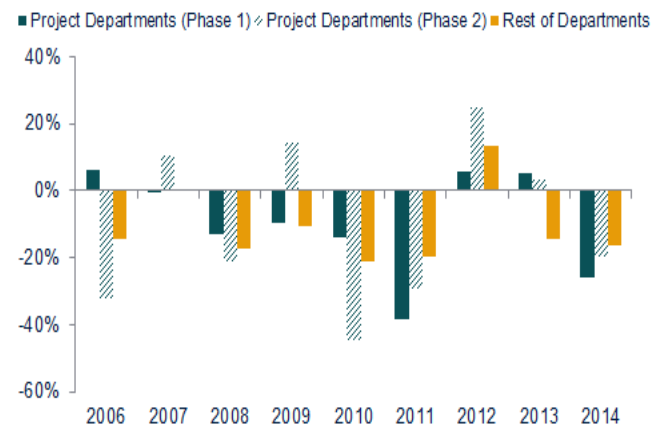
Differences between B40 and T60 in water access by type of water provision
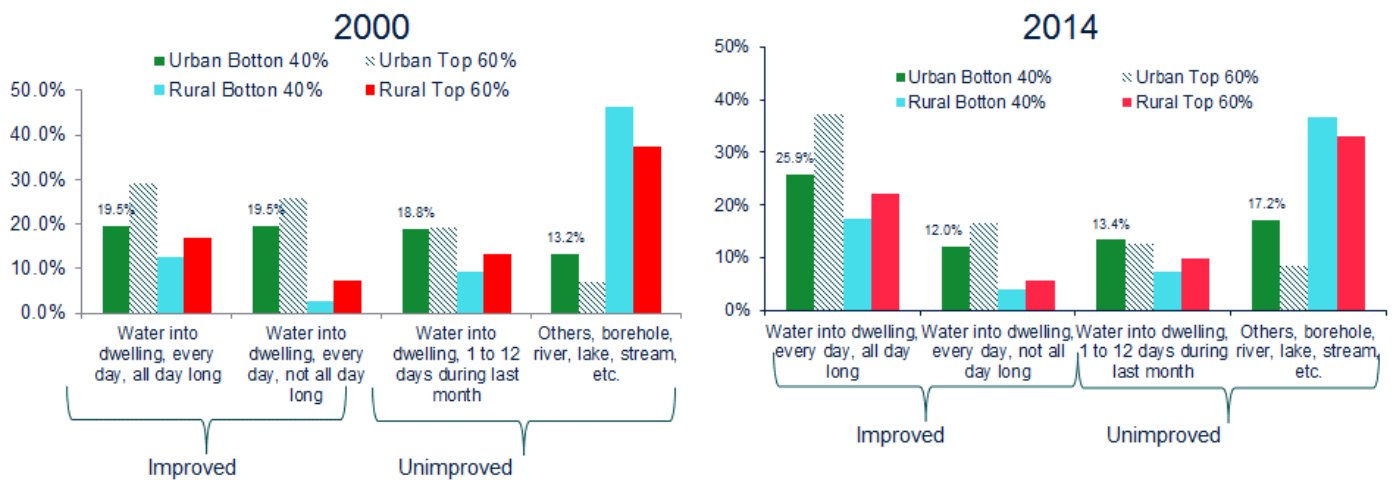
Sources: ENCOVI, 2000 and 2014

Percent distribution of mean days per month with water service, Guatemala

2000

Urban

- 4.0%
- 11.6%
- 22.0%
- 62.5%

Rural

- 4.2%
- 10.5%
- 29.2%
- 56.1%

- All days of month with water
- From 1 to 9 days
- From 10 to 19 days
- More than 20 days

2014

Urban

- 2.82%
- 17.32%
- 15.27%
- 64.60%

Rural

- 1.71%
- 15.26%
- 24.66%
- 58.30%

- All days of month with water
- From 1 to 9
- From 10 to 19
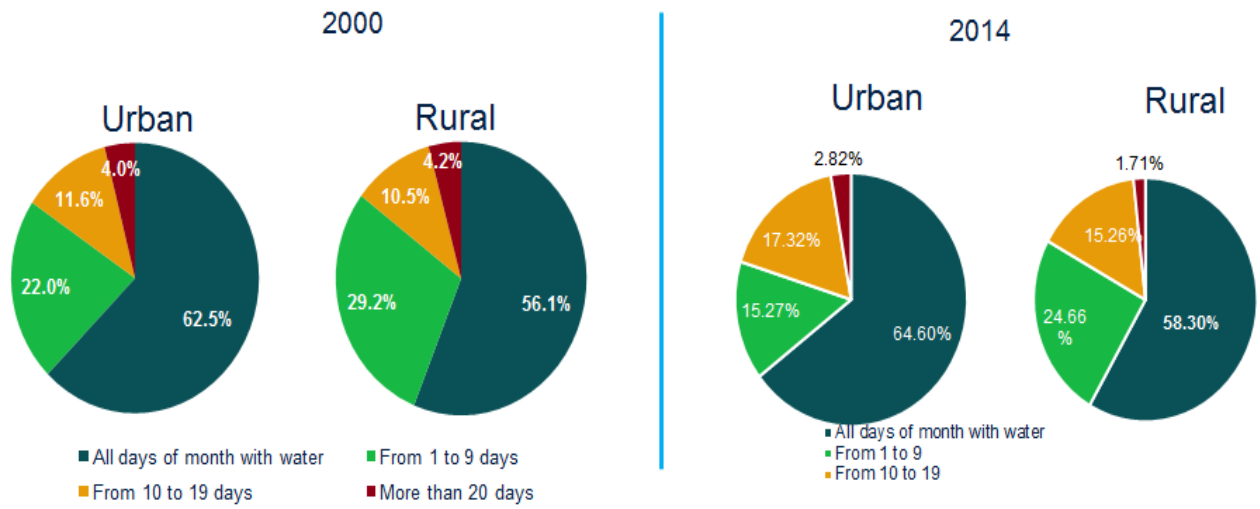
Sources: ENCOVI, 2000 and 2014

Increasing sewerage waste and reduction in reused solid waste

- Porcentaje de residuos alcantarillado
- Porcentaje Residuos pesados estabilizados reutilizados
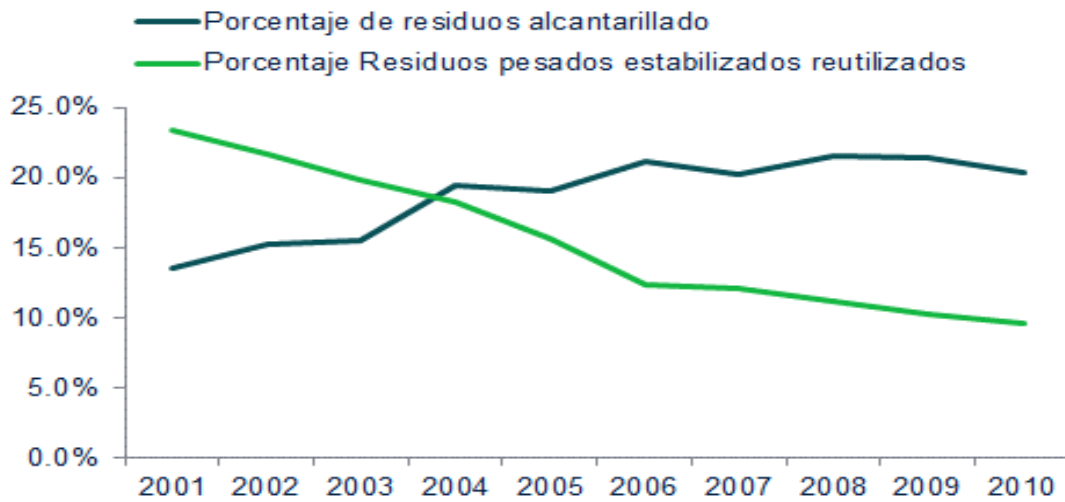
Source: IARN, 2015

Shapley decomposition, HOI for improved access to water
Children aged 0-16
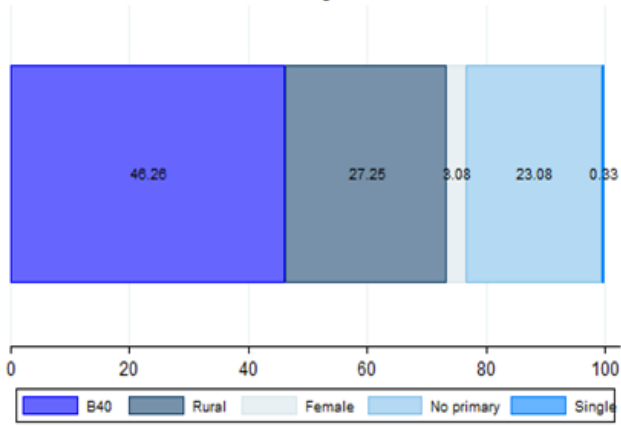
| 46.26 | 27.25 | 3.08 | 23.08 | 0.33 |

B40 — Rural — Female — No primary — Single

Source: own calculations using ENCOVI survey data, year 2014

Shapley decomposition, HOI for access to piped water
Children aged 0-16
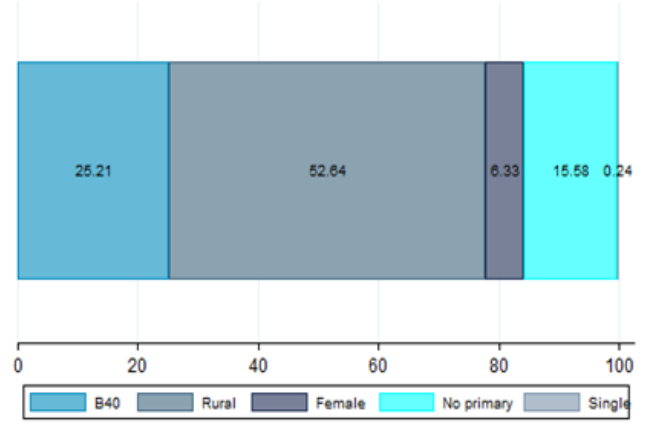
| 25.21 | 52.64 | 6.33 | 15.58 | 0.24 |

B40 — Rural — Female — No primary — Single

Source: own calculations using ENCOVI survey data, year 2014

Shapley decomposition, HOI for improved sanitation
Children aged 0-16
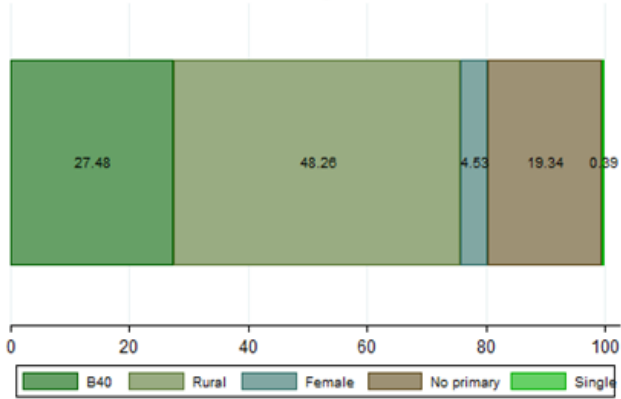
| 27.48 | 48.26 | 4.53 | 19.34 | 0.39 |

B40 — Rural — Female — No primary — Single

Source: own calculations using ENCOVI survey data, year 2014

Shapley decomposition, HOI for non-open defecation
Children aged 0-16

| 34.28 | 43.77 | 1.85 | 20.02 | 0.08 |

B40 — Rural — Female — No primary — Single
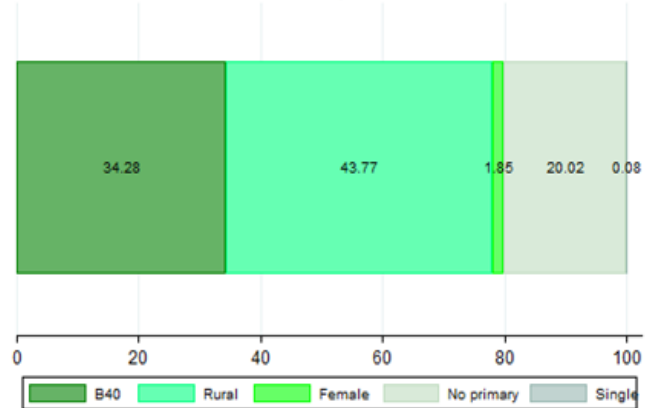
Source: own calculations using ENCOVI survey data, year 2014

Departmental Rates 2000-2014

Percent Households in Rural areas by Department (2000-2014)
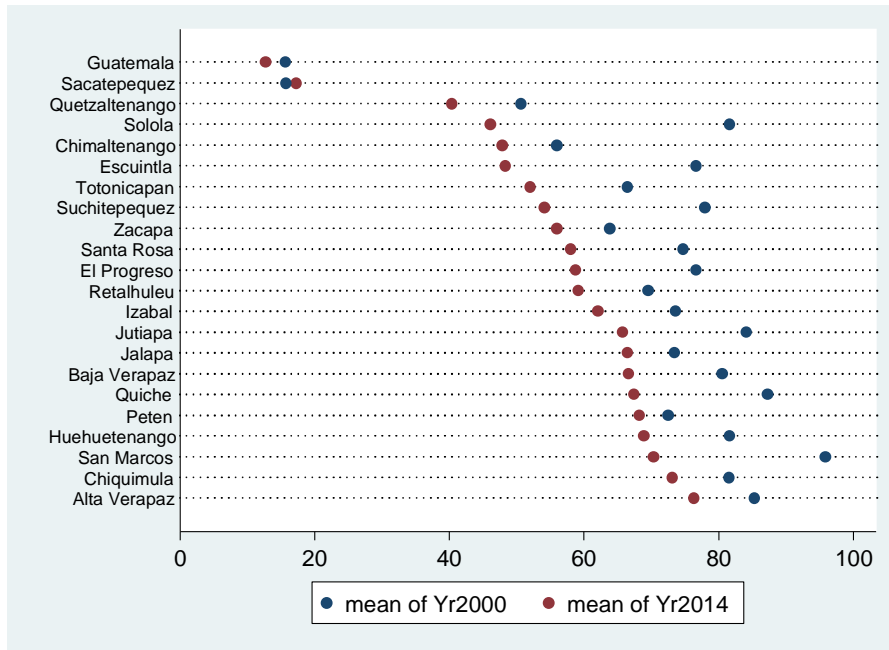
Source: ENCOVI, 2000 and 2014.

Percent Households in Urban areas by Department (2000-2014)
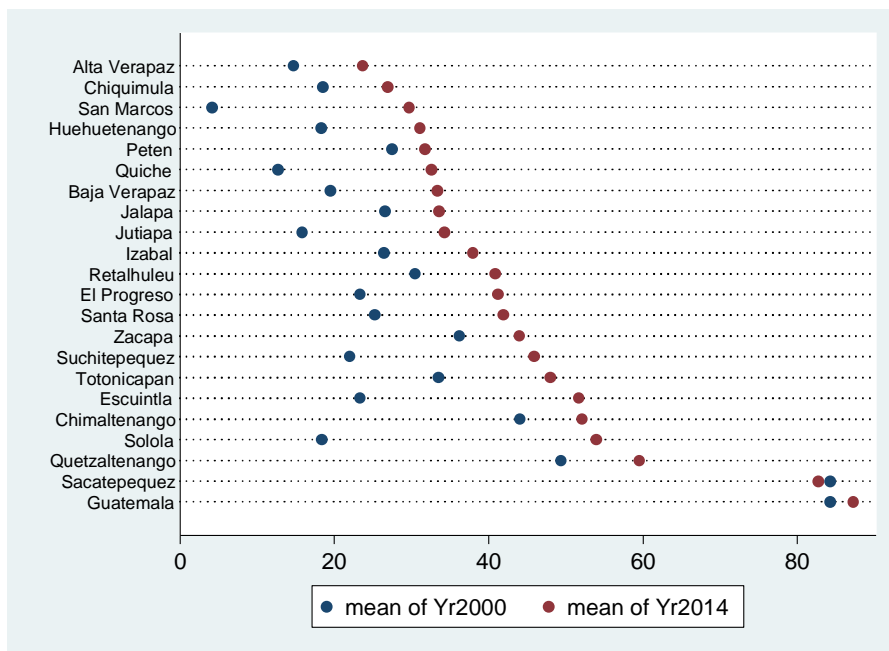
Source: ENCOVI, 2000 and 2014.

Percent Households in Extreme Poverty by Department (2000-2014)
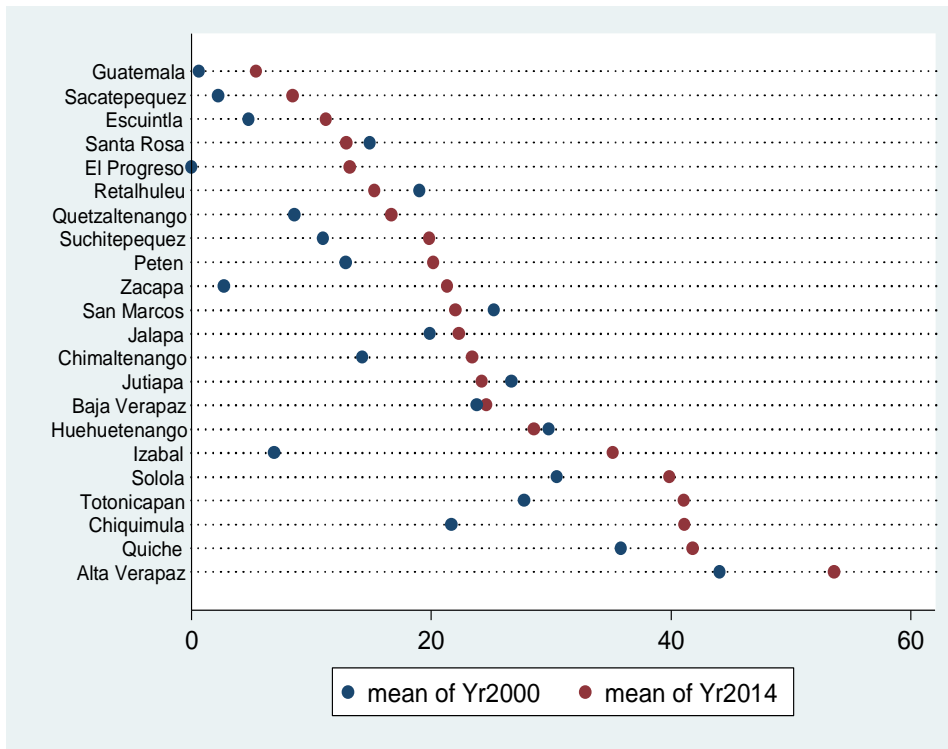
Source: ENCOVI, 2000 and 2014.

Percent of Female-Headed Households by Department (2000-2014)
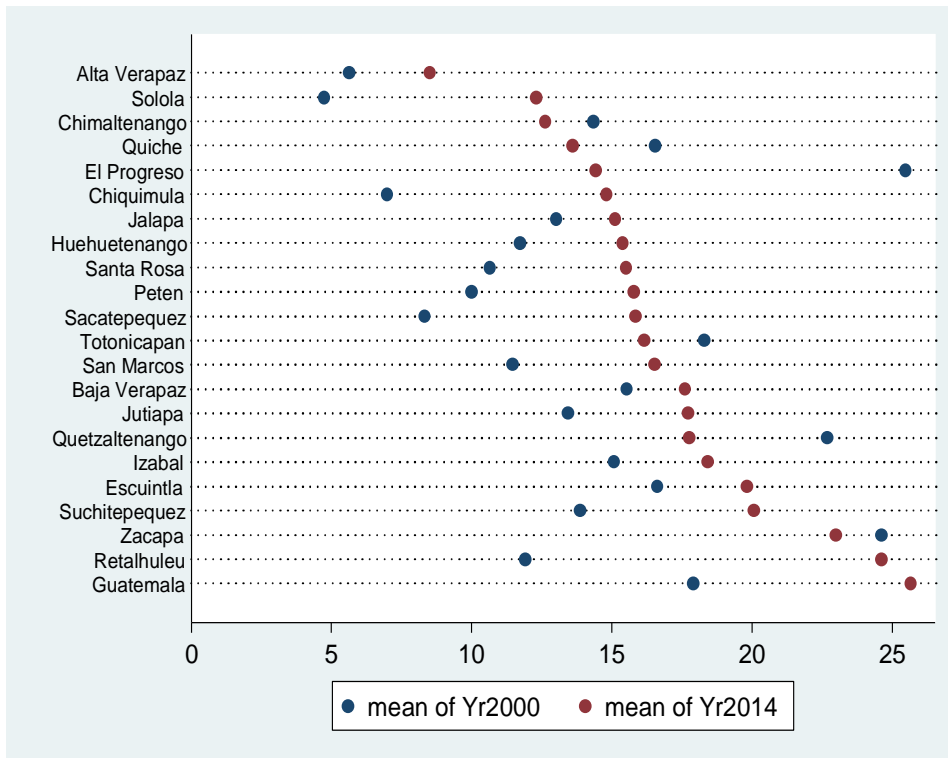
Source: ENCOVI, 2000 and 2014.

Percent of Households Connected to Water Meter by Department (2000-2014)
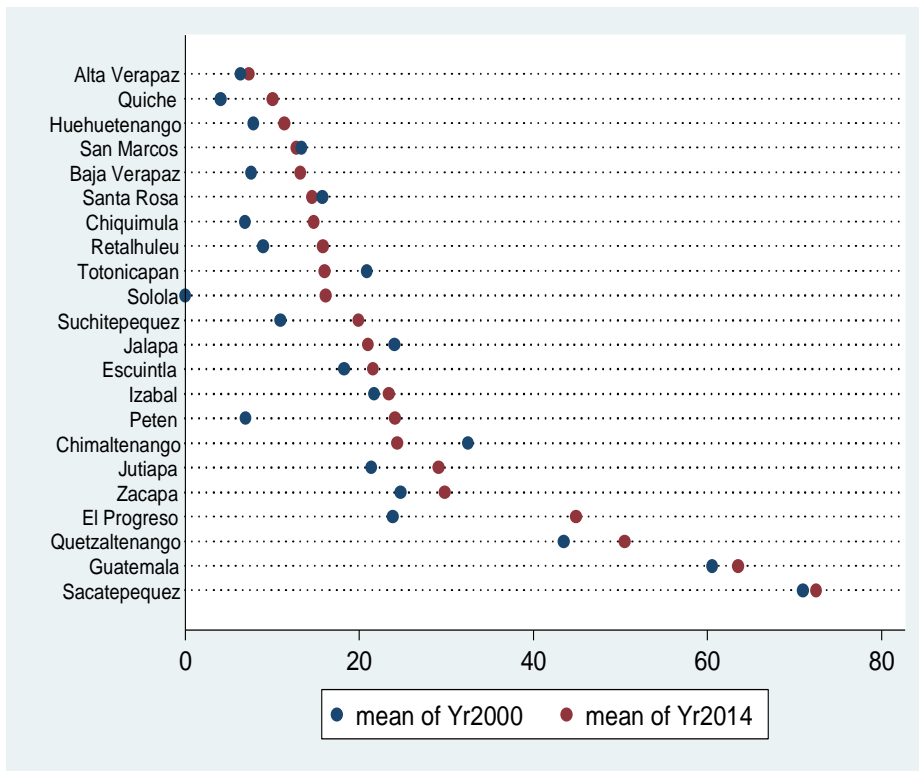
Source: ENCOVI, 2000 and 2014.

Percent of Households Connected to Public Provider by Department (2000-2014)
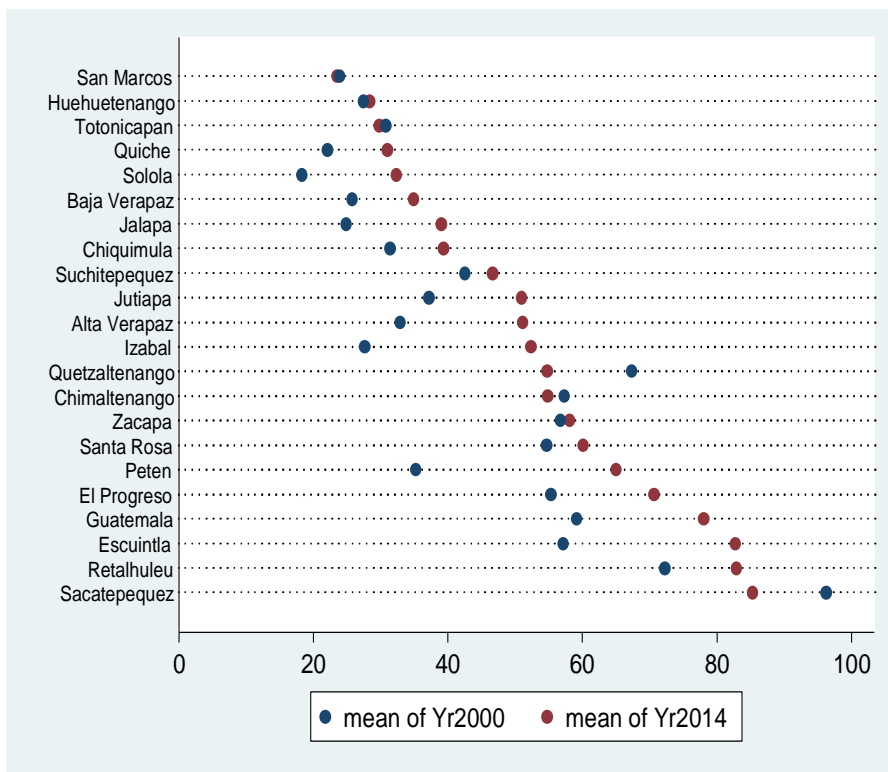
Source: ENCOVI, 2000 and 2014.

Percent of Households Connected to Private Provider by Department (2000-2014)
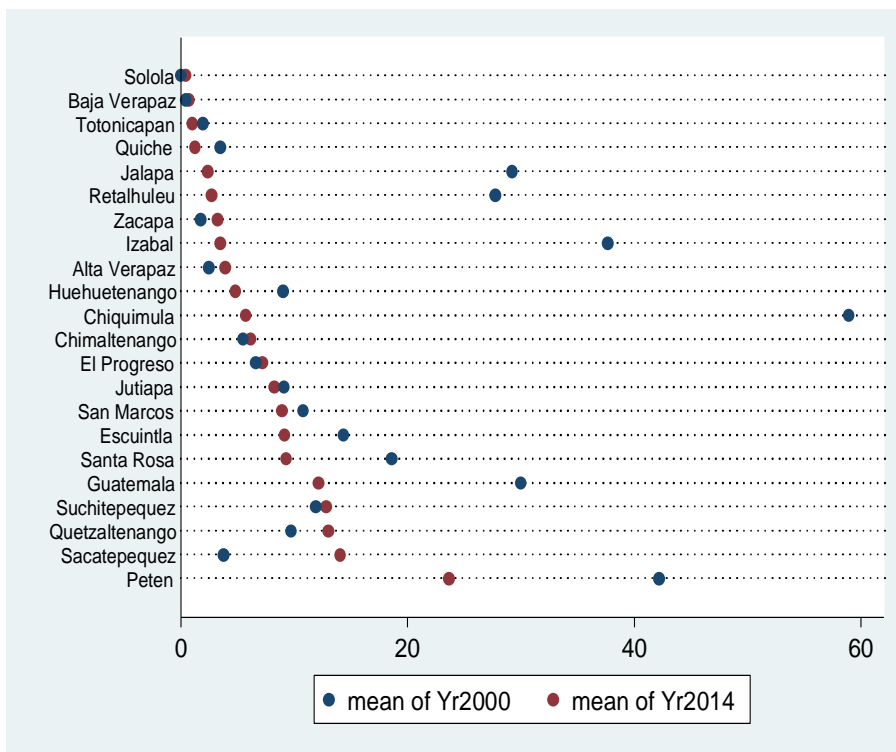
Source: ENCOVI, 2000 and 2014.

Percent of Households with water service owned by water committee by Department (2000-2014)
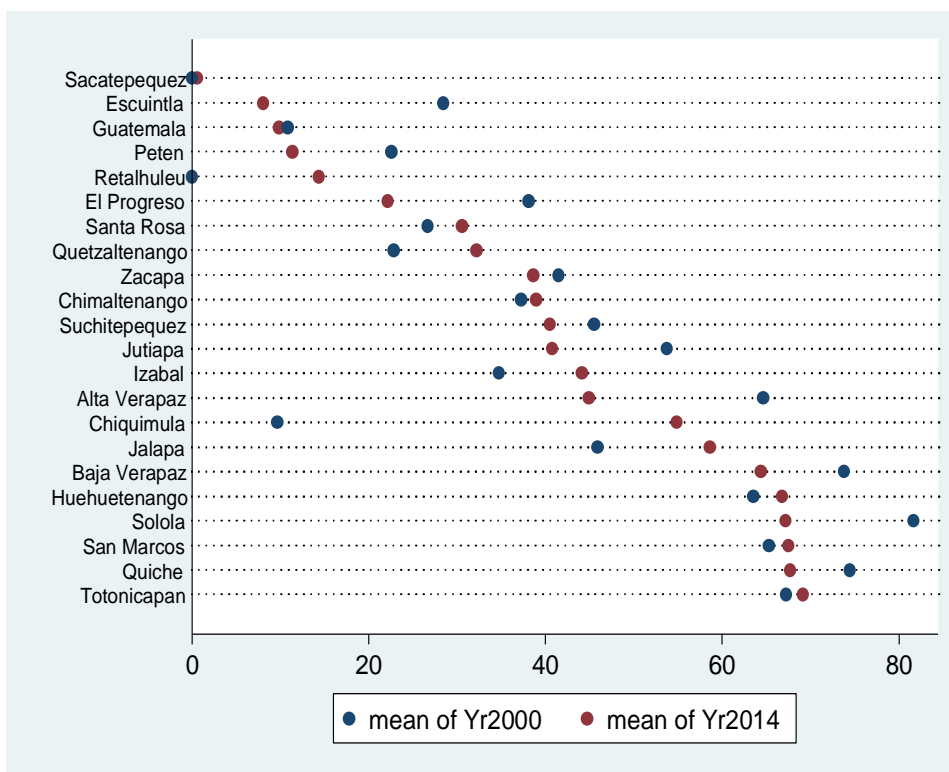
Source: ENCOVI, 2000 and 2014.

Monthly Cost of Water (Q/M3) by Department (2000-2014)
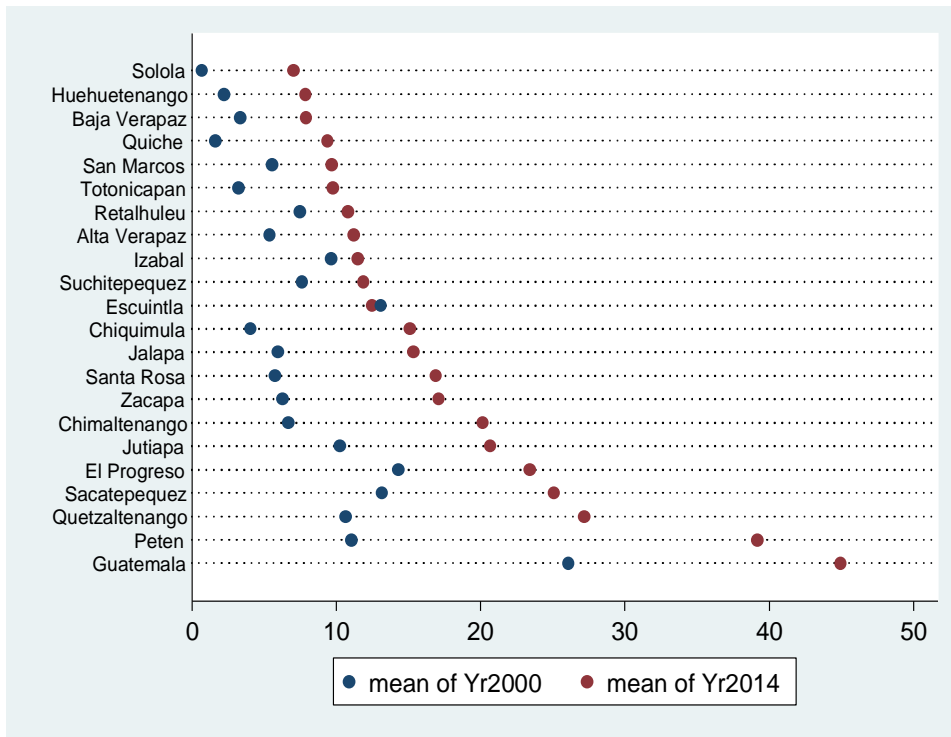
Source: ENCOVI, 2000 and 2014.

Number of days without water per month, by Department (2000-2014)
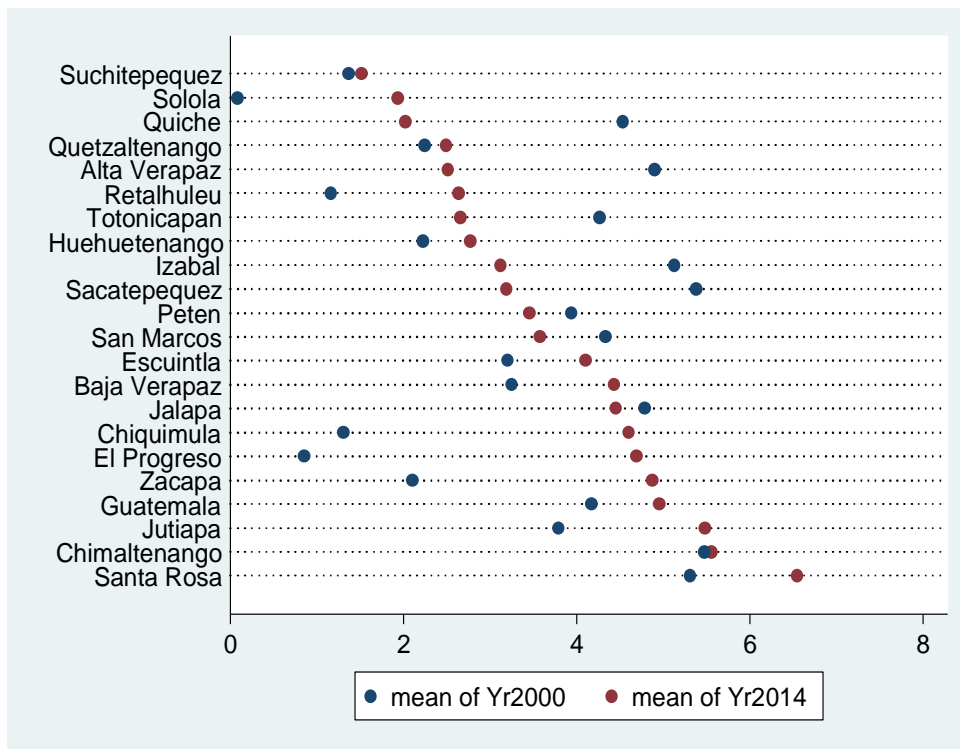
Source: ENCOVI, 2000 and 2014.

Hours per days without water, by Department (2000-2014)
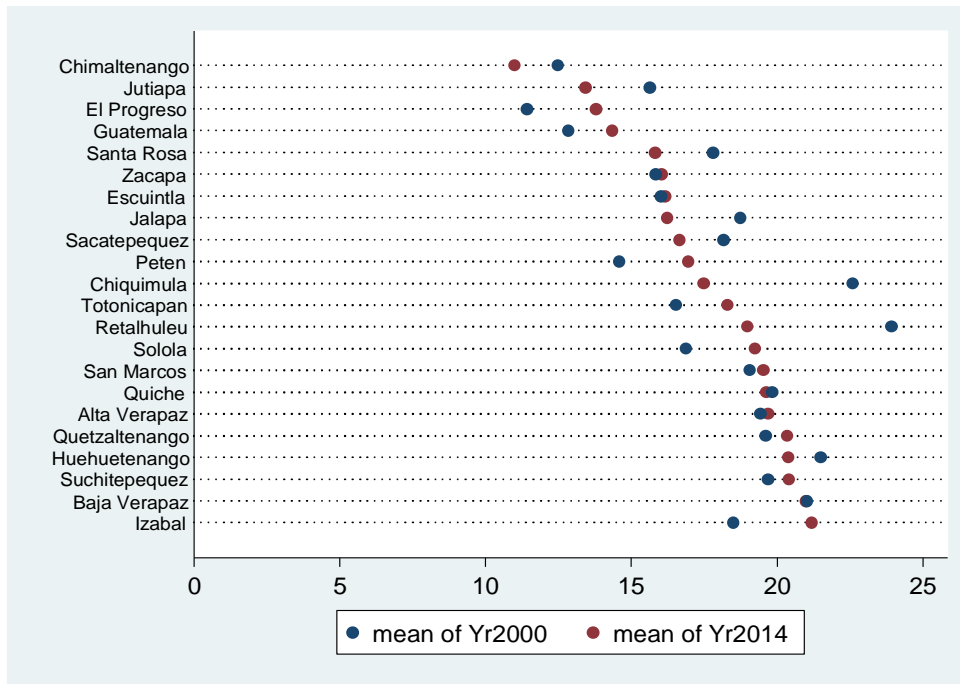
Source: ENCOVI, 2000 and 2014.

Distance to water supply (roundtrip in minutes) by Department (2000-2014)
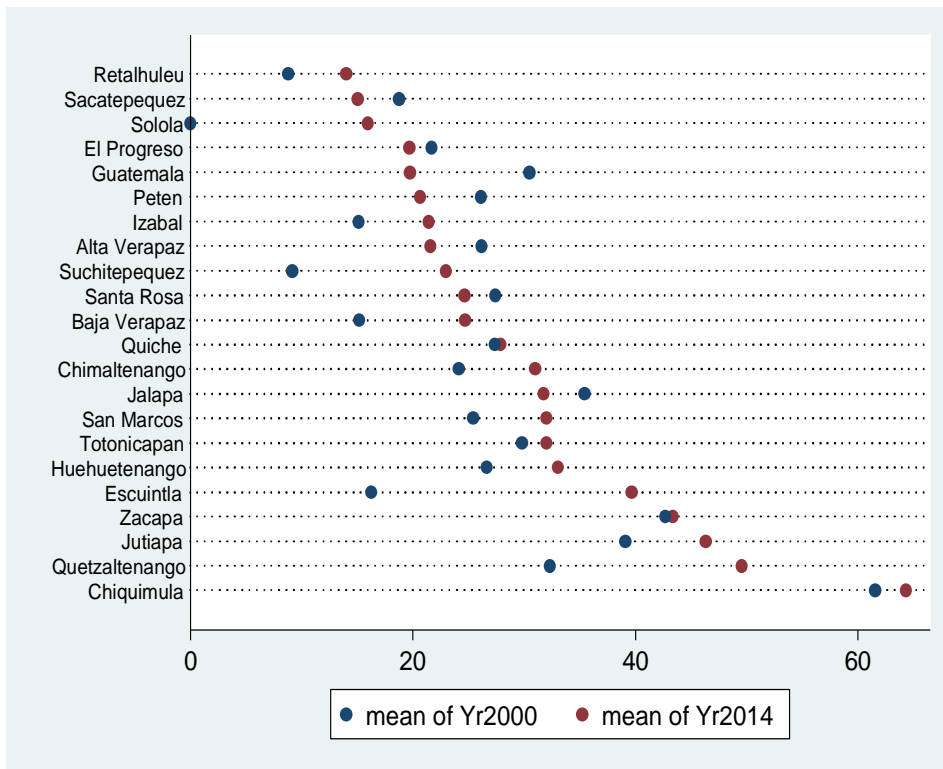
Source: ENCOVI, 2000 and 2014.

Percent of Households that Boil Water by Department (2000-2014)
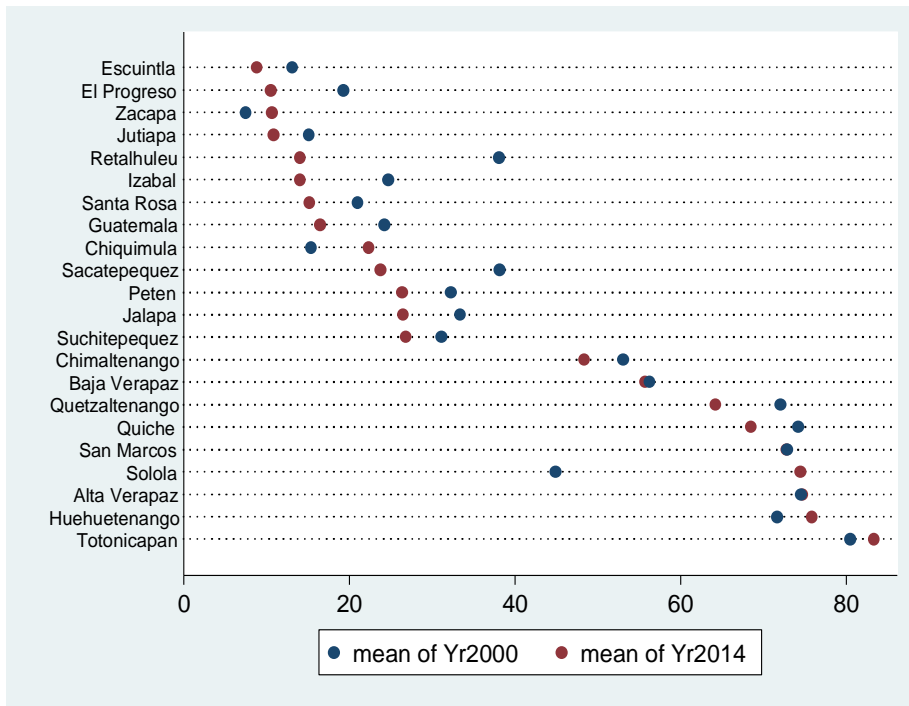
Source: ENCOVI, 2000 and 2014.

Percent of Households that Filter Water by Department (2000-2014)
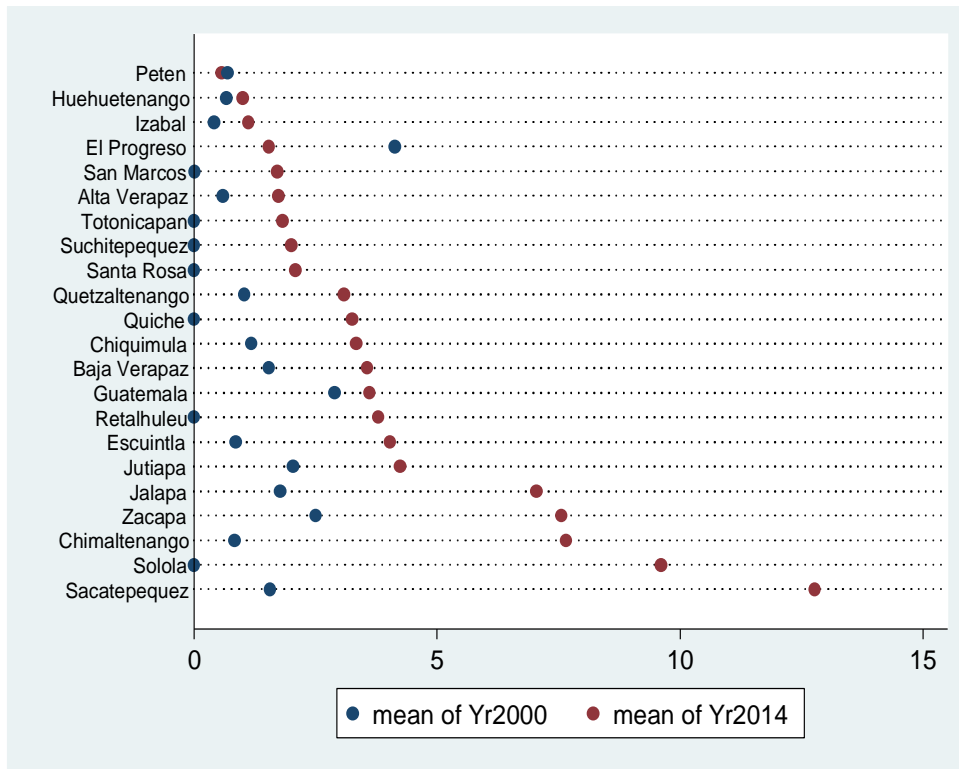
Source: ENCOVI, 2000 and 2014.

Percent of households that add chlorinate to water by Department (2000-2014)
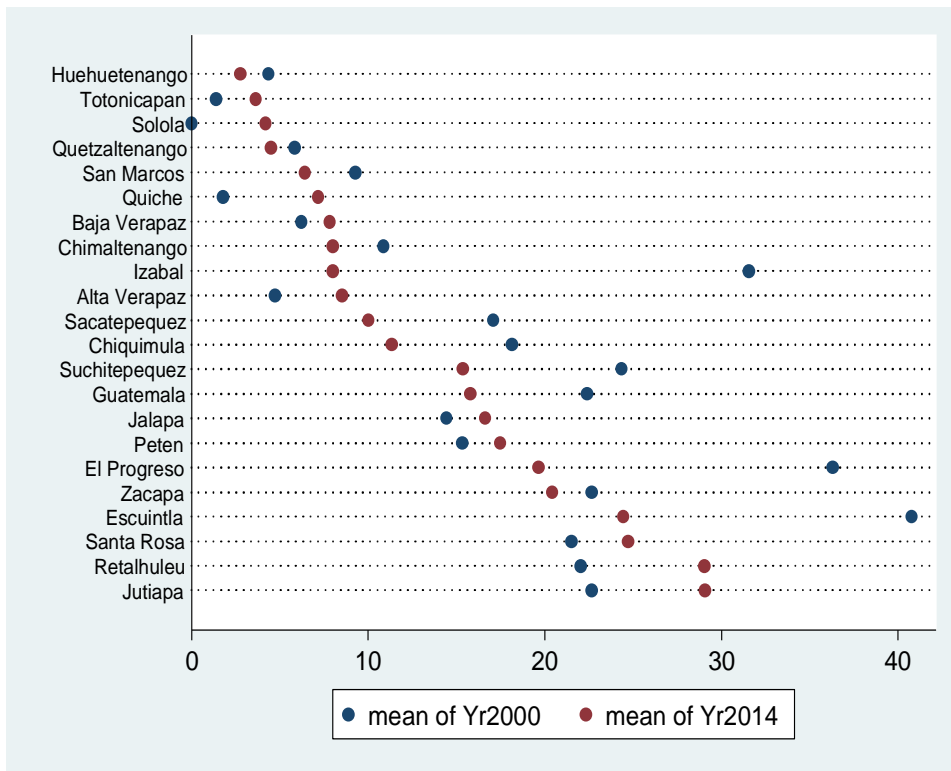
Source: ENCOVI, 2000 and 2014.

Percentage of Households Connected to drainage system by Department (2000-2014)
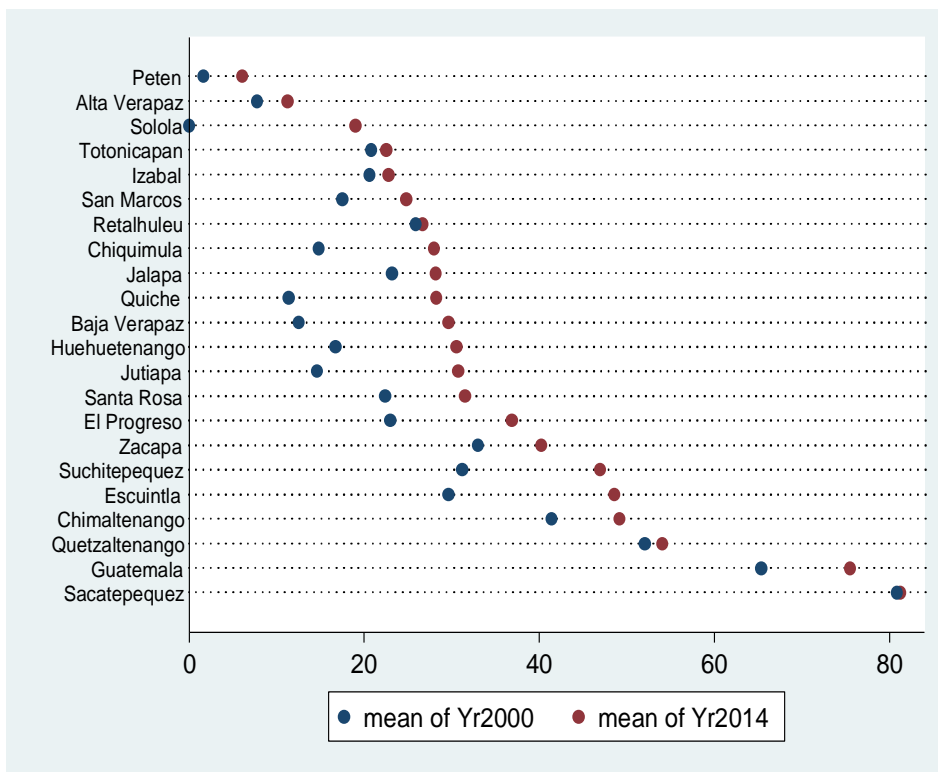
Source: ENCOVI, 2000 and 2014.

Percentage of Households practicing Open Defecation by Department (2000-2014)
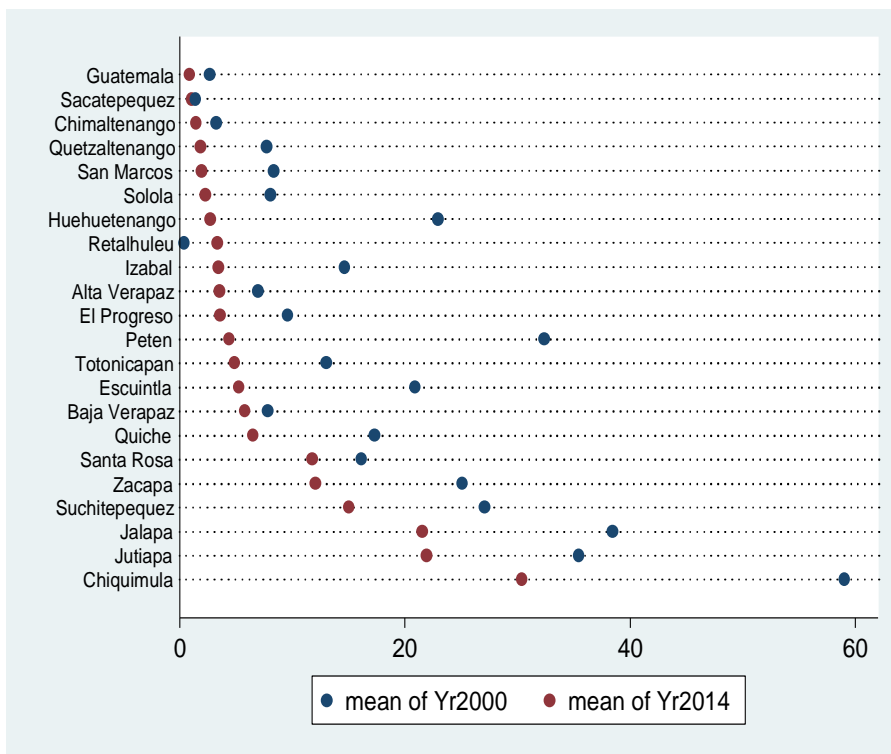
Source: ENCOVI, 2000 and 2014.

Percentage of Children with Reported Diarrhoea in the last month by Department (2000-2014)
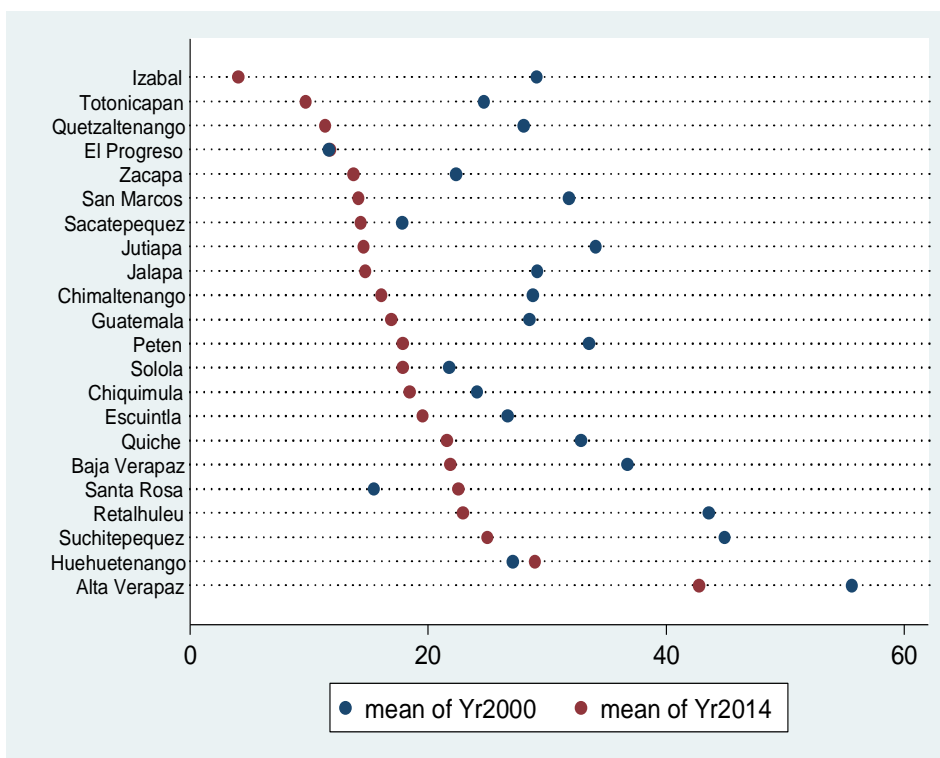
Source: ENCOVI, 2000 and 2014.

Percentage of children receiving (Oral Rehydration Supplements) ORS by Department (2000-2014)
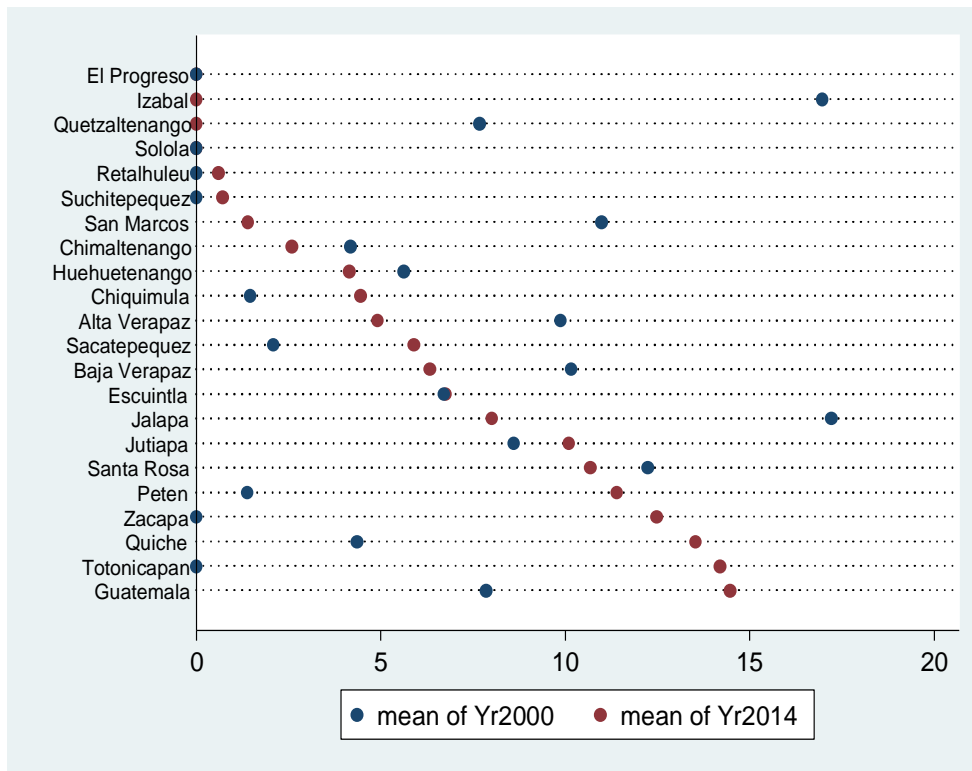
Source: ENCOVI, 2000 and 2014.

Percentage of children treating diarrhoea with medicines by Department (2000-2014)
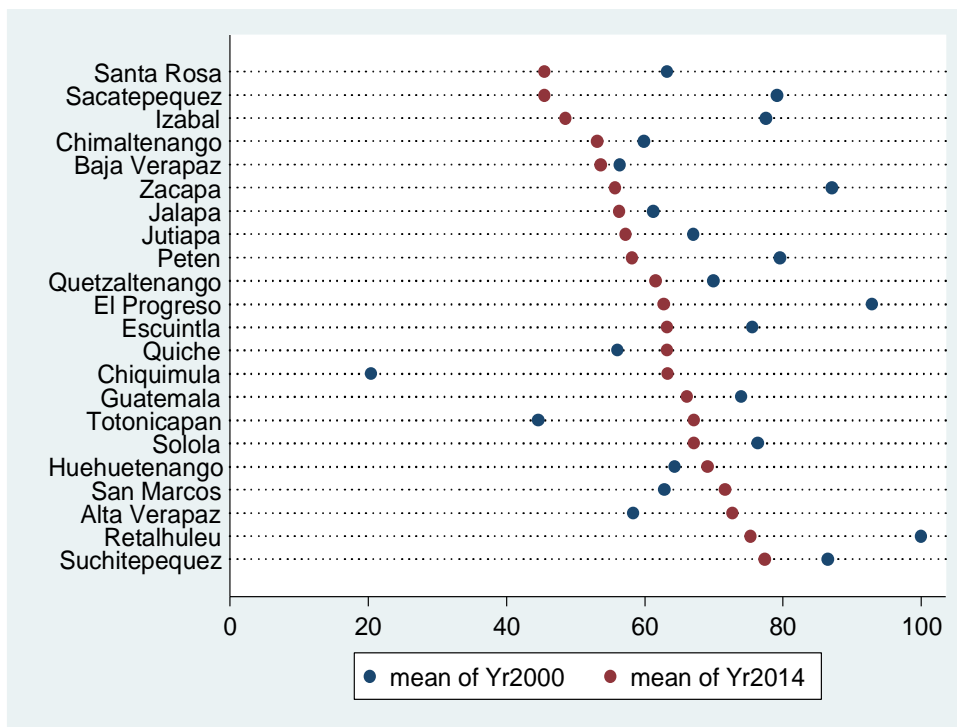
Source: ENCOVI, 2000 and 2014.

Percentage of children without diarrhoea treatment by Department (2000-2014)
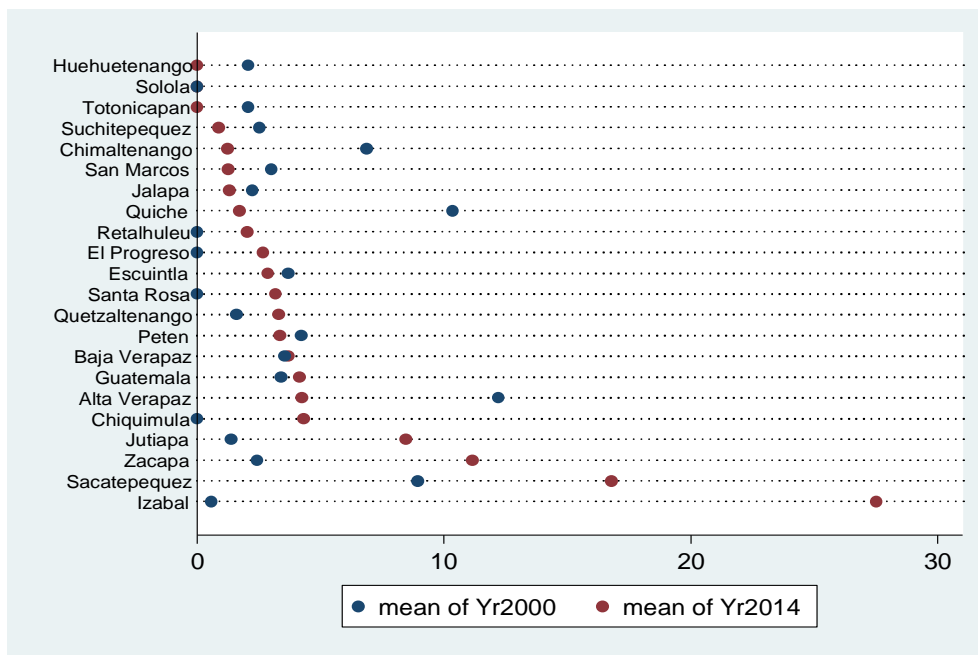
Source: ENCOVI, 2000 and 2014.

Maps and Spatial Distributions

Percent of systems with at least one water quality monitoring per year

More than 46% of systems
Between 36 and 45%
Between 26 and 35%
Between 10 and 25%
Less than 10%

Diarrhea rates per 1000 inhab

More than 100
51 to 100
26-50
11 - 25
0 -10

Source: ENCOVI, 2014 Own elaboration.

Water Supply MDG targets

Sanitation MDG targets

Highly unmet target
Unmet target
On track
Target met
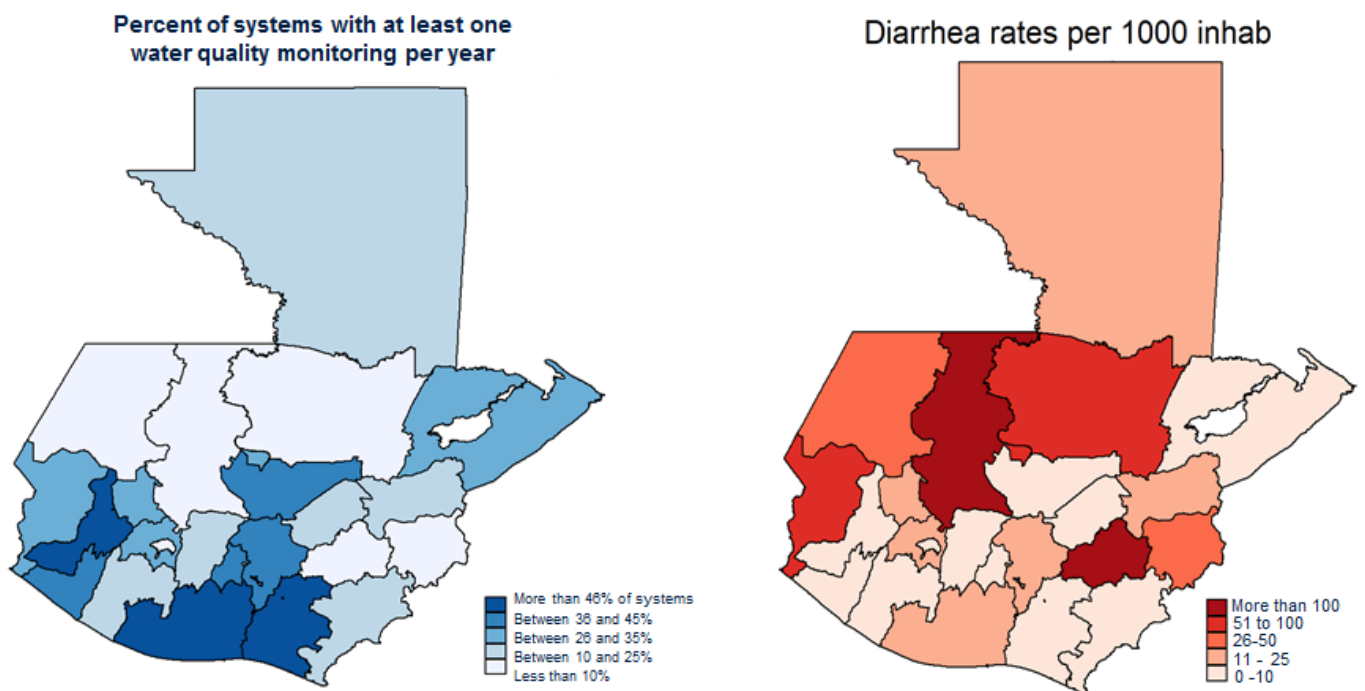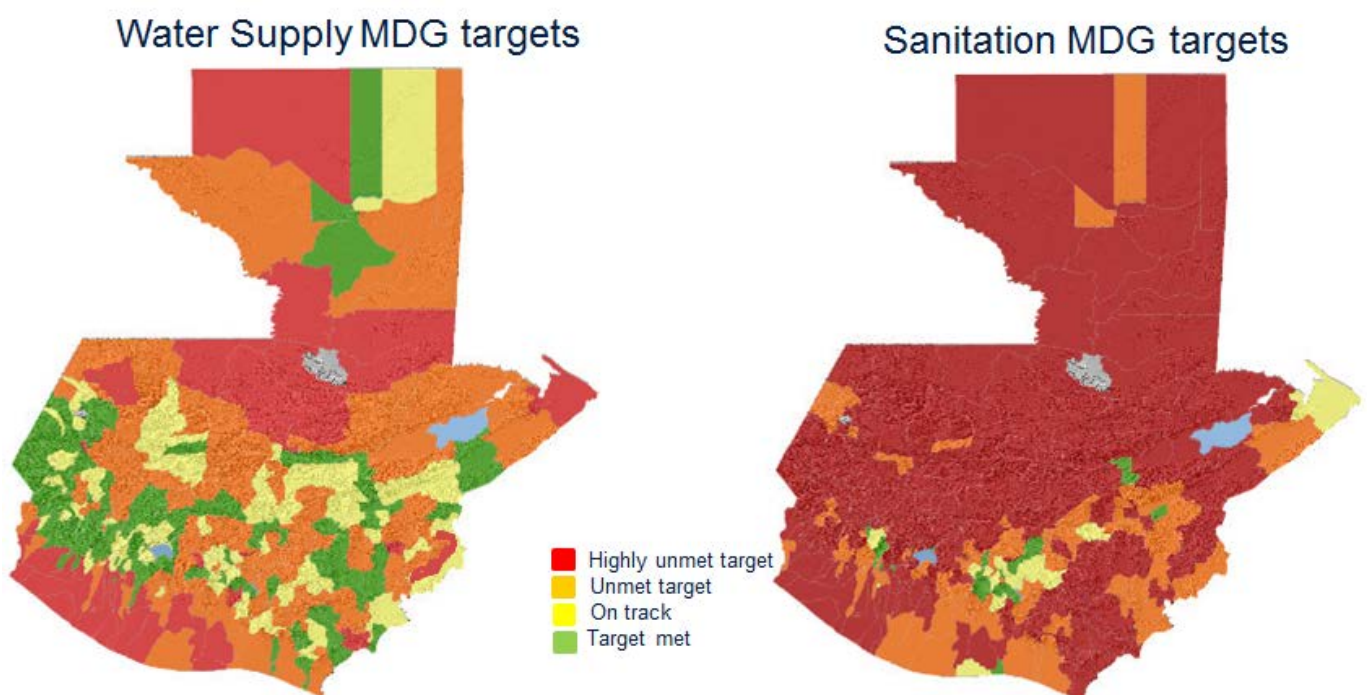
Sanitation MDG targets, which are closely linked to health and nutrition outcomes of mothers and children, have not be met and substantial coverage gaps still exist.

Source: Own elaboration. Based on SEGEPLAN/Sinit data, 2014.

Access to continuous piped water supply by Department, 2006-2014

2006

2014

Legend (2006):
- (>25%)
- [20.1 to 24.9%]
- [15.1 to 20%]
- [10.1 to 15%]
- [5 to 10%]

Legend (2014):
- >35%
- 25-34%
- 15-24%
- 10-14%
- 0-9%
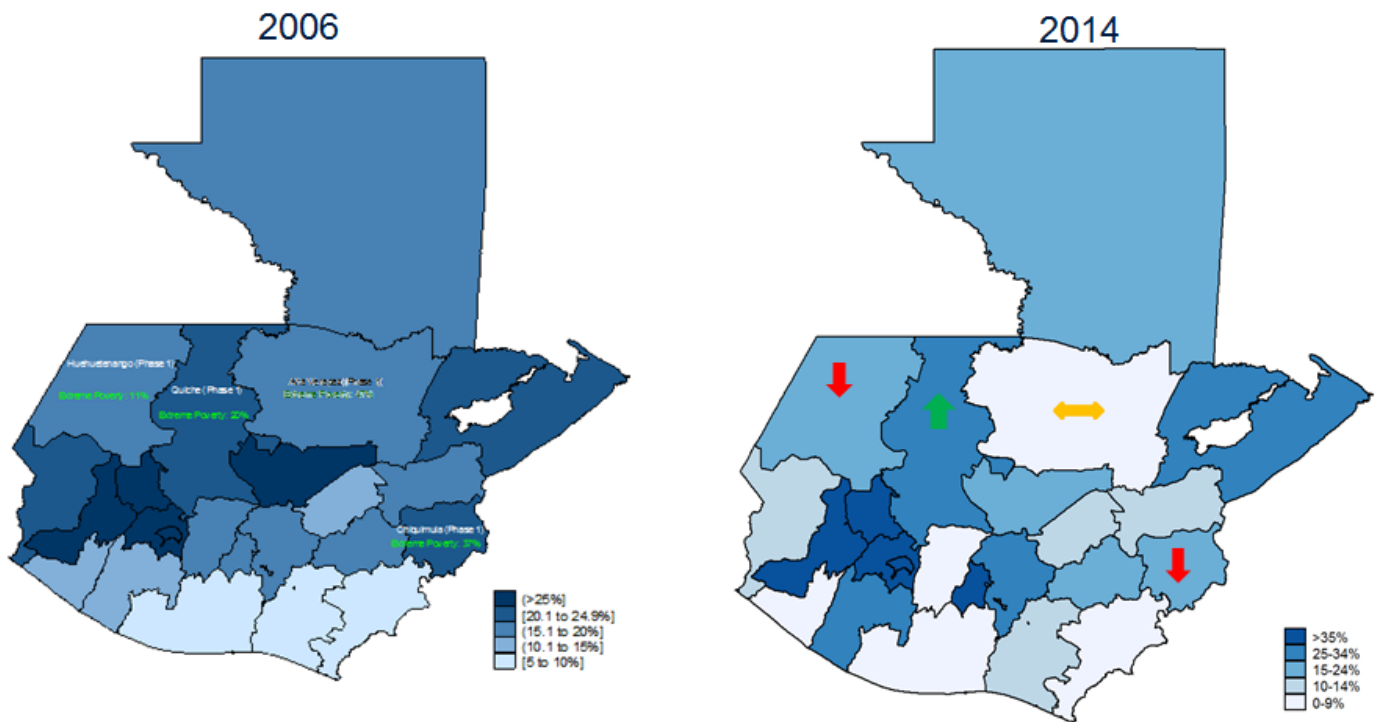
Source: ENCOVI, 2014 Own elaboration.

Proportion of Households with intermittency of water (piped in dwelling or yard)

2006

2014

- Very High Intermittency (more than 20 days per month without service)
- High Intermittency (between 13 and 20 days per month without service)
- Moderate Intermittency (between 7 and 12 days per month without service)
- Low Intermittency (between 3 and 6 days per month without service)
- Very Low Intermittency (less than 2 days per month without service)
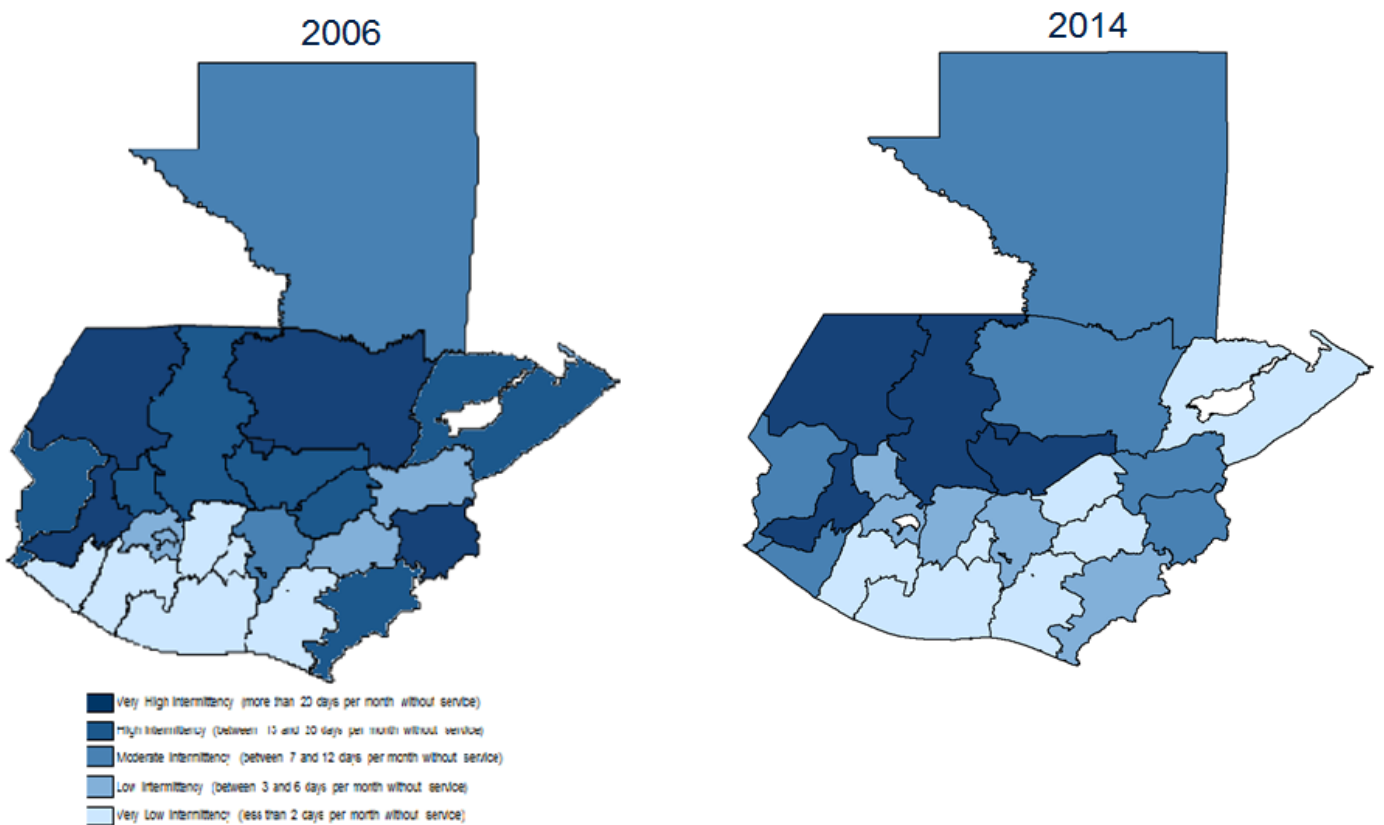
Sources: ENCOVI, 2006 and 2014

Chronic Malnutrition of Children (< 5 y.o.), 2011

Muy Alta
Alta
Moderada
Baja

Municipal Health index, 2012

Very Low
Low
High
Very High
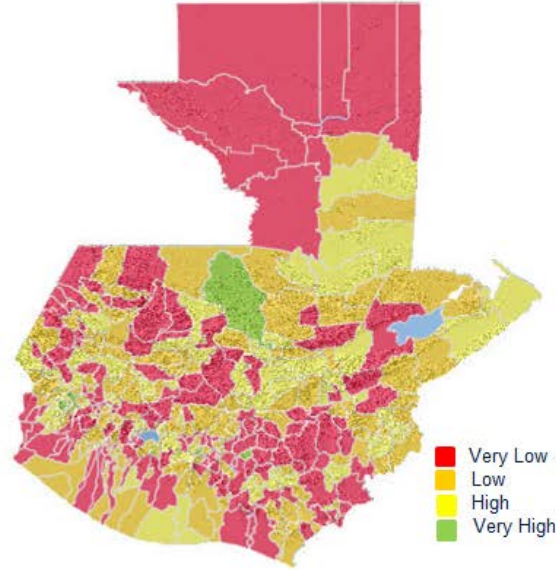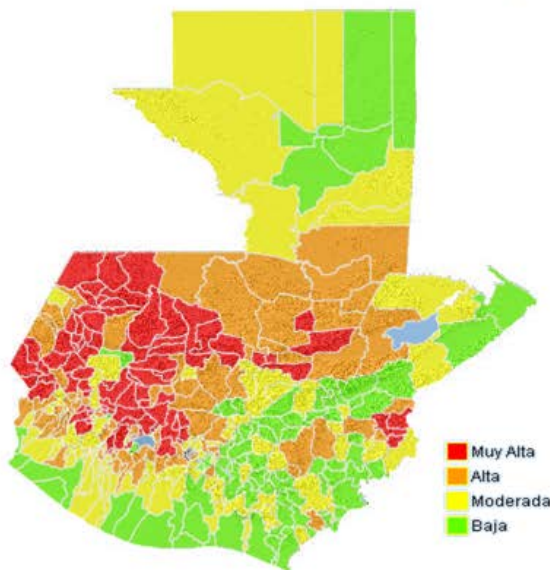
Source: SEGEPLAN/Sinit, 2014. Data based on SINIT combines admin health records from SESAN, adjusted with CENSUS 2011. Health facilities and Index by MINSA.

Social Vulnerability Index

Municipal Fiscal Capacity
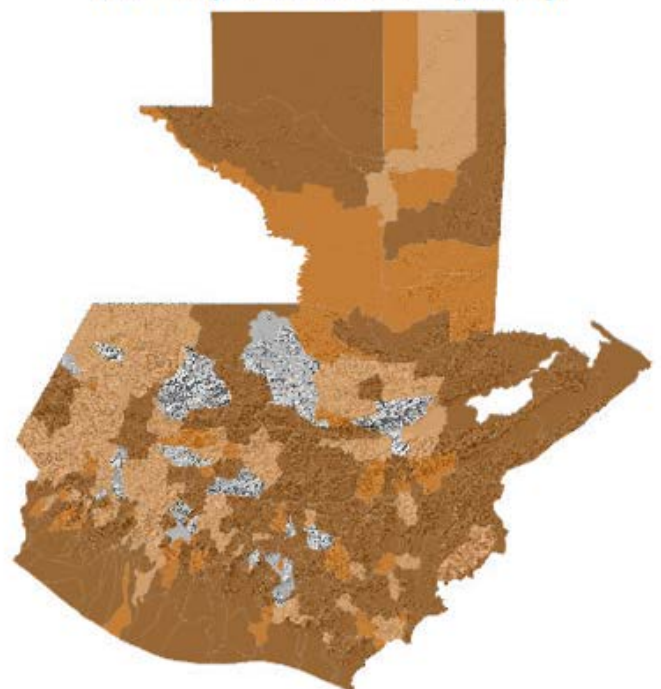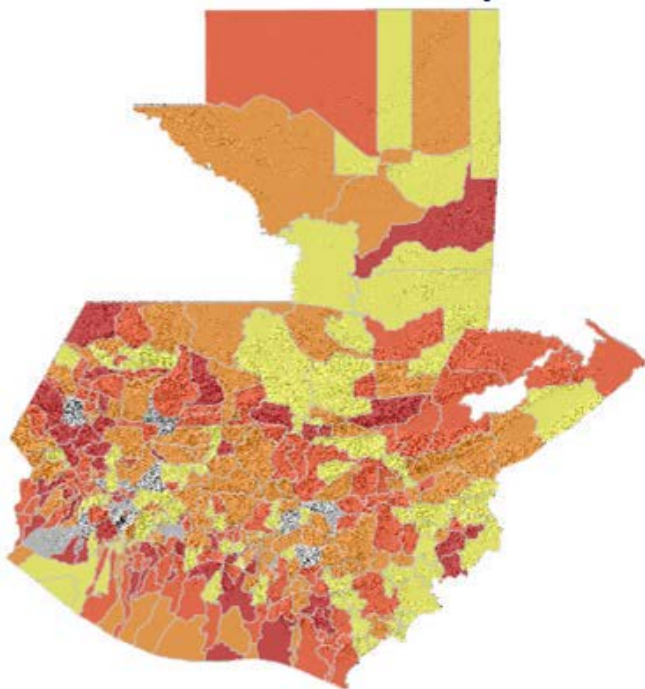
Social vulnerability combines the food insecurity index and the municipal marginality index that measures the levels of education, health and access to basic infrastructure (energy, WASH) and the households' materials quality. Red colour denotes higher vulnerability, yellow colour denotes moderate vulnerability. Although the Government has implemented a decentralization process, not all local governments and institutions are prepared to execute budgets due to limited fiscal space and capacity. This could be an institutional constraint for WASH delivery and delivery of other social services. Darker brown colours with low fiscal capacity. Grey colours in both maps denote no data available.

Source: SEGEPLAN, 2014. Orthophotos available at: http://ide.segeplan.gob.gt/geoportal/index.html Also see: http://web.maga.gob.gt/wp-content/blogs.dir/13/files/2013/widget/public/visan_2011.pdf

Municipalities prioritized with HAMBRE CERO program, 2015 (red high priority, orange low priority)
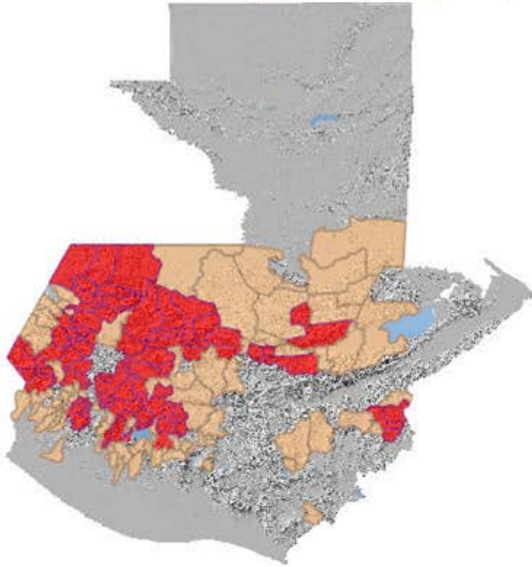
Budget support projects from SNIP (red) and SPP, 2012-2015
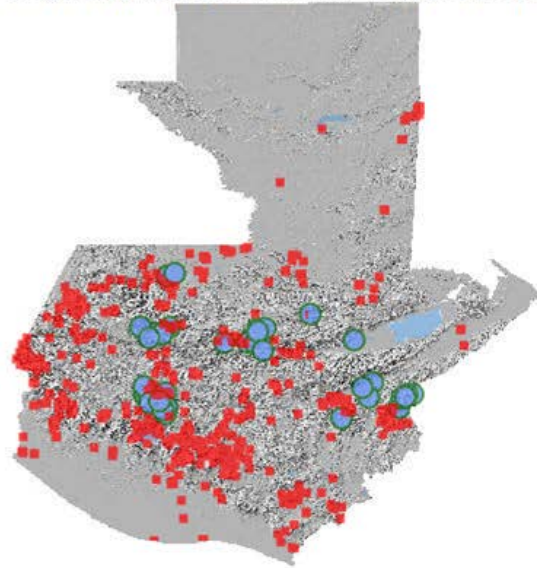
Source: Based on data from Segeplan, 2016. http://ide.segeplan.gob.gt/geoportal/index.html

Indigenous Population (%) by Municipality

- 0 – 25%
- 26-50%
- 50% and more
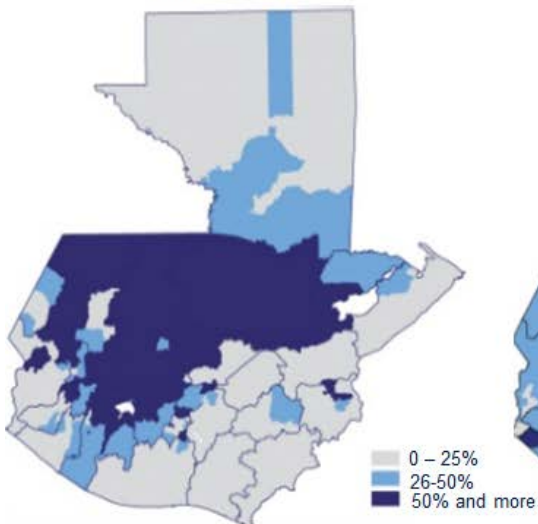
Access to primary health care by level

- Primary
- Secondary
- Tertiary
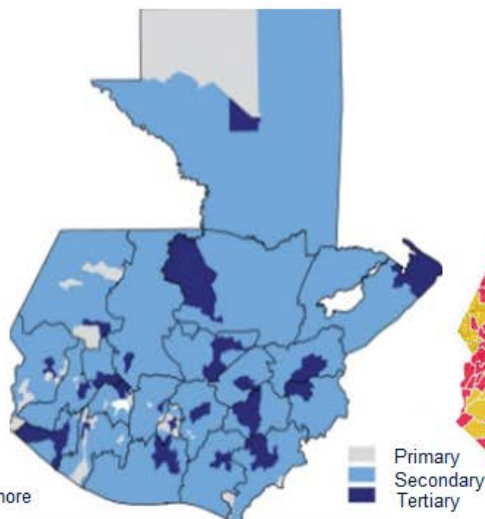
Access to infrastructure by municipality

- Very Low
- Low
- High
- Very High
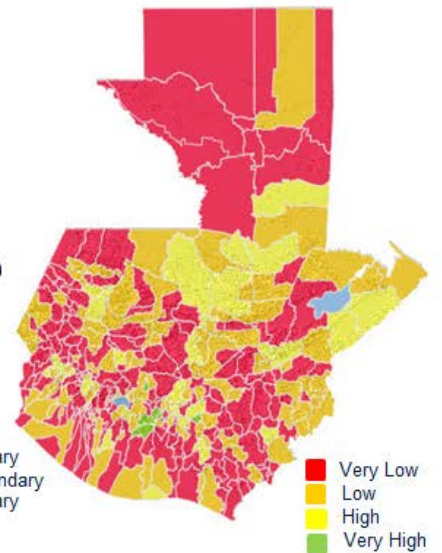
Population density by district, 2012   **Surface and underground water accumulation, 2014**
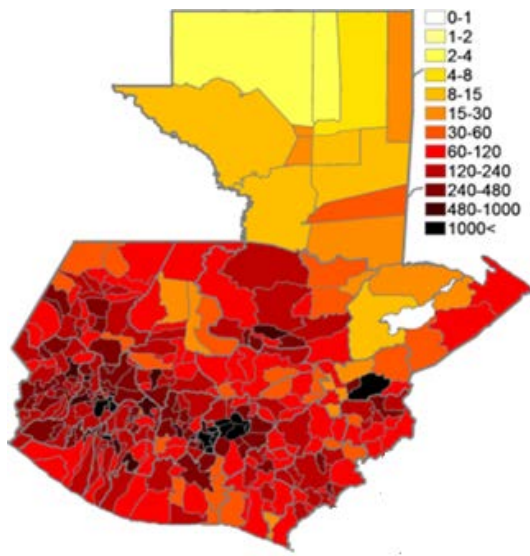
0-1	
1-2	
2-4	
4-8	
8-15	
15-30	
30-60	
60-120	
120-240	
240-480	
480-1000	
1000<	
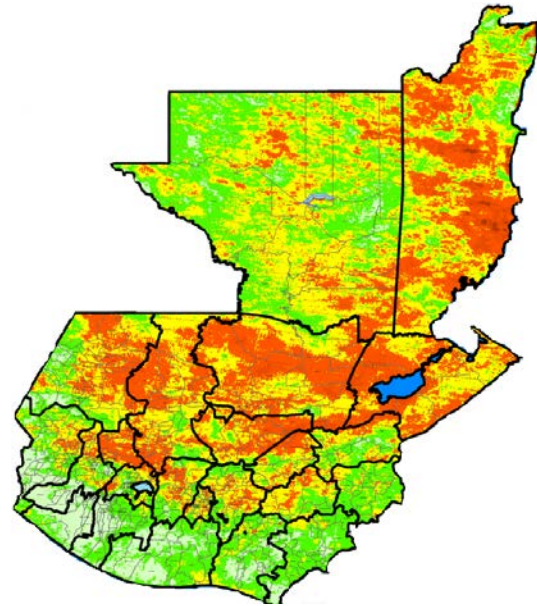
Sources: UN Population and INE data, 2012. CONRED Guatemala. Right hand side map includes Belize's water accumulation. Red colours in right-hand side map denote lower water accumulation levels.

Access Plus Framework

Access to Drinking Water in Guatemala

Year	URBAN							RURAL						
	Total improved (T1)	JMP total improved	Improved + 30 min (T2)	Improved on premises	Improved on premises available when needed	Piped on premises	JMP piped on premises	Total improved (T1)	JMP total improved	Improved + 30 min (T2)	Improved on premises	Improved on premises available when needed	Piped on premises	JMP piped on premises
2000	94.5	95.6	93.7	87.9	53.9	87.3	90.0	82.1	83.8	77.6	54.7	40.8	53.8	60.6
2006	95.3	95.6	91.3	89.3	56.7	89.3	90.0	83.5	83.8	69.7	60.6	43.7	60.6	60.6
2011	94.9	94.5	92.0	90.0	57.7	90.0	89.9	79.8	78.4	66.4	57.3	42.0	57.3	56.1
2014	94.9	🟥	90.1	88.5	57.8	88.5	🟥	87.5	🟥	72.7	61.0	47.0	61.0	🟥

Access to Sanitation in Guatemala

Year	URBAN								RURAL							
	Open Defecation	JMP Open defecation	Total Improved	JMP Total improved	Improved (Tier 1)	Sewer Connection	Sewer Connection (unshared)	JMP Sewer connection	Open Defecation	JMP Open defecation	Total Improved	JMP Total improved	Improved (Tier 1)	Sewer Connection	Sewer Connection (unshared)	JMP Sewer connection
2000	2.8	1.8	88.9	90.4	74.2	60.0	51.2	68.4	20.8	17.4	45.9	52.2	40.2	4.5	3.9	7.6
2006	1.9	1.8	88.5	90.4	72.0	65.2	53.5	68.4	17.2	17.4	51.1	52.2	45.7	6.7	5.8	7.6
2011	1.9	2.1	90.2	90.8	77.2	69.6	59.9	72.4	13.5	14.2	54.5	55.3	48.7	7.8	6.9	8.6
2014	1.6	🟥	89.7	🟥	77.6	68.1	59.3	🟥	8.9	🟥	58.7	🟥	54.2	9.1	8.4	🟥

Access to piped water, by selected characteristics of the household head - percentages

	2000	2006	2011	2014	2014-2000	
Male	71.26	77.77	74.00	76.41	5.15	**
Female	78.79	81.68	80.00	82.85	4.06	
Age 13-24	65.54	74.12	62.84	69.14	3.6	
Age 25-44	71.98	77.07	73.15	76.63	4.65	*
Age 45-64	74.75	81.57	79.05	79.19	4.44	*
Age 65 or more	73.52	78.97	78.91	81.48	7.96	***
Less than primary educ.	61.95	72.76	68.69	72.10	10.15	***
Completed primary or more	79.34	87.72	84.40	85.16	5.82	***
Wage earner	73.10	79.59	76.87	77.38	4.28	*
Non-wage earner	71.01	76.24	71.15	76.62	5.61	*
Unemployed or inactive	76.68	83.17	79.56	82.02	5.34	*
Employed in other sectors	83.66	85.38	82.92	84.98	1.32	
Employed in primary sector	57.29	65.62	61.98	64.71	7.42	**
Not indigenous language speaker	84.77	81.57	78.83	79.93	-4.84	
Indigenous language speaker	70.01	72.44	68.02	73.22	3.21	
No electricity	44.43	46.09	41.99	49.22	4.79	
Dependency ratio: 0-1	77.09	83.53	78.91	80.45	3.36	
Dependency ratio: 1-2	70.22	76.29	73.54	75.01	4.79	*
Dependency ratio: 2+	66.14	69.49	64.63	69.48	3.34	
Non-migrant	72.66	78.70	75.17	77.62	4.96	**
Migrant	72.20	77.98	77.92	84.72	12.52	**

*p<0.05, ** p<0.01, *** p<0.001 Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014

Use of surface water, by selected characteristics of the household head - percentages

	2000	2006	2011	2014	2014-2000	
Age 25-44	6.571	6.661	8.004	5.412	-1.2	
Age 45-64	8.395	4.806	6.193	4.569	-3.8	***
Age 65 or more	6.461	5.645	6.841	4.513	-1.9	
Less than primary educ.	12.29	8.605	10.58	7.246	-5.0	***
Completed primary or more	4.132	1.878	3.026	2.205	-1.9	***
Wage earner	6.026	4.775	5.544	4.964	-1.1	
Non-wage earner	9.542	8.023	11.23	5.914	-3.6	**
Unemployed or inactive	3.801	3.259	4.653	3.283	-0.5	
Employed in other sectors	2.122	2.031	2.690	2.431	0.3	
Employed in primary sector	14.94	13.56	15.68	9.909	-5.0	**
Not indigenous language speaker	1.637	3.643	5.425	3.035	1.4	*
Indigenous language speaker	12.10	10.85	11.48	9.310	-2.8	
No electricity	23.00	22.29	24.35	16.83	-6.2	*
Dependency ratio: 0-1	5.825	3.462	5.593	3.931	-1.9	*
Dependency ratio: 1-2	8.443	7.431	7.790	5.918	-2.5	*
Dependency ratio: 2+	8.781	10.51	13.63	9.658	0.9	

Non-migrant	7.413	5.866	7.470	5.125	-2.3	**
Migrant	5.102	7.250	5.989	2.006	-3.1	*

*p<0.05, ** p<0.01, *** p<0.001 Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014

Improved sanitation access, by district and year - percentages

	2000	2006	2011	2014	2014-2000	
Guatemala	82.02	88.71	87.40	89.74	7.7	*
El Progreso	42.43	54.22	57.58	64.81	22.4	**
Sacatepequez	83.20	87.95	91.12	89.94	6.7	
Chimaltenango	43.87	58.34	55.05	59.22	15.4	*
Escuintla	44.69	58.82	71.07	71.61	26.9	***
Santa Rosa	34.60	45.46	50.13	64.84	30.2	***
Solola	8.354	26.04	34.60	38.28	29.9	***
Totonicapan	23.37	23.60	24.71	30.05	6.7	
Quetzaltenango	50.35	56.18	52.89	61.69	11.3	
Suchitepequez	32.72	50.78	66.76	61.11	28.4	***
Retalhuleu	34.86	45.88	42.23	44.24	9.4	
San Marcos	19.72	30.34	39.03	35.59	15.9	
Huehuetenango	19.99	36.33	38.86	37.30	17.3	**
Quiche	13.08	23.59	31.06	38.53	25.5	***
Baja Verapaz	24.98	27.03	43.39	46.02	21.0	**
Alta Verapaz	10.65	20.30	17.27	22.31	11.7	
Peten	12.60	25.36	22.98	31.58	19.0	***
Izabal	43.03	57.67	69.40	62.58	19.6	
Zacapa	37.79	55.81	59.90	68.94	31.2	**
Chiquimula	28.46	48.95	50.85	51.68	23.2	*
Jalapa	27.82	32.88	41.33	50.15	22.3	**
Jutiapa	23.58	43.37	51.03	59.76	36.2	***

*p<0.05, ** p<0.01, *** p<0.001 Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014

Improved access to water, by district and year - percentages

	2000	2006	2011	2014	2014-2000	
Guatemala	93.09	93.52	91.76	93.05	-0.04	
El Progreso	86.94	88.19	87.42	88.6	1.66	
Sacatepequez	97.96	94.52	94.22	96.12	-1.84	
Chimaltenango	93.18	97.5	90.42	93.56	0.38	
Escuintla	97.82	98.23	92.76	96.24	-1.58	
Santa Rosa	89.02	92.5	81.31	86.32	-2.7	
Solola	100	96.08	96.93	98.4	-1.6	**
Totonicapan	87.49	97.15	92.73	91.4	3.91	
Quetzaltenango	95.64	93.88	85.21	93.83	-1.81	
Suchitepequez	98.34	95.84	89.97	96.23	-2.11	
Retalhuleu	99.24	95.76	95.02	95.48	-3.76	**
San Marcos	84.03	91.55	77.94	89.85	5.82	
Huehuetenango	79.27	82.45	83.19	89.75	10.48	**
Quiche	84.98	84.55	82.58	92.56	7.58	

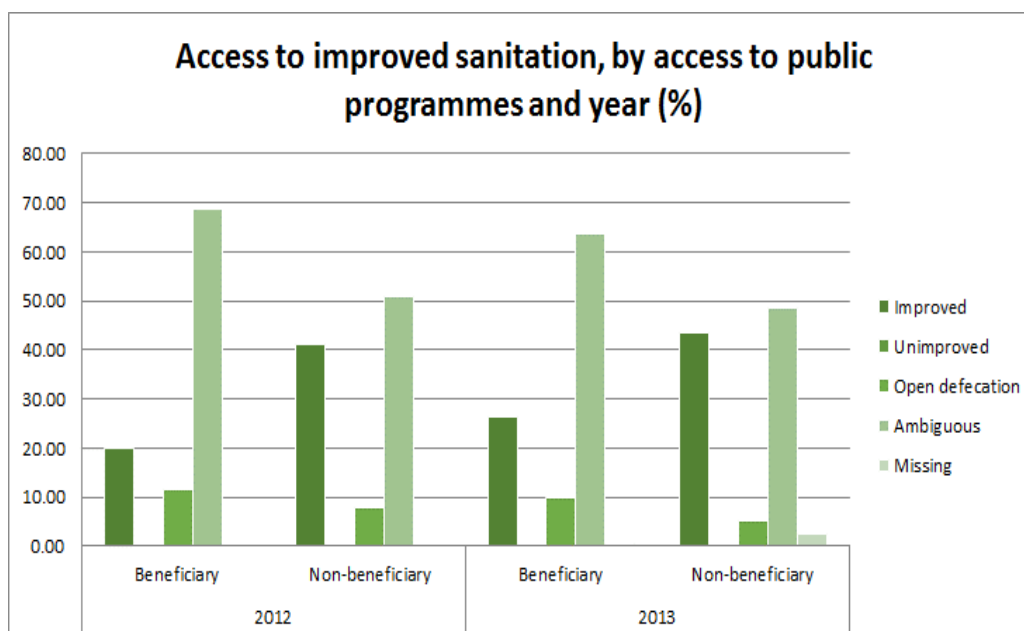|						
Baja Verapaz	83.21	78.84	80.1	89.05	5.84	
Alta Verapaz	63.08	69.3	81.3	80.7	17.62	**
Peten	76.24	79.13	76.4	87.99	11.75	**
Izabal	80.93	87.83	86.38	93.98	13.05	**
Zacapa	79.2	92.62	90.63	89.66	10.46	
Chiquimula	54.53	86.82	81.88	83.12	28.59	*
Jalapa	86.36	87.02	80.33	89.61	3.25	
Jutiapa	91.65	89.57	84.52	90.24	-1.41	
Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014						

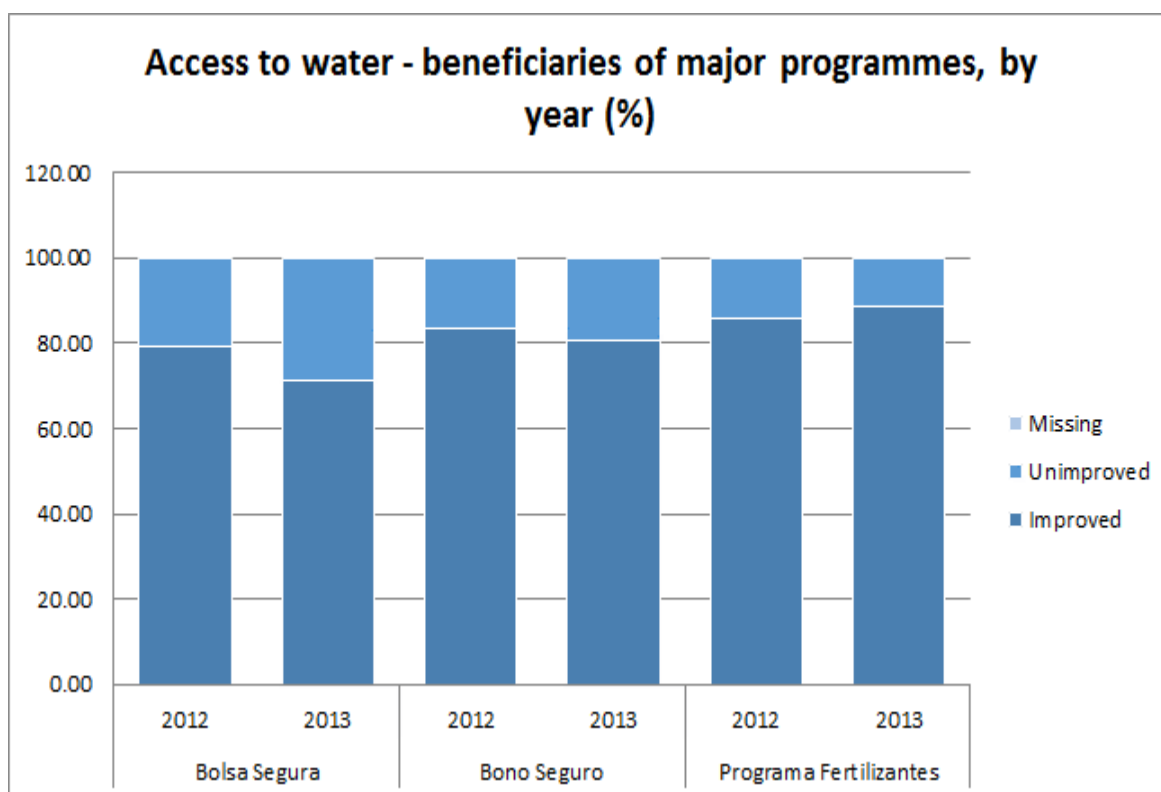| Access to flush sanitation, by selected characteristics of the household head - percentages						
	2000	2006	2011	2014	2014-2000	
Female	42.99	53.59	57.63	59.08	16.1	***
Age 13-24	27.78	45.54	40.53	46.61	18.8	***
Age 25-44	33.11	46.99	46.38	49.87	16.8	***
Age 45-64	34.22	48.93	51.97	52.05	17.8	***
Age 65 or more	36.30	45.17	54.24	51.70	15.4	***
Less than primary educ.	15.27	30.01	32.78	35.66	20.4	***
Completed primary or more	44.91	73.91	71.38	70.16	25.3	***
Wage earner	37.15	52.46	51.85	52.07	14.9	***
Non-wage earner	26.53	38.93	40.46	46.06	19.5	***
Unemployed or inactive	44.80	56.61	59.06	56.90	12.1	***
Employed in other sectors	50.04	63.76	66.27	68.47	18.4	***
Employed in primary sector	8.833	16.10	18.67	20.21	11.4	***
Not indigenous	57.33	57.18	60.29	60.53	3.2	
Indigenous	12.34	26.23	26.43	29.90	17.6	***
No electricity	1.872	8.119	9.964	12.98	11.1	***
Electricity	44.99	54.92	56.36	57.10	12.1	***
Dependency ratio: 0-1	41.57	56.36	55.78	55.93	14.4	***
Dependency ratio: 1-2	29.59	42.02	43.65	46.69	17.1	***
Dependency ratio: 2+	20.59	30.52	34.29	32.92	12.3	***
Non-migrant	32.41	46.72	48.69	50.18	17.8	***
Migrant	50.66	57.87	55.29	71.64	21.0	***
Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014						

Open defecation, by selected characteristics of the household head - percentages						
	2000	**2006**	**2011**	**2014**	**2014-2000**	
Age 13-24	18.79	13.24	17.22	9.665	-9.1	***
Age 25-44	12.98	9.347	8.668	5.416	-7.6	***
Age 45-64	12.09	7.324	5.354	4.005	-8.1	***
Age 65 or more	13.80	10.01	6.616	4.402	-9.4	***
Less than primary educ.	20.19	13.49	11.27	7.141	-13.0	***
Completed primary or more	8.787	2.096	3.020	2.279	-6.5	***
Wage earner	11.46	8.353	7.346	5.179	-6.3	***
Non-wage earner	15.74	10.30	9.006	4.957	-10.8	***
Unemployed or inactive	10.33	7.115	6.540	4.673	-5.7	***
Employed in other sectors	6.571	3.848	3.779	2.505	-4.1	***
Employed in primary sector	22.50	18.36	14.41	9.126	-13.4	***
Not indigenous	7.202	7.505	6.850	5.139	-2.1	
Indigenous	15.53	12.21	9.912	4.801	-10.7	***
No electricity	31.68	30.73	25.01	15.37	-16.3	***
Dependency ratio: 0-1	10.32	6.434	5.702	3.709	-6.6	***
Dependency ratio: 1-2	14.20	9.819	9.138	5.928	-8.3	***
Dependency ratio: 2+	17.89	14.74	12.52	9.178	-8.7	***
Non-migrant	13.34	9.046	7.937	5.075	-8.3	***
Migrant	10.57	8.277	4.437	2.855	-7.7	***
Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014						

Changes in improved access to water and poverty convergence of districts
2000-2014
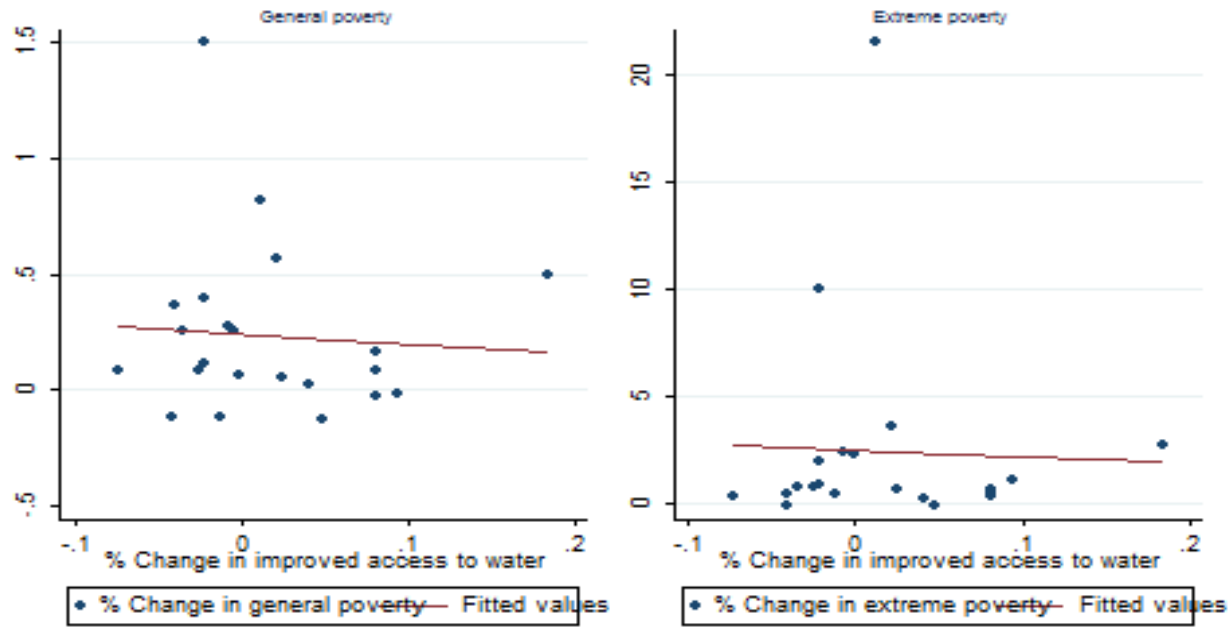
Source: own calculations using ENCOVI survey data, years 2000, 2014

Changes in access to improved sanitation and poverty convergence of districts
2000-2014
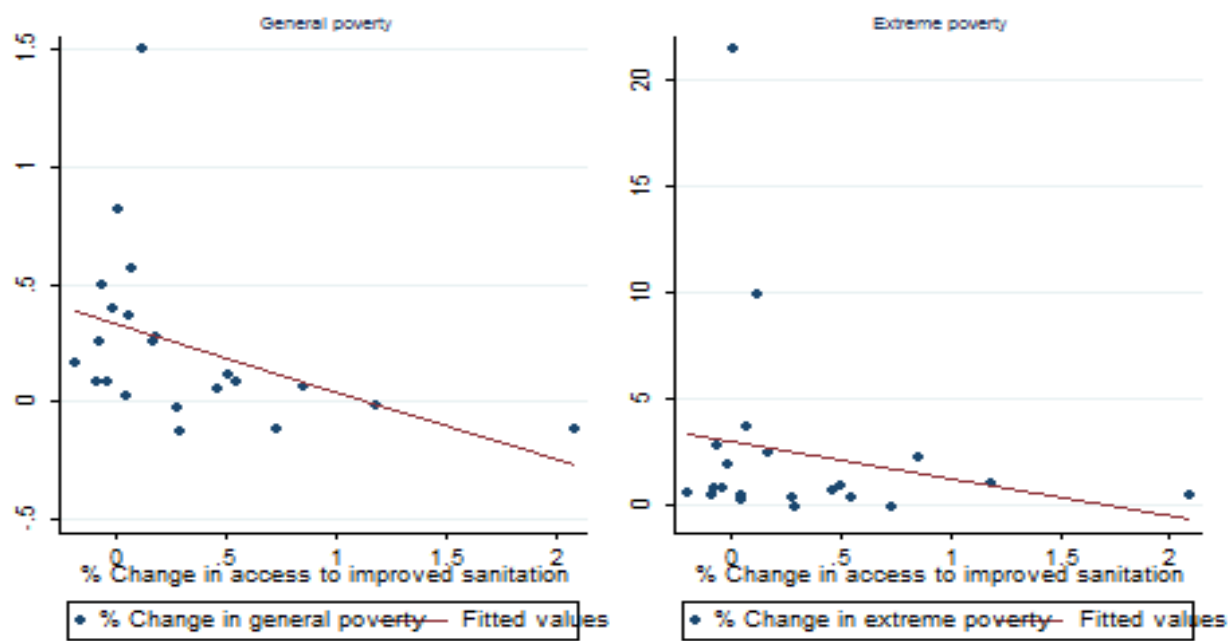
Source: own calculations using ENCOVI survey data, years 2000, 2014

The effect of improved access to water and sanitation on household consumption, year 2000

VARIABLES	(1) Consumption	(2) Consumption	(3) Consumption	(4) Consumption	(5) Consumption	(6) Consumption	(7) Consumption
Improved water	0.559***	0.213***	0.195***				
	(0.024)	(0.037)	(0.040)				
Female		0.214***	0.186***		0.183***	0.163***	0.170***
		(0.033)	(0.034)		(0.032)	(0.034)	(0.034)
Age		-0.005	-0.006		-0.007*	-0.007**	-0.006*
		(0.004)	(0.004)		(0.004)	(0.004)	(0.003)
Age squared		0.000*	0.000**		0.000**	0.000**	0.000**
		(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Dep.ratio		-0.269***	-0.253***		-0.251***	-0.241***	-0.234***
		(0.013)	(0.011)		(0.011)	(0.011)	(0.012)
Employed, wage earner		-0.058	-0.063		-0.053	-0.058	-0.062
		(0.043)	(0.044)		(0.044)	(0.045)	(0.041)
Employed, non-wage earner		-0.056	-0.023		-0.043	-0.017	-0.017
		(0.041)	(0.042)		(0.042)	(0.043)	(0.040)
Urban		0.676***	0.465***		0.352***	0.224***	0.223***
		(0.024)	(0.021)		(0.026)	(0.025)	(0.027)
Primary or more		0.425***	0.355***		0.342***	0.296***	0.298***
		(0.022)	(0.021)		(0.021)	(0.021)	(0.021)
Improved sanitation				0.899***	0.554***	0.460***	
				(0.014)	(0.026)	(0.025)	
Improved water and sanitation							0.470***
							(0.031)
Constant	8.501***	8.160***	8.307***	8.529***	8.323***	8.442***	8.427***
	(0.022)	(0.089)	(0.087)	(0.009)	(0.084)	(0.080)	(0.081)
Observations	18,811	7,081	7,081	18,811	7,081	7,081	7,081
R-squared	0.041	0.451	0.516	0.290	0.497	0.545	0.548
District fixed effects	NO	NO	YES	NO	NO	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The outcome is the natural logarithm of household consumption. Data come from the 2000 wave of the National Household Living Standards Survey of Guatemala.

The effect of improved access to water and sanitation on household consumption, year 2014

VARIABLES	(1) Consumption	(2) Consumption	(3) Consumption	(4) Consumption	(5) Consumption	(6) Consumption	(7) Consumption
Improved water	0.559***	0.186***	0.186***				
	(0.024)	(0.024)	(0.023)				
Female		0.153***	0.124***		0.128***	0.108***	0.108***
		(0.019)	(0.019)		(0.019)	(0.019)	(0.019)
Age		-0.005*	-0.004		-0.006**	-0.005	-0.004
		(0.003)	(0.003)		(0.003)	(0.003)	(0.003)
Age squared		0.000***	0.000***		0.000***	0.000***	0.000***
		(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
depratio		-0.234***	-0.223***		-0.217***	-0.212***	-0.210***
		(0.010)	(0.010)		(0.010)	(0.009)	(0.010)
Employed, wage earner		-0.000	-0.004		-0.004	-0.006	-0.002
		(0.029)	(0.028)		(0.028)	(0.028)	(0.028)
Employed, non-wage earner		0.044	0.066**		0.044*	0.059**	0.062**
		(0.027)	(0.027)		(0.026)	(0.026)	(0.027)
Urban		0.310***	0.238***		0.148***	0.115***	0.120***
		(0.015)	(0.015)		(0.015)	(0.015)	(0.015)
Primary or more		0.499***	0.455***		0.428***	0.406***	0.401***
		(0.016)	(0.016)		(0.016)	(0.016)	(0.016)
Improved sanitation				0.899***	0.374***	0.331***	
				(0.014)	(0.015)	(0.015)	
Improved water and sanitation							0.326***
							(0.015)
Constant	8.501***	8.890***	8.922***	8.529***	8.978***	9.007***	9.013***
	(0.022)	(0.077)	(0.076)	(0.009)	(0.072)	(0.072)	(0.072)
Observations	18,811	11,071	11,071	18,811	11,071	11,071	11,071
R-squared	0.041	0.370	0.410	0.290	0.412	0.438	0.439
District fixed effects	NO	NO	YES	NO	NO	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The outcome is the natural logarithm of household consumption. Data come from the 2000 wave of the National Household Living Standards Survey of Guatemala.

Human Opportunity Index - Access to water
Children aged 0-59 months

Source: own calculations using ENCOVI survey data, years 2000, 2014.

Human Opportunity Index - Sanitation
Children aged 0-16

Source: own calculations using ENCOVI survey data, years 2000, 2014.

Access to improved water, by access to public programmes and year (%)

Access to improved sanitation, by access to public programmes and year (%)
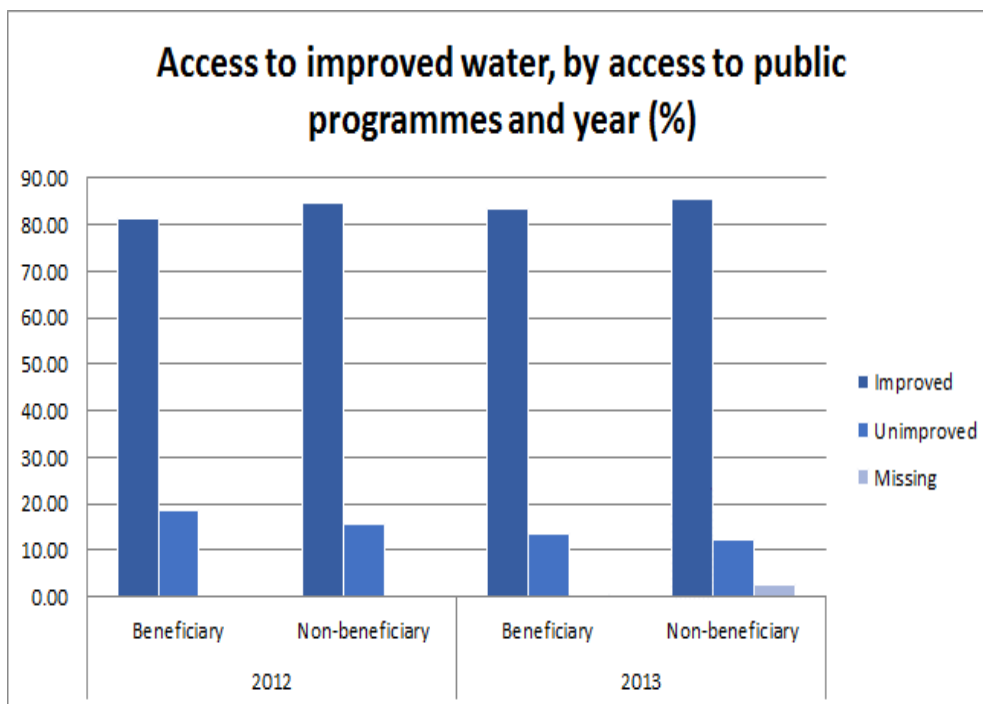
Source: ENCOVI survey, 2014

Access to water - beneficiaries of major programmes, by year (%)

Access to sanitation - beneficiaries of major programmes, by year (%)
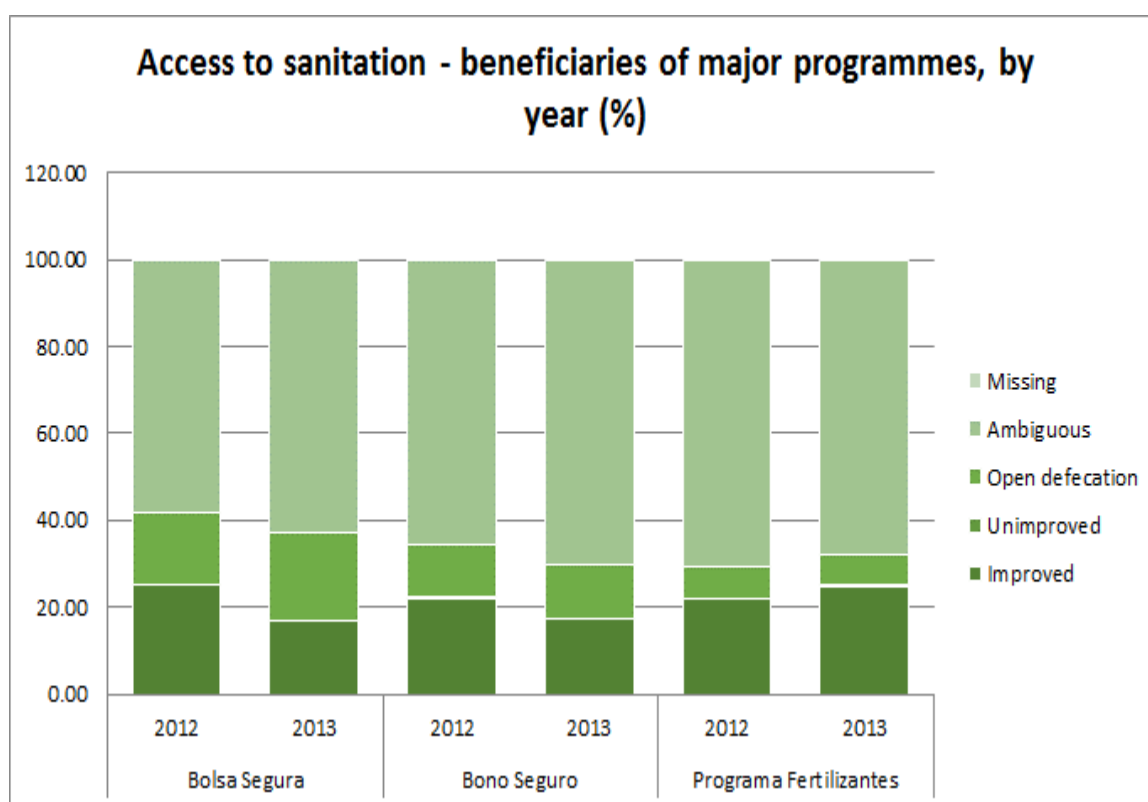
Water

Access Plus - Improved water, by area and year (%)

		2000	2006	2011	2014
	Urban				
Tier 1	Improved water	94.5	95.3	94.9	94.9
Tier 2	Basic water	93.7	91.3	92	90.1
Water 4	Improved on premises	87.9	89.3	90	88.5
Water 5	Piped on premises	87.3	89.3	90	88.5
	Rural				
Tier 1	Improved water	82.1	83.5	79.8	87.5
Tier 2	Basic water	77.6	69.7	66.4	72.7
Water 4	Improved on premises	54.7	60.6	57.3	61
Water 5	Piped on premises	53.8	60.6	57.3	61
	National				
Tier 1	Improved water	86.9	89.2	87.1	91.2
Tier 2	Basic water	83.8	80.1	78.8	81.3
Water 4	Improved on premises	67.5	74.4	73.1	74.6
Water 5	Piped on premises	66.7	74.4	73.1	74.6

Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014

Sanitation

Access Plus - Improved sanitation, by area and year (%)

		2000	2006	2011	2014
	Urban				
Sanitation 1	Open defecation	2.8	1.9	1.9	1.6
Sanitation 2	Improved sanitation (including shared)	88.9	88.5	90.2	89.7
Tier 1	Improved sanitation	74.2	72	77.2	77.6
Sanitation 3	Flush to sewage	60	65.2	69.6	68.1
	Rural				
Sanitation 1	Open defecation	20.8	17.2	13.5	8.9
Sanitation 2	Improved sanitation (including shared)	45.9	51.1	54.5	58.7
Tier 1	Improved sanitation	40.2	45.7	48.7	54.2
Sanitation 3	Flush to sewage	4.46	6.72	7.75	9.09
	National				
Sanitation 1	Open defecation	13.8	9.9	7.9	5.3
Sanitation 2	Improved sanitation (including shared)	62.5	69.1	71.8	74.1
Tier 1	Improved sanitation	53.3	58.4	62.5	65.8
Sanitation 3	Flush to sewage	25.9	34.8	37.7	38.3

Source: own calculations using ENCOVI survey data, years 2000, 2006, 2011, 2014

	Children 3 to 60 Months Old		
Quintile of Income	Chronic Undernutrition prevalence (%)	Anaemia	% Height below 145 cm
I	70.2	50.7	46.9
II	59.7	51.4	36.3
III	43.8	46.4	29.8
IV	25.5	43.2	18.6
V	14.1	39.8	10.3
Indigenous	65.9	49.5	48.3
Non-Indigenous	36.2	42.1	19.0

Scatterplots with trends in access and key variables by Department 2000-2014
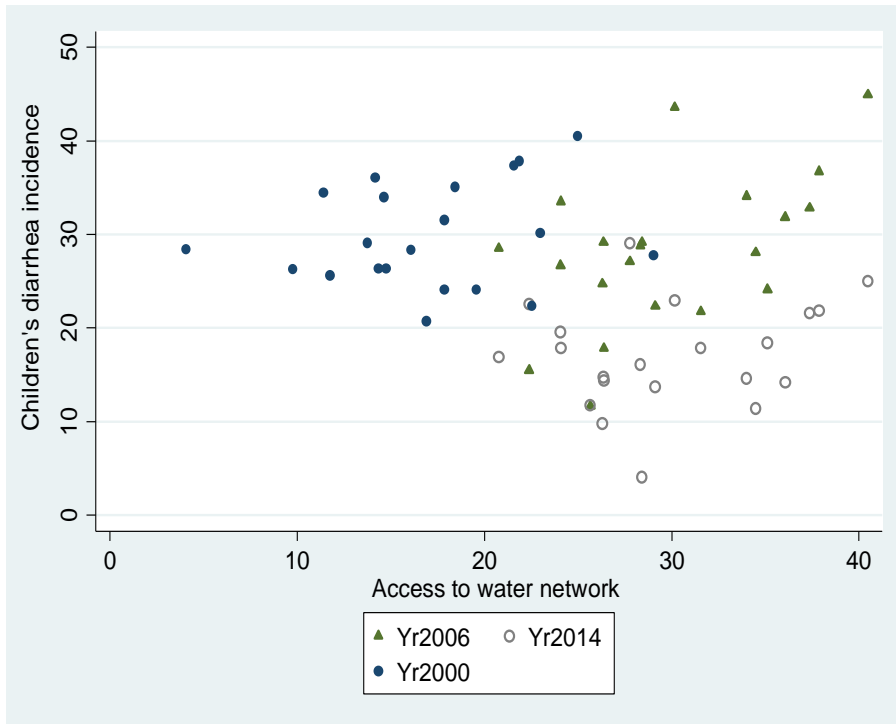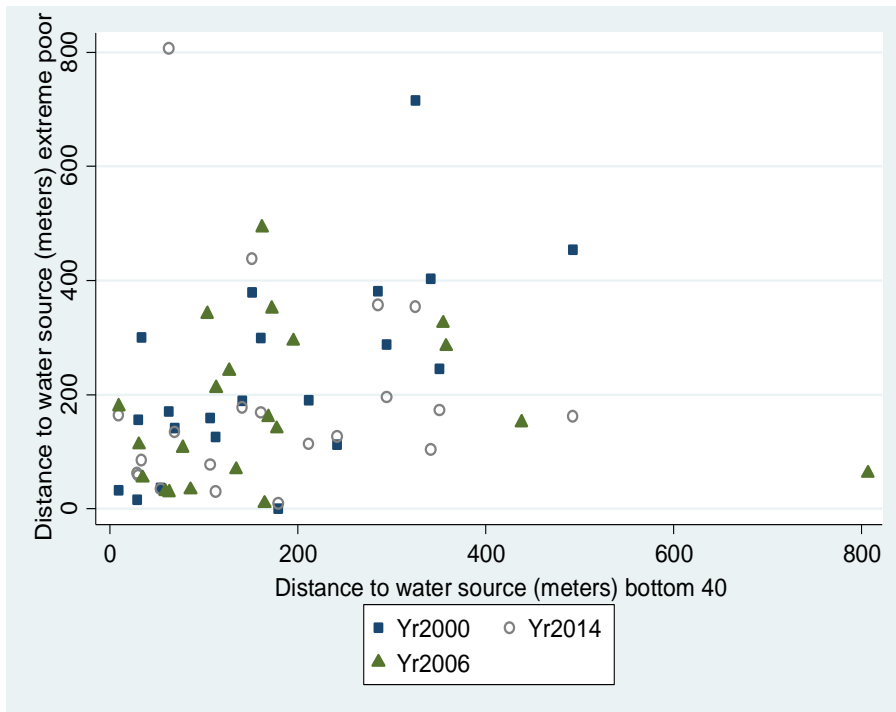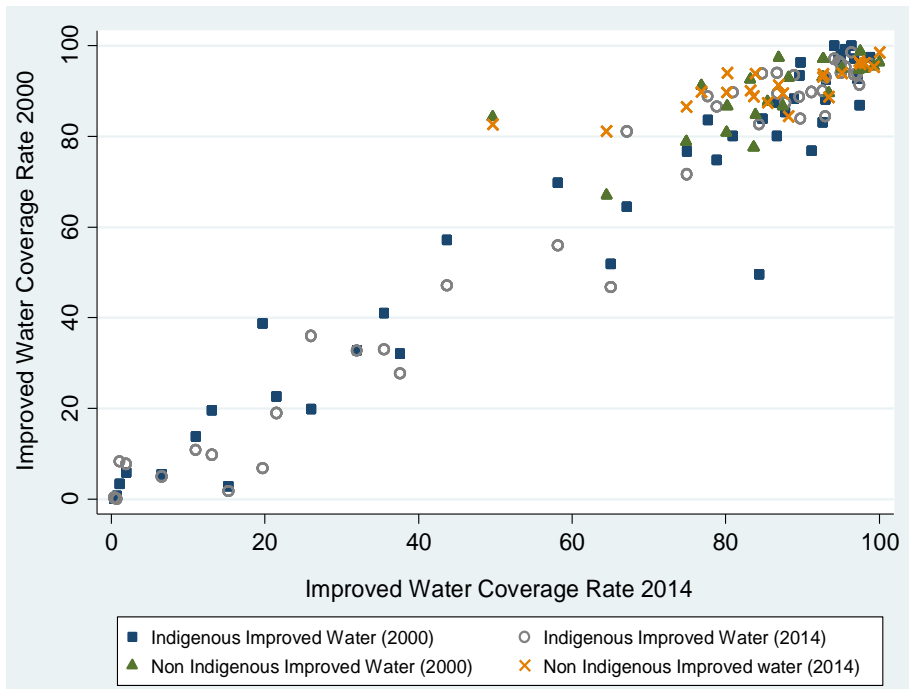
Source: ENCOVI, 2000, 2006, 2014.

Source: ENCOVI, 2000, 2006, 2014.

Source: ENCOVI, 2000, 2006, 2014.
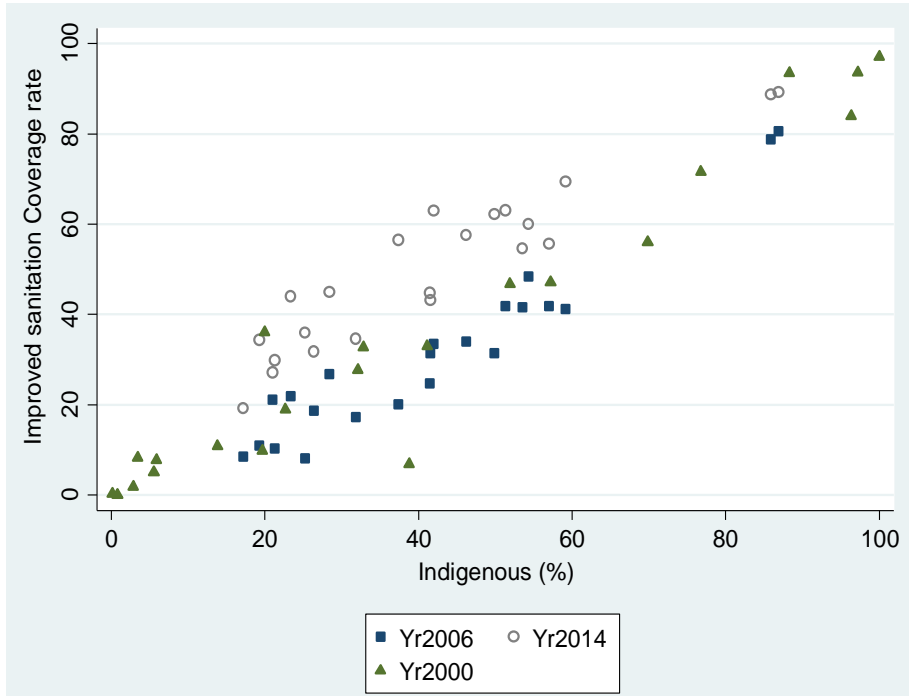
Source: ENCOVI, 2000, 2006, 2014.
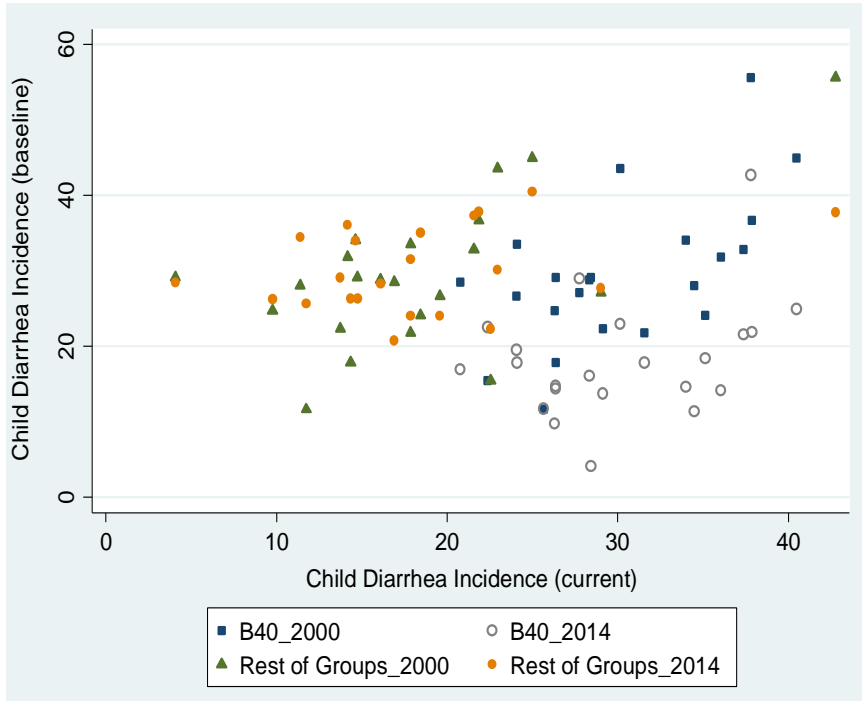
Source: ENCOVI, 2000, 2006, 2014.
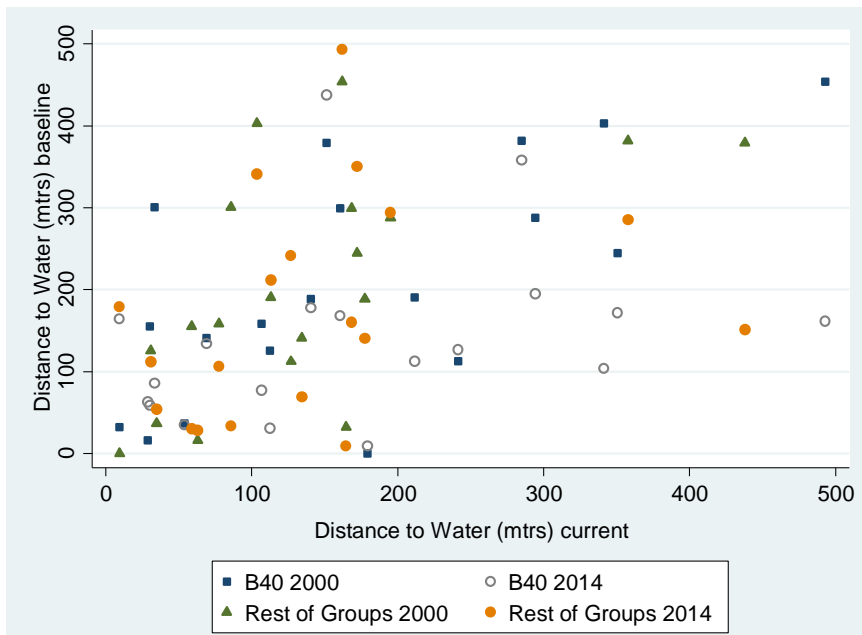
Source: ENCOVI, 2000, 2006, 2014.
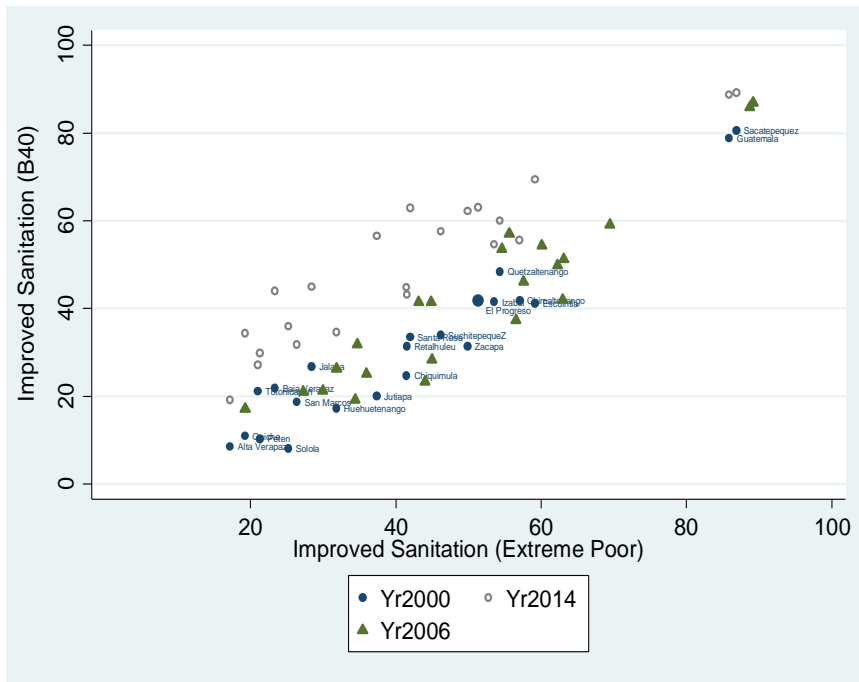
Source: ENCOVI, 2000, 2006, 2014.
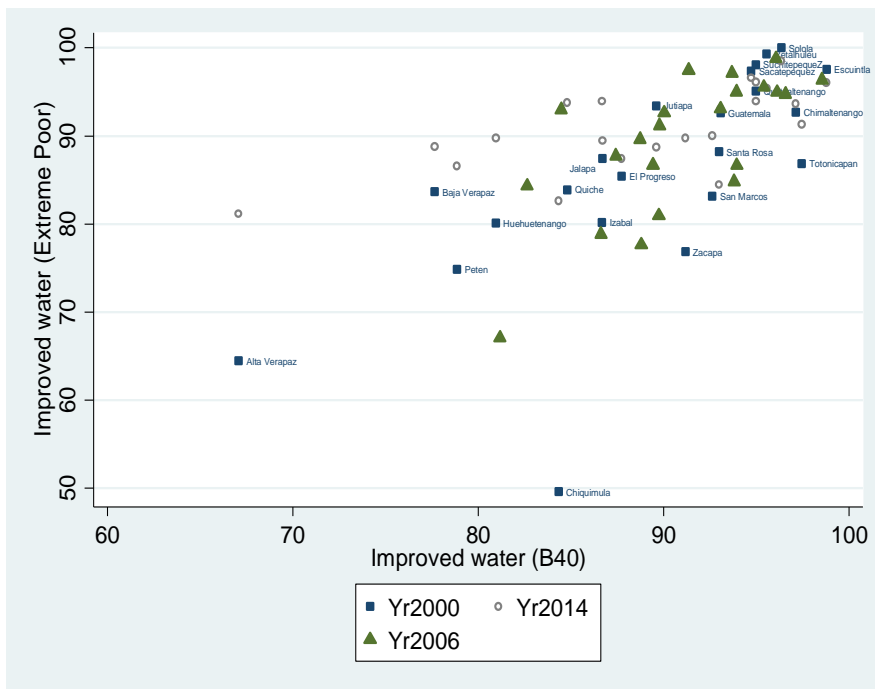
Source: ENCOVI, 2000, 2006, 2014.
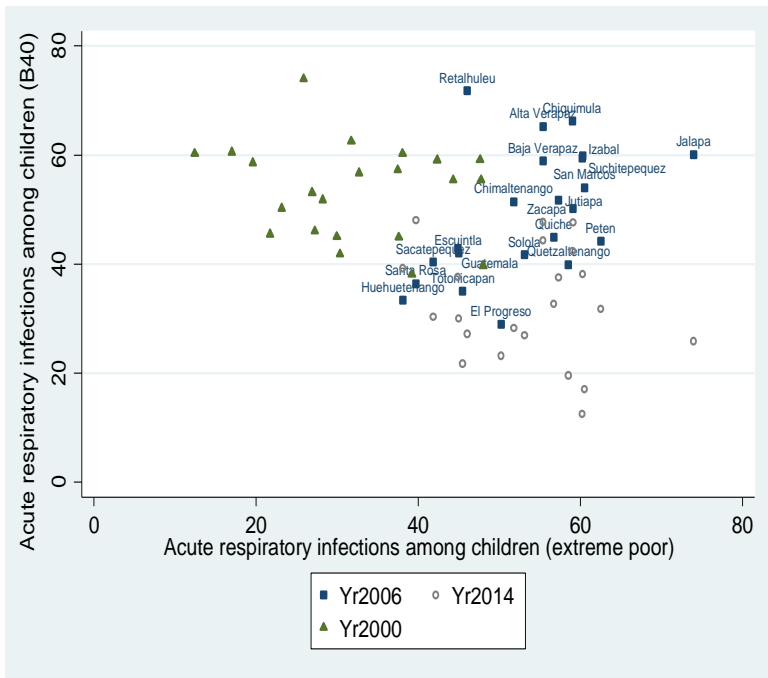
Source: ENCOVI, 2000, 2006, 2014.
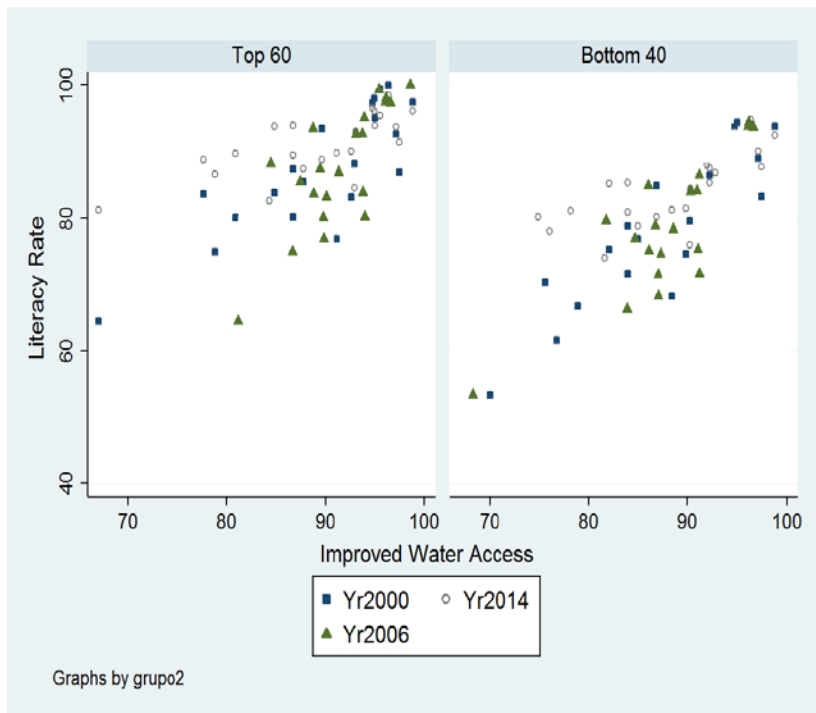
Source: ENCOVI, 2000, 2006, 2014.

Source: ENCOVI, 2000, 2006, 2014.

Other indicators and graphs
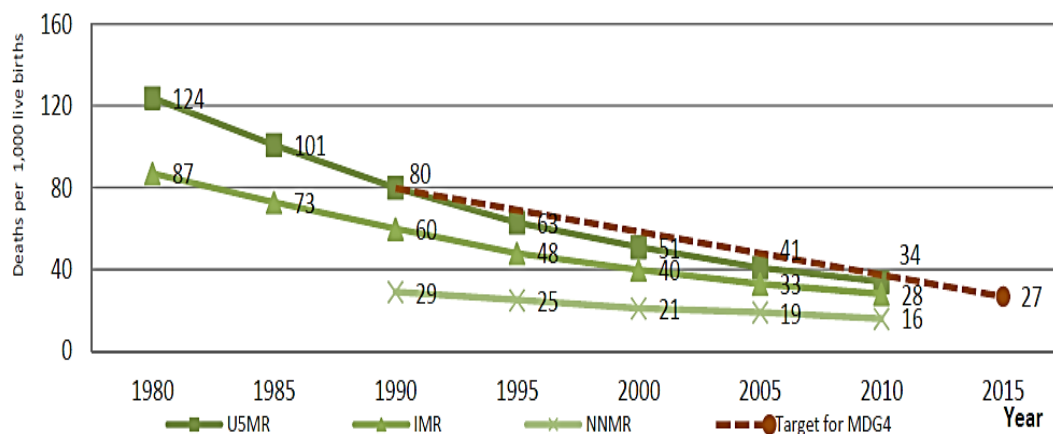
Source: UNICEF/WHO/The World Bank/UN Pop Div. *Levels and Trends in Child Mortality. Report 2013*.
Note: These figures are computed by the UN agencies through the IGME and are not necessarily the official statistics of the Member State, which may use alternative methods of estimation of mortality. All Member States have undergone an official country consultation on these estimations.

Inequities in under-five mortality
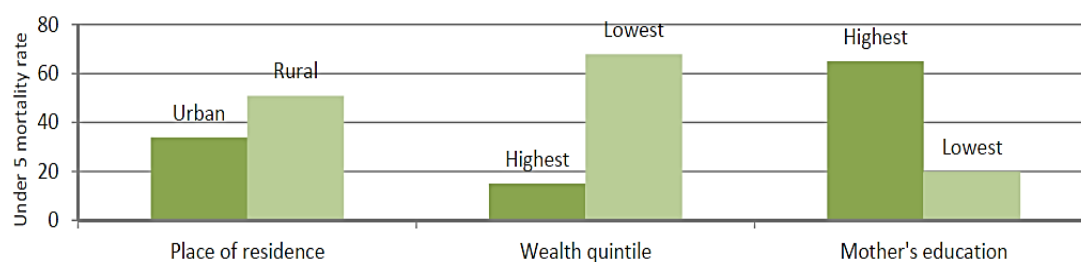
Source: Guatemala MICS 2008-09

Notes: *Lowest=No education; Highest= Completed higher secondary+

Inequities in coverage of some interventions along the continuum of care by wealth quintile
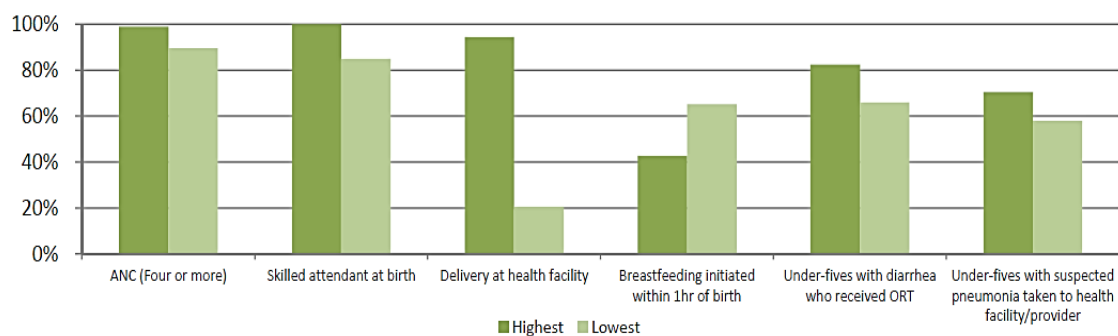
Source: Guatemala ENSMI-2008-09

59

Statistical Analyses

Chi-squared test for independence

Attribute	Lack of access to improved water	Lack of access to improved sanitation
Rural	2.7e+05***	5.0e+06***
General poverty	3.7e+05***	3.2e+06***
Extreme poverty	2.2e+05***	2.3e+06***
Bottom 40 percent	3.5e+05***	3.0e+06***
Household head is female and employed outside the home	1.0e+04***	2.2e+05***
Indigenous	1.1e+05***	2.0e+06***
Illiterate	9.7e+04***	5.8e+05***
Household size	0.011***	0.210***
Dependency ratio	0.103***	0.192***
Lack of access to improved water		7.1e+05***
Lack of access to improved sanitation	7.1e+05***	

*** p<0.01

Source: Authors' calculations based on ENCOVI, 2014.

Regression analyses by department

Regression was run at the household level, restricting the sample period to the year 2014 only. Regressions are weighted using the sampling weights provided in the ENCOVI dataset. The analysis was performed both at the national level, with the inclusion of Department indicators, and for each Department separately.

The outcomes that were investigated can be grouped into two categories:
1. Access to WASH services;
2. Child disease.

Access to WASH services

Outcome variables pertaining to group 1 were household access to improved water and access to improved sanitation. For these variables, the analysis was performed via Probit regression.

Given a binary outcome Y taking either value 0 or 1, the probability that $Y = 1$ for household h was therefore modelled as

$$P(y_h = 1) = \Phi\left(\underline{x_h}\underline{\beta}\right),$$

where $\underline{x}$ is a row vector of covariates (including a constant), $\underline{\beta}$ is a vector of coefficients and Φ is the distribution function of a Standard Normal random variable.

The vector of covariates $\underline{x}$ included the following regressors:
- An indicator for living in a rural area

- An indicator for being poor using the Guatemalan poverty line as defined by the ENCOVI survey
- An indicator for being extremely poor using the Guatemalan extreme poverty line as defined by the ENCOVI survey[10]
- An indicator for belonging to the Bottom 40 of the consumption distribution at the national level
- An indicator for female household head
- An indicator for belonging to an indigenous ethnicity
- An indicator for illiteracy
- Household size
- Household dependency ratio (measured as the ratio between number of household members younger than 15 and older than 65 and number of household members aged 15-65)
- An indicator for access to improved sanitation (when the outcome was access to improved water) or for access to improved water (when the outcome was access to improved sanitation)
- (A set of Department fixed effects when the analysis was performed at the national level).

The output tables report the average marginal effects of the covariates. For a continuous variable x_1, the interpretation of a marginal effect equal to $\hat{\beta}_1$ is that a marginal increase in x_1 raises the probability that $Y = 1$ by $100 \times \hat{\beta}_1$ percentage points. For a binary variable x_2, the interpretation of a marginal effect equal to $\hat{\beta}_2$ is that when x_2 switches from 0 to 1 the probability that $Y = 1$ increases by $100 \times \hat{\beta}_2$ percentage points.

Child disease
Outcome variables pertaining to group 2 were household proportion of children with diarrheal disease and with respiratory infection in the month before the interview. For these variables, analysis followed an OLS approach. Given a continuous outcome Y, its realisation for household h was therefore modelled as

$$y_h = \underline{x}_h \underline{\beta} + \epsilon_h,$$

where $\underline{x}$ is a row vector of covariates (including a constant), $\underline{\beta}$ is a vector of coefficients and ϵ is an individual error term which is assumed to follow a Normal distribution.

The vector of covariates $\underline{x}$ included:
- An indicator for living in a rural area
- An indicator for having water on premises
- A set of mutually exclusive indicators for type of access to water, namely:
    - Piped to home
    - Piped to yard
    - Piped to neighbour/public
    - Tube-well/borehole
    - Rainwater
    - Truck or barrel
    - Surface water
    - (Other unimproved source is the omitted category)
- An indicator for no treatment of drinking water
- A set of mutually exclusive indicators for type of access to sanitation, namely:
    - Flush to sewer

---

[10] The dummy variable for extremely poor therefore identifies a subset of those who also qualify as generally poor in terms of the dummy variable "poor" described above.

- o Flush to septic tank
- o Pour flush/composting toilet/other improved type
- o Latrine
- o Open defecation

The output tables report the coefficient of the covariates, which can be interpreted as their marginal effects. For a continuous variable x_1, the interpretation of a marginal effect equal to $\hat{\beta}_1$ is that a marginal increase in x_1 raises the outcome Y by $\hat{\beta}_1$. For a binary variable x_2, the interpretation of a marginal effect equal to $\hat{\beta}_2$ is that Y increases by $\hat{\beta}_2$ when x_2 switches from 0 to 1.

The regression model

The analysis focusses on five child anthropometric outcomes:

1. height (measured in cm);
2. weight (measured in kg);
3. stunting (height-for-age Z-score ≤ 2);
4. wasting (weight-for-height Z-score ≤ 2);
5. underweight (weight-for-age Z-score ≤ 2).

For items 1 and 2 of the list above, which are continuous in nature, OLS regression is per- formed, whereas items 3-5, which consist of binary variables, are studied through a Probit model. The set of controls included in the regressions does not however vary across specifications, and is composed of the following groups of variables:

1. Main covariates of interest (WASH variables):
   - Lack of access to improved water

   - Either: Lack of access to improved sanitation; Or: Open defecation

   - Unsafe disposal of child stools.

2. Location controls:
   - Rural-urban location (Rural=1)

   - 22 Department fixed effects.

3. Household socio-demographic characteristics:
   - Age of household head (linear and square)

   - Years of education of household head

   - Gender of household head (Female=1)

   - Household dependency ratio (ratio of number of household members aged 14- or 65+ over number of members aged 15-64)

[1]The Z-score of an anthropometric index is computed as:

$$Z\text{-score} = \frac{(\text{observed value} - \text{median of the reference population})}{\text{standard deviation of reference population}}.$$

For a child to be stunted, their height-for-age ratio therefore has to be at least 2 standard deviations below the refer- ence median. The reference population is obtained from US CDC (Centre for Disease Control) Standard Deviation- derived Growth Reference Curves from the Reference Population recommended by the WHO, based on data from the National Centre for Health Statistics (NCHS).

- Household wealth index.[2]

4. Mother characteristics:
   - Mother's age in years
   - Mother has primary education
   - Mother has secondary or higher education
   - Mother's age at first birth
   - Mother's height in cm
   - Mother's BMI
   - Total number of children ever born to the mother.

5. Child characteristics:
   - Child age in months
   - Child gender (Male=1)
   - Child birth order
   - Child month of birth
   - Indicator for whether child is from a multiple birth
   - Child received iron supplementation in the last 7 days
   - Child has health and vaccination card (seen by enumerator)
   - Number of antenatal visits received by mother
   - Child was delivered in a healthcare institution
   - Child received Vitamin A supplements (on health card)
   - Child received Vitamin A supplements (recalled by mother).

Regressions are weighted using the sampling weights provided in the DHS dataset, which make the analysis representative of the country's population. Standard errors are clustered at the primary sampling unit level. The analysis is performed both on the total national sample of all children aged 0-59 months and on the following sub-samples:

- Urban vs. Rural location
- Bottom 40 vs. Top 60 percent of the wealth distribution in the country[3]
- Children aged 0-24 vs. 25-59 months/boys and girls

---

[2]The wealth index is built as the first principal component from principal component analysis on a set of household assets and dwelling characteristics (excluding WASH information), weighted by rural-urban location.

[3]As mentioned in a previous footnote, the wealth index is built as the first principal component from principal component analysis on a set of household assets and dwelling characteristics (excluding WASH information), weighted by rural-urban location.

In what follows, Sections report results for each outcome in turn. Within Sections, each plot reports the coefficient/marginal effect of one WASH variable of interest at a time. Different rows in the same plot identify the sample on which the regression is performed.

Child´s height

Regression Coefficients for lack of access to improved water (dependent variable)

Coefficients from OLS regression, own estimates. Data source: DHS, year 2014.
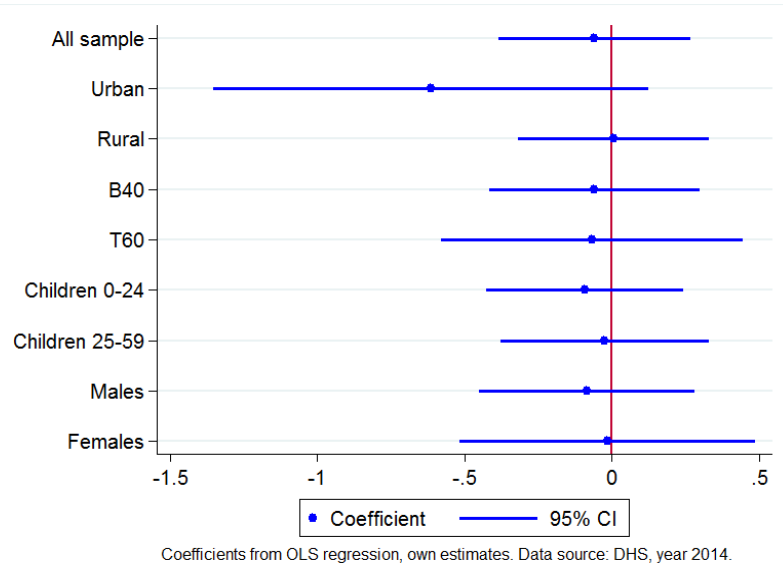
Regression Coefficients for lack of access to improved sanitation (dependent variable)

Coefficients from OLS regression, own estimates. Data source: DHS, year 2014.
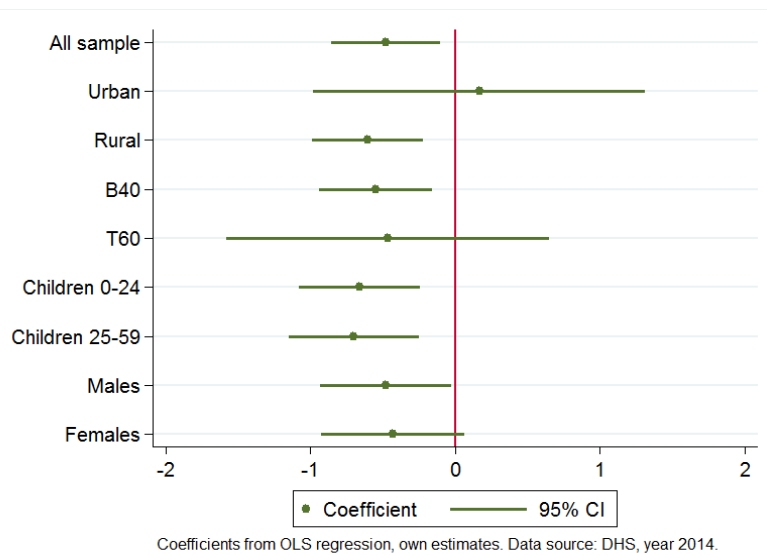
Regression Coefficients for lack of access to open defecation (dependent variable)

Coefficients from OLS regression, own estimates. Data source: DHS, year 2014.
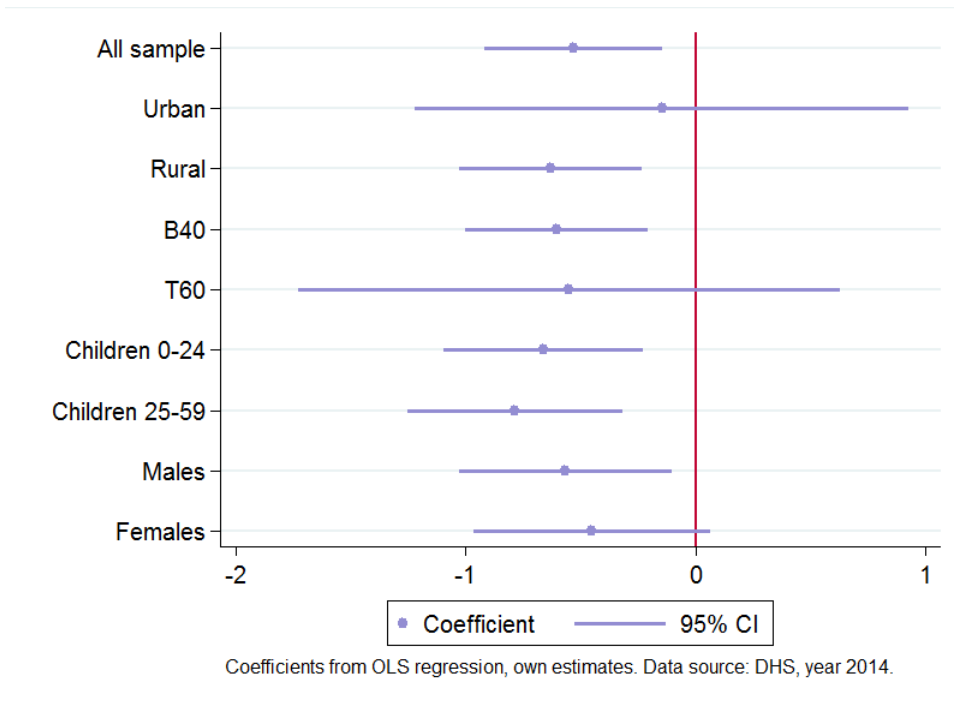
Regression Coefficients for lack of access unsafe disposal of child faeces (dependent variable)

Coefficients from OLS regression, own estimates. Data source: DHS, year 2014.
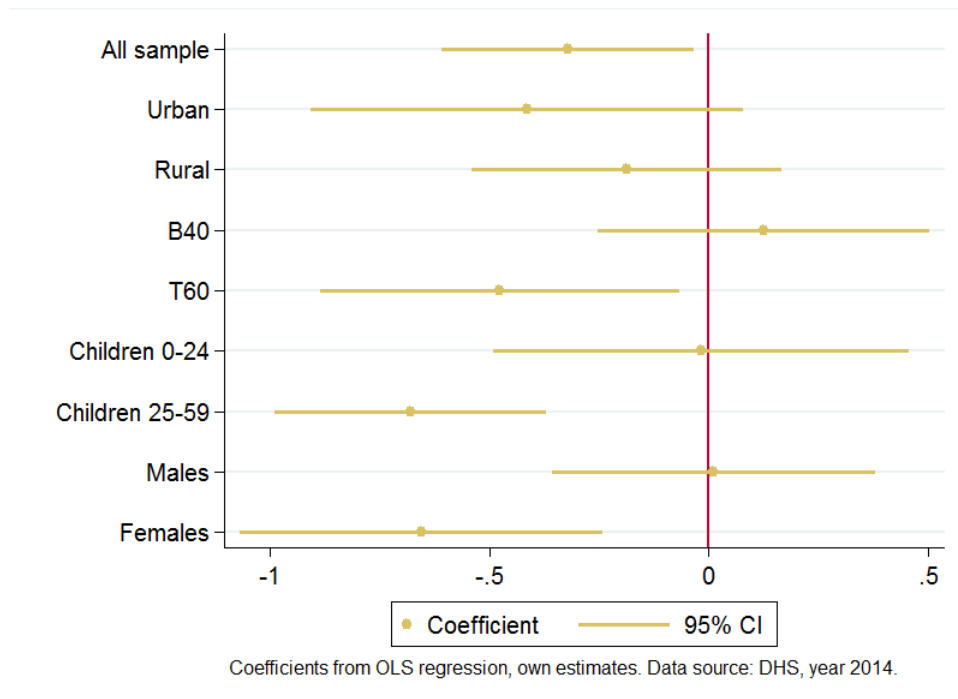
Regression Plots for Access to Improved Water by Department and Basic Characteristics, DHS 2014
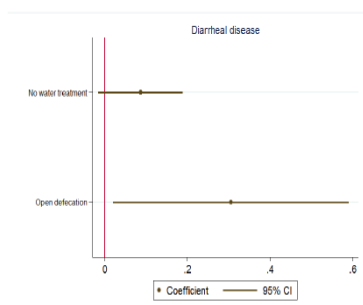

(a) Alta Verapaz
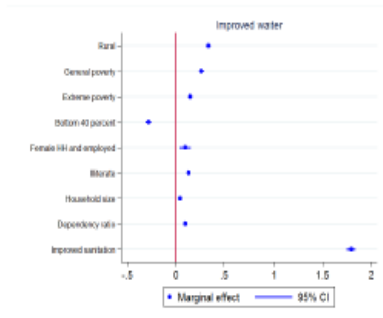
(b) Baja Verapaz
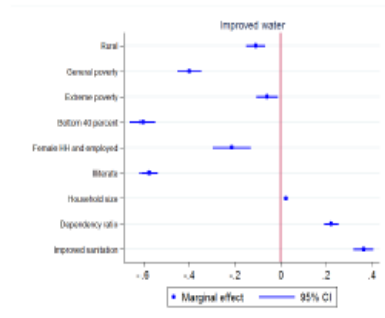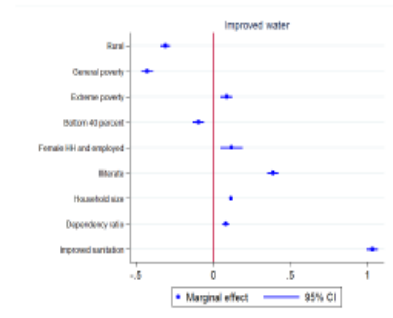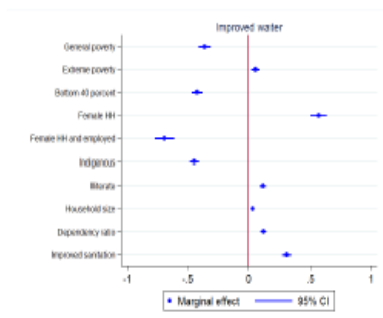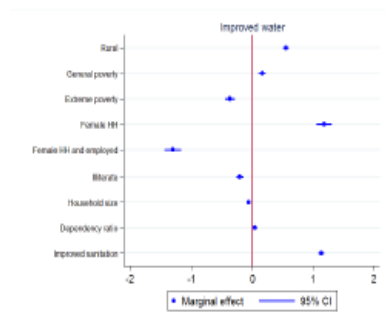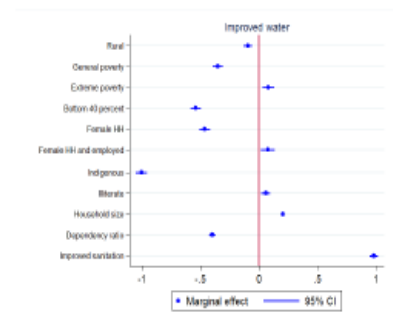
(c) Chimaltenango

(d) Chiquimula

(e) El Progreso

(f) Escuintla

(g) Guatemala
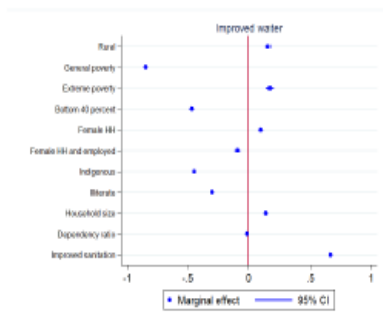
(h) Huehuetenango
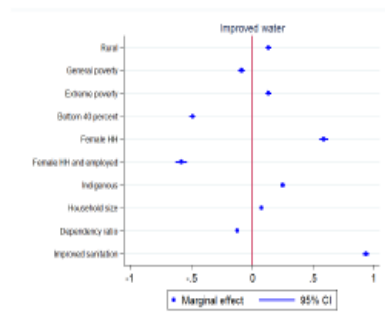
(i) Izabal
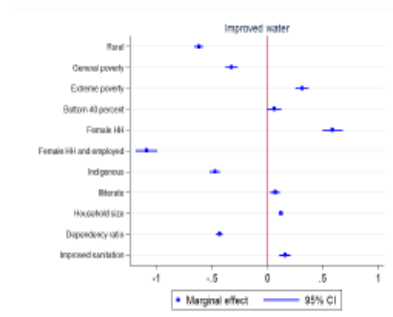
(j) Jalapa
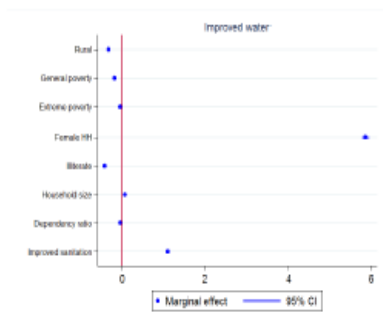
(k) Jutiapa
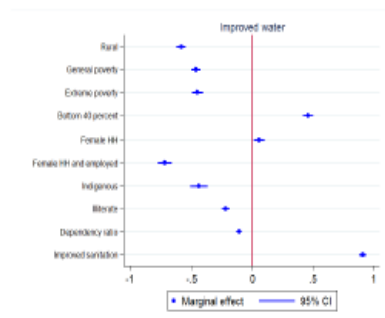
(l) Peten
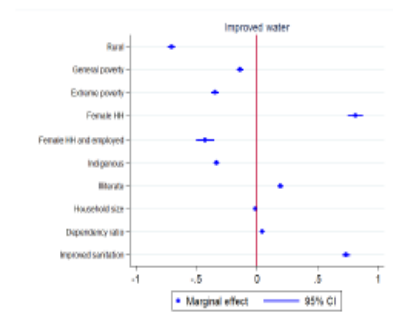
(a) Quetzaltenango
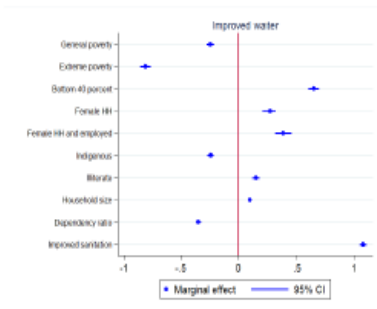
(b) Quiche
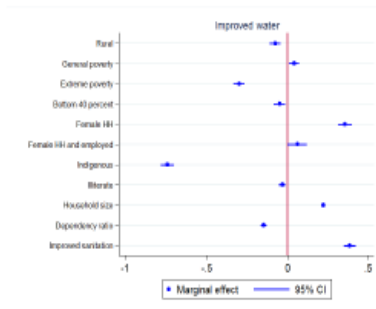
(c) Retalhuleu
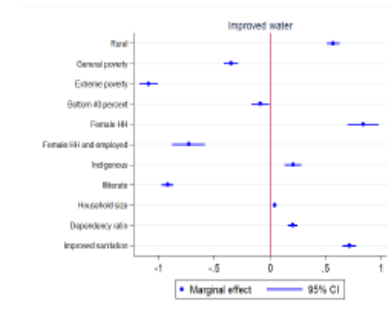
(d) Sacatepequez
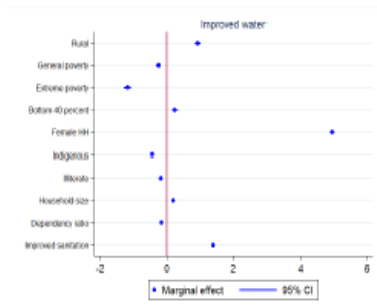
(e) San Marcos
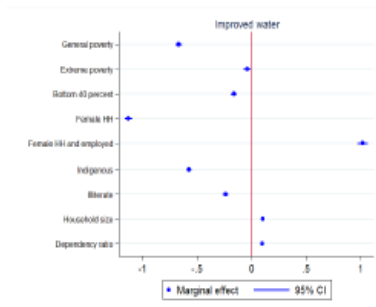
(f) Santa Rosa
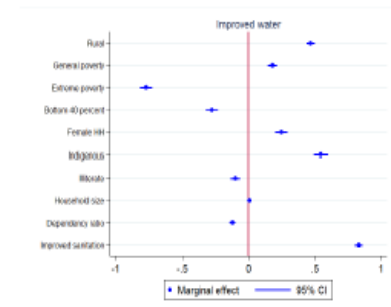
(g) Solola
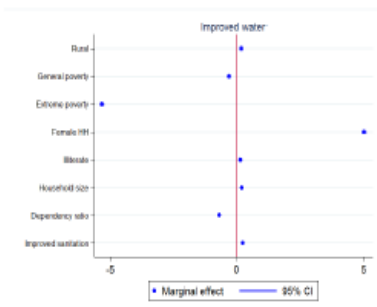
(h) Suchitepequez
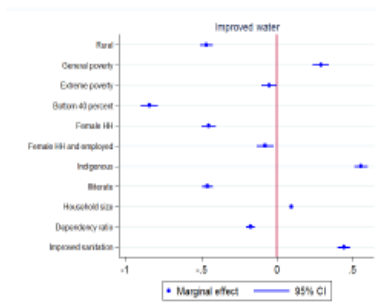
(i) Totonicapan
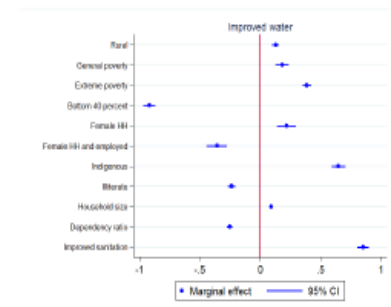
(j) Zacapa
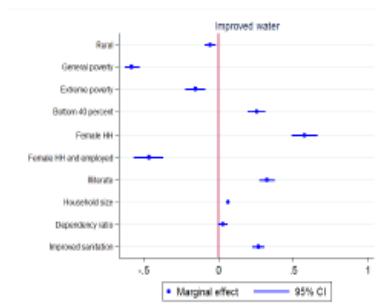
Regression Plots for Access to Improved Sanitation by Department and Basic Characteristics, 2015

(a) Alta Verapaz
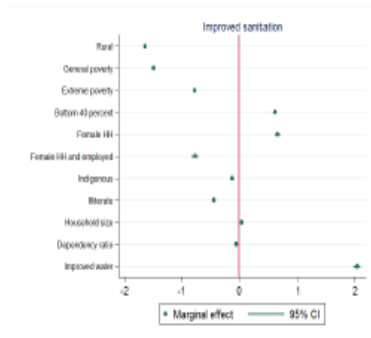
(b) Baja Verapaz
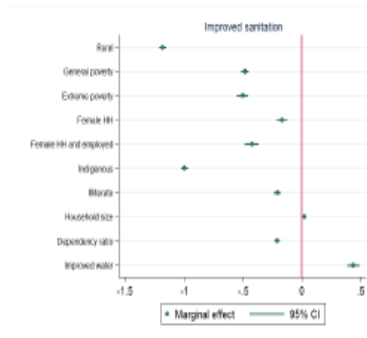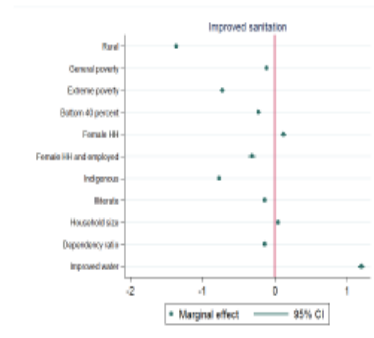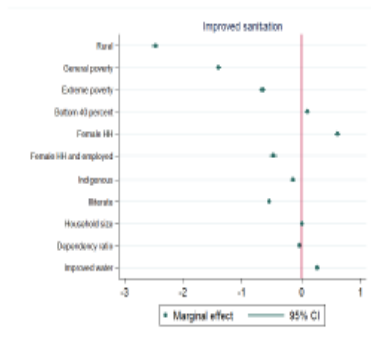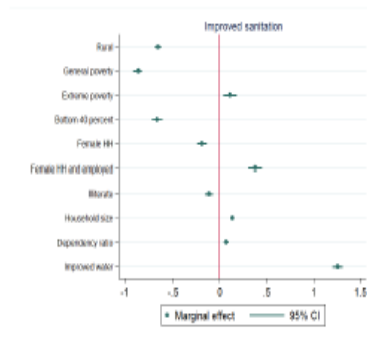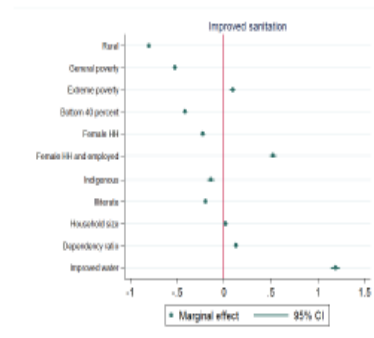
(c) Chimaltenango


(d) Chiquimula


(e) El Progreso

(f) Escuintla

(g) Guatemala

(h) Huehuetenango

(i) Izabal

(j) Jalapa

(k) Jutiapa

(l) Peten

68
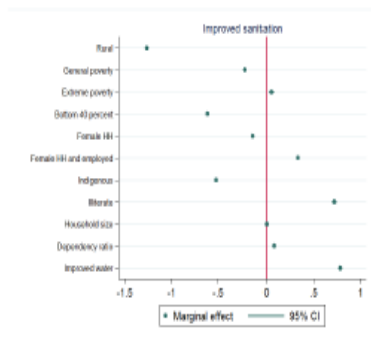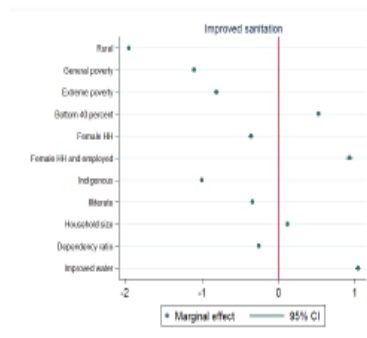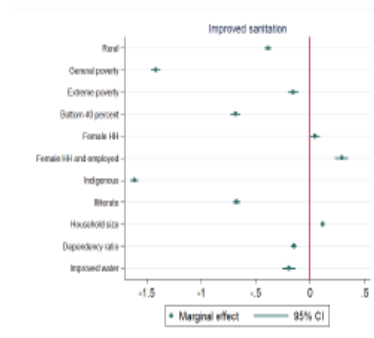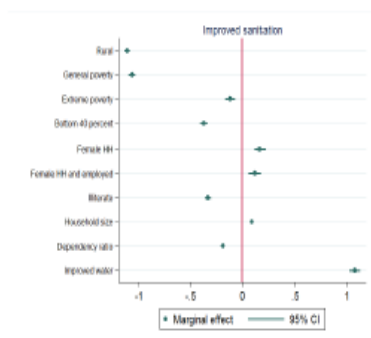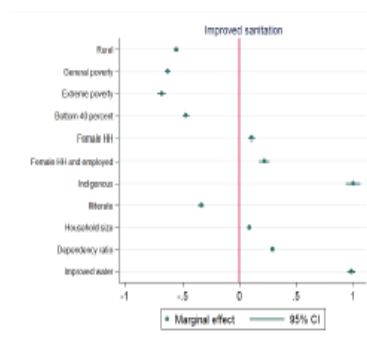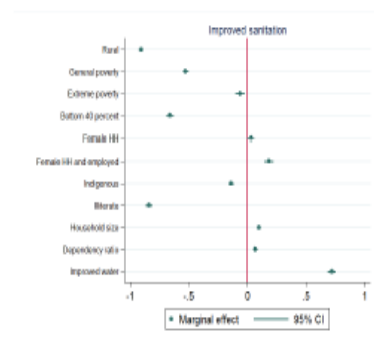
(a) Quetzaltenango
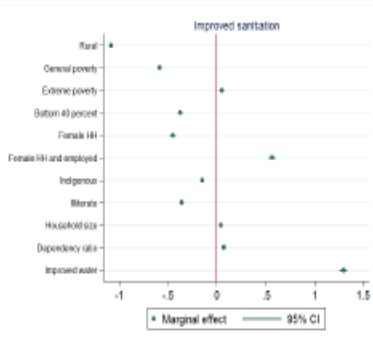
(b) Quiche
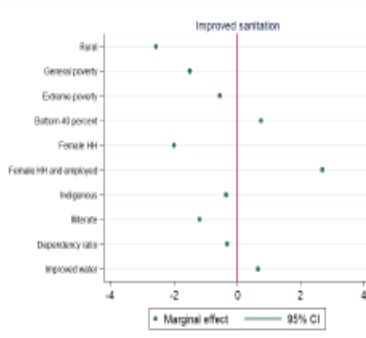
(c) Retalhuleu
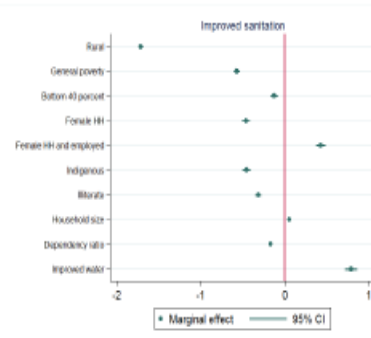
(d) Sacatepequez
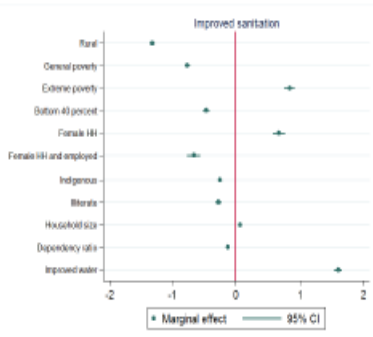
(e) San Marcos
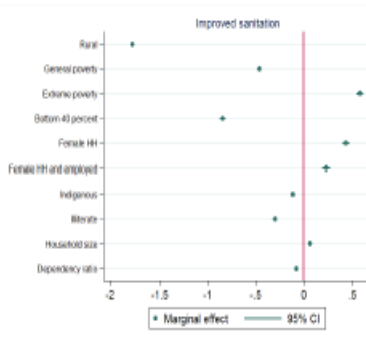
(f) Santa Rosa
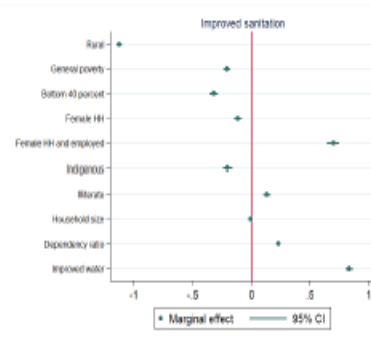
(g) Solola
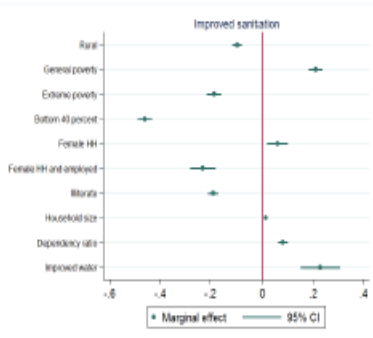
(h) Suchitepequez
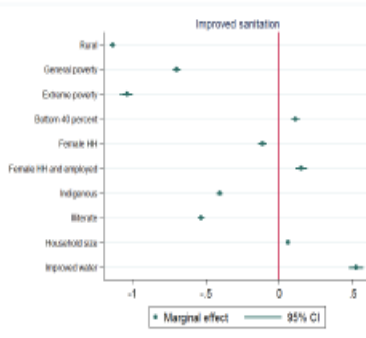
(i) Totonicapan
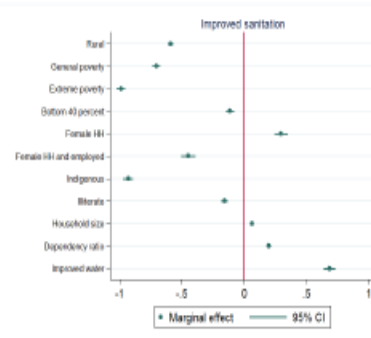
(j) Zacapa
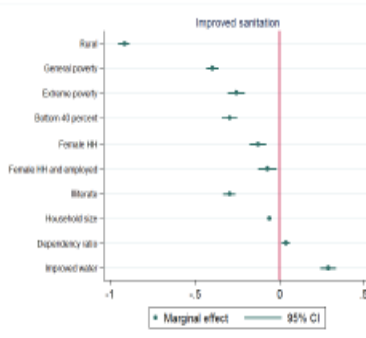
Regression coefficients and confidence intervals of determinants of children´s diarrhea 2015
(By department, only significance of coefficients at 10 and 5 percent reported)

(a) Alta Verapaz
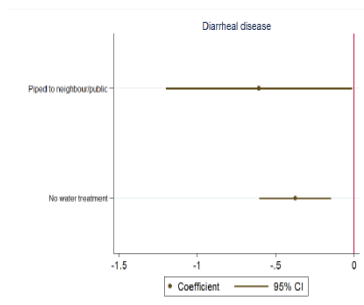
(b) Baja Verapaz
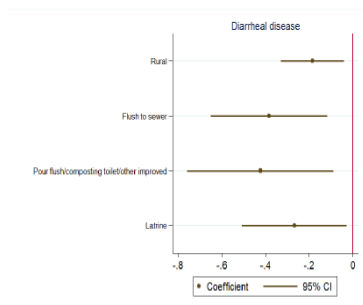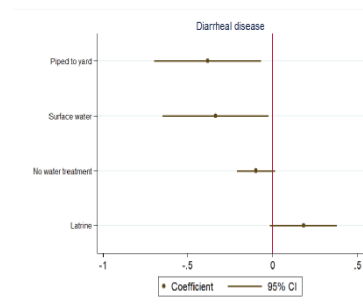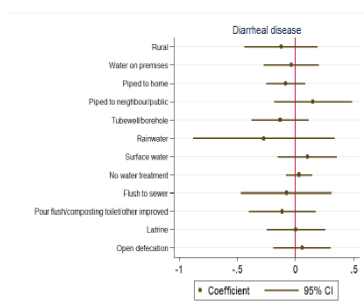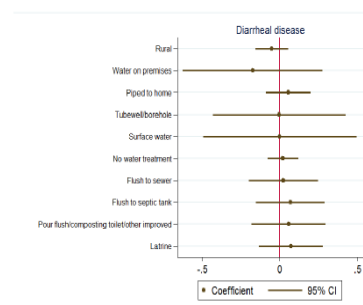
(c) Chimaltenango

(d) Chiquimula
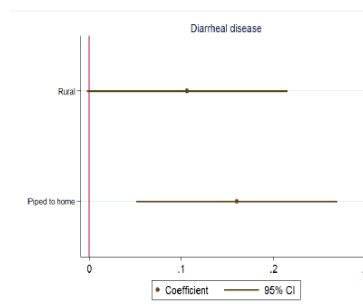
(e) El Progreso
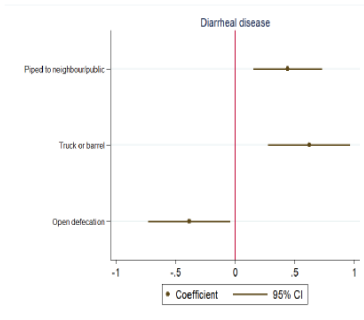
(f) Escuintla
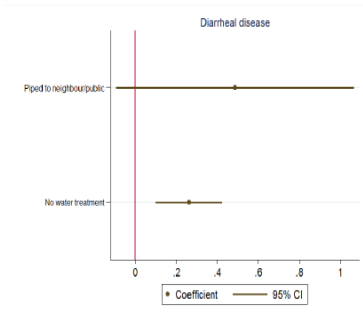
(g) Guatemala
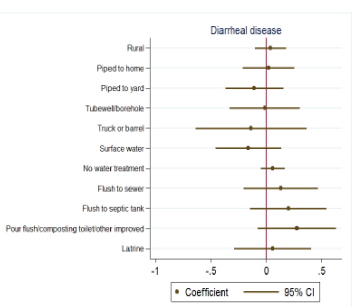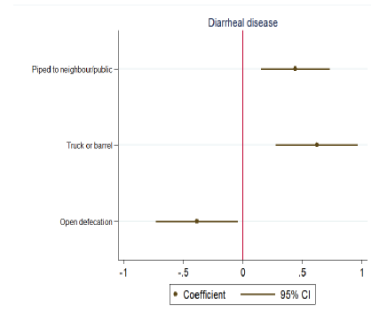
(h) Huehuetenango
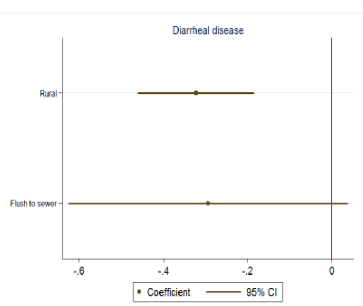
(i) Izabal
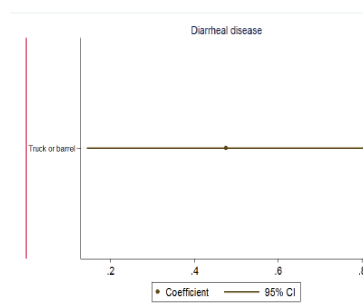
(j) Jalapa
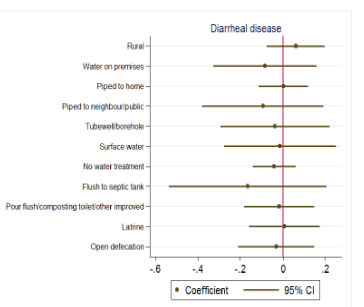
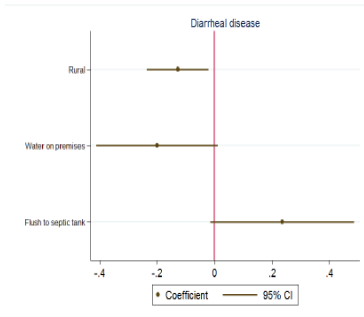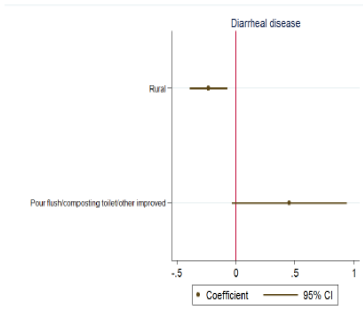(k) Jutiapa
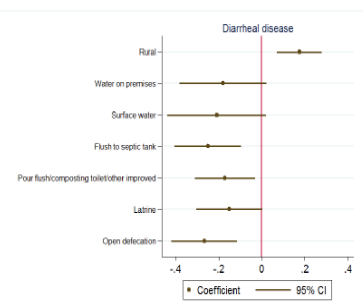
(l) Peten

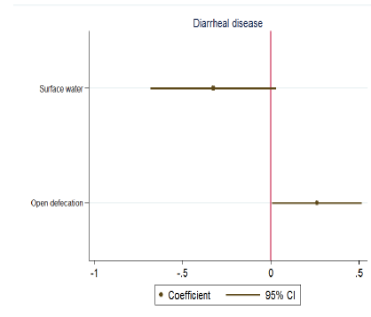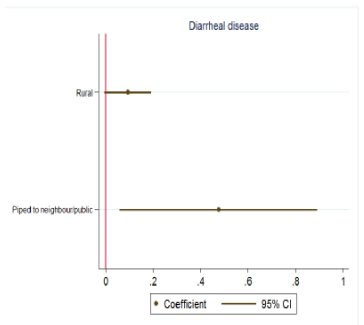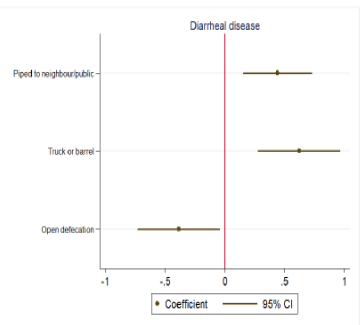(a) Quetzaltenango

(b) Quiche

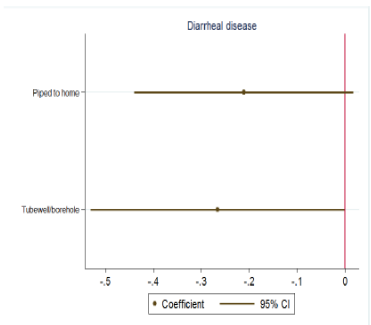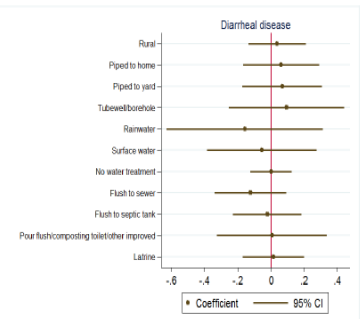(c) Retalhuleu

(d) Sacatepequez

(e) San Marcos

(f) Santa Rosa

(g) Solola

(h) Suchitepequez

(i) Totonicapan

(j) Zacapa

Conceptual Framework of Institutional Analysis

MAPAS Methodology

The MAPAS initiative seeks to overcome the limitations of the traditional monitoring processes, which are focused solely on determining progress in the sector based on the expansion of water and sanitation coverage, and analyzes other factors that contribute to the sustainability of the service related to the quality and management of the service provided, equitable distribution, and user satisfaction. The usefulness of MAPAS lies in its capacity to identify, through two instruments—the scorecard and financial analysis—the sectoral strengths and challenges for the provision of high-quality water and sanitation services in urban and rural areas. In addition, the MAPAS initiative stimulates broad sectoral dialogue, facilitating a suitable environment for national governments to expedite sectoral reform processes and encourage the transformation of the processes of economic and technical resources into sustainable services.

The scorecard evaluates the service delivery pathway through which the country transforms funding in to sustainable water and sanitation services in each of the four subsectors: rural water, urban water, rural sanitation, urban sanitation (Table 1). The pathway is evaluated through nine building blocks, which are grouped into three main pillars, analyzed through: (1) the effectiveness of the institutional framework, (2) the concrete results obtained through the process of developing plans and sector activities, and (3) the sustainability of the services provided. Each building block is scored from 0 to 3 depending on the responses to the three to five indicators per block. The scorecard uses a traffic-light color code. A green block means a highly satisfactory score (higher than 2); a yellow block means a neutral score (between 1 and 2); and a red block means an unsatisfactory score.

The development of the MAPAS initiative included the following steps:

1. Collection and organization of the sectoral technical and financial information in each country.
2. Analysis and validation of the sectoral information and assessment of subsector capacity to convert available financial resources into sustainable water and sanitation services.
3. National dialogue to establish a consensus on the initial analysis.

Results of Balanced Scorecard of the WSS sector in Guatemala

The MAPAS analysis suggests that there is a framework of policies in the sector that has favored the water subsector. However, despite the existence of a long-term National Plan, planning is "unsatisfactory" in all the subsectors; there are no comprehensive strategies that would address in an integral manner the problems affecting the sector at different levels of intervention.

Table 1: MAPAS Scorecard Guatemala 2016

| Cuadro de Mandos	Guatemala								
	Marco Institucional			Desarrollo			Sostenibilidad		
	Políticas	Planes	Presupuesto	Ejecución	Equidad	Resultados	Operación y Mantenimiento	Expansión	Usuarios
Agua Rural	2.5	0	1.5	1	2	0.5	0	1	0.9
Agua Urbana	2.5	0	1.5	0	1	0.75	0	1.5	0.75
Saneamiento Rural	2	0.5	1.5	0.5	1.5	0.6	0	0	0
Saneamiento Urbano	2	0.5	1	0.5	1.5	0.9	0.3	0	0.75

Source: MAPAS.
Legend: Green fill means a highly satisfactory score (higher than 2.0); yellow fill means a fairly satisfactory score (1.0 ≤ x ≤ 2.0); and red fill means an unsatisfactory score (less than 1.0).

Because of the lack of strategic planning and investment in the sector, it is difficult to allocate resources, which is reflected in a budget that does not cover expectations and lacks criteria of equity in its allocation, combined with low budgetary execution in recent years. This situation is reflected in the results at the level of the four subsectors, with low performance in the quality of services, access, and protection of water resources. Finally, there is low operational and managerial capacity in the providers, both rural and urban, which makes the services provided unsustainable because of the limited technical and managerial capacity of the municipal or rural providers and the virtually nonexistent monitoring by the central government, especially in the rural area, where scores of "0" in the Scorecard[11] reveal that the rural sanitation situation is one of the most important challenges confronting the sector in Guatemala.

WDR Framework

Following the WDR 2004 framework, this lens examines the set of oversight and accountability relationships between service users, providers and the state. In this subsection we assess the strength of both the short and long route of accountability. The short route of accountability relies on consumers' direct engagement with service providers, while the long route relies on citizens' exercising their 'voice' through elections and the government's 'compact' with service providers (see Figure 6.3). In the Guatemalan context, the extent of decentralization requires particular attention be paid in the long route to the municipal authorities who hold responsibility for provision. The nature of these relationships, including the interests, incentives and power of the actors involved, help to shape behavior in ways that contribute to the identified service delivery outcomes. It should be noted that rural water provision in Guatemala does not fit neatly into the WDR 2004 framework, since water users (through community drinking water providers, CAAP) play an important role in service provision. CAAPs are thus simultaneously agents of the community and agents of the providers.
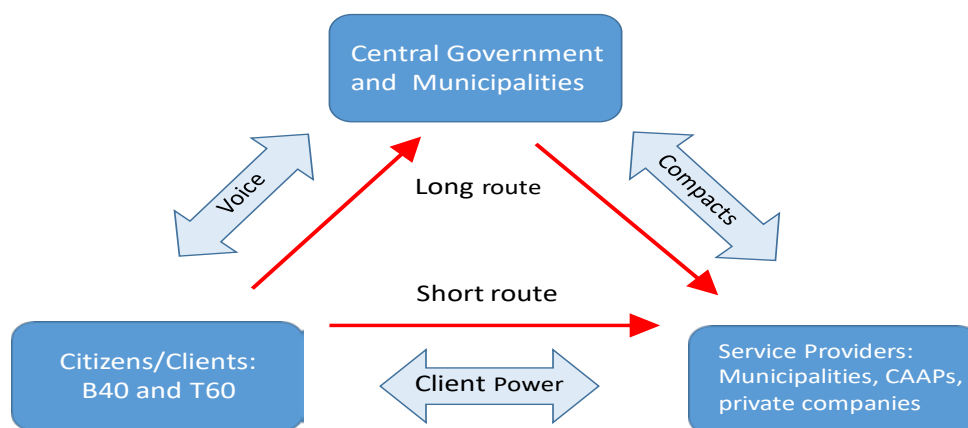
Source: World Bank based on WDR (2004).
Note: Includes short and long routes of accountability in the WASH Sector in Guatemala

A generic PEA framework (Harris 2012) has been adapted in a revised framework, presented below, to draw on thinking in and since the World Development Report (WDR) 2004, with a focus on:

- Problems are focused on the bottom 40%, including disaggregation and comparisons between different groups

- The specific sector and sub-sector ('service') characteristics relevant to these problem(s) are identified, with a focus on the implications for monitoring, accountability and other relationships between core actors

---

[11] The MAPAS Scorecard is generated based on secondary information, bibliography, interviews, and a broad process of consultation with representatives of the urban and rural sector, in this case in Guatemala.

- Core sets of relationships are explored as part of actor mapping, with a focus on citizens – policymakers – service providers

- Heterogeneity within these groups will also be explored – including the potential for multiple, overlapping 'triangles' (following the WDR 2004 framework)

- A wider set of motivations and networks will be taken into account

- The understanding that the bottom 40% are more likely to use informal service providers than the broader population.

The framework below is structured around:

- Step 1: Initial problem identification, with a focus on the bottom 40%

- Step 2: Analysis of relevant institutional arrangements, structural factors and stakeholder mapping, that explain why this problem persists, exploring both sub-sector and sector level factors, and factors in the wider context, structured around the sets of relationships identified in WDR 2004 'triangle' (the 'Key relationships of power')

- Step 3: Identifying potential reform entry points – developing up options for interventions, processes for reform and potential progress markers (e.g. how to measure whether these interventions are contributing to the institutional changes envisaged).

For all countries undertaking CQ#4 analysis the first phase involves completing steps 1 and 2 as a desk-based exercise, leading to identification of hypotheses about the key political economy problem (rather than identification of specific reform entry points). This is the focus of this note and constitutes a 'B40-focused WASH institutional diagnostic'. The Global Firm refers to this level of analysis 'Tier 1'. For those countries, such as Mozambique, which progress to the full problem-driven political economy analysis, referred to as 'Tier 2' the research team will deepen step 2 and extend to step 3 through analysis in-country. For Indonesia the detailed approach to this Tier 2 work will be agreed through a separate Task Order and Approach Paper. MAPAS contains some elements of Tier 1 and 2.

Overarching PEA framework for WASH Poverty Diagnostics (Tier 1 and Tier 2)
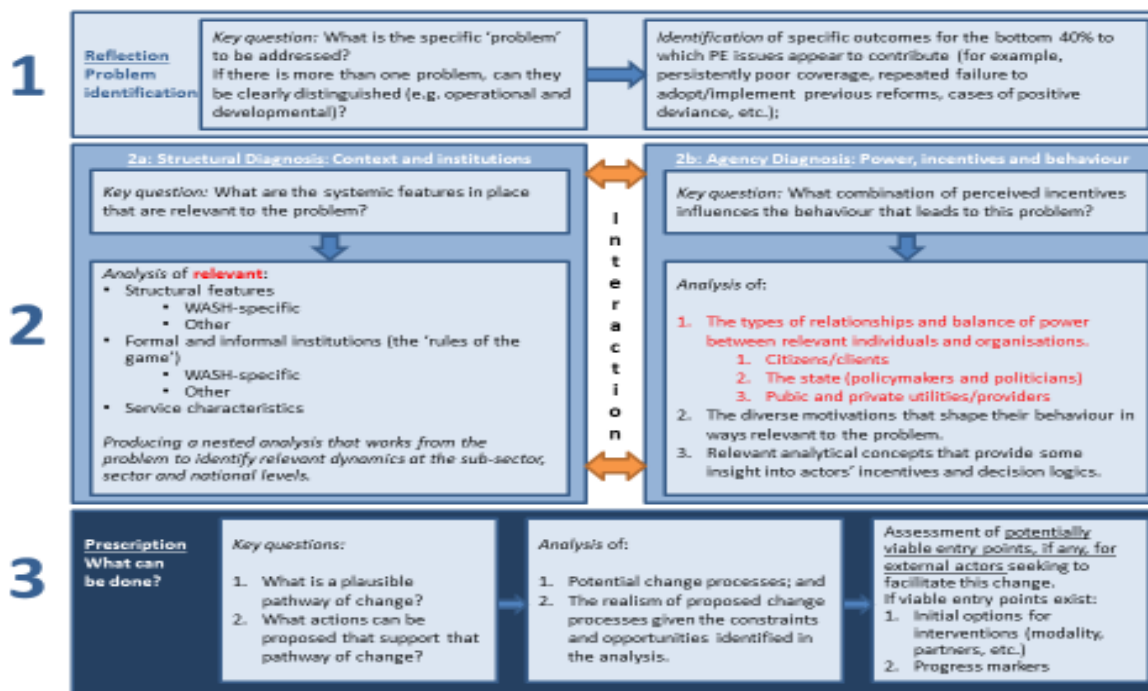
In Guatemala, clients do not have significant scope for exercising client power, particularly in rural areas. As mentioned previously, in rural areas community-managed systems dominate. Though municipalities are legally responsible for providing WASH services in rural areas, communities generally build, operate, and maintain their own systems through drinking-water committees. This makes it difficult to distinguish between "citizens/clients" and "service providers" in the rural sector, and represents a constraint in itself: The fact that water users are responsible for operations and maintenance (O&M) makes it difficult for water users to express "client power" and make use of the short route of accountability.

In terms of institutional aspects available to ensure water quality, the Municipal Code requires municipalities to provide chlorinated water to their communities, a requirement with which few municipalities currently comply. Under the Peace Accords of 1996 and the Decentralization Law of 2002, municipal governments are guaranteed a "Constitutional Assistance" (*Aporte Constitucional*) of 10 percent of government ordinary revenue plus 1.5 percent of the 10 percent value added tax. Municipalities are required to spend a minimum of 90 percent of the *Aporte Constitucional* on infrastructure, including – but not limited to – potable water and sanitation. While MSPAS oversees compliance with water and sanitation laws and promotes improvements to water and sanitation infrastructure, it is primarily the responsibility of the municipalities to undertake both their construction and financing