

Unimproved water and sanitation: Reductions in prevalence, deaths, and DALYs
in developing countries between 1980 and 2011

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Abstract

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Introduction

Access to safe water and improved sanitation is a critical indicator of development and is directly associated with child health outcomes, particularly diarrheal morbidity and mortality. The methodology currently utilized by the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP) for tracking progress toward achieving Millenium Development Goal 7c fails to address a substantial proportion of household survey options for water source and toilet facility type and uses an inflexible and outdated linear modeling strategy.

Methods

We empirically determine 14 additional classifications for household water source and sanitation facility to supplement those designated by the JMP and develop and implement an improved non-linear modeling technique that provides confidence intervals for country trends. We assess progress toward MDG 7c using these updated methods, then quantify the contribution of unimproved water and sanitation to deaths and DALYs in children under five.

Findings

Our improved approach allows for the systematic analysis of data from all households in censuses and surveys and results in trends that provide a measure of uncertainty and more accurately reflect rapid scale-ups in development in some countries. Of 137 developing countries, 69 and 71 are on track to meet MDG 7c for water and sanitation, respectively. Promising declines have occurred for deaths and DALYs attributable to unimproved water and unimproved sanitation, particularly in India and China, but the burden remains large.

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Dedication

To my fellow Fellows, for your unfailing friendship, patience, and love.

1 Introduction

Access to safe water and improved sanitation is a critical indicator of development and is directly associated with child health outcomes, particularly diarrheal morbidity and mortality. The third leading cause of death in children under five, intestinal infectious diseases contribute an estimated 60 million disability-adjusted life years (DALYs) to the global burden of disease for that age group^{1,2}. Beyond improvements in diarrheal outcomes, increased access to safe water and sanitation lowers the risk of malnutrition³ and infection with diseases transmitted via means other than faecal-oral⁴. The reduction of sanitation-related diseases such as intestinal worm infections during childhood is associated with substantial increases in adult earnings and exhibits a high rate of social return⁵.

The International Drinking Water Supply and Sanitation Decade from 1981 to 1990 aimed to provide universal access to safe drinking water supply and sanitation by 1990⁶. Although some progress was made, the goal was missed by a substantial margin⁷⁻⁹. Water and sanitation infrastructure remained a priority when the Millennium Development Goals (MDGs) were set, with MDG 7c calling for reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation between 1990 and 2015¹⁰. Progress is measured by two indicators: the proportion of the population using an improved drinking water source, and the proportion of the population using an improved sanitation facility, as specified by the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. The United Nations declared 2008 to be the International Year of Sanitation¹¹ and 2005-2015 to be the International Decade for Action “Water for Life¹².”

To date, progress toward achieving MDG 7c has been tracked by the JMP. However, their current methodology has a number of shortcomings that can be improved upon. First, a substantial proportion of household surveys include water source and toilet facility options that are too vague or ambiguous to fall clearly within the definitions of improved and unimproved facilities provided by the JMP. Analyses using the current JMP definitions must either exclude these households, thereby creating a biased estimate, or make strong assumptions about the likelihood that a given facility is improved on a survey-by-survey basis. The JMP also continues to employ the linear regression technique that was first used when data were scarce, despite the fivefold increase in available data sources since the original JMP report in 2000¹³. This linear approach cannot capture the nuances of rapid changes in access and is likely to underestimate progress to date.

In this paper, we improve upon the JMP approach to classifying households according to water source and sanitation facility by employing empirical techniques to predict the probability that an ambiguous survey option was improved. We propose seven additional categories each for water and sanitation in order

to fully encompass census and survey options. We develop and apply an improved non-linear modeling methodology that takes into account the uncertainty in the data and provides confidence intervals for each trend. This methodology is used to generate updated estimates of the proportion of the population with access to improved water and improved sanitation from 1980 to 2011 for all developing countries. We assess progress toward MDG 7c and use these results to identify areas with the greatest need for intervention and where successful scale-ups have already occurred. We also identify remaining limitations with current data collection methods that severely hinder their use for monitoring progress and estimating health effects of increased access. Finally, we quantify the contribution of unimproved water and sanitation to deaths and DALYs in children under five so that policy makers can be fully informed of the magnitude and trends in the burden of unimproved water and sanitation.

2 Methods

2.1 Data Sources

We performed a systematic search for publically available household surveys and national censuses that collected information on household water source or household sanitation facility. Our final database included 1,304 country-years of data for water and 1,153 country-years of data for sanitation between 1980 and 2011, throughout 137 developing countries (Table 2.1). Major data sources included the Demographic and Health Surveys (DHS), the Multiple Indicator Cluster Surveys (MICS), the Living Standard and Measurement Surveys (LSMS), the Reproductive Health Surveys (RHS), country-specific surveys, and national censuses. We used survey questions of the following forms: 1) What is the main source of drinking water for this household? and 2) What type of toilet facility does this household usually use?

When household-level data were available, we estimated the proportion of households with access to improved water and improved sanitation, taking into account the survey sampling design. When household-level data were not available, we used tabulated data presented in national census reports and reports from the JMP¹⁴. A qualitative review identified implausible values or outliers in the data based on proximity to other estimates within the country, region, and other countries with similar levels of development. These data were excluded from the analysis.

Previously reported estimates were used for gross domestic product (GDP) per capita¹⁵ and mean years of education at the national level¹⁶. The percent of the population residing within an urban area was obtained from the United Nations World Population Prospects¹⁷. The number of deaths and DALYs due to intestinal infectious diseases (diarrheal diseases, and typhoid and paratyphoid fevers) in children under five was obtained from the Global Burden of Disease 2010 study^{1,2}.

We extensively surveyed the literature for estimates of the relative risk of intestinal infectious diseases

Table 2.1: Country-years of data by source

Source	Water	Sanitation
Multiple Indicator Cluster Surveys (MICS)	89	89
Demographic and Health Surveys (DHS)	206	207
Reproductive Health Surveys (RHS)	26	25
Living Standard and Measurement Surveys (LSMS)	31	29
Other Survey	99	94
Census Microdata	101	32
Census Report	80	66
JMP Report	594	552
Other Report	78	59
Total	1304	1153

due to unimproved water and unimproved sanitation. We conducted a citation trail starting with published meta-analyses and systematic reviews by Cairncross et al.¹⁸, Clasen et al.¹⁹, Waddington et al.²⁰, Fewtrell et al.²¹, and Esrey et al.²² and supplemented these data with a Google Scholar search from January 2010 to March 2012 for the following terms: (*water supply* OR *water quality* OR *sanitation* OR *hygiene*) AND (*diarrhea* OR *diarrhoea*) AND (*RCT* OR *trial* OR *experiment*). Included studies were those that utilized an experimental design—i.e. RCTs with individual- or community-level assignment—or quasi-experimental design—i.e. non-RCTs with baselines and concurrent control groups matched by confounding variables, studies applying propensity-score matching to survey data, and studies employing a pipeline approach to identify beneficiaries scheduled to receive treatment in the future as the control group. Included studies also reported on specific water, sanitation, and/or hygiene interventions and estimated the impact on diarrheal morbidity under endemic conditions. Observational studies were not included. In total, 84 studies met the inclusion criteria.

2.2 Definitions

Table 2.2 shows the water source and toilet facility categorizations that were used in this analysis. When possible, water source and toilet facility classifications were assigned according to JMP categories¹³. Water obtained from a household connection, a public tap or standpipe, a tubewell or borehole, a protected well or spring, or rainwater collection was considered to be improved. Unimproved water sources included

Table 2.2: Water source and toilet facility categorizations

	Origin	Improved	Unimproved
Water Source	JMP designated	Piped water Public tap or standpipe Tubewell or borehole Protected well or spring Rainwater collection	Unprotected well or spring Vendor-provided water Tanker truck Surface water Other
	Empirically derived	Bottled water Private, indoor, or neighbor’s well Other private source Cistern or drum	Spring, unspecified Public well Other public source
Toilet Facility	JMP designated	Public sewer Septic system Flush or pour-flush Ventilated improved (VIP) latrine Simple pit latrine without squatting slab Composting toilet	Open latrine without squatting slab Bucket latrine Hanging latrine Open defecation Other
	Empirically derived	Private toilet Toilet, unspecified Latrine with drainage	Public toilet Traditional facilities Latrine, unspecified Other public facility

unprotected wells or springs, vendor-provided water, tanker trucks, surface water, and other or unspecified sources. The JMP specifies that bottled water is an improved source of drinking water only if the household source of water for cooking and cleaning purposes is also improved. However, this was rarely recorded, so we considered all bottled drinking water to be improved. Improved sanitation facilities were those that ensure some level of separation between individuals and human excreta, including public sewers, septic systems, flush or pour-flush facilities, ventilated improved (VIP) latrines, simple pit latrines with squatting slabs, and composting toilets. Unimproved facilities were traditional latrines, open latrines without squatting slabs, bucket latrines, hanging latrines, open defecation or no facilities, and other or unspecified facilities. Although shared facilities are currently specified as unimproved by the JMP, this characteristic is rarely available and is under consideration for revision by a JMP task force¹³, so it was disregarded in this analysis.

The survey options for water sources and sanitation facilities vary widely across survey instruments, even differing across countries and years within the same survey family. We have identified 2,346 different water categories and 1,534 different sanitation categories, a large number of which are too vague or ambiguous to be classified as improved or unimproved using the JMP categories. On average, 14.1% of households reported using a water source that did not clearly fit into a JMP category, and over a quarter of households (28.0%) reported using such a sanitation facility. We therefore used DHS with other household-specific variables to inform the likelihood that an ambiguous survey option should be classified as improved. For households where the water source or sanitation facility was clearly improved or unimproved according to JMP definitions, we performed a logistic regression, taking into account survey design:

$$S_i = \beta_0 + \beta_1 \text{wealth}_i + \beta_2 \text{education}_i + \beta_3 \text{urban}_i + \beta_4 \text{electricity}_i + \varepsilon_i$$

where S_i is the water or sanitation source for household i ; wealth is the household wealth quintile; education is the educational attainment of the head of household grouped into three broad categories; urban is the household location in an urban or rural area; and electricity is the presence of electricity in the household. The resultant coefficients were used to predict the probability that an ambiguous survey option was improved.

For ambiguous water sources, we determined that bottled water; private, indoor, or neighbors wells; cisterns or drums; and other private sources were more likely to be improved. Springs, public wells, and other public sources were designated as unimproved. Ambiguous toilet facilities were classified such that private toilets, toilets of unspecified type, and latrines with drainage were improved. Public toilets, traditional facilities, latrines of unspecified type, and other public facilities were considered unimproved.

2.3 Completing the Time Series

We used the three-stage methodology analysis detailed by Hogan et al.²³ and Foreman et al.²⁴ to create a complete time series for 137 developing countries from 1980 to 2011. In the first stage, we predicted access to improved water and improved sanitation using an ordinary least squares (OLS) regression with percent urban, GDP per capita, and mean years of education as covariates:

$$\text{logit}(A_{it}) = \beta_0 + \beta_1 \text{logit}(\text{urban}_{it}) + \beta_2 \ln(\text{GDP}_{it}) + \beta_3 \text{education}_{it} + \varepsilon_{it}$$

where i and t refer to countries and years, respectively. We used the logit transformation of the proportion of households with access to improved water or sanitation as the dependent variable so that predictions would be restricted to the $[0,1]$ range.

For the second stage, we applied a variant of spatial-temporal regression that uses a weighting algorithm to take advantage of correlation in the residuals from the first stage across time and space. A local weighted regression was applied in two dimensions (geographic region and year) on the residual from the first stage for each data point. The predicted residual was then added to the prediction from the first stage to result in an estimate that more accurately reflects spatial and temporal trends in the data than would otherwise be captured through a simple OLS regression. Data from surveys that were not nationally representative were given reduced weight in this stage of the estimation process.

The third stage used a Gaussian process regression (GPR), a Bayesian estimation technique in which the mean function is the estimate from the second stage and uncertainty due to sampling error and data type are incorporated using a set of variance parameters. GPR draws from a multinomial distribution based on the uncertainty in the data and in the mean function to generate final estimates and confidence intervals incorporating all available information.

To assess whether countries were on track to meet MDG 7c, we calculated yearly rates of change in lack of access to improved water and sanitation facilities between 1990 and 2010. The average rate of decline necessary to meet the MDG is 2.77% per year.

2.4 Attribution of Deaths and DALYs to Unimproved Water and Sanitation

We used the comparative risk assessment method for attribution of disease burden to risk factors²⁵. Relative risk estimates were synthesized by random effects meta-regression with indicator variables for intervention components (sanitation, hygiene, blinded point-of-use water treatment, unblinded point-of-use water treatment, and source water treatment) and two baseline scenarios (improved water source at baseline, and improved sanitation facility at baseline). Water source interventions served as the reference category. Anal-

yses were performed for all ages combined as well as for ages under five and over five separately. However, effect sizes were similar for each age group, so estimates for all ages were included to provide as much data as possible.

We calculated the population attributable fraction (PAF) for diarrheal mortality and morbidity due to unimproved water and unimproved sanitation using the following formula:

$$PAF = \frac{P(RR - 1)}{P(RR - 1) + 1}$$

where P is the prevalence of unimproved water or sanitation and RR is the corresponding relative risk. The PAF was applied to the total deaths and DALYs due to intestinal infectious diseases in children under five to estimate the number of deaths and DALYs attributable to unimproved water and unimproved sanitation.

2.5 Uncertainty Estimation

The GPR estimation technique resulted in 1,000 draws from the model's posterior distributions, which were used to estimate the median and 95% uncertainty interval for access to improved water and sanitation for each country-year. We developed 1,000 draws of each relative risk assuming a normal distribution around the mean and standard deviation, and 1,000 draws of the deaths and DALYs due to intestinal infectious diseases were available from previous endeavors using similar approaches^{1,2}. Each draw from these quantities was combined one-to-one to result in 1,000 estimates each of deaths and DALYs attributable to water and sanitation. The mean, 2.5th percentile, and 97.5th percentile of the resultant draws composed the point estimate and confidence interval for the quantity of interest.

All analyses were run using STATA version 12 (Stata Corporation, Texas USA) except for GPR, which was run using Enthought Python Distribution version 4.3.0 (Enthought Scientific Computing Solutions, Texas USA).

3 Results

3.1 Prevalence of Improved Water and Improved Sanitation

More data was available for water source than for sanitation facility, with the majority of inputs coming from JMP reports, DHS, and censuses (Table 2.1). We developed estimates of the proportion of the population with access to an improved drinking water source or an improved sanitation facility for 137 developing countries, for all years from 1980 to 2011 (Table A.1; Figures A.1-A.274). Between 1990 and 2011, the mean prevalence of access to improved water sources increased from 64.7% to 84.8%. Mean prevalence of access to improved sanitation facilities started much lower, at 35.3% in 1990, and had not yet surpassed 1990 levels for water in 2011 (63.3%). Overall, developing countries are well on track to meet MDG 7c for water with a 4.00% per year average rate of decline in lack of access to improved drinking water sources between 1990 and 2011, as compared to the 2.77% per year goal rate of change. However, observed trends in sanitation have just missed the goal, with a rate of change of 2.70% per year. As shown in Table A.1, 61 developing countries have already met the MDG for water, with an additional 7 countries on track to meet the goal by 2015. For sanitation, 59 countries have met the target, and 12 additional countries are currently on track. 46 countries are currently meeting target rates of change for both water and sanitation, 39 of which have already reached the goal.

At the country level, prevalence of access to improved facilities was much higher for water than for sanitation throughout the time of study. In 1990, less than 40% of the population had access to improved sanitation facilities in 63 countries, whereas only 20 countries had comparably low access to improved water sources. With the exception of Equatorial Guinea, all 20 countries also had low access to improved sanitation facilities (Figure 3.1). Prevalence of access was above 90% for only 21 and 13 countries for water and sanitation, respectively. 9 countries, predominantly in the Middle East, had comparably high prevalence for both water and sanitation: Bahrain, Jordan, Kuwait, Lebanon, Qatar, Samoa, Saudi Arabia, United Arab Emirates, and Uruguay. By 2011, prevalence remained below 40% for only one country (Somalia) for water, but 29 countries were still below this threshold for sanitation (Figure 3.2). Prevalence was above 90% for 55 countries for water, 39 countries for sanitation, and 29 countries for both water and sanitation.

Figure 3.3 illustrates the absolute change in prevalence of access between 1990 and 2011. Levels of absolute change varied widely across countries, ranging from -6.5% in Togo to 45.4% in Equatorial Guinea for water, and from -8.2% in Madagascar to 72.2% in Rwanda for sanitation. In general, absolute change was greater for sanitation than for water; it exceeded 30% in 27 countries for sanitation, but only in 11 countries for water and 5 countries (China, Equatorial Guinea, Ghana, Indonesia, and Rwanda) for both indicators. 71 countries exhibited an absolute change of less than 10% for improved water, whereas only 39

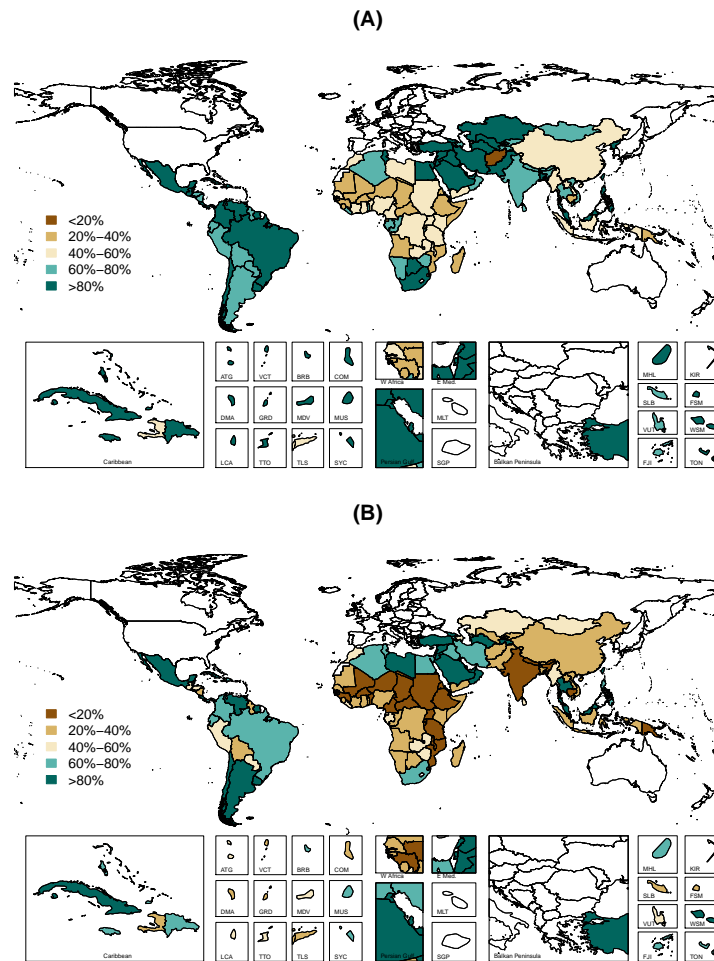


Figure 3.1: Access to improved water (A) and sanitation (B) in 1990

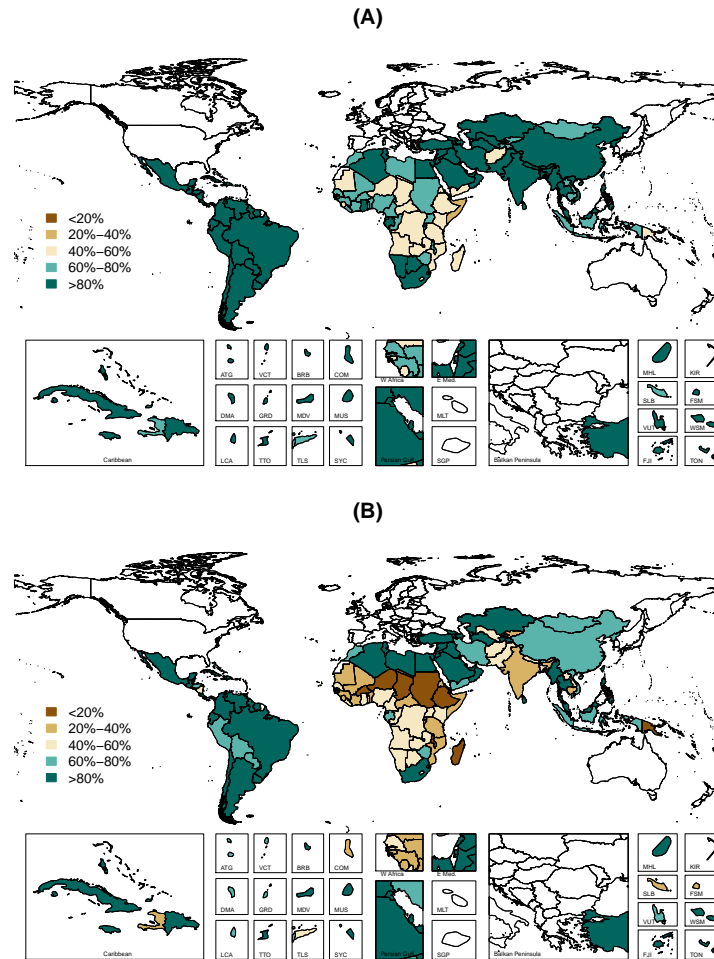


Figure 3.2: Access to improved water (A) and sanitation (B) in 2011

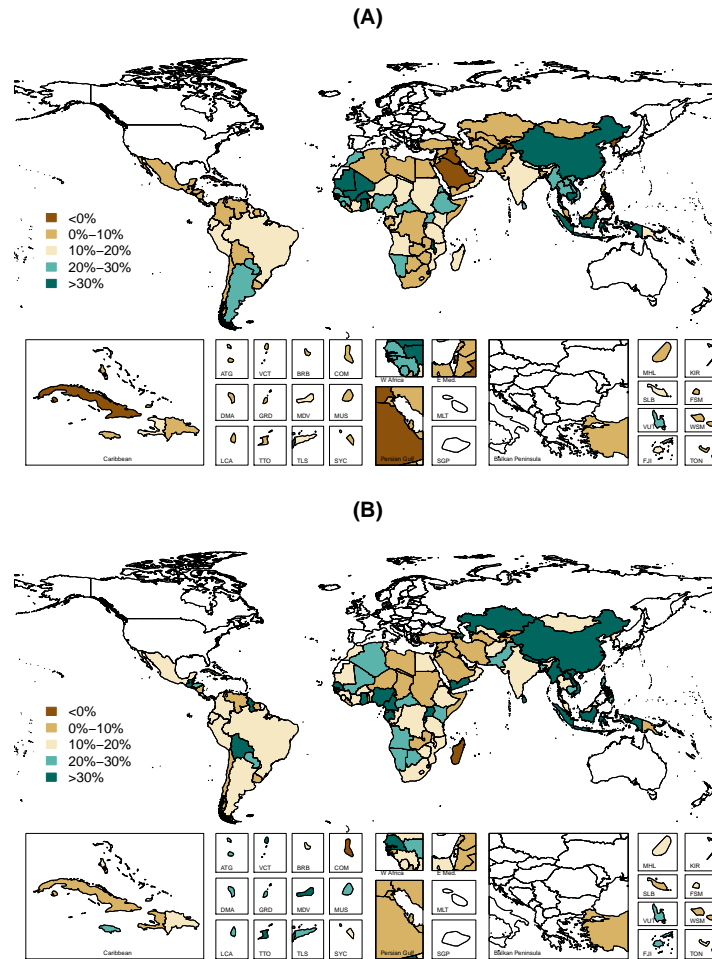


Figure 3.3: Absolute change in access from 1990 to 2011 for water (A) and sanitation (B)

had similarly low change for sanitation. Seven countries have made no progress in access to improved water since 1990: Cuba, Iraq, North Korea, Occupied Palestinian Territory, Saudi Arabia, Tajikistan, and Togo. Levels of access in Saudi Arabia, however, were already greater than 90% in 1990, so a lack of improvement is understandable. Only 2 countries—Comoros and Madagascar—have made no progress in access to improved sanitation.

Annual rates of decline in lack of access to improved facilities between 1990 and 2011 are given in Table A.1 and Figure 3.4. Countries with rates of decline exceeding 2.77% per year are on track to meet MDG 7c. As with absolute change, large variation is present in rates of change across countries. The greatest progress was observed in Jordan, where lack of access to improved sanitation facilities declined 16.62% per year between 1990 and 2011. In contrast, the least progress for sanitation occurred in Madagascar, where lack of access increased 0.64% per year. For water, rates of change ranged from an increase of 3.10% per year in Saudi

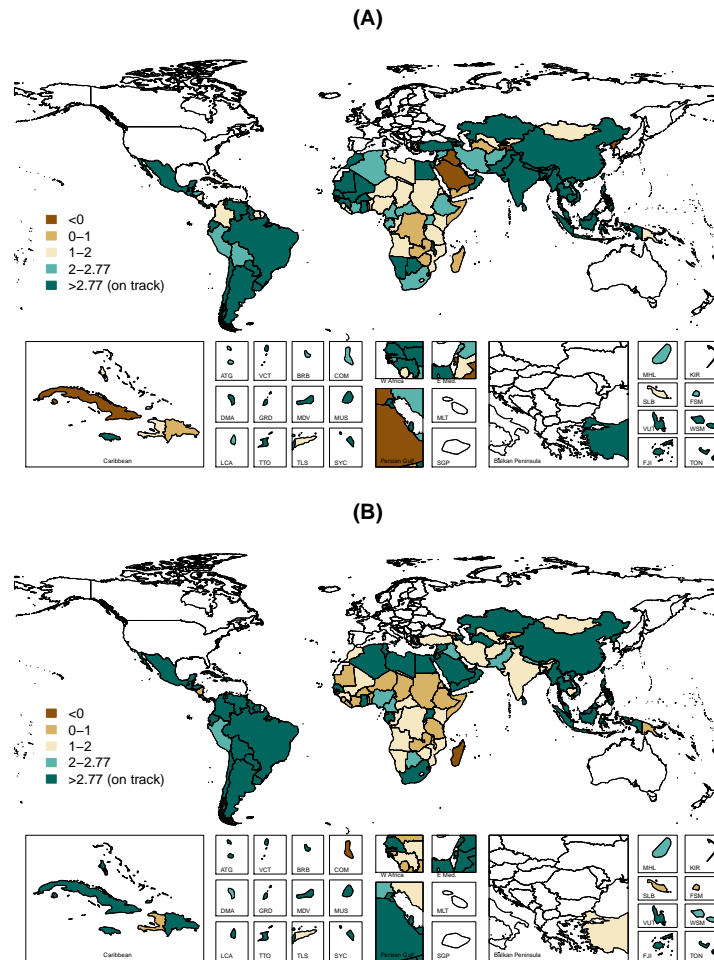


Figure 3.4: Annualized rate of decline in lack of access to improved water (A) and sanitation (B) between 1990 and 2011

Arabia to a decline of 10.67% per year in Mauritius.

Table 3.3 shows changes in access to improved facilities between 1990 and 2011 for the worlds most populous developing countries. Substantial progress has been made in China and Indonesia, where the absolute change in access was greater than 30% for both water and sanitation. Furthermore, annual rates of decline in lack of access to improved facilities exceeded the target for both indicators in these two countries as well as in Brazil, Mexico, the Philippines, and Vietnam. Of these ten most populous developing countries, only Nigeria failed to meet the goal annual rate of decline for both water and sanitation, with rates of 2.00% and 2.30% for water and sanitation, respectively. Initial levels of access were higher for improved water than for improved sanitation in India, Pakistan, and Bangladesh, meaning that greater absolute change in sanitation is necessary to meet the MDG in these countries. Thus, although absolute change in access for sanitation exceeded that for water, India, Pakistan, and Bangladesh are on track to meet the MDG for water but not for sanitation.

Table 3.3 also illustrates the gap between improved water and improved sanitation in 1990 and 2011. This gap is staggeringly large in India and Bangladesh, where over 40% of the population has access to improved water but not improved sanitation. In contrast, access to improved sanitation exceeds access to improved water by 2.1% in Mexico. China, Brazil, Mexico, the Philippines, and Vietnam are successfully decreasing the gap between water and sanitation while simultaneously making substantial progress for both indicators.

Table 3.3: Absolute change, annualized rate of decline, and gap in access between improved water and sanitation for ten most populous countries

Country	Absolute Change 1990-2011		Rate of Decline 1990-2011		Gap in Access	
	Water	Sanitation	Water	Sanitation	1990	2011
China	36.9	53.1	7.28	5.68	29.2	12.9
India	15.6	19.9	4.29	1.34	54.9	50.5
Indonesia	36.5	32.9	4.74	3.72	2.8	6.4
Brazil	13.6	19.6	6.07	3.86	16.4	10.4
Pakistan	9.0	25.6	3.41	2.25	50.5	33.8
Bangladesh	6.5	21.5	4.05	1.90	54.1	39.0
Nigeria	20.4	30.2	2.00	2.30	19.4	9.5
Mexico	7.3	12.2	3.48	6.10	2.8	-2.1
Philippines	8.2	25.2	3.17	5.35	20.6	3.5
Vietnam	23.4	35.1	5.23	3.53	32.0	20.3

3.2 Attributable Deaths and DALYs

Studies^{26–105} that contributed to our estimate of the relative risk of diarrheal morbidity are listed by intervention component in Table 3.4. The magnitude of the effect was similar for all six interventions, with nearly equal effects for water supply and sanitation (Table 3.5). As expected, the perceived relative risk of lack of point-of-use water quality interventions was greater for unblinded studies as compared to blinded studies.

The number of deaths attributable to unimproved water and sanitation in children under five declined dramatically between 1980 and 2010, with a reduction from 274,780 to 57,448 for water and from 430,496 to 101,133 for sanitation (Figure 3.5). A substantial portion of the reduction occurred in South Asia, where the number of deaths attributable to unimproved water declined nearly 90% from 94,719 to 10,021 and deaths attributable to unimproved sanitation declined 81% from 203,138 to 37,855. Attributable deaths in Central Sub-Saharan Africa almost stagnated in comparison, with a 9% increase for water and a 10% decrease for sanitation.

Deaths attributable to unimproved water are shown at the country level adjusted for population in

Table 3.4: Water, sanitation, and hygiene intervention studies by intervention components

Intervention	Number of Studies
Water supply only ^{26–28}	3
Sanitation only ^{29–36}	8
Hygiene education only ^{37–53}	17
Point-of-use water quality only ^{44,46,54–88}	37
Source water quality only ^{89–91}	3
Water supply and sanitation ⁹²	1
Water supply and hygiene education ⁹³	1
Water supply and point-of-use water quality ⁹⁴	1
Sanitation and hygiene education ^{95,96}	2
Hygiene education and point-of-use water quality ^{46,96,97}	3
Water supply, sanitation, and hygiene education ^{98–102}	5
Water supply, sanitation, hygiene education, and point-of-use water quality ¹⁰³	1
Water supply, sanitation, hygiene education, and source water quality ^{104,105}	2
Total	84

Table 3.5: Relative risk of diarrheal morbidity for those without intervention

Intervention	Relative Risk (95% CI)
Water supply	1.34 (1.04-1.72)
Sanitation	1.33 (1.02-1.74)
Hygiene education	1.38 (1.15-1.67)
Point-of-use water quality, blinded	1.20 (0.94-1.53)
Point-of-use water quality, unblinded	1.59 (1.35-1.84)
Source water quality	1.24 (0.89-1.73)

Figure 3.6. The same is shown for deaths attributable to unimproved sanitation in Figure 3.7. The countries with the highest water- and sanitation-attributable death rates are concentrated mainly in Western and Eastern Sub-Saharan Africa, with rates in Niger, Chad, Malawi, and Burkina Faso exceeding 200 deaths per 100,000 attributable to unimproved water in 1990. In that year, rates in Niger (433 per 100,000) were nearly twice those observed in Chad (245 per 100,000), the next highest country. Despite a promising 73% reduction to 118 deaths per 100,000 in 2011, Niger remains in the top two countries for water-attributable death rate. In contrast, Malawi showed impressive progress between 1990 and 2011, dropping from the 3rd highest death rate with 237 deaths per 100,000 to 30th highest, with only 18 deaths per 100,000. Similar trends were observed for sanitation-attributable deaths.

Finally, Figure 3.8 illustrates DALYs attributable to unimproved water and sanitation in children under five, by region, for 1990, 2005, and 2010. Water-attributable DALYs declined 68% between 1990 and 2010 in developing regions, dropping from 17.0 million to 5.3 million in just 20 years. Similar progress was made for sanitation, with a 66% reduction from 28.2 million in 1990 to 9.5 million in 2010. As with deaths, the greatest progress occurred in South Asia, driven primarily by India, though substantial declines were seen in most regions, including Southeast Asia and Eastern and Western Sub-Saharan Africa.

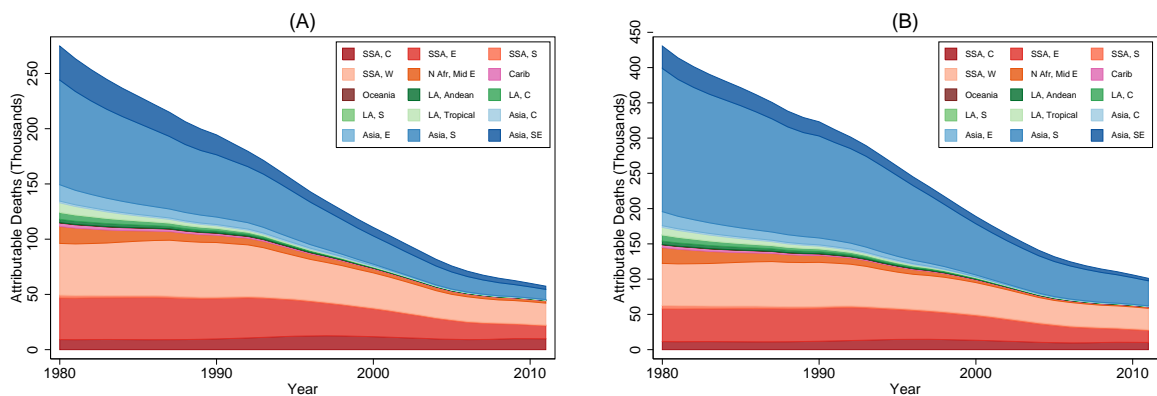


Figure 3.5: Deaths attributable to unimproved water (A) and sanitation (B) in children under five, by region, from 1980 to 2010

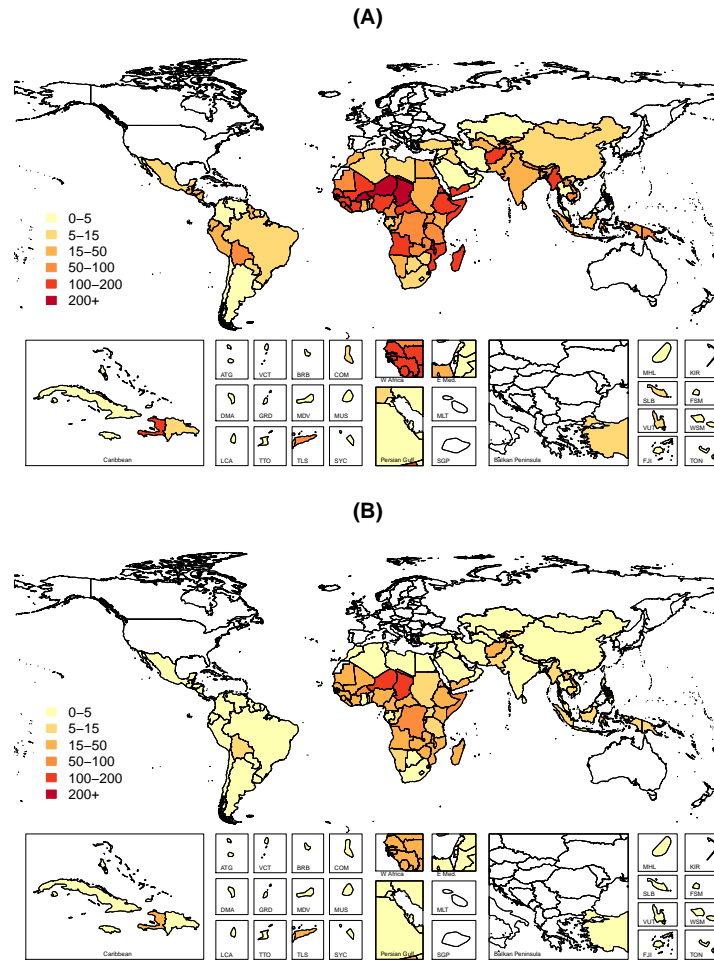


Figure 3.6: Deaths per 1000 population attributable to unimproved water in children under five in 1990 (A) and 2011 (B)

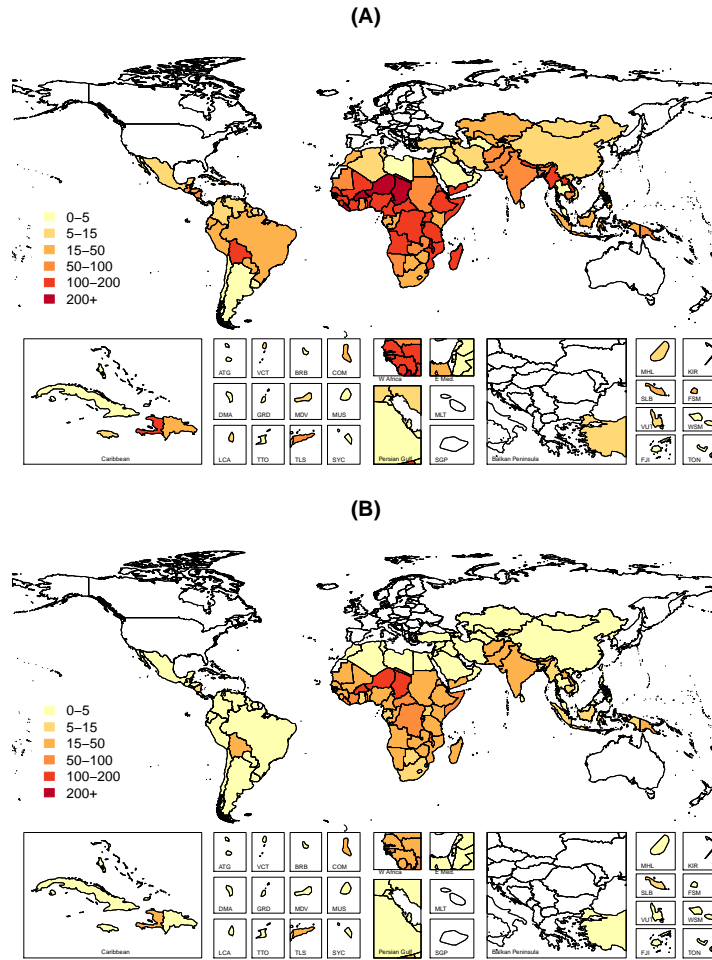


Figure 3.7: Deaths per 1000 population attributable to unimproved sanitation in children under five in 1990 (A) and 2011 (B)

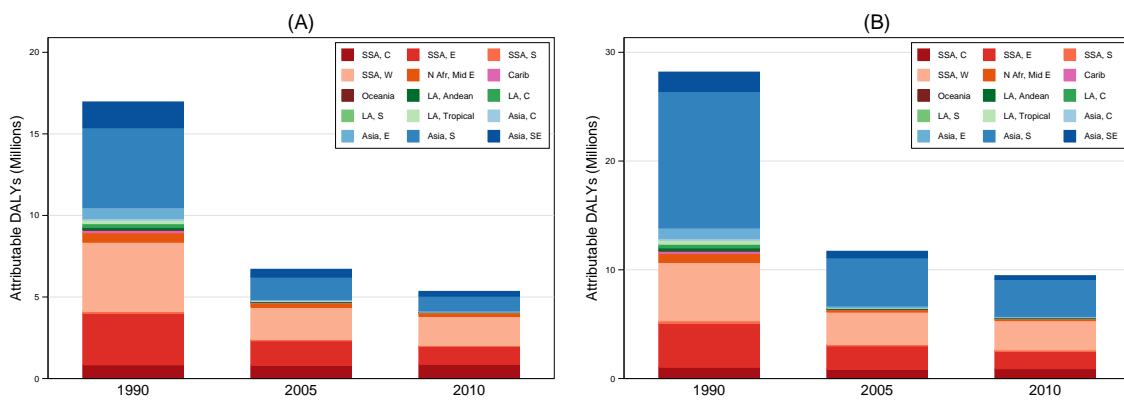


Figure 3.8: DALYs attributable to unimproved water (A) and sanitation (B) in children under five, by region, for 1990, 2005, and 2010

4 Discussion

We have developed an enhanced approach for the estimation of access to an improved water source and an improved toilet facility for the assessment of progress toward MDG 7c. We propose 14 empirically determined additional classifications for household water source and sanitation facility to supplement those designated by the JMP so that data from all households may be systematically utilized in future research. We also develop and implement an improved non-linear modeling methodology that takes into account uncertainty in the data and provides confidence intervals for country trends. The resultant time trends indicate that substantial progress has been achieved for both water and sanitation, but increases in access tended to be greater for sanitation, in part because of lower initial levels. In general, access to improved water sources tends to be much higher than access to improved sanitation facilities, but this gap is gradually closing in most countries.

Our results are consistent with those obtained by the JMP in that they each indicate achievement of MDG 7c for water but not for sanitation¹³. The two estimation techniques yield similar results for most countries, though agreement is greater for water because the majority of ambiguous survey options were for toilet facilities rather than water sources. Notably different trends were found in Ghana (Figure A.184), Jamaica (Figure A.196), and Rwanda (Figure A.237), where survey data using the modified technique indicate rapid scale-ups in access to improved sanitation that are not reflected in the relatively flat trends reported by the JMP. These differences illustrate the benefit of non-linear modeling when data are abundant.

There are a number of remaining limitations to the currently available data and measurement approaches that prevent us from directly measuring sustainable access to safe drinking water and basic sanitation. The MDG indicators address access to improved facilities, which is intended to be a proxy for safe facilities. However, current survey methods measure only at point-of-source and not at point-of use. This approach fails to address the potential (and likelihood) for contamination between collection and use, particularly during transport and storage. Furthermore, in many developing countries, such as India, Bangladesh, and Ghana, a high percentage of rural water supplies are contaminated with elevated levels of arsenic, fluoride, iron, lead, and microbiological pollutants^{106–109}. These contaminants can have a substantial detrimental impact on health outcomes, including disability and death due to cancer¹¹⁰, but more research is needed to determine the prevalence of contamination and the effect of exposure on morbidity and mortality.

While the same broad categories of “improved” and “unimproved” facilities are used over time, the specific questions that are included in surveys are often customized for each survey and country and have changed, making the classification of households into these broad categories challenging and inconsistent. The community would benefit from widespread adoption of the core questions for household surveys developed

by the JMP¹¹¹. In the meantime, and for historical data, our additional classifications supplement those designated by the JMP so that data from all households may be used in future research.

The current framework depends on measurement of a single “main” or “usual” source of water and type of sanitation facility. However, throughout the course of a day, individuals are exposed to multiple water sources and have access to several types of sanitation facilities. The currently available instruments do not have the ability to appropriately capture an individual’s exposure to all water and sanitation sources they come into contact with. In a similar vein, current measurement occurs at the household, rather than individual, level. Effective monitoring of exposure at the individual level is imperative for future research linking exposure data to health outcomes.

Current data collection techniques limited our ability to capture whether toilet facilities were shared or private. However, the JMP recognizes that shared sanitation is not unhygienic by definition and may be the only possibility for the growing global population living in dense urban areas. The JMP has commissioned a task force to explore the importance of shared sanitation in accurate estimates of access to safe sanitation¹³. Future research would benefit from more consistent documentation of the privacy level of household sanitation facilities and from a quantification of the health effects of shared facilities so the importance of private facilities can be fully ascertained.

Sustainability was an explicit priority of the MDG, but the term has not been clearly defined such that future surveys can capture information on the reliability and sustainability of water and sanitation resources in a standardized way. Furthermore, experts agree that factors beyond water source, such as water quality, water treatment, time spent retrieving water, water affordability, and water scarcity, have a substantial impact on the sustainability and safety of drinking water. Looking beyond the MDGs, it is essential that the water and sanitation community come together to develop a more holistic approach to tracking water safety in the future.

Regardless of the current landscape, the data and methods available for assessment of the burden due to unimproved water and sanitation are continually improving. The resultant estimates indicate that promising progress is being made in a number of countries for both water and sanitation, but continued efforts are necessary. Although developing countries as a whole are on track to meet MDG 7c for water and will come closer to reaching the goal for sanitation than previously expected, substantial heterogeneity exists both among and within countries. Only half of developing countries have achieved the levels of change necessary to meet the goal, with some countries failing to make progress over the last 30 years. Although similar numbers of countries are on track to meet MDG 7c for water (68) as compared to sanitation (71), three highly populous countries—India, Pakistan, and Bangladesh—have made substantially more progress for water and are driving trends for developing countries as a whole. Within countries, access in rural areas can

lag behind that in urban areas by a factor of five or more¹³. An estimated 72% of the global population without access to improved sanitation lives in rural areas, as compared to the 45% of the total population that this group comprises¹³.

Promising declines have occurred for deaths and DALYs attributable to unimproved water and unimproved sanitation, particularly in India and China, but the burden remains large. In contrast to the impressive rates of change in South and Southeast Asia, many countries in Sub-Saharan Africa, particularly Central and Eastern Sub-Saharan Africa, have made discouragingly little progress over the past decades. Approximately 8.5% and 15.0% of intestinal infectious disease deaths and DALYs in children under five are attributable to unimproved water and unimproved sanitation, respectively.

The analytic improvements presented here are one step along the path to increasing knowledge about the burdens of unsafe water and sanitation. With this knowledge, we hope that country governments and the global health community as a whole will continue to make the necessary investments in water and sanitation infrastructure beyond 2015 until universal access to safe and sustainable water and sanitation is achieved.

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Appendices

Table A.1: Country progress in access to improved water and sanitation, 1980-2011

	Water						Sanitation					
	1980	1990	2011	Goal	Rate of Decline	MDG Status	1980	1990	2011	Goal	Rate of Decline	MDG Status
Asia, Central												
Armenia	89.0	91.5	96.3	95.7	3.93	Target Reached	70.2	77.0	82.3	88.5	1.24	Insufficient Progress
Azerbaijan	64.6	70.7	87.0	85.4	3.87	Target Reached	34.3	45.7	83.3	72.8	5.62	Target Reached
Georgia	85.3	88.7	94.4	94.4	3.33	Target Reached	95.4	96.9	97.4	98.4	0.84	Insufficient Progress
Kazakhstan	86.7	90.1	95.2	95.0	3.45	Target Reached	36.1	47.0	94.6	73.5	10.88	Target Reached
Kyrgyzstan	58.2	63.2	71.3	81.6	1.19	Insufficient Progress	22.1	28.3	37.7	64.1	0.67	Insufficient Progress
Mongolia	58.3	66.7	75.6	83.3	1.48	Insufficient Progress	46.4	58.1	71.2	79.0	1.79	Insufficient Progress
Tajikistan	65.0	71.5	69.4	85.8	-0.35	Insufficient Progress	92.4	94.9	96.2	97.5	1.41	Insufficient Progress
Turkmenistan	79.9	83.8	84.4	91.9	0.17	Insufficient Progress	96.1	97.3	98.7	98.6	3.64	Target Reached
Uzbekistan	83.9	87.3	90.6	93.6	1.46	Insufficient Progress	23.5	29.3	45.2	64.6	1.21	Insufficient Progress
Asia, East												
China	47.2	52.9	89.8	76.4	7.28	Target Reached	22.2	23.7	76.9	61.9	5.68	Target Reached
North Korea	98.2	99.0	98.6	99.5	-1.85	Insufficient Progress	46.3	58.2	77.5	79.1	2.95	On Track
Taiwan	82.6	91.2	98.0	95.6	7.12	Target Reached	75.8	87.2	95.9	93.6	5.38	Target Reached
Asia, South												
Bangladesh	73.0	88.7	95.2	94.4	4.05	Target Reached	30.7	34.6	56.2	67.3	1.90	Insufficient Progress
Bhutan	71.1	79.7	94.2	89.8	5.99	Target Reached	22.3	34.6	68.0	67.3	3.41	Target Reached
India	67.9	73.7	89.3	86.9	4.29	Target Reached	13.0	18.9	38.8	59.4	1.34	Insufficient Progress
Nepal	63.5	68.9	87.4	84.5	4.31	Target Reached	7.3	9.4	48.6	54.7	2.69	Insufficient Progress
Pakistan	78.2	82.5	91.4	91.2	3.41	Target Reached	26.4	32.0	57.6	66.0	2.25	Insufficient Progress
Asia, Southeast												
Cambodia	20.4	23.3	62.0	61.6	3.35	Target Reached	8.1	11.2	38.2	55.6	1.72	Insufficient Progress
Indonesia	23.3	42.1	78.6	71.1	4.74	Target Reached	25.7	39.3	72.2	69.7	3.72	Target Reached
Laos	35.6	43.3	68.0	71.6	2.73	Insufficient Progress	14.6	21.3	55.8	60.7	2.74	Insufficient Progress
Malaysia	76.4	83.8	92.8	91.9	3.85	Target Reached	76.3	86.3	97.0	93.1	7.17	Target Reached
Maldives	65.8	85.0	97.6	92.5	8.80	Target Reached	20.7	44.4	95.1	72.2	11.61	Target Reached
Mauritius	95.3	93.7	99.3	96.8	10.47	Target Reached	53.2	72.1	96.0	86.1	9.31	Target Reached
Myanmar	50.2	55.8	80.3	77.9	3.86	Target Reached	38.4	44.9	81.0	72.4	5.08	Target Reached
Philippines	80.5	83.2	91.4	91.6	3.17	On Track	55.6	62.6	87.8	81.3	5.35	Target Reached
Seychelles	74.9	81.6	91.4	90.8	3.59	Target Reached	53.9	67.7	86.7	83.8	4.24	Target Reached
Sri Lanka	62.6	65.5	89.1	82.7	5.49	Target Reached	40.6	54.9	93.6	77.4	9.29	Target Reached
Thailand	44.0	68.6	90.3	84.3	5.59	Target Reached	79.5	87.7	98.7	93.8	10.57	Target Reached
Timor-Leste	38.7	44.6	63.5	72.3	1.99	Insufficient Progress	23.5	31.4	53.0	65.7	1.80	Insufficient Progress

Table A.1 continued.

	Water						Sanitation					
	1980	1990	2011	Goal	Rate of Decline	MDG Status	1980	1990	2011	Goal	Rate of Decline	MDG Status
Vietnam	54.7	64.9	88.3	82.5	5.23	Target Reached	24.6	33.0	68.0	66.5	3.53	Target Reached
Caribbean												
Antigua and Barbuda	94.4	96.9	98.1	98.5	2.39	Insufficient Progress	39.2	53.1	77.9	76.5	3.60	Target Reached
Bahamas	95.2	96.7	97.5	98.3	1.29	Insufficient Progress	67.2	75.8	90.0	87.9	4.23	Target Reached
Barbados	95.4	96.7	98.1	98.4	2.55	Insufficient Progress	48.5	66.4	85.2	83.2	3.90	Target Reached
Belize	73.2	77.7	95.9	88.9	8.03	Target Reached	30.8	58.4	92.0	79.2	7.84	Target Reached
Cuba	76.7	90.6	90.3	95.3	-0.15	Insufficient Progress	77.5	89.9	95.9	95.0	4.35	Target Reached
Dominica	82.6	88.6	94.9	94.3	3.85	Target Reached	23.0	37.1	62.1	68.6	2.41	Insufficient Progress
Dominican Republic	70.8	83.6	85.8	91.8	0.68	Insufficient Progress	69.1	78.5	89.1	89.3	3.23	On Track
Grenada	89.7	91.5	95.6	95.7	3.13	On Track	29.6	37.7	66.0	68.9	2.88	On Track
Guyana	77.1	77.1	93.4	88.5	5.92	Target Reached	30.1	32.3	83.8	66.1	6.80	Target Reached
Haiti	41.8	46.2	60.1	73.1	1.43	Insufficient Progress	14.5	31.5	37.7	65.8	0.45	Insufficient Progress
Jamaica	82.2	85.6	93.4	92.8	3.71	Target Reached	64.3	61.7	90.8	80.8	6.79	Target Reached
Saint Lucia	83.3	91.8	94.7	95.9	2.09	Insufficient Progress	28.5	42.6	71.0	71.3	3.25	On Track
Saint Vincent and the Grenadines	90.2	88.7	95.1	94.3	4.01	Target Reached	25.3	34.5	65.4	67.2	3.04	On Track
Suriname	83.6	85.7	90.6	92.8	1.99	Insufficient Progress	74.3	82.3	90.9	91.1	3.16	On Track
Trinidad and Tobago	90.4	91.0	96.8	95.5	4.83	Target Reached	54.7	57.1	97.3	78.6	13.15	Target Reached
Latin America, Andean												
Bolivia	76.8	77.6	85.7	88.8	2.14	Insufficient Progress	32.7	35.7	67.1	67.9	3.18	On Track
Ecuador	64.1	71.8	87.3	85.9	3.81	Target Reached	54.4	65.0	84.1	82.5	3.75	Target Reached
Peru	65.1	69.9	80.8	84.9	2.14	Insufficient Progress	47.2	52.8	72.1	76.4	2.51	Insufficient Progress
Latin America, Central												
Colombia	80.8	86.2	90.7	93.1	1.91	Insufficient Progress	66.7	76.3	89.7	88.2	3.98	Target Reached
Costa Rica	86.9	89.5	96.0	94.7	4.66	Target Reached	85.1	87.3	98.8	93.7	11.21	Target Reached
El Salvador	74.2	73.0	89.4	86.5	4.45	Target Reached	50.8	48.8	90.2	74.4	7.85	Target Reached
Guatemala	66.3	81.2	90.6	90.6	3.33	Target Reached	52.8	51.3	85.6	75.7	5.79	Target Reached
Honduras	74.4	78.0	87.0	89.0	2.52	Insufficient Progress	40.7	53.3	77.5	76.7	3.48	Target Reached
Mexico	82.5	85.9	93.2	93.0	3.48	Target Reached	76.1	83.1	95.3	91.6	6.10	Target Reached
Nicaragua	78.0	77.8	84.8	88.9	1.80	Insufficient Progress	37.9	38.0	45.5	69.0	0.61	Insufficient Progress
Panama	77.9	83.2	94.0	91.6	4.93	Target Reached	52.8	63.4	67.7	81.7	0.59	Insufficient Progress
Venezuela	85.8	88.4	94.6	94.2	3.68	Target Reached	79.3	84.4	93.4	92.2	4.09	Target Reached
Latin America, Southern												
Argentina	65.5	74.1	96.0	87.1	8.91	Target Reached	76.8	82.1	92.4	91.1	4.05	Target Reached

Table A.1 continued.

	Water						Sanitation					
	1980	1990	2011	Goal	Rate of Decline	MDG Status	1980	1990	2011	Goal	Rate of Decline	MDG Status
Chile	80.2	85.6	95.3	92.8	5.33	Target Reached	80.5	86.7	95.8	93.4	5.47	Target Reached
Uruguay	94.7	94.7	98.2	97.4	5.01	Target Reached	87.7	91.6	97.1	95.8	5.05	Target Reached
Latin America, Tropical												
Brazil	68.1	81.2	94.7	90.6	6.07	Target Reached	58.7	64.8	84.3	82.4	3.86	Target Reached
Paraguay	55.6	62.0	83.7	81.0	4.03	Target Reached	36.3	44.5	71.5	72.3	3.17	On Track
North Africa / Middle East												
Afghanistan	16.9	18.2	52.7	59.1	2.61	Insufficient Progress	30.8	35.1	49.8	67.5	1.23	Insufficient Progress
Algeria	75.1	79.9	87.3	90.0	2.17	Insufficient Progress	65.7	73.8	94.0	86.9	6.98	Target Reached
Bahrain	94.2	94.9	97.6	97.4	3.53	Target Reached	93.2	95.3	98.6	97.6	5.88	Target Reached
Egypt	83.7	88.7	96.3	94.4	5.36	Target Reached	69.8	78.2	96.7	89.1	9.01	Target Reached
Iran	83.5	85.6	91.6	92.8	2.56	Insufficient Progress	64.0	70.0	79.6	85.0	1.83	Insufficient Progress
Iraq	85.0	84.7	81.3	92.4	-0.95	Insufficient Progress	77.0	78.4	87.3	89.2	2.54	Insufficient Progress
Jordan	94.3	96.3	97.4	98.2	1.71	Insufficient Progress	84.0	91.7	99.7	95.8	15.55	Target Reached
Kuwait	98.7	98.4	99.2	99.2	2.95	On Track	96.5	97.6	99.2	98.8	5.31	Target Reached
Lebanon	90.7	92.9	95.6	96.5	2.31	Insufficient Progress	94.5	97.0	98.8	98.5	4.37	Target Reached
Libya	62.8	59.5	67.9	79.7	1.12	Insufficient Progress	94.3	95.3	97.5	97.7	3.04	On Track
Morocco	41.0	57.0	79.7	78.5	3.57	Target Reached	46.7	56.2	70.2	78.1	1.83	Insufficient Progress
Occupied Palestinian Territory	84.4	88.6	84.7	94.3	-1.41	Insufficient Progress	78.4	86.3	97.1	93.2	7.37	Target Reached
Oman	69.1	78.5	89.3	89.2	3.33	Target Reached	68.4	83.1	95.1	91.6	5.92	Target Reached
Qatar	97.6	97.2	98.6	98.6	3.50	Target Reached	96.5	97.0	99.2	98.5	6.23	Target Reached
Saudi Arabia	91.8	92.3	86.4	96.1	-2.67	Insufficient Progress	88.5	92.7	97.6	96.4	5.28	Target Reached
Syria	79.3	82.8	89.7	91.4	2.44	Insufficient Progress	84.1	88.7	97.0	94.3	6.28	Target Reached
Tunisia	91.6	89.0	92.4	94.5	1.74	Insufficient Progress	64.4	75.7	91.4	87.8	4.93	Target Reached
Turkey	86.4	88.5	97.0	94.3	6.44	Target Reached	76.1	87.3	91.4	93.7	1.83	Insufficient Progress
United Arab Emirates	97.1	97.0	98.3	98.5	2.53	Insufficient Progress	95.8	96.3	98.7	98.2	4.83	Target Reached
Yemen	46.9	54.3	54.8	77.1	0.06	Insufficient Progress	18.5	22.2	62.3	61.1	3.45	Target Reached
Oceania												
Fiji	60.6	70.0	88.0	85.0	4.35	Target Reached	55.3	62.4	83.9	81.2	4.03	Target Reached
Kiribati	76.6	74.1	87.8	87.0	3.61	Target Reached	56.2	58.3	79.8	79.1	3.45	Target Reached
Marshall Islands	76.8	83.0	89.9	91.5	2.49	Insufficient Progress	57.4	67.0	80.0	83.5	2.40	Insufficient Progress
Micronesia, Federated States of	84.9	87.4	92.9	93.7	2.70	Insufficient Progress	22.2	28.3	39.3	64.2	0.79	Insufficient Progress
Papua New Guinea	29.3	31.9	45.9	66.0	1.09	Insufficient Progress	5.5	7.3	12.0	53.6	0.25	Insufficient Progress
Samoa	90.0	91.8	96.8	95.9	4.45	Target Reached	93.7	94.9	96.8	97.5	2.22	Insufficient Progress
Solomon Islands	59.0	63.7	75.2	81.8	1.81	Insufficient Progress	15.9	22.1	26.3	61.1	0.26	Insufficient Progress

Table A.1 continued.

	Water						Sanitation					
	1980	1990	2011	Goal	Rate of Decline	MDG Status	1980	1990	2011	Goal	Rate of Decline	MDG Status
Tonga	71.9	83.9	92.8	92.0	3.79	Target Reached	59.3	74.1	88.0	87.0	3.65	Target Reached
Vanuatu	55.9	62.0	86.1	81.0	4.80	Target Reached	34.8	44.6	72.6	72.3	3.36	Target Reached
Sub-Saharan Africa, Central												
Angola	37.2	39.5	52.9	69.7	1.19	Insufficient Progress	19.8	27.5	52.0	63.7	1.97	Insufficient Progress
Central African Republic	30.2	33.2	58.8	66.6	2.31	Insufficient Progress	7.2	9.7	37.6	54.9	1.76	Insufficient Progress
Congo	49.8	60.1	70.7	80.0	1.48	Insufficient Progress	17.4	27.6	47.0	63.8	1.49	Insufficient Progress
Congo, DR	45.5	46.2	46.5	73.1	0.02	Insufficient Progress	19.9	22.9	42.8	61.4	1.43	Insufficient Progress
Equatorial Guinea	31.6	33.5	79.0	66.8	5.47	Target Reached	39.6	49.3	87.3	74.7	6.57	Target Reached
Gabon	75.4	77.6	86.4	88.8	2.39	Insufficient Progress	29.1	40.1	72.3	70.1	3.67	Target Reached
Sub-Saharan Africa, East												
Burundi	60.1	65.9	70.2	82.9	0.65	Insufficient Progress	2.3	3.9	29.7	52.0	1.48	Insufficient Progress
Comoros	84.3	87.7	92.0	93.9	2.06	Insufficient Progress	20.3	28.5	28.4	64.2	0.00	Insufficient Progress
Djibouti	78.4	78.9	86.4	89.5	2.08	Insufficient Progress	58.6	62.5	73.6	81.3	1.67	Insufficient Progress
Eritrea	19.8	21.6	48.1	60.8	1.97	Insufficient Progress	10.1	11.9	25.9	56.0	0.82	Insufficient Progress
Ethiopia	21.0	23.2	50.2	61.6	2.06	Insufficient Progress	4.0	2.8	15.5	51.4	0.66	Insufficient Progress
Kenya	36.0	40.1	51.6	70.0	1.02	Insufficient Progress	16.8	20.4	46.9	60.2	1.93	Insufficient Progress
Madagascar	33.0	30.7	43.3	65.4	0.95	Insufficient Progress	20.7	27.4	19.2	63.7	-0.51	Insufficient Progress
Malawi	38.2	42.8	78.5	71.4	4.66	Target Reached	6.3	6.3	18.5	53.2	0.67	Insufficient Progress
Mozambique	16.7	29.9	46.6	64.9	1.29	Insufficient Progress	8.5	8.3	28.2	54.2	1.16	Insufficient Progress
Rwanda	31.2	28.9	66.2	64.5	3.55	Target Reached	4.2	1.6	73.8	50.8	6.30	Target Reached
Somalia	26.6	25.7	29.9	62.9	0.28	Insufficient Progress	31.9	33.8	38.5	66.9	0.35	Insufficient Progress
Sudan	44.6	57.9	68.5	79.0	1.38	Insufficient Progress	8.4	13.6	18.7	56.8	0.29	Insufficient Progress
Tanzania	40.0	43.8	56.6	71.9	1.23	Insufficient Progress	4.7	5.2	20.3	52.6	0.82	Insufficient Progress
Uganda	39.0	46.4	69.8	73.2	2.73	Insufficient Progress	3.9	2.0	47.3	51.0	2.95	On Track
Zambia	51.8	50.0	58.6	75.0	0.89	Insufficient Progress	31.7	40.4	45.6	70.2	0.43	Insufficient Progress
Sub-Saharan Africa, Southern												
Botswana	79.0	89.7	96.0	94.8	4.53	Target Reached	10.1	28.7	56.1	64.4	2.31	Insufficient Progress
Lesotho	43.6	57.0	80.6	78.5	3.78	Target Reached	7.0	13.8	38.7	56.9	1.62	Insufficient Progress
Namibia	66.2	68.4	88.8	84.2	4.96	Target Reached	25.9	32.5	53.5	66.2	1.77	Insufficient Progress
South Africa	83.0	85.7	91.9	92.9	2.69	Insufficient Progress	61.4	67.8	84.2	83.9	3.40	Target Reached
Swaziland	44.0	50.7	71.5	75.3	2.60	Insufficient Progress	21.6	39.9	64.7	70.0	2.54	Insufficient Progress
Zimbabwe	71.0	76.0	76.1	88.0	0.02	Insufficient Progress	41.1	51.5	62.3	75.8	1.20	Insufficient Progress
Sub-Saharan Africa, West												

Table A.1 continued.

	Water						Sanitation					
	1980	1990	2011	Goal	Rate of Decline	MDG Status	1980	1990	2011	Goal	Rate of Decline	MDG Status
Benin	53.6	58.5	71.9	79.3	1.85	Insufficient Progress	13.4	17.6	31.5	58.8	0.88	Insufficient Progress
Burkina Faso	38.0	37.0	70.9	68.5	3.67	Target Reached	5.9	5.8	17.7	52.9	0.65	Insufficient Progress
Cameroon	42.0	49.3	68.2	74.7	2.22	Insufficient Progress	11.8	14.4	50.7	57.2	2.62	Insufficient Progress
Cape Verde	25.3	71.0	86.2	85.5	3.54	Target Reached	16.7	30.6	59.3	65.3	2.55	Insufficient Progress
Chad	33.3	34.3	48.5	67.2	1.16	Insufficient Progress	7.4	8.4	12.6	54.2	0.23	Insufficient Progress
Cte d'Ivoire	57.6	56.5	75.5	78.3	2.74	Insufficient Progress	21.8	23.4	35.6	61.7	0.82	Insufficient Progress
Gambia	55.2	65.7	86.5	82.8	4.43	Target Reached	44.3	52.2	80.7	76.1	4.31	Target Reached
Ghana	38.9	47.5	80.7	73.8	4.76	Target Reached	19.0	23.6	57.7	61.8	2.81	On Track
Guinea	20.4	38.5	65.7	69.3	2.78	On Track	12.1	14.3	30.9	57.1	1.02	Insufficient Progress
Guinea-Bissau	33.5	36.0	59.4	68.0	2.17	Insufficient Progress	26.7	33.9	37.5	67.0	0.26	Insufficient Progress
Liberia	61.7	62.9	72.7	81.5	1.46	Insufficient Progress	37.1	41.0	46.2	70.5	0.44	Insufficient Progress
Mali	21.1	29.4	61.3	64.7	2.87	On Track	1.6	2.0	30.7	51.0	1.65	Insufficient Progress
Mauritania	24.0	25.9	59.2	62.9	2.84	On Track	16.7	22.6	35.8	61.3	0.89	Insufficient Progress
Niger	36.3	30.6	47.6	65.3	1.33	Insufficient Progress	4.8	6.3	10.1	53.1	0.20	Insufficient Progress
Nigeria	41.1	40.6	60.9	70.3	2.00	Insufficient Progress	19.7	21.2	51.4	60.6	2.30	Insufficient Progress
Sao Tome and Principe	77.5	76.4	90.9	88.2	4.53	Target Reached	14.4	19.6	40.7	59.8	1.45	Insufficient Progress
Senegal	42.0	48.9	74.4	74.5	3.28	On Track	18.6	26.7	59.8	63.3	2.86	On Track
Sierra Leone	23.6	31.3	53.4	65.7	1.84	Insufficient Progress	13.6	23.2	36.0	61.6	0.87	Insufficient Progress
Togo	69.3	68.2	61.6	84.1	-0.89	Insufficient Progress	7.7	32.5	40.4	66.3	0.59	Insufficient Progress

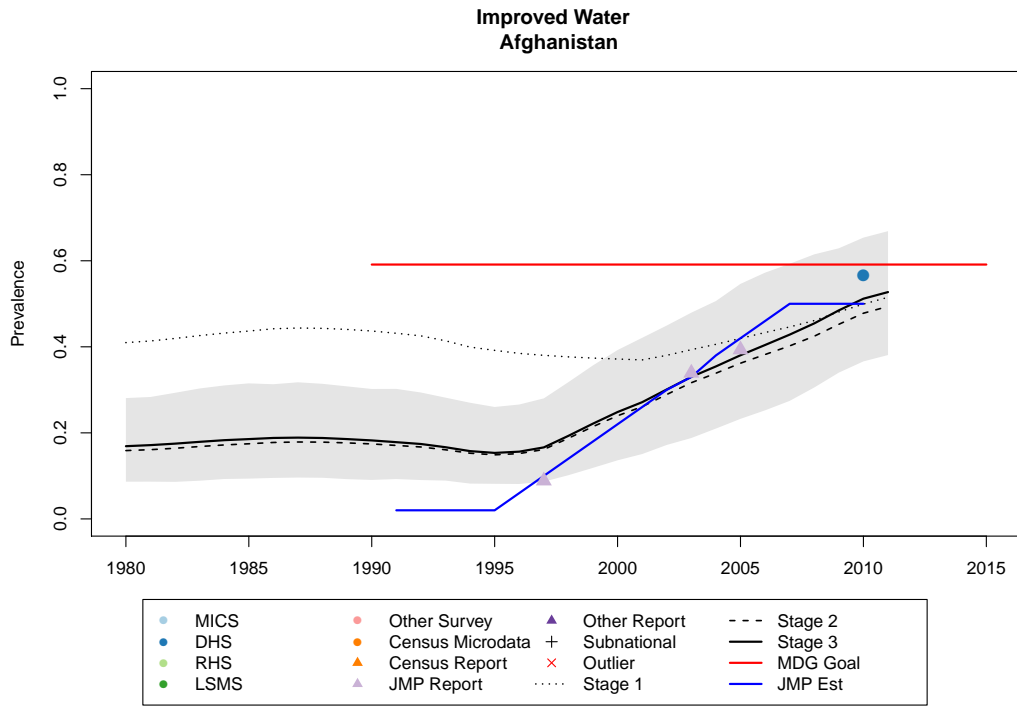


Figure A.1: Prevalence of access to improved water, Afghanistan

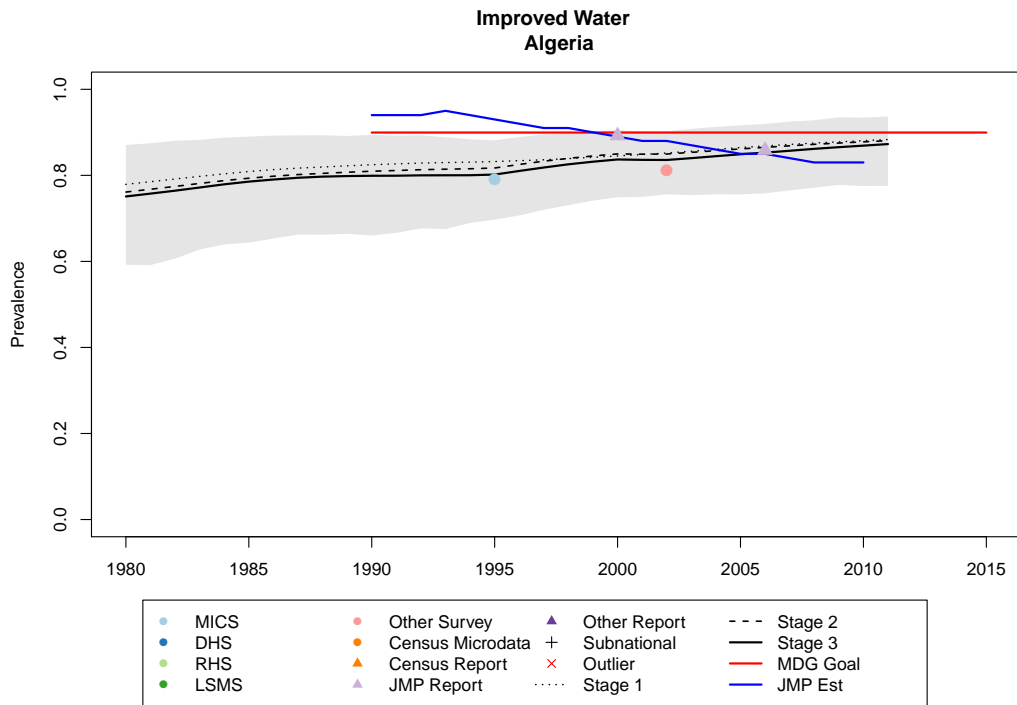


Figure A.2: Prevalence of access to improved water, Algeria

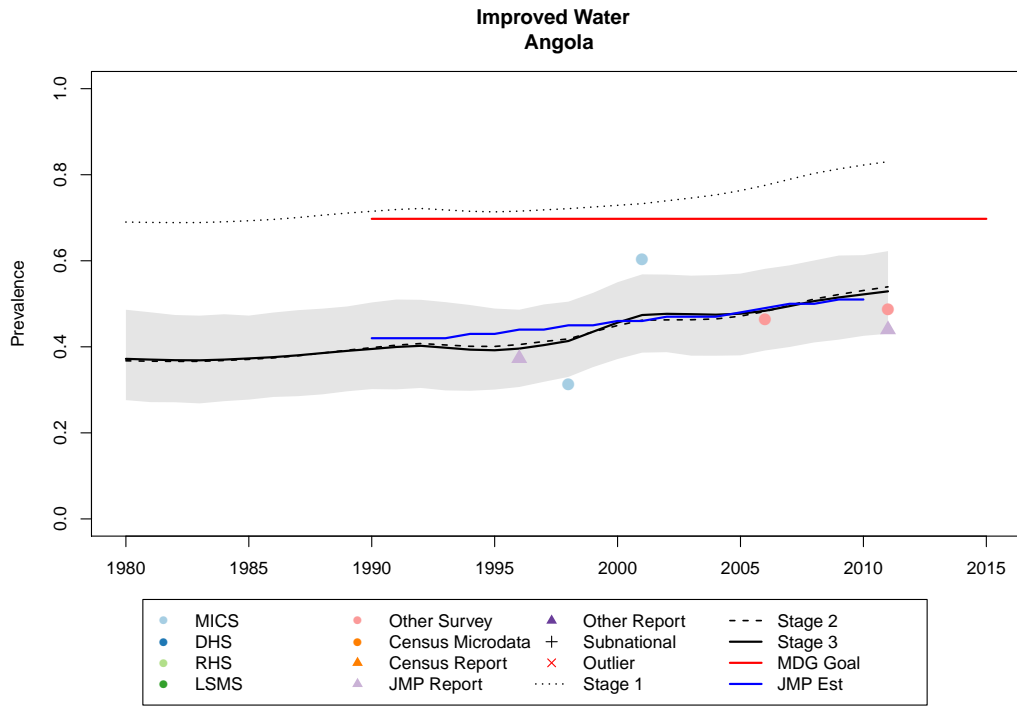


Figure A.3: Prevalence of access to improved water, Angola

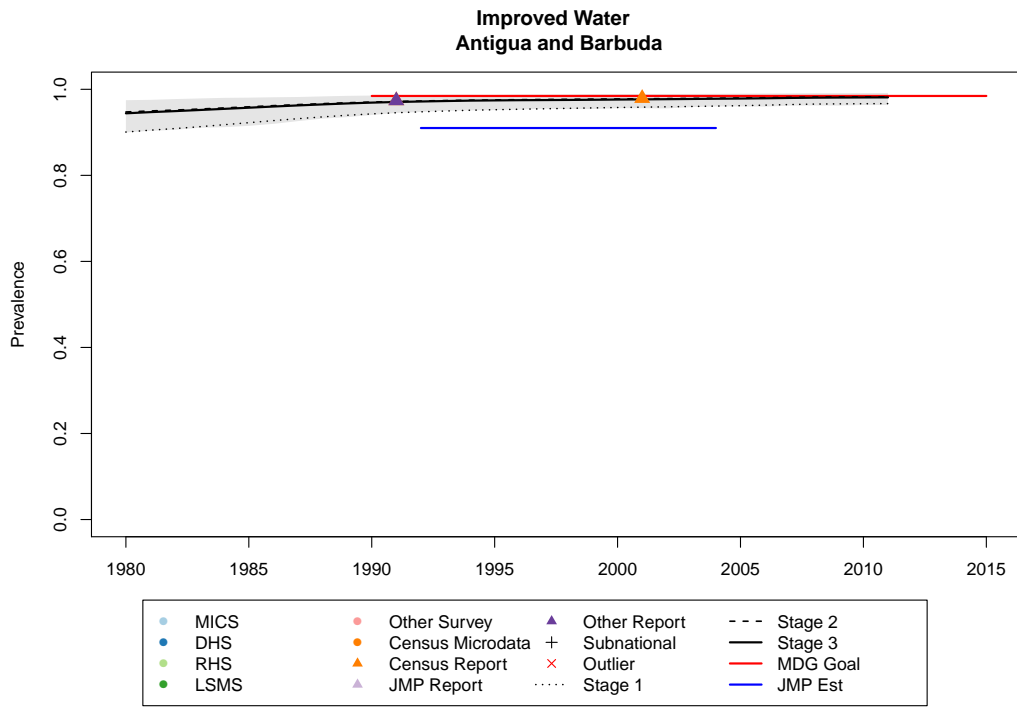


Figure A.4: Prevalence of access to improved water, Antigua and Barbuda

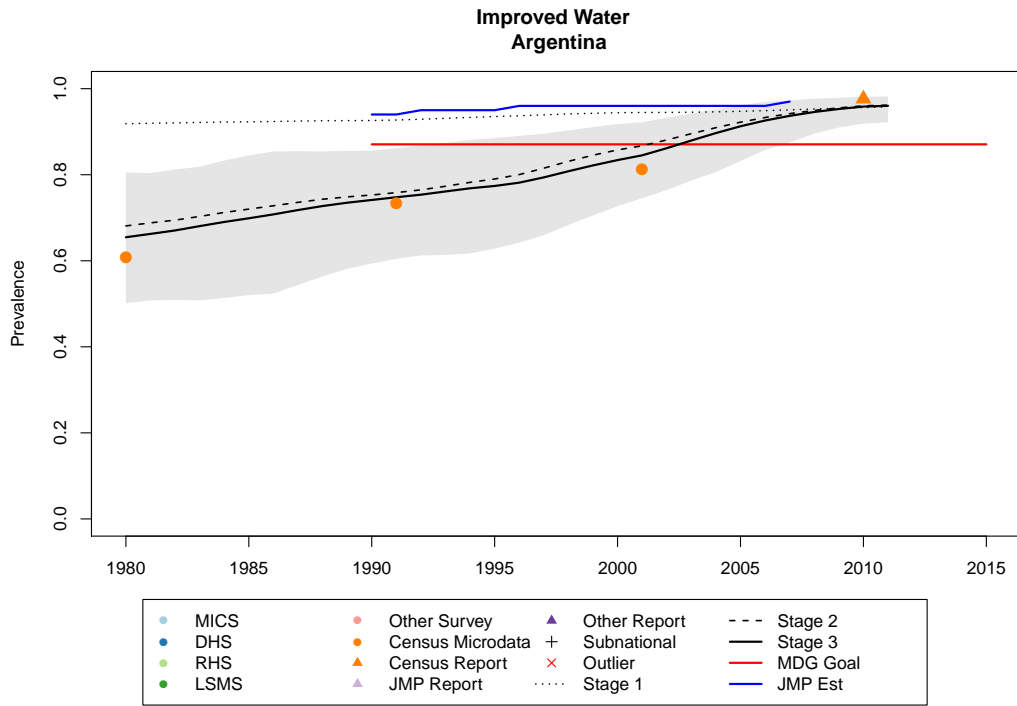


Figure A.5: Prevalence of access to improved water, Argentina

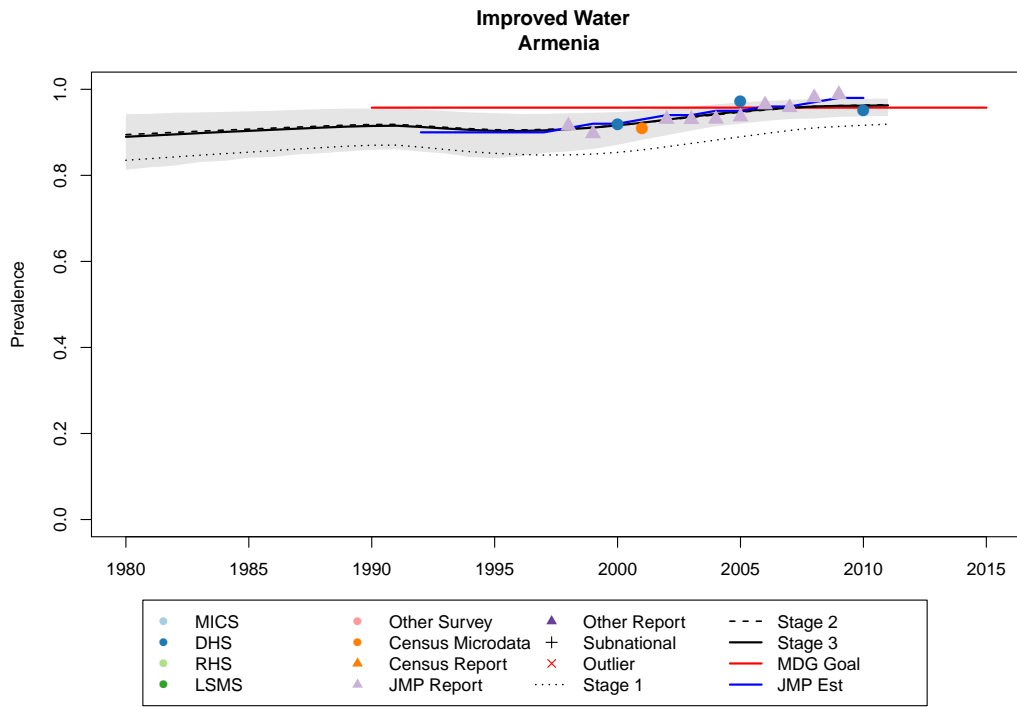


Figure A.6: Prevalence of access to improved water, Armenia

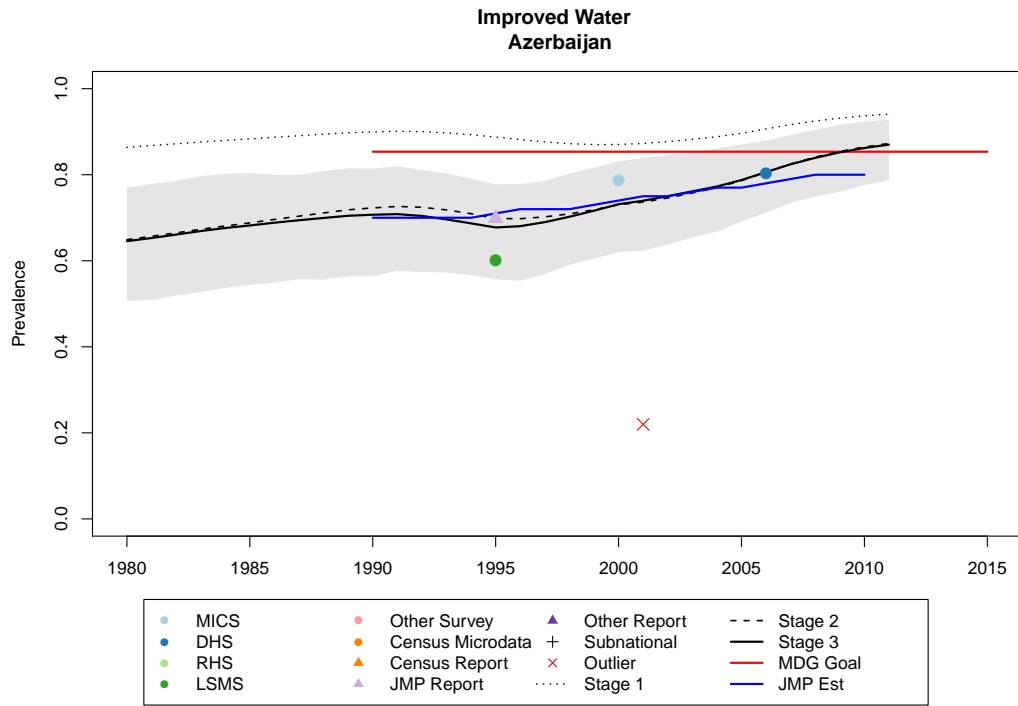


Figure A.7: Prevalence of access to improved water, Azerbaijan

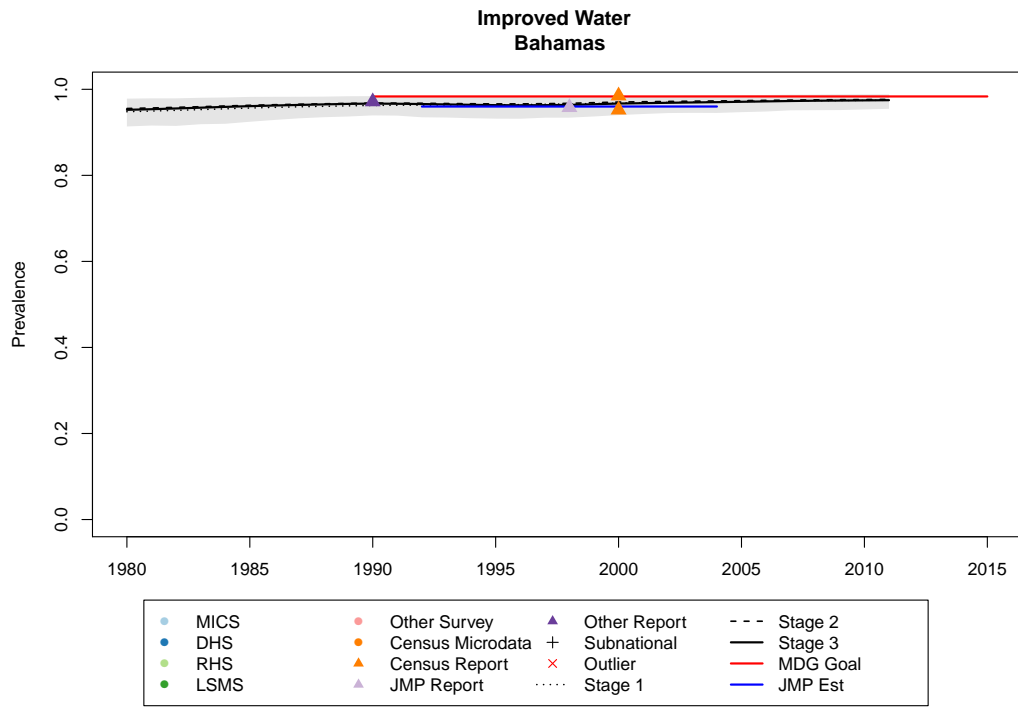


Figure A.8: Prevalence of access to improved water, Bahamas

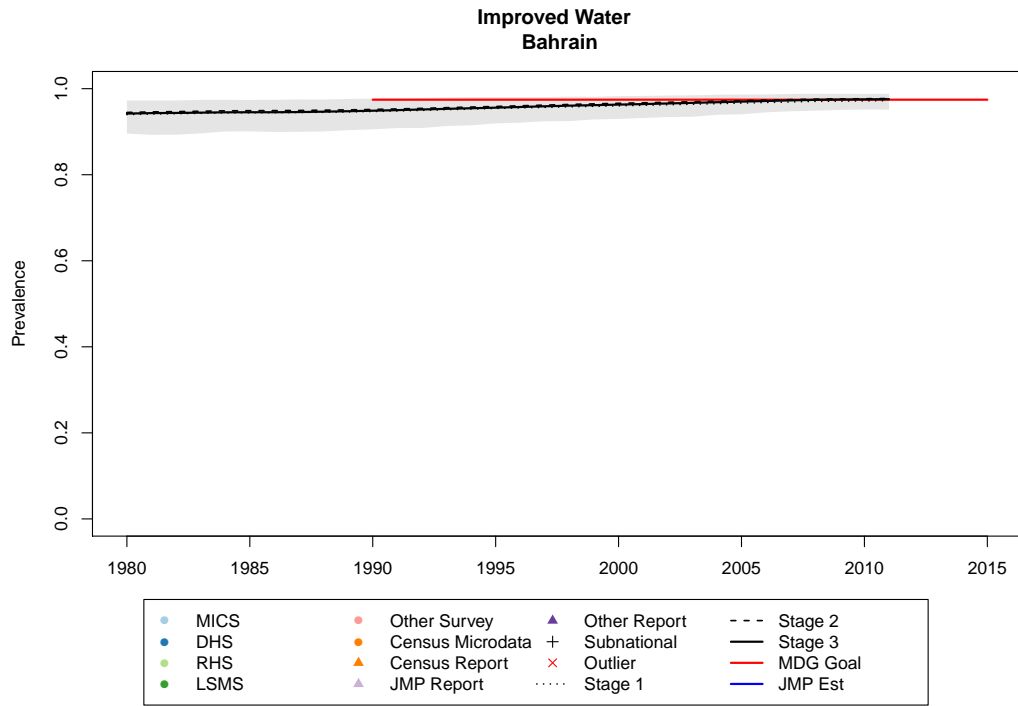


Figure A.9: Prevalence of access to improved water, Bahrain

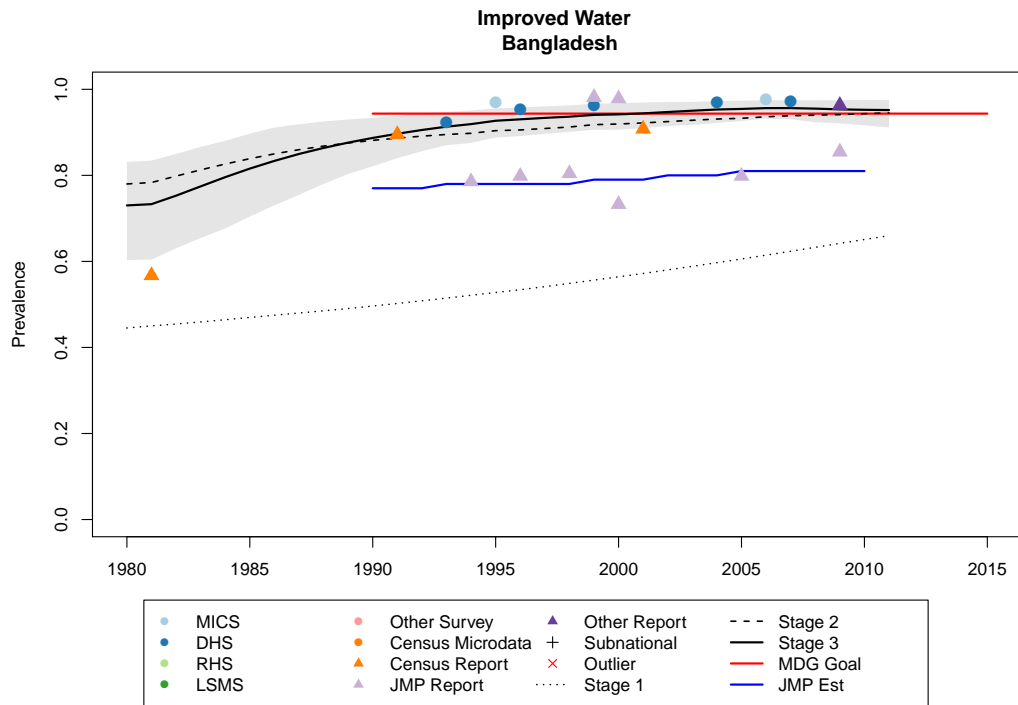


Figure A.10: Prevalence of access to improved water, Bangladesh

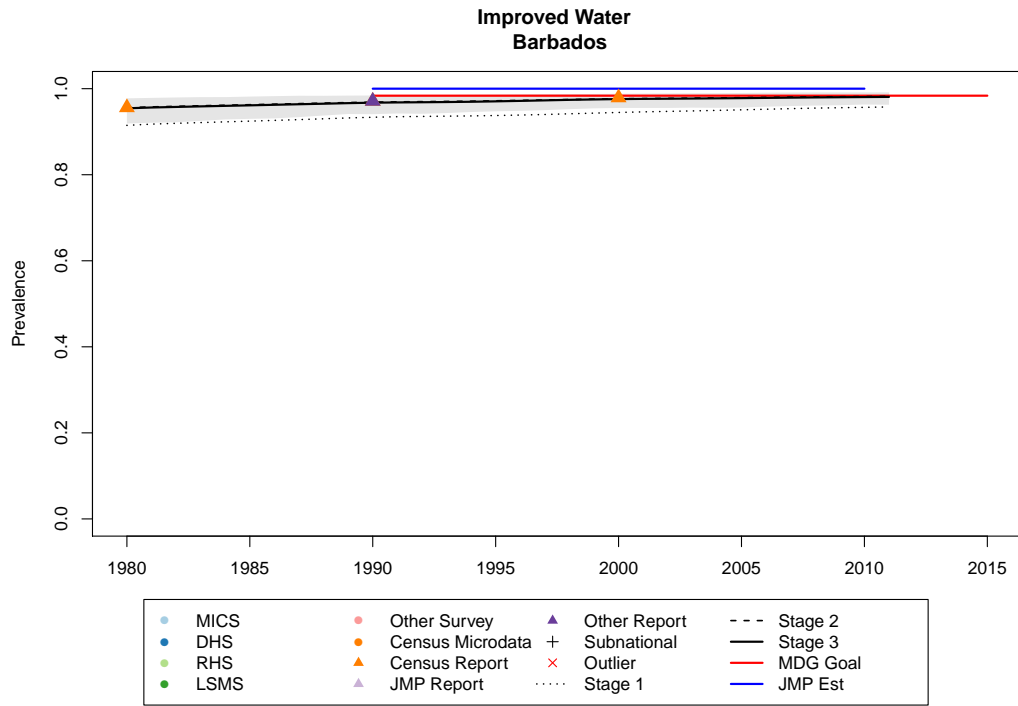


Figure A.11: Prevalence of access to improved water, Barbados

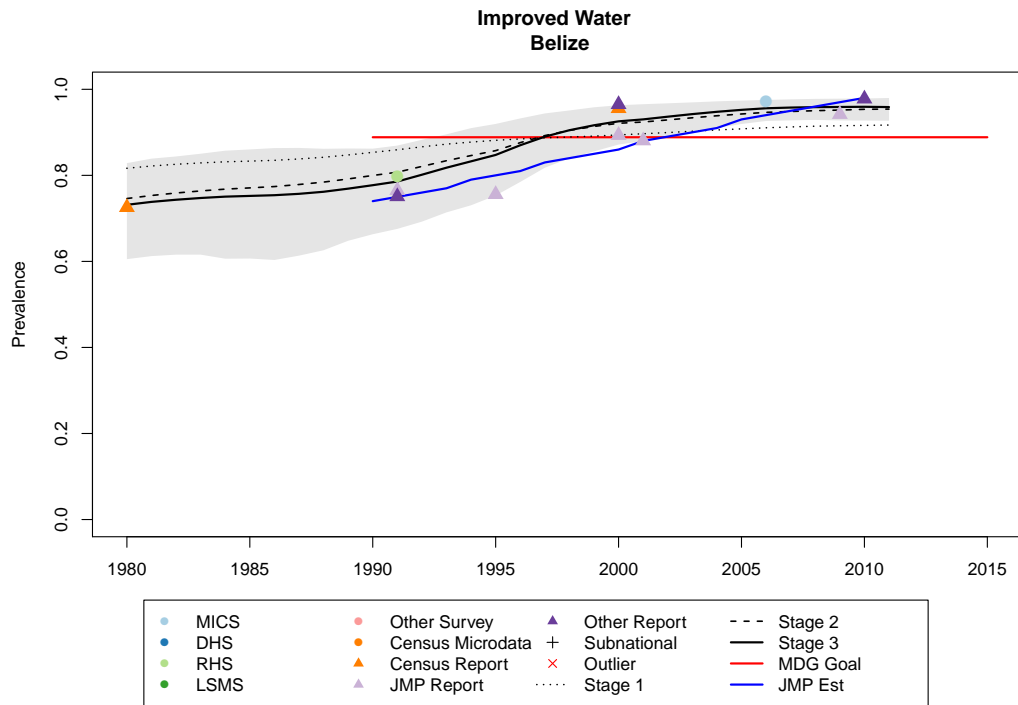


Figure A.12: Prevalence of access to improved water, Belize

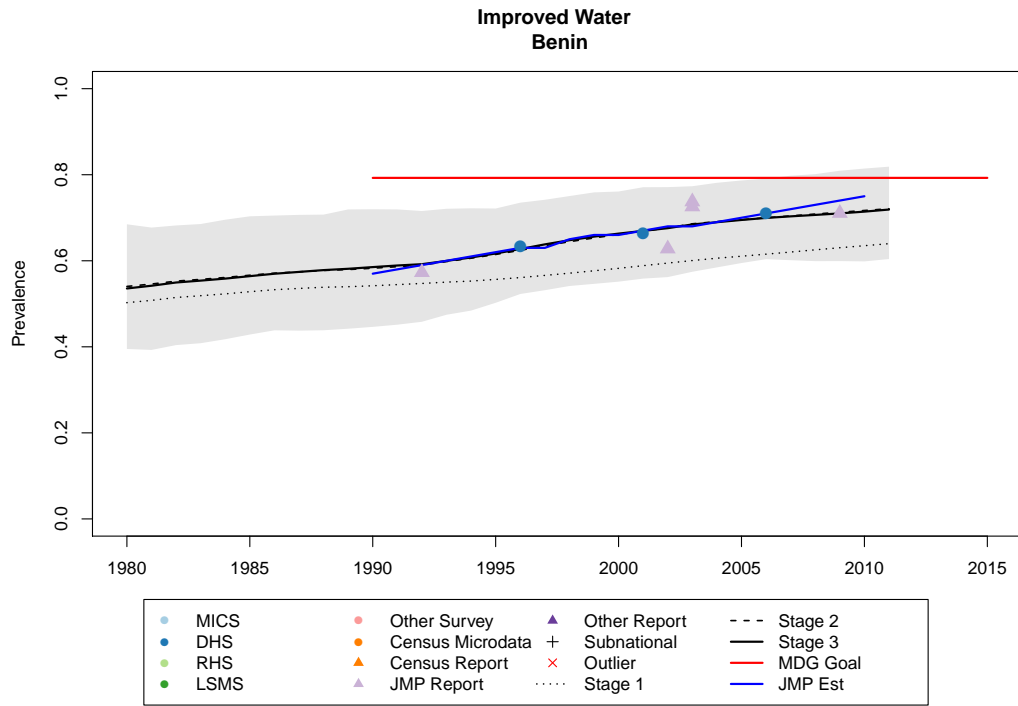


Figure A.13: Prevalence of access to improved water, Benin

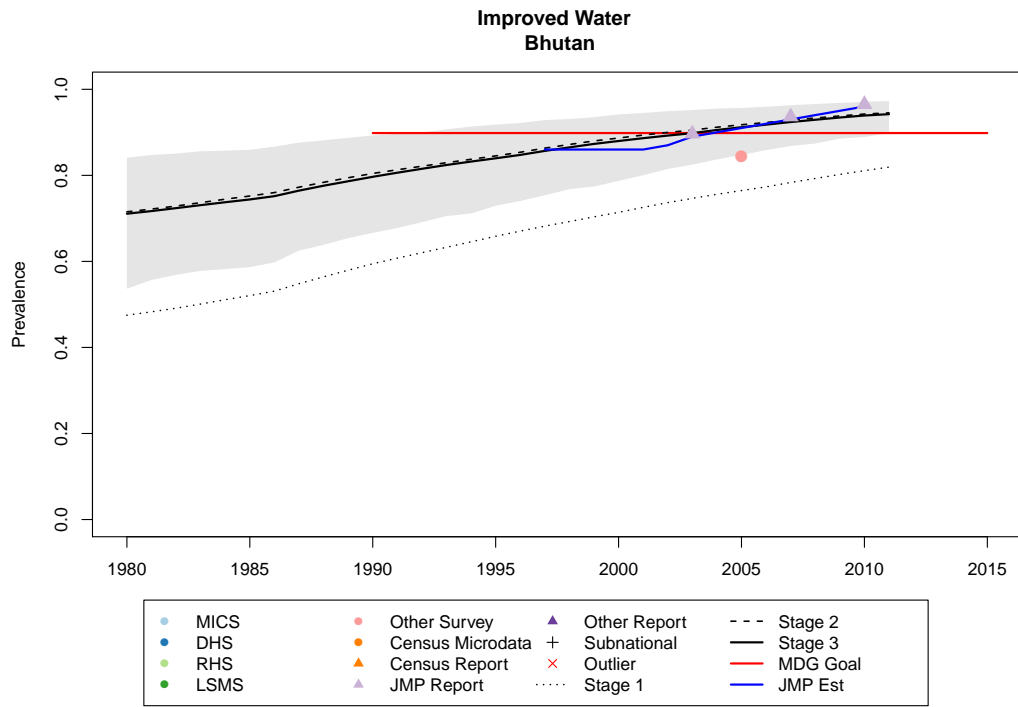


Figure A.14: Prevalence of access to improved water, Bhutan

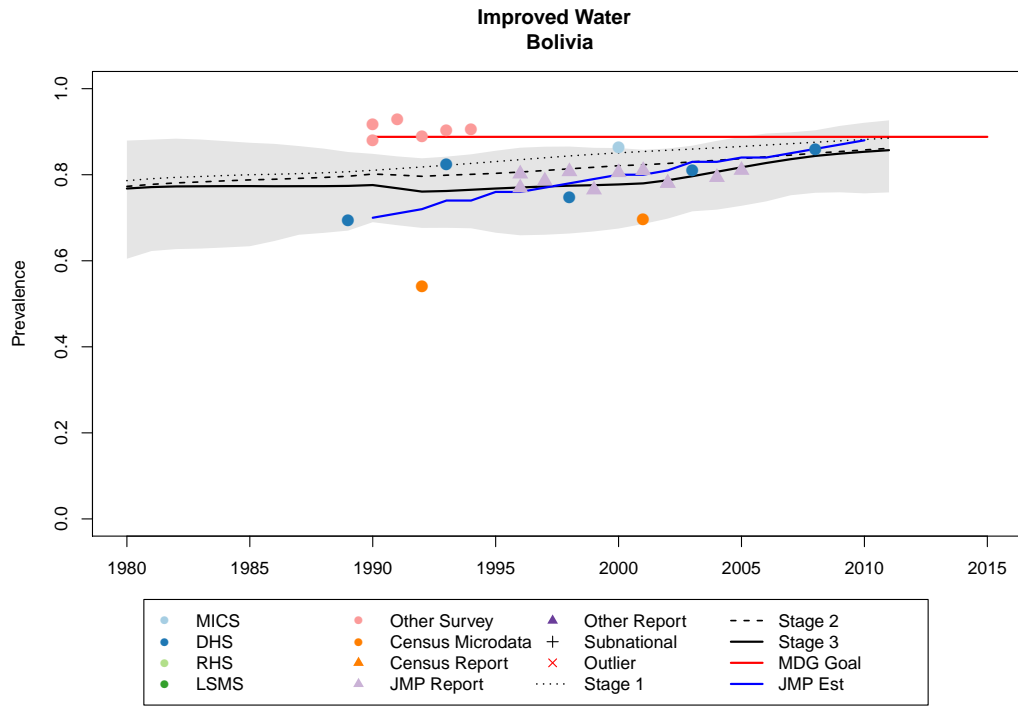


Figure A.15: Prevalence of access to improved water, Bolivia

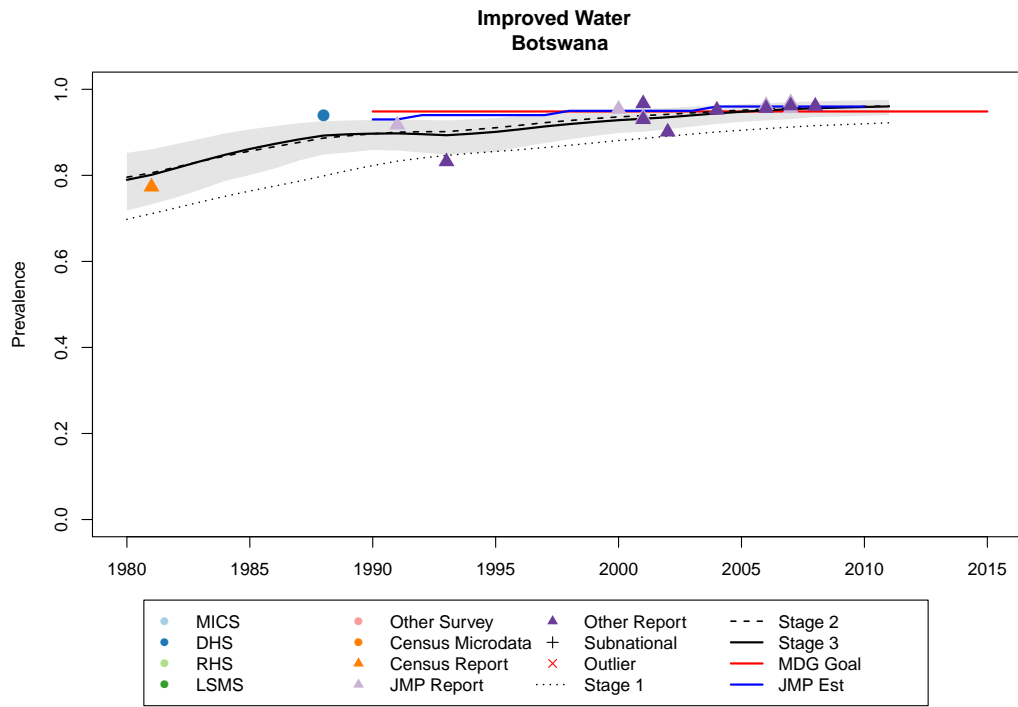


Figure A.16: Prevalence of access to improved water, Botswana

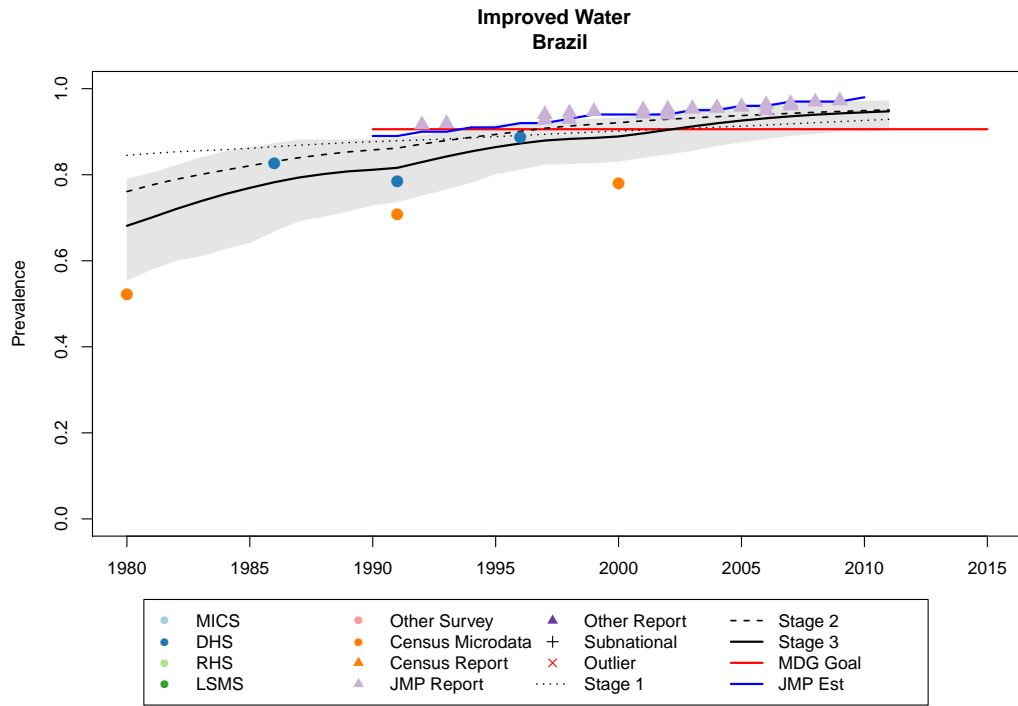


Figure A.17: Prevalence of access to improved water, Brazil

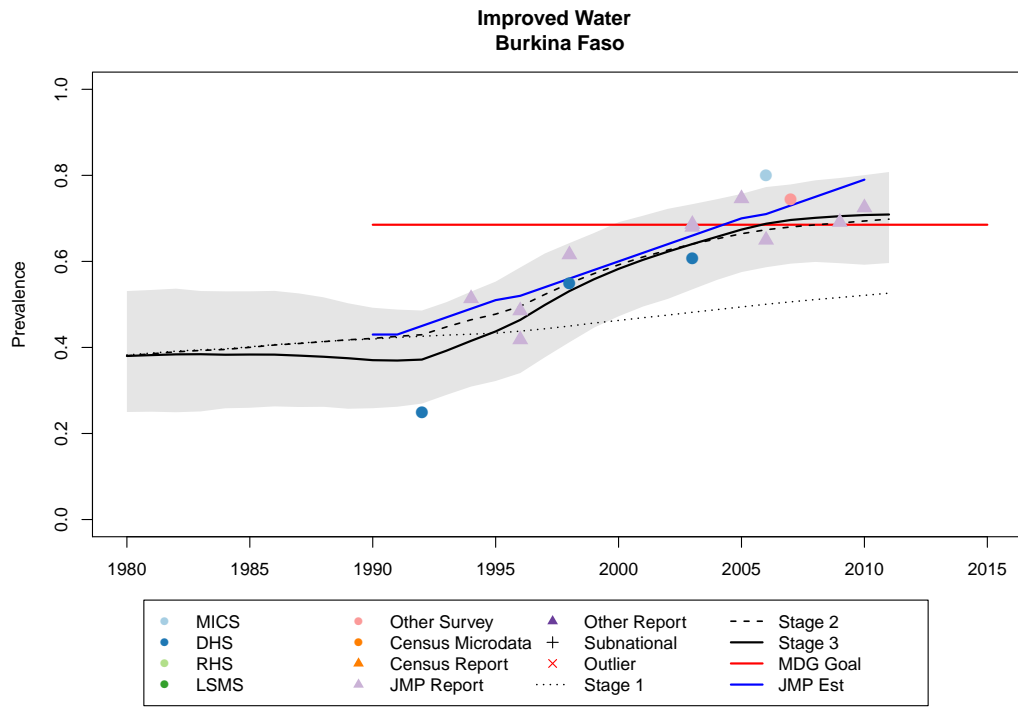


Figure A.18: Prevalence of access to improved water, Burkina Faso

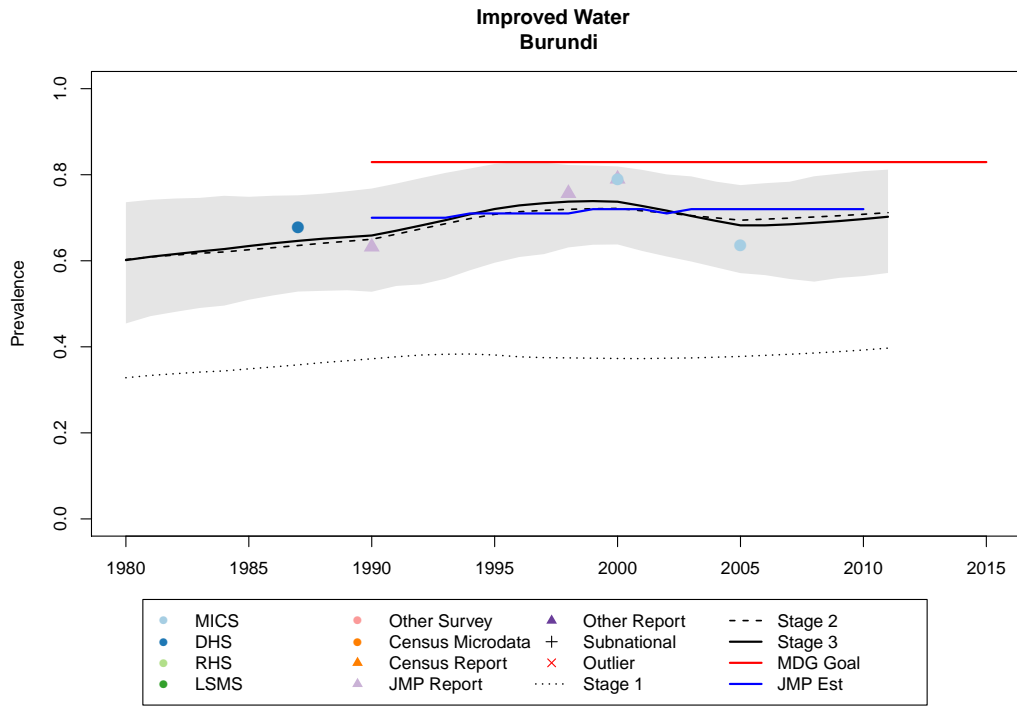


Figure A.19: Prevalence of access to improved water, Burundi

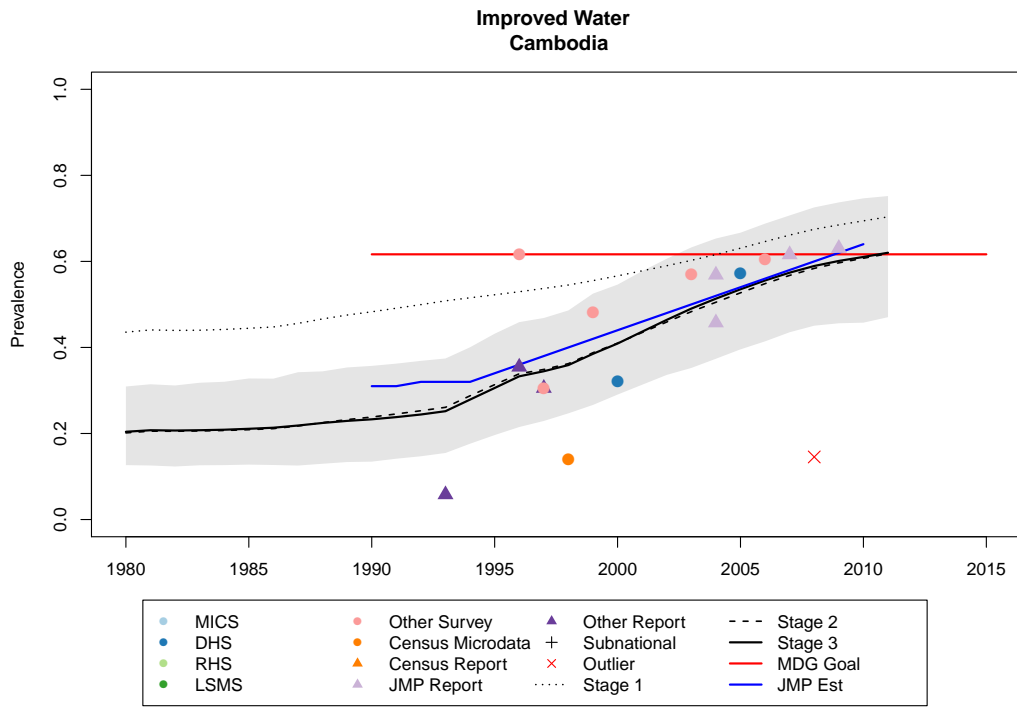


Figure A.20: Prevalence of access to improved water, Cambodia

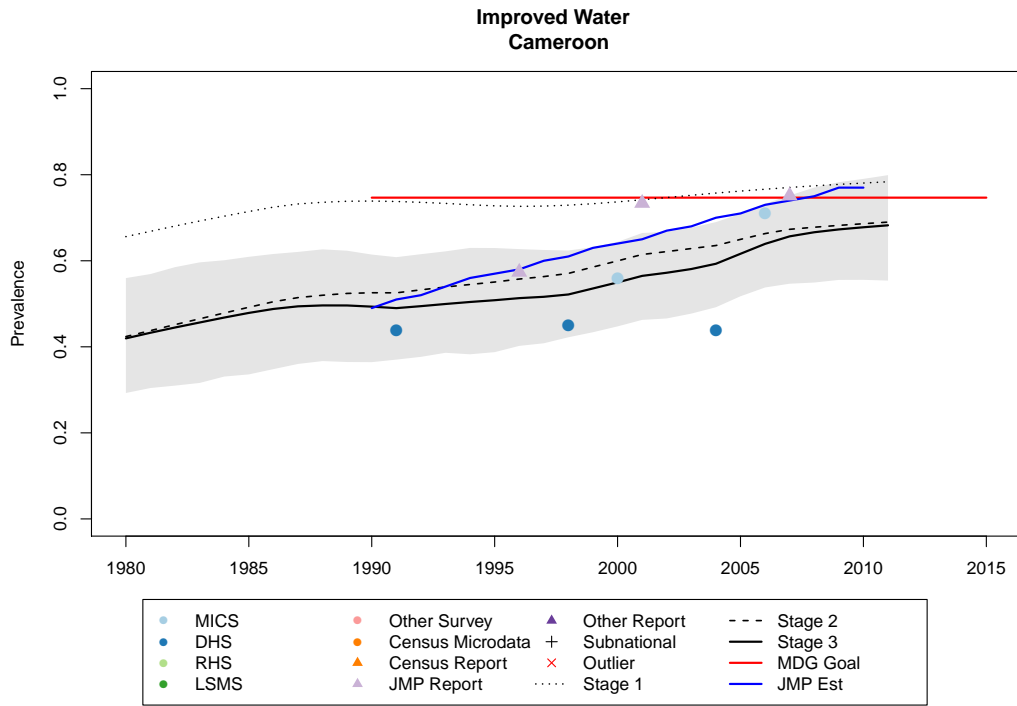


Figure A.21: Prevalence of access to improved water, Cameroon

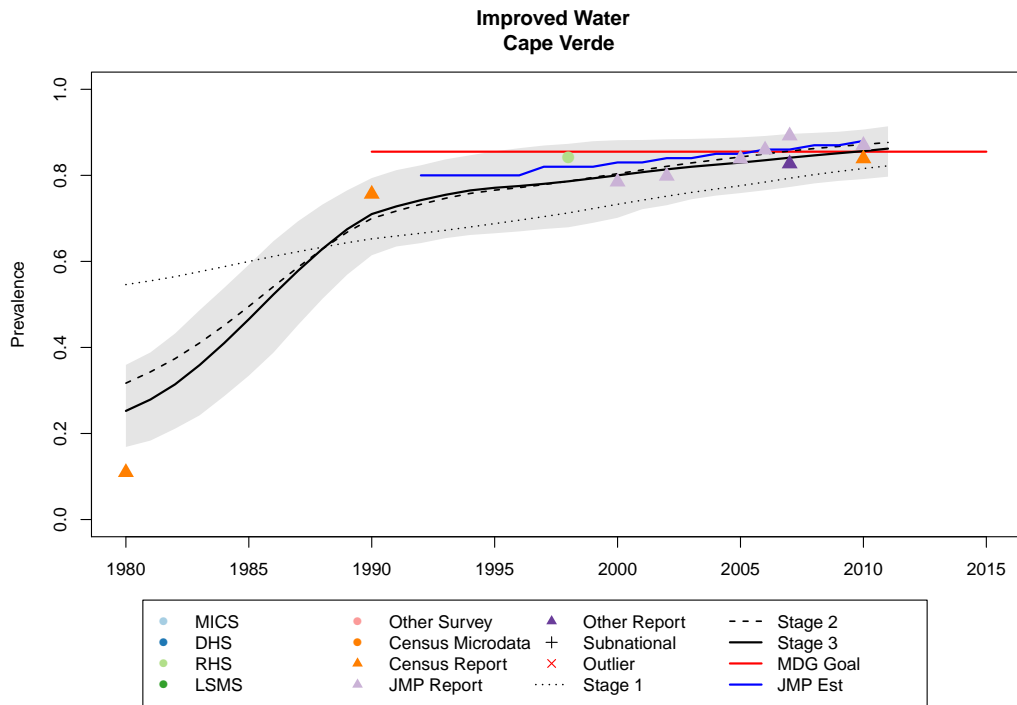


Figure A.22: Prevalence of access to improved water, Cape Verde

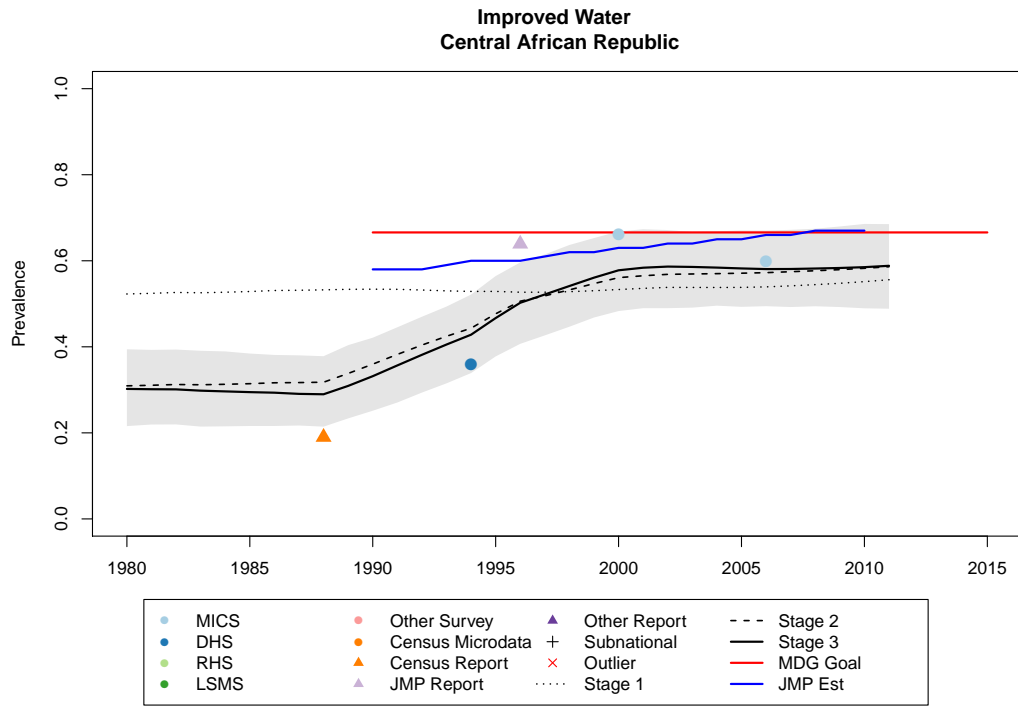


Figure A.23: Prevalence of access to improved water, Central African Republic

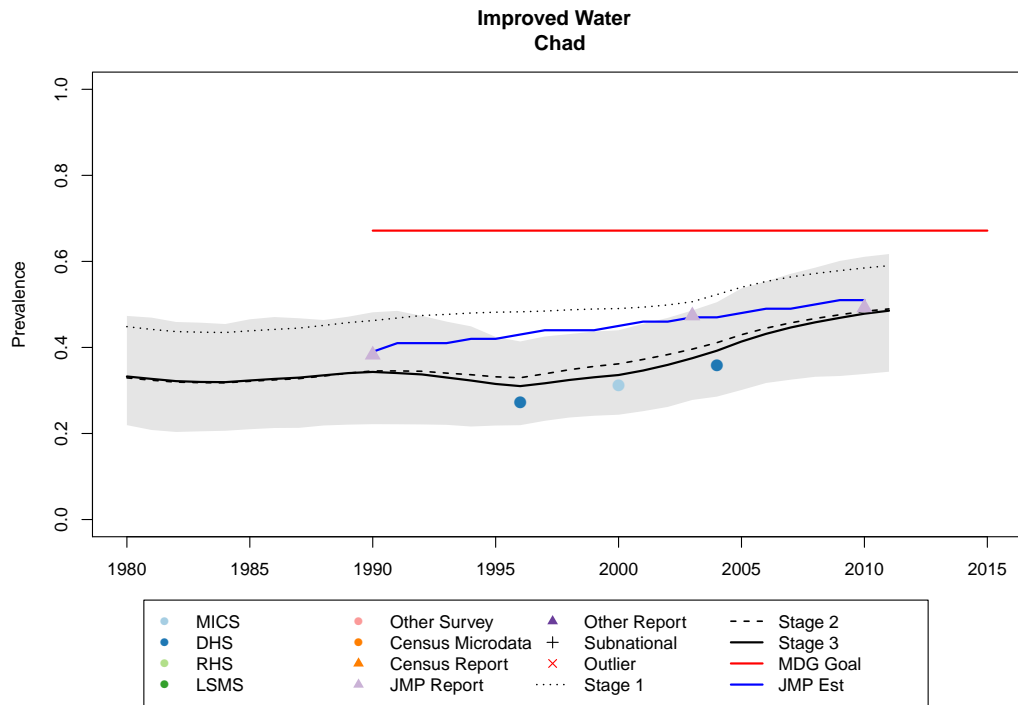


Figure A.24: Prevalence of access to improved water, Chad

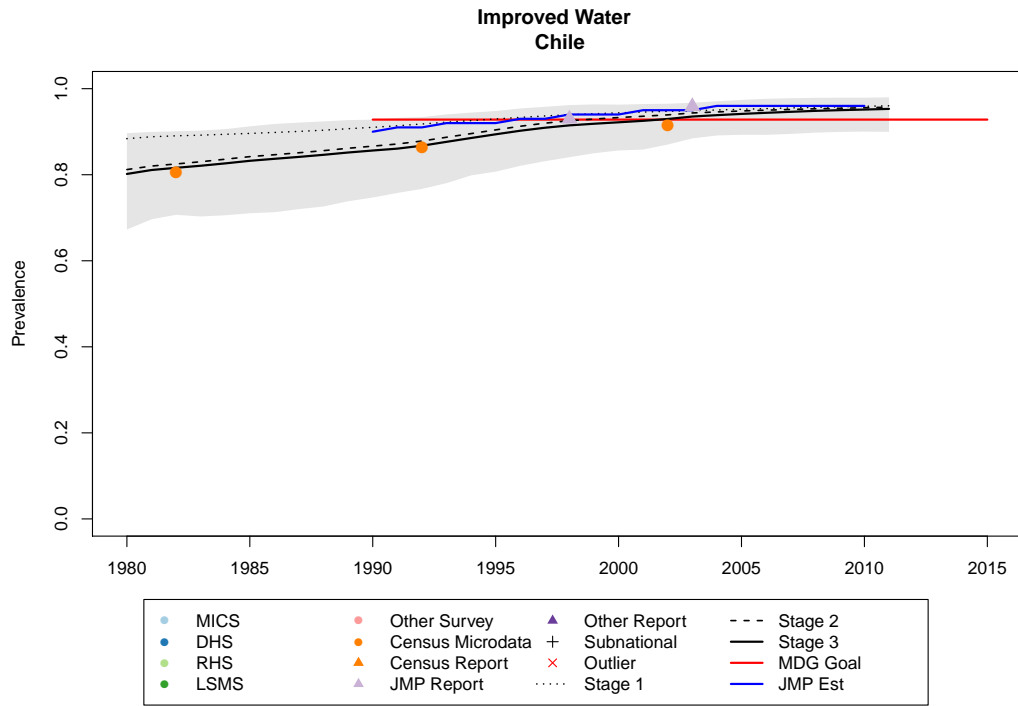


Figure A.25: Prevalence of access to improved water, Chile

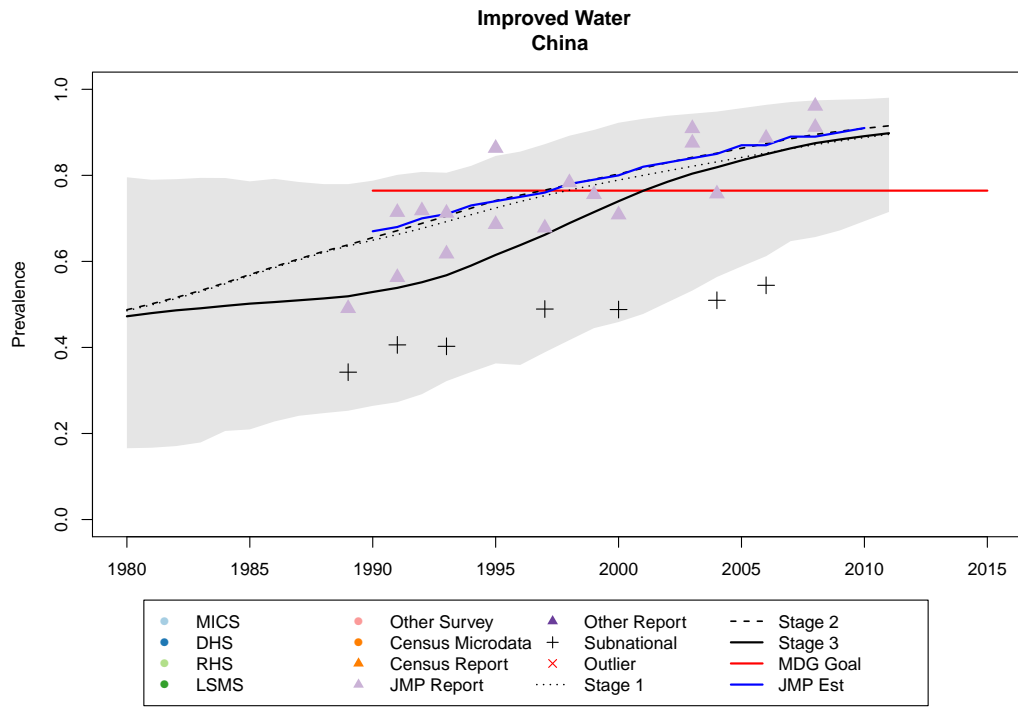


Figure A.26: Prevalence of access to improved water, China

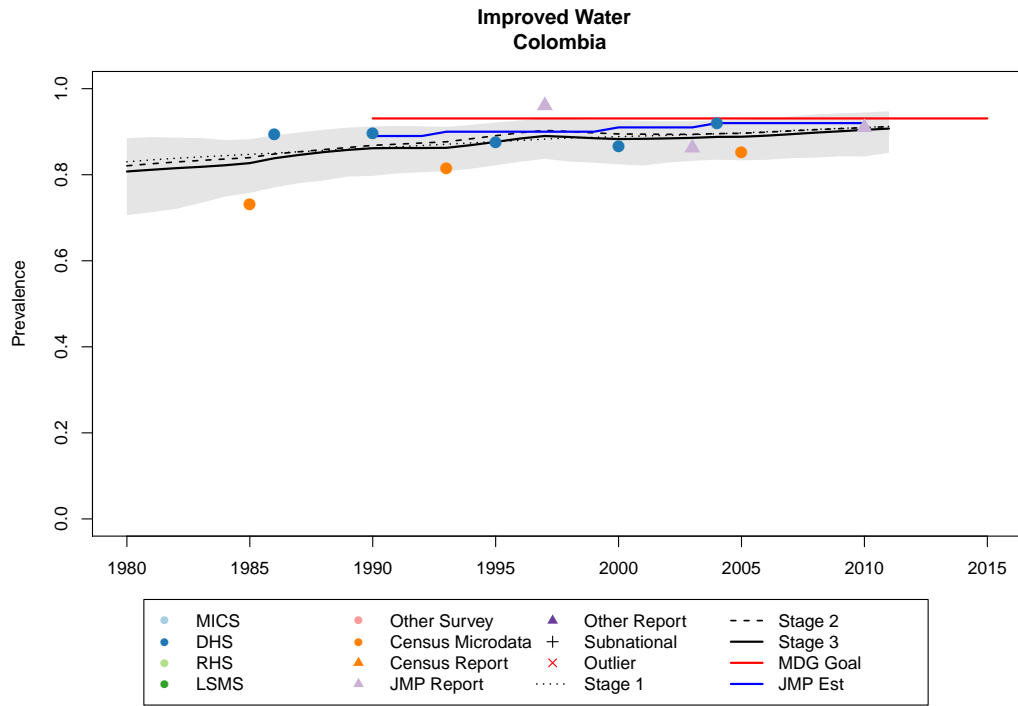


Figure A.27: Prevalence of access to improved water, Colombia

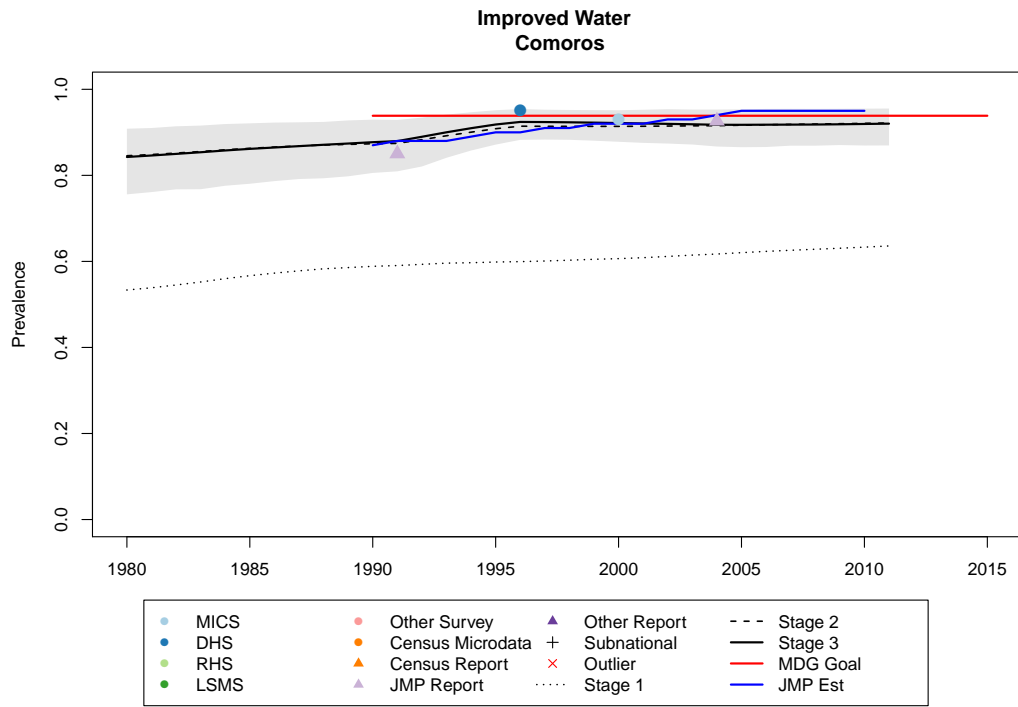


Figure A.28: Prevalence of access to improved water, Comoros

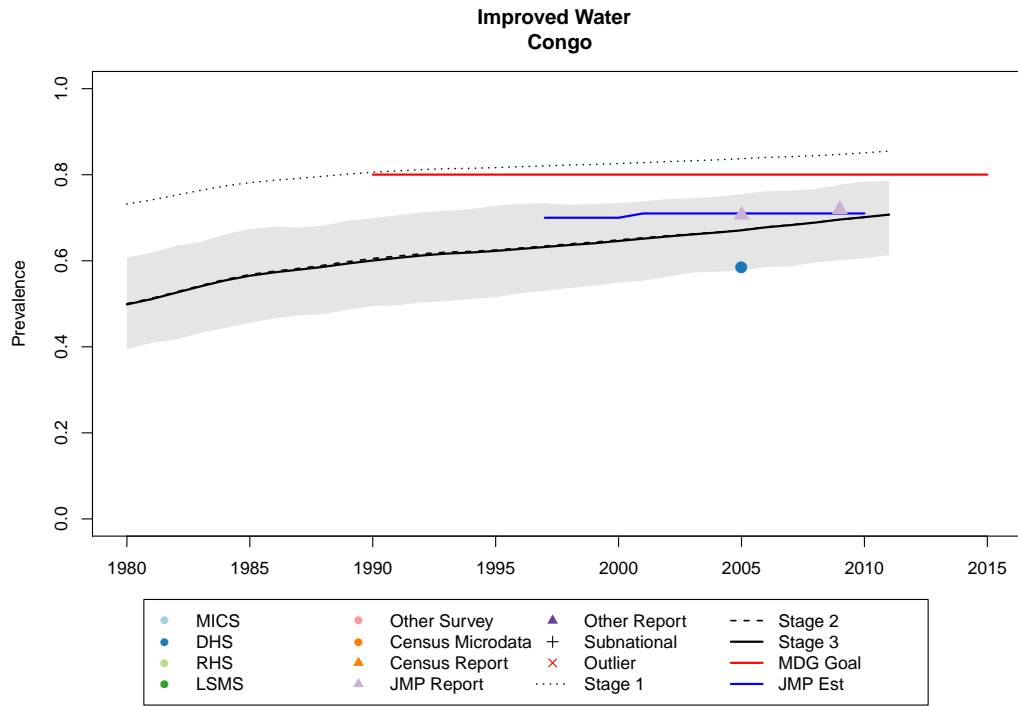


Figure A.29: Prevalence of access to improved water, Congo

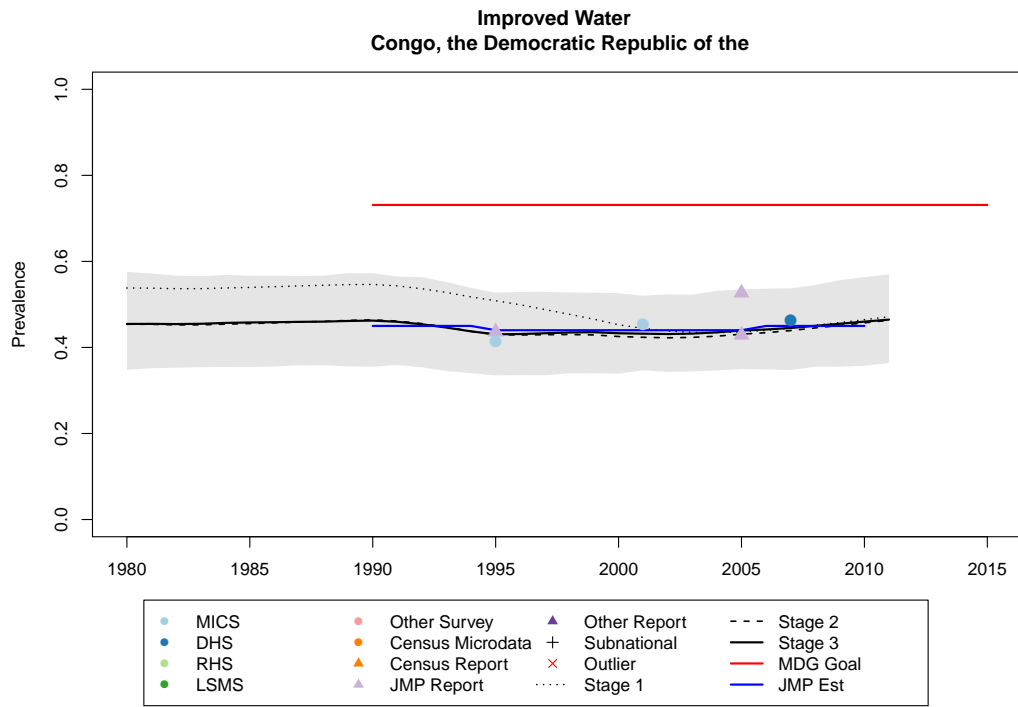


Figure A.30: Prevalence of access to improved water, Congo, the Democratic Republic of the

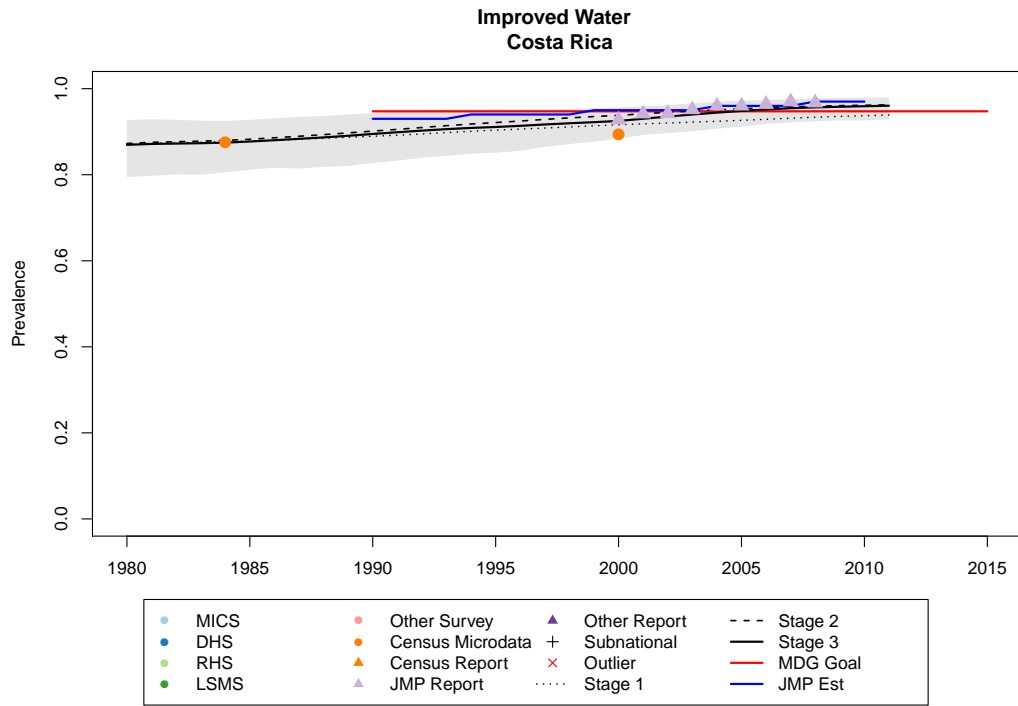


Figure A.31: Prevalence of access to improved water, Costa Rica

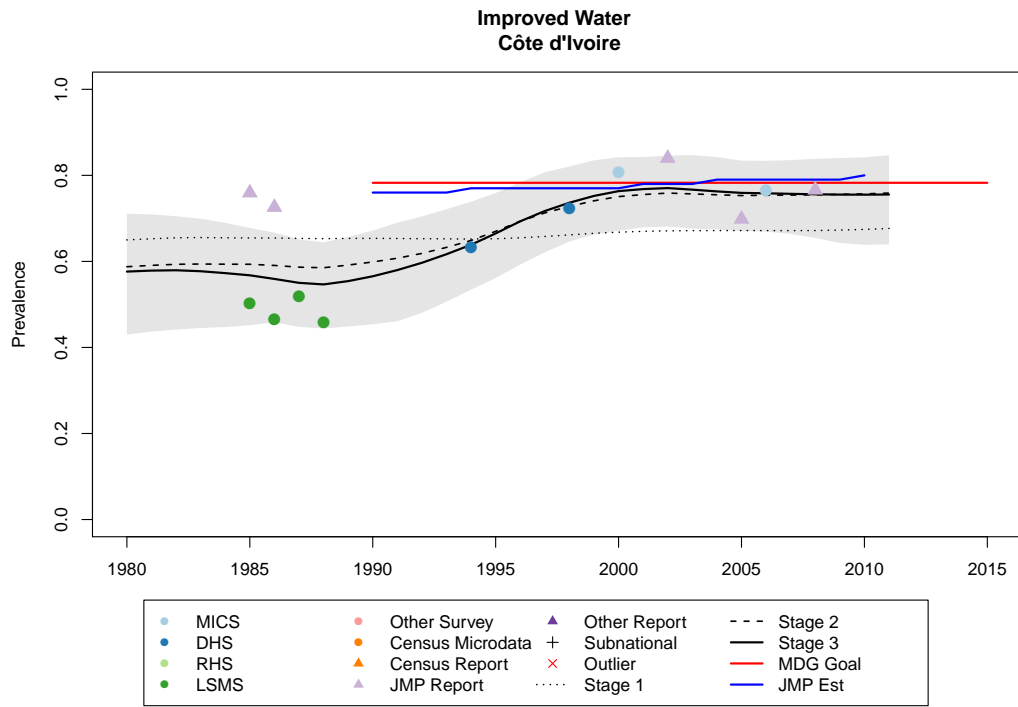


Figure A.32: Prevalence of access to improved water, Cte d'Ivoire

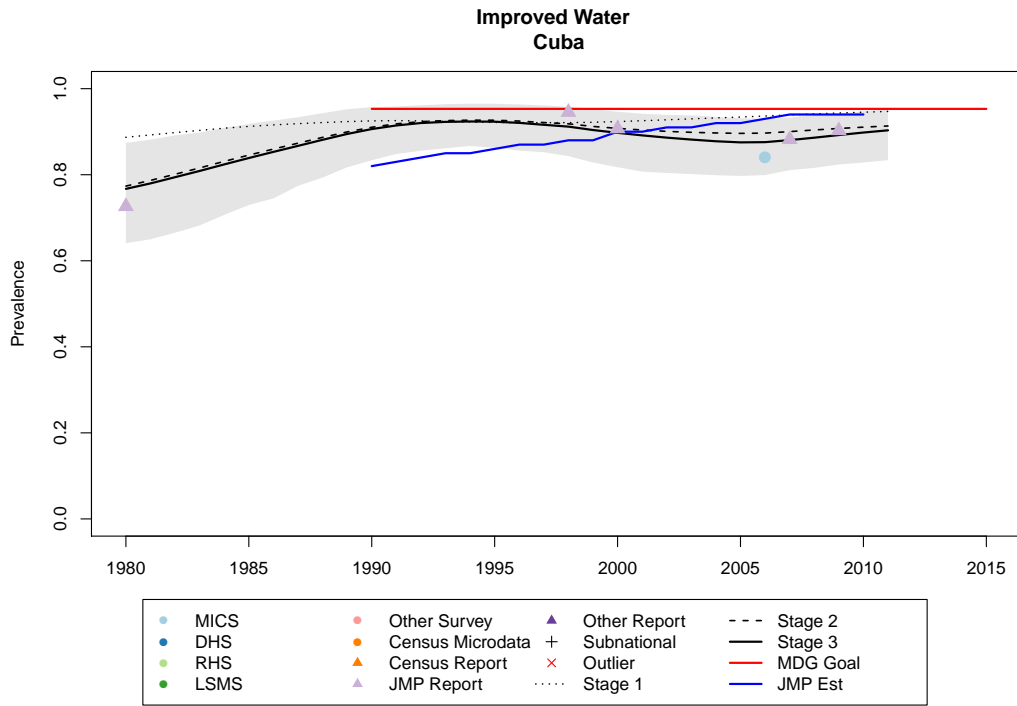


Figure A.33: Prevalence of access to improved water, Cuba

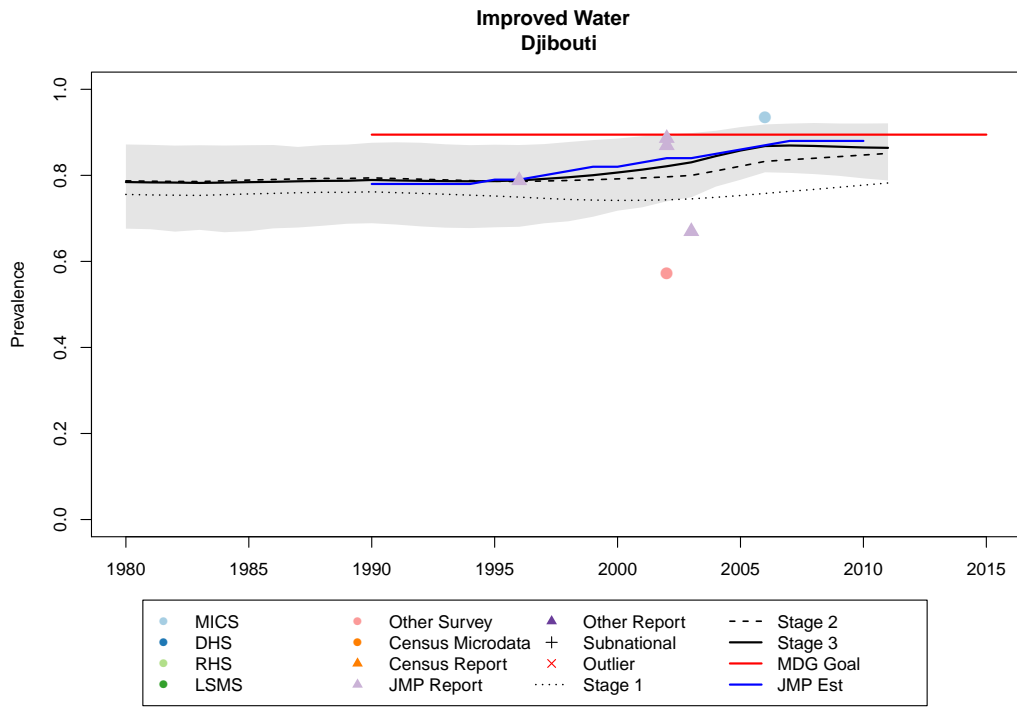


Figure A.34: Prevalence of access to improved water, Djibouti

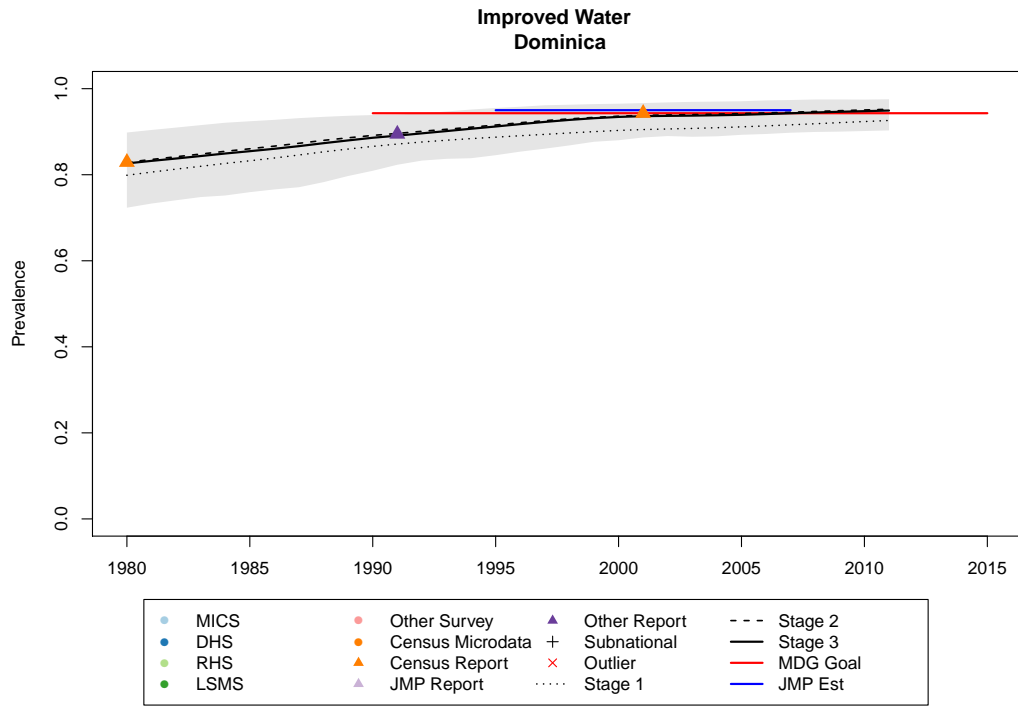


Figure A.35: Prevalence of access to improved water, Dominica

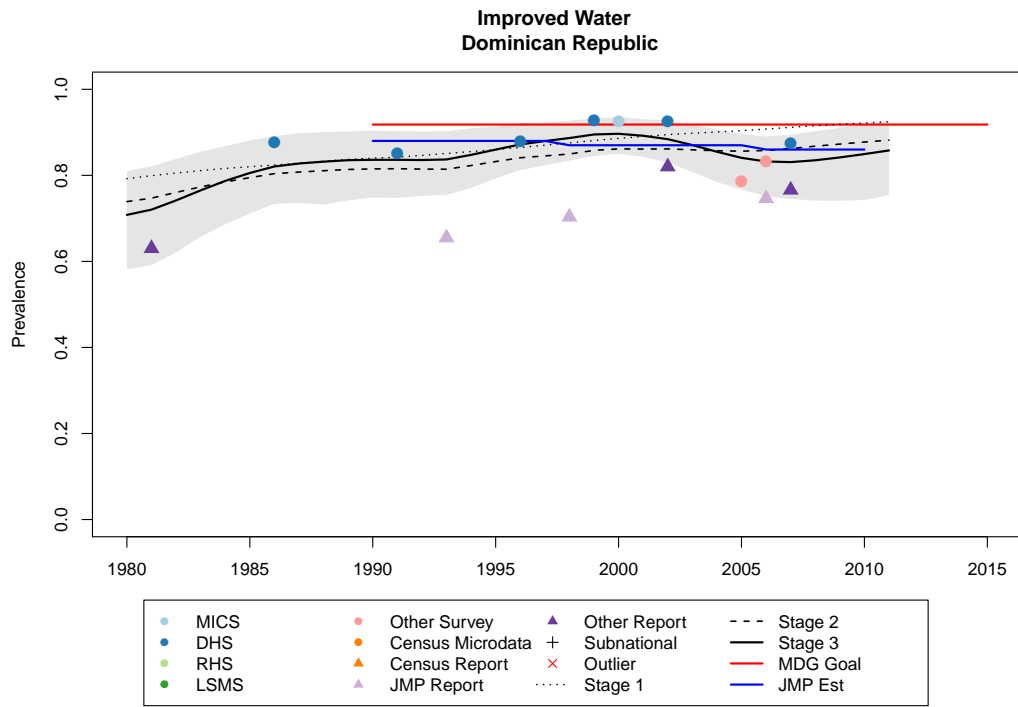


Figure A.36: Prevalence of access to improved water, Dominican Republic

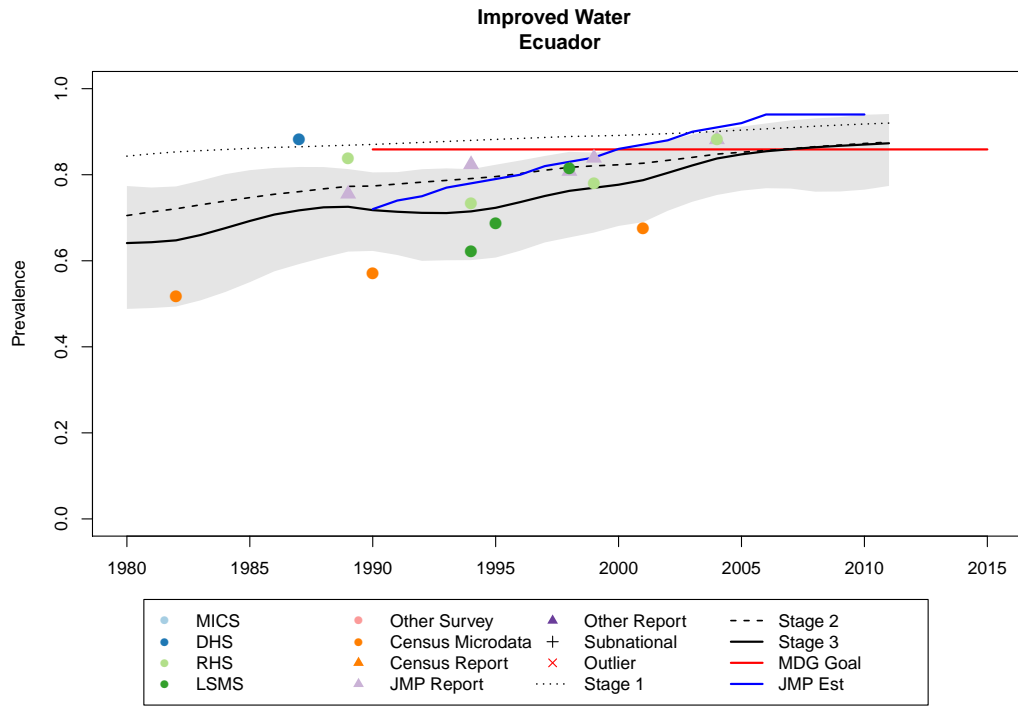


Figure A.37: Prevalence of access to improved water, Ecuador

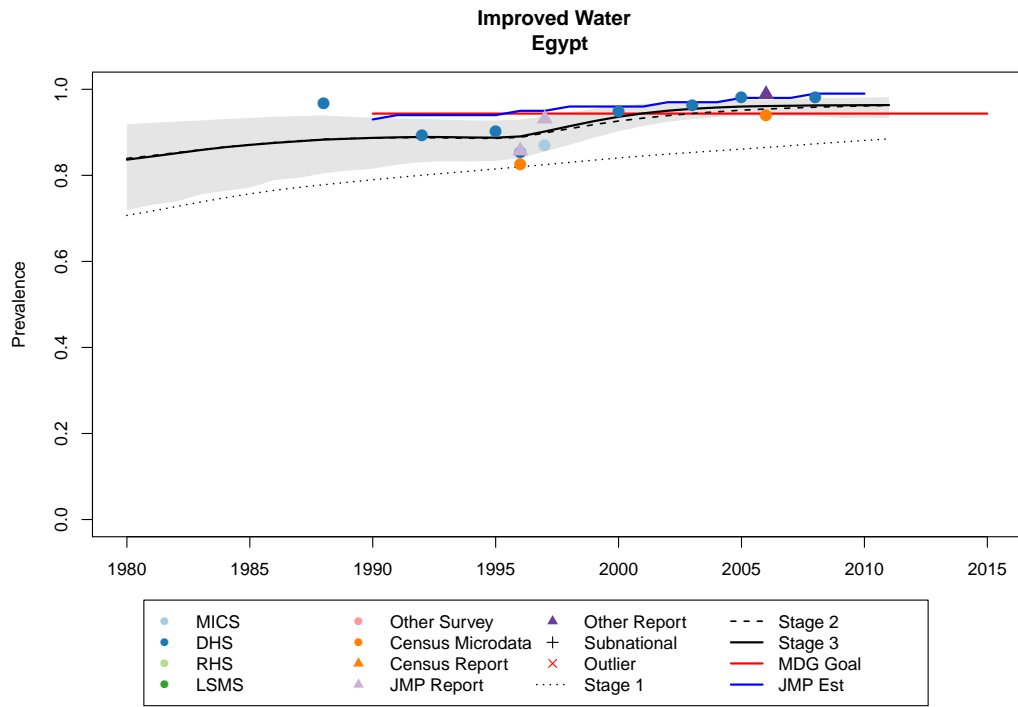


Figure A.38: Prevalence of access to improved water, Egypt

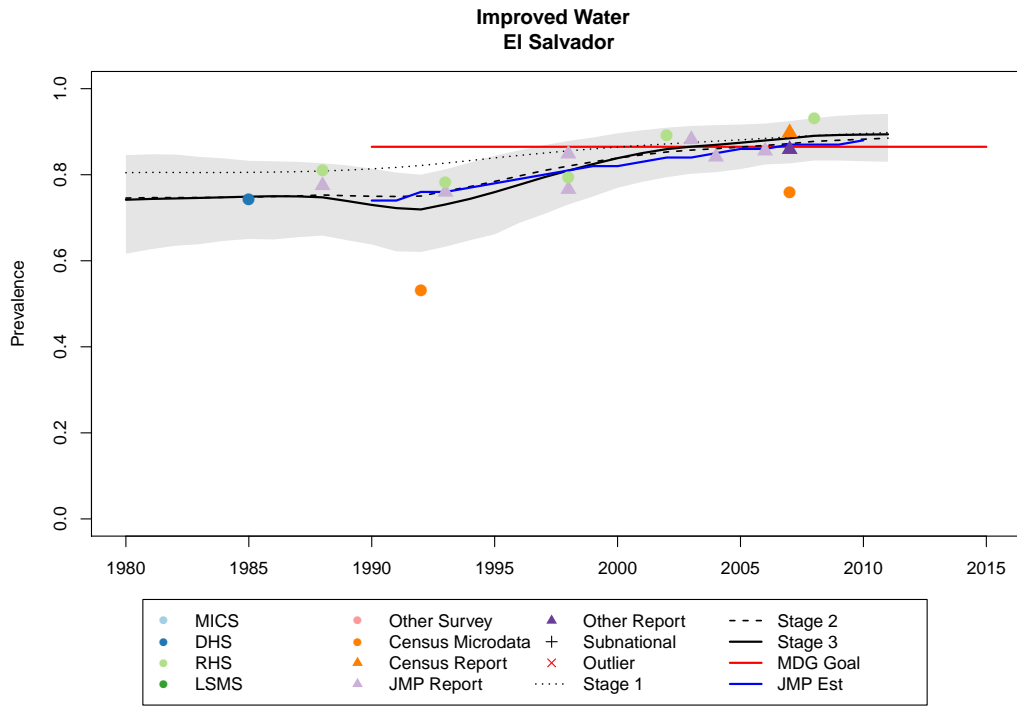


Figure A.39: Prevalence of access to improved water, El Salvador

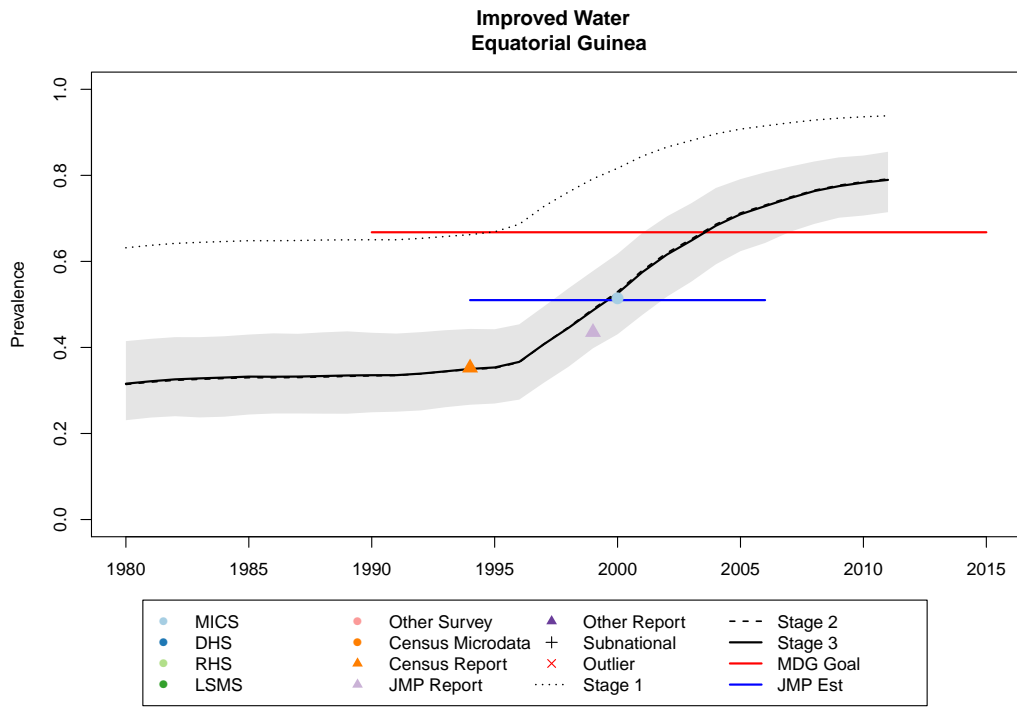


Figure A.40: Prevalence of access to improved water, Equatorial Guinea

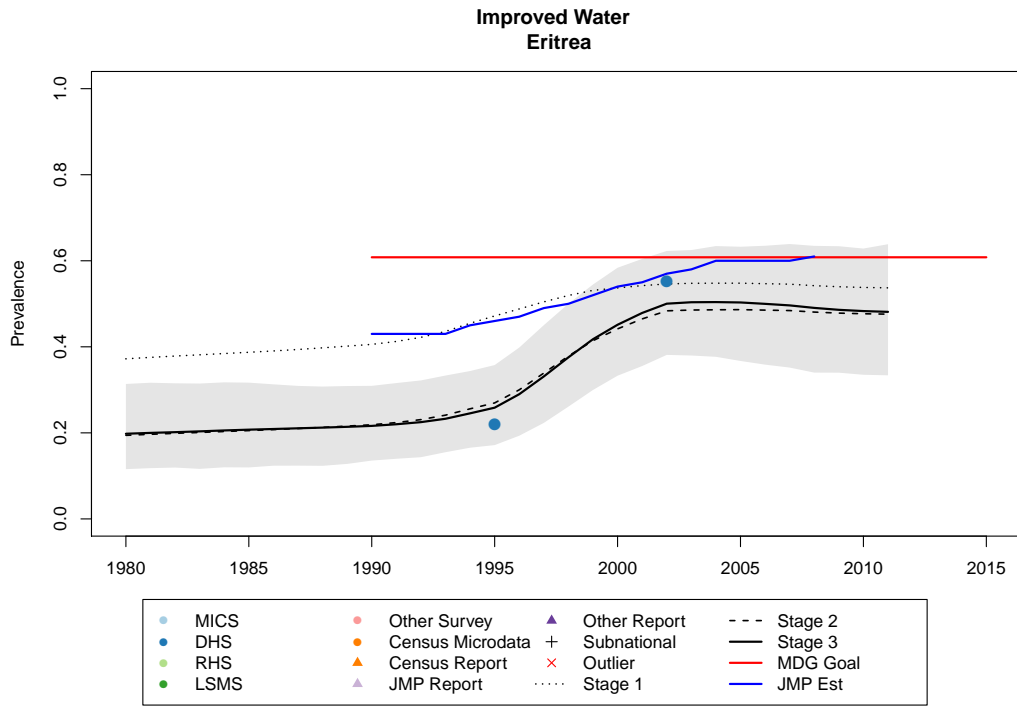


Figure A.41: Prevalence of access to improved water, Eritrea

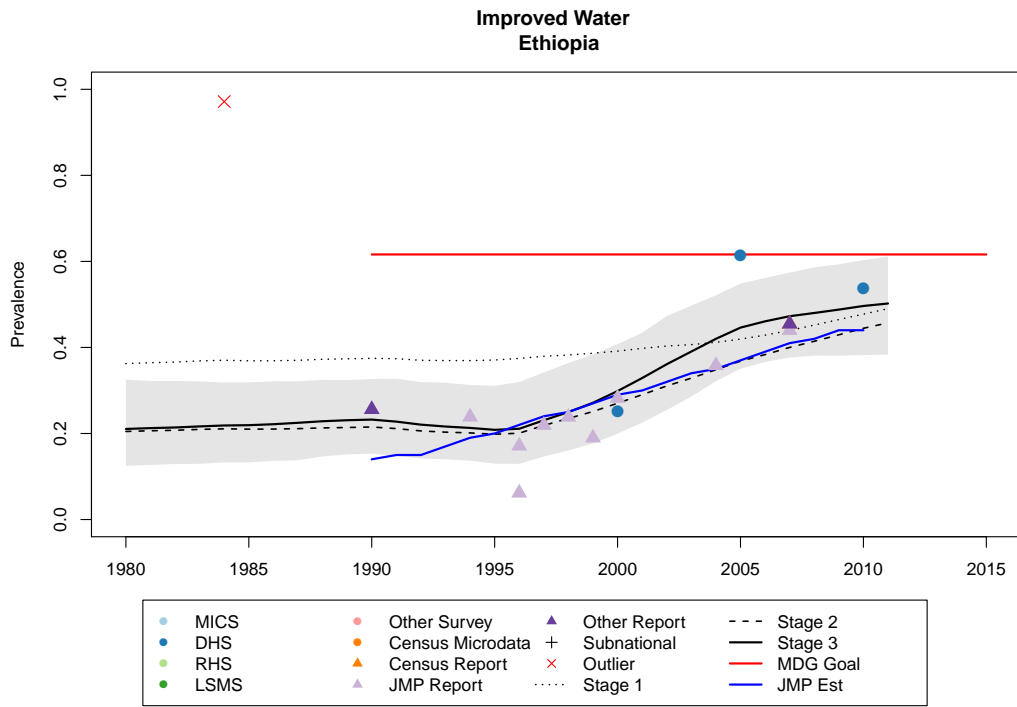


Figure A.42: Prevalence of access to improved water, Ethiopia

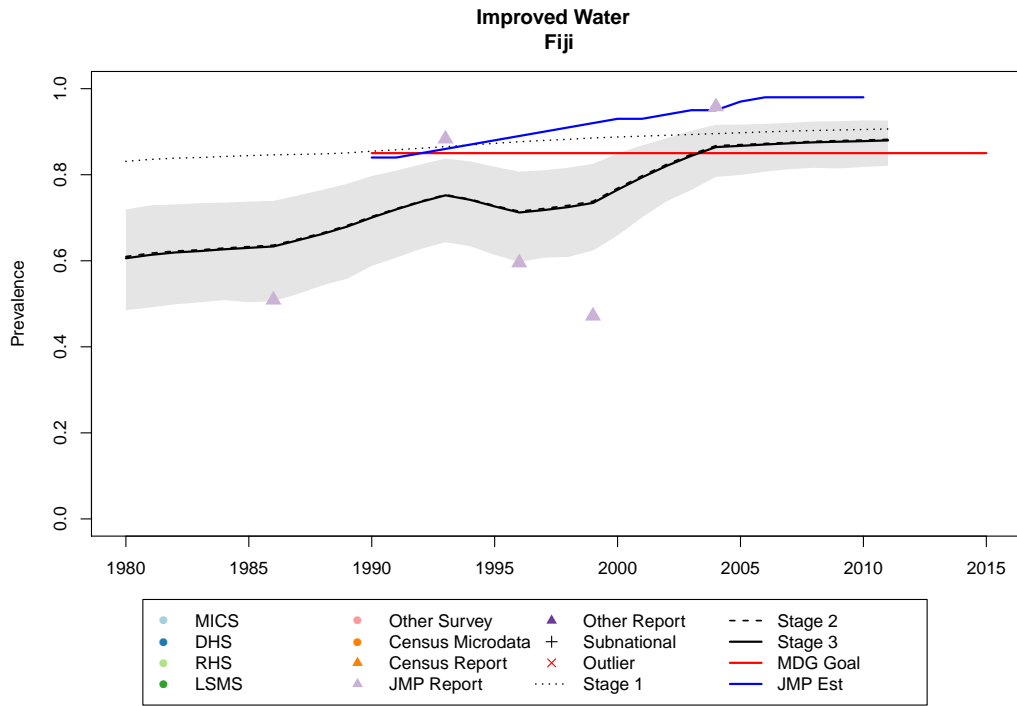


Figure A.43: Prevalence of access to improved water, Fiji

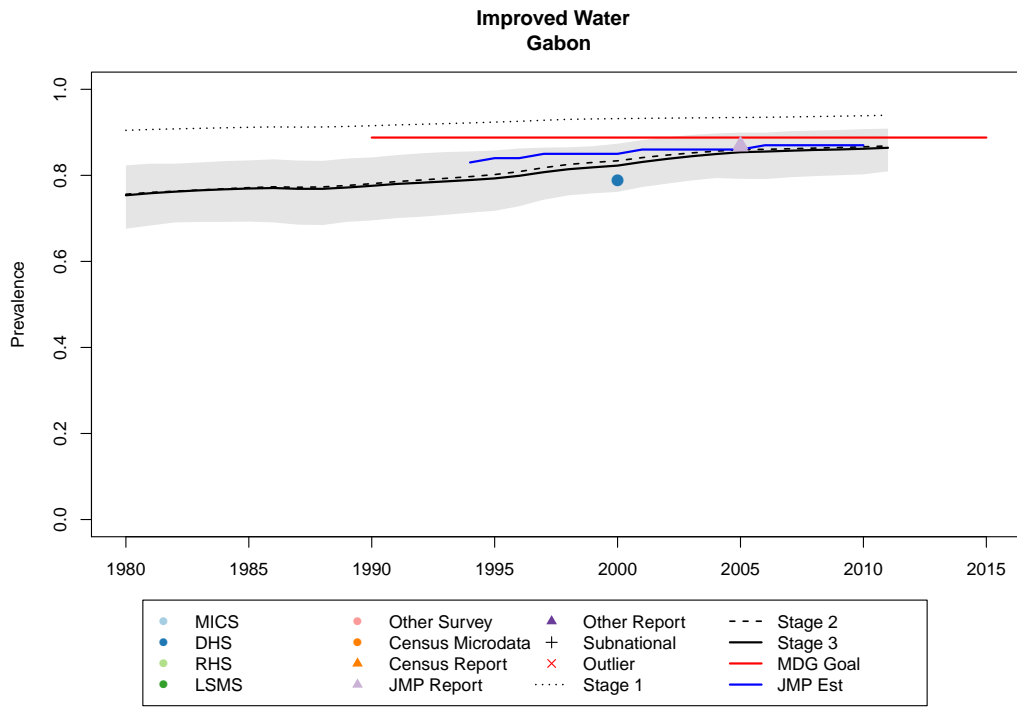


Figure A.44: Prevalence of access to improved water, Gabon

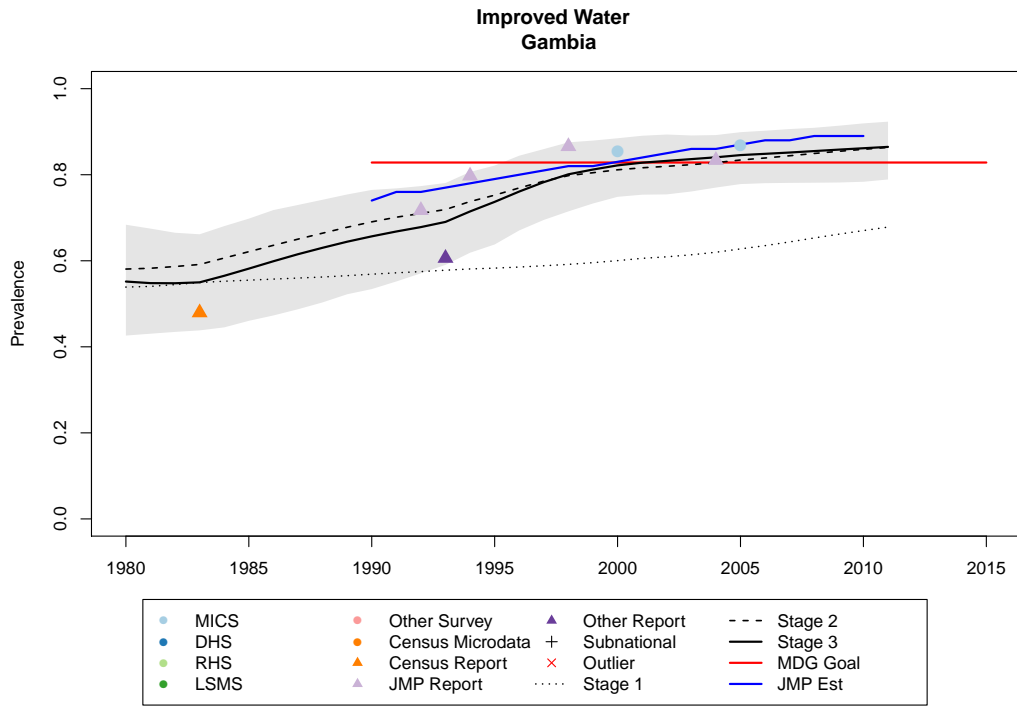


Figure A.45: Prevalence of access to improved water, Gambia

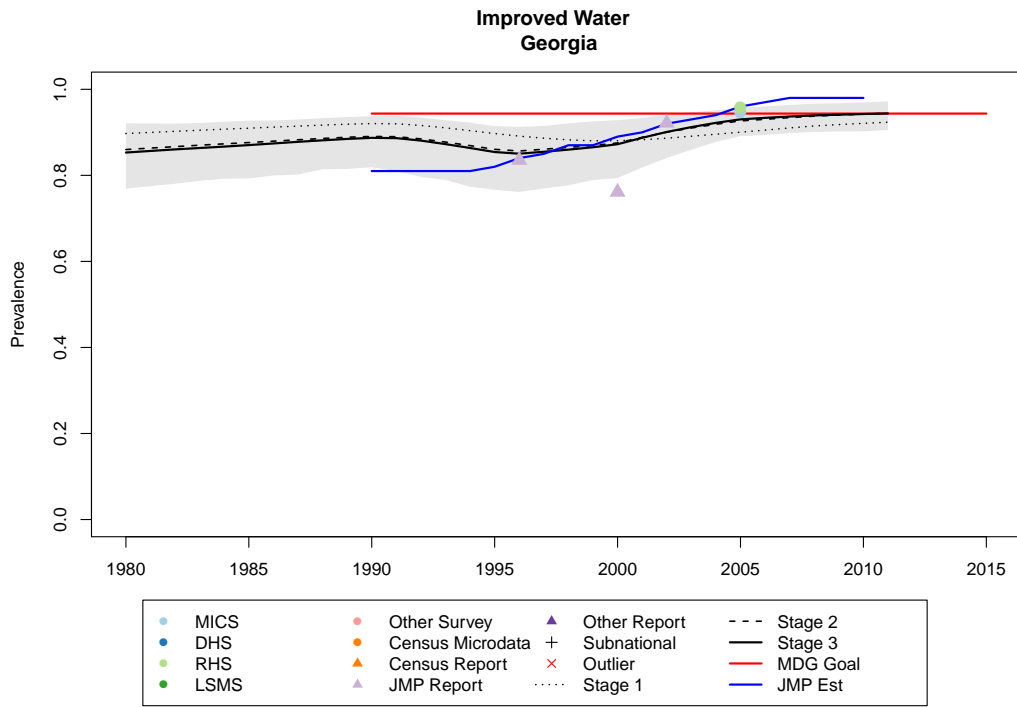


Figure A.46: Prevalence of access to improved water, Georgia

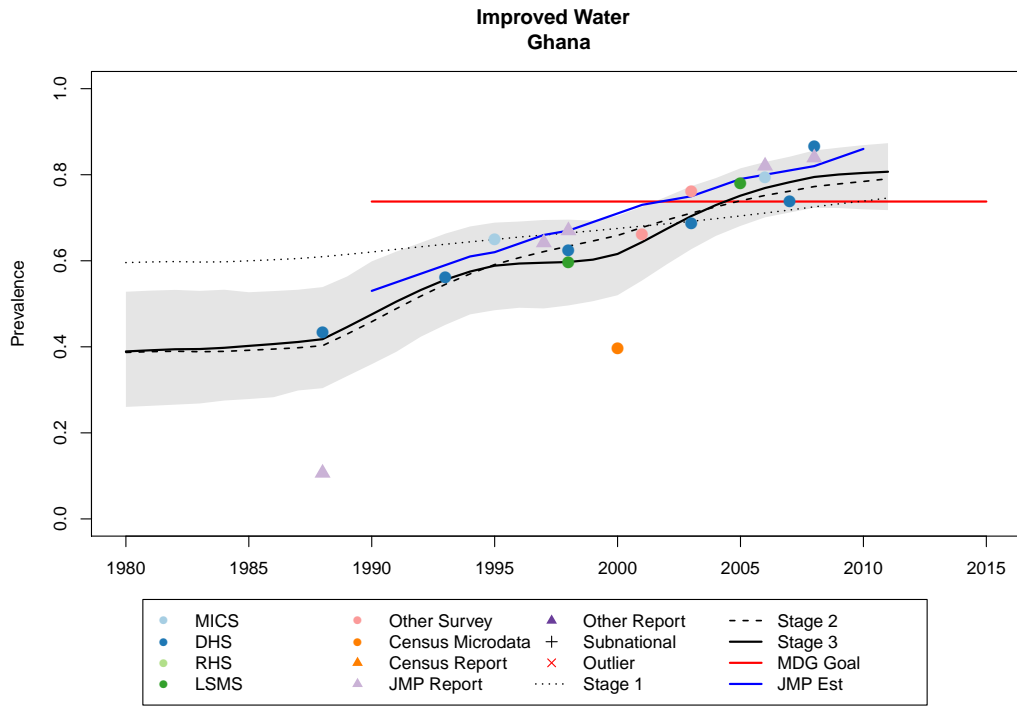


Figure A.47: Prevalence of access to improved water, Ghana

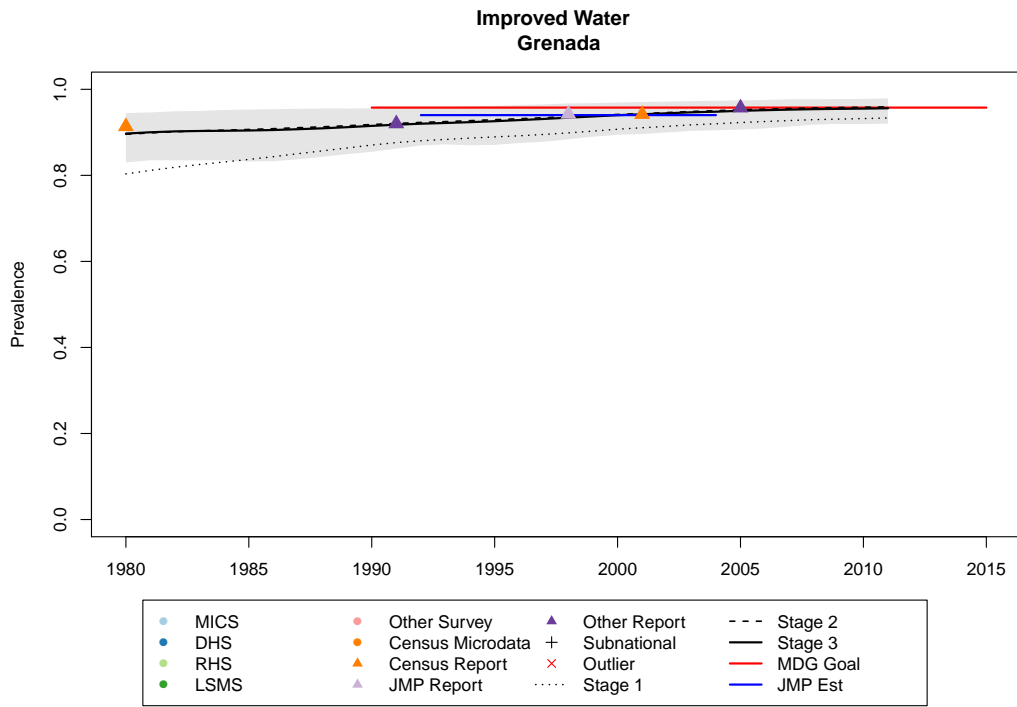


Figure A.48: Prevalence of access to improved water, Grenada

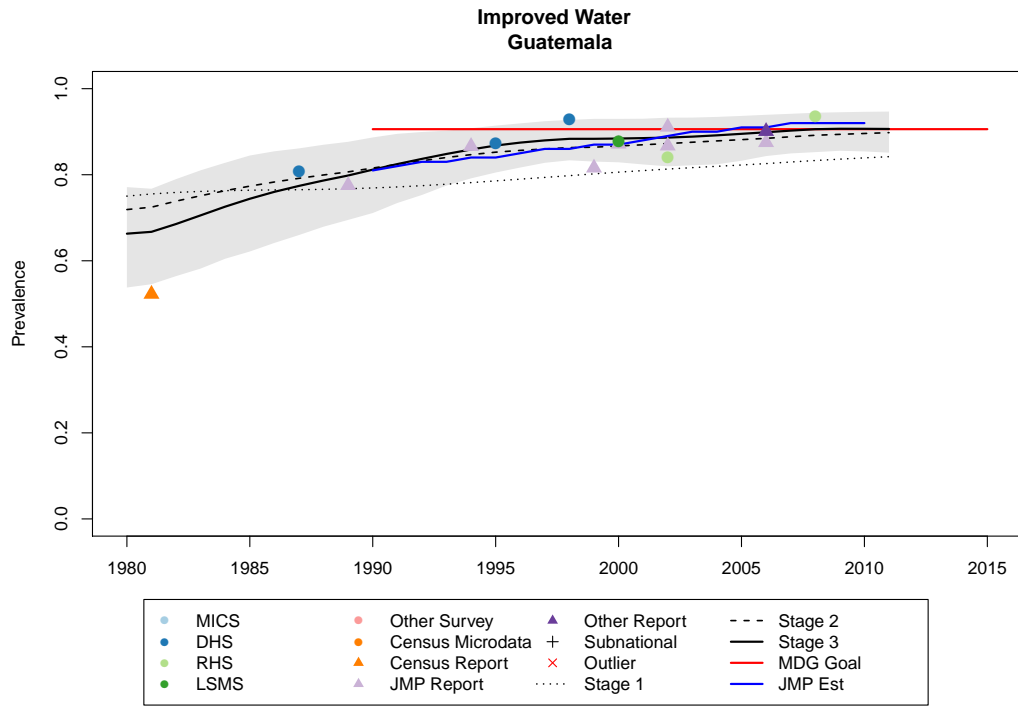


Figure A.49: Prevalence of access to improved water, Guatemala

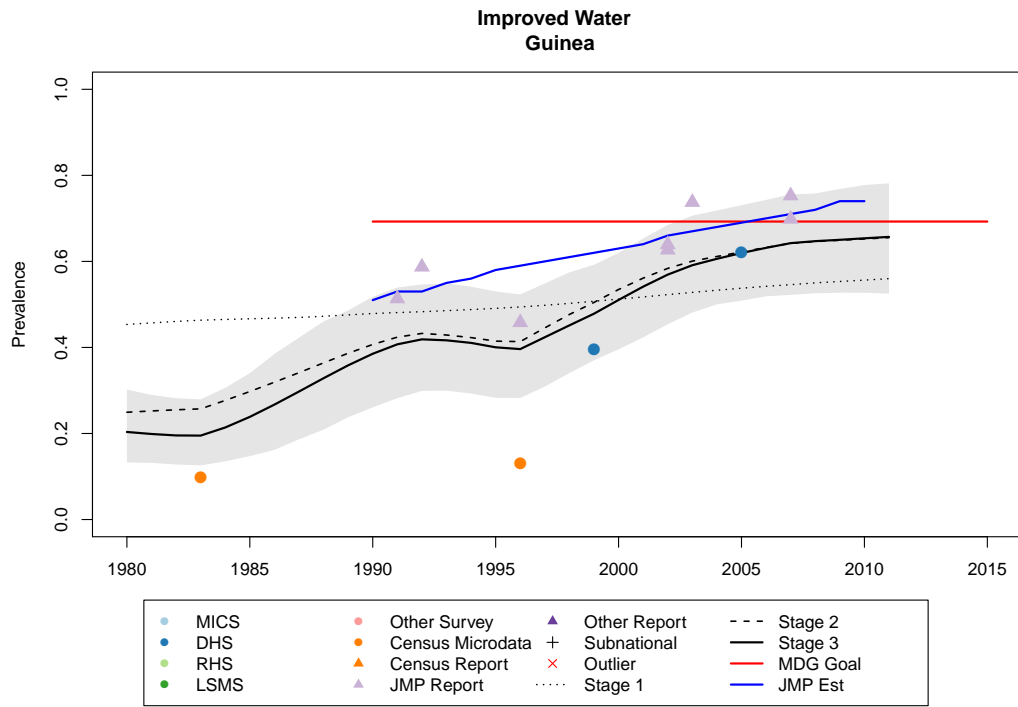


Figure A.50: Prevalence of access to improved water, Guinea

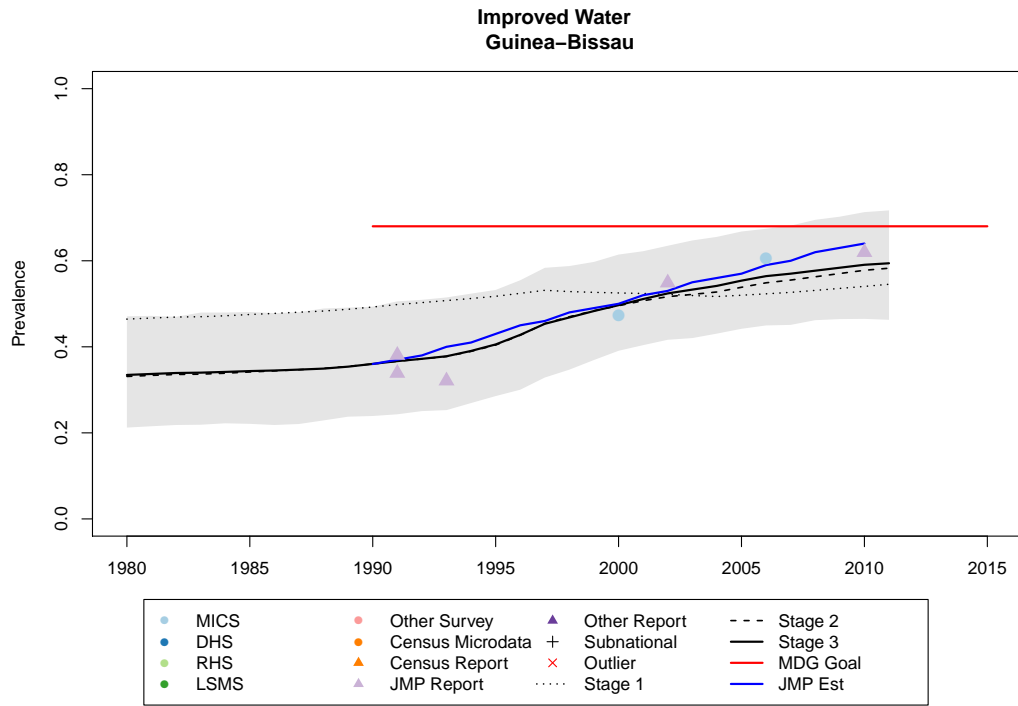


Figure A.51: Prevalence of access to improved water, Guinea-Bissau

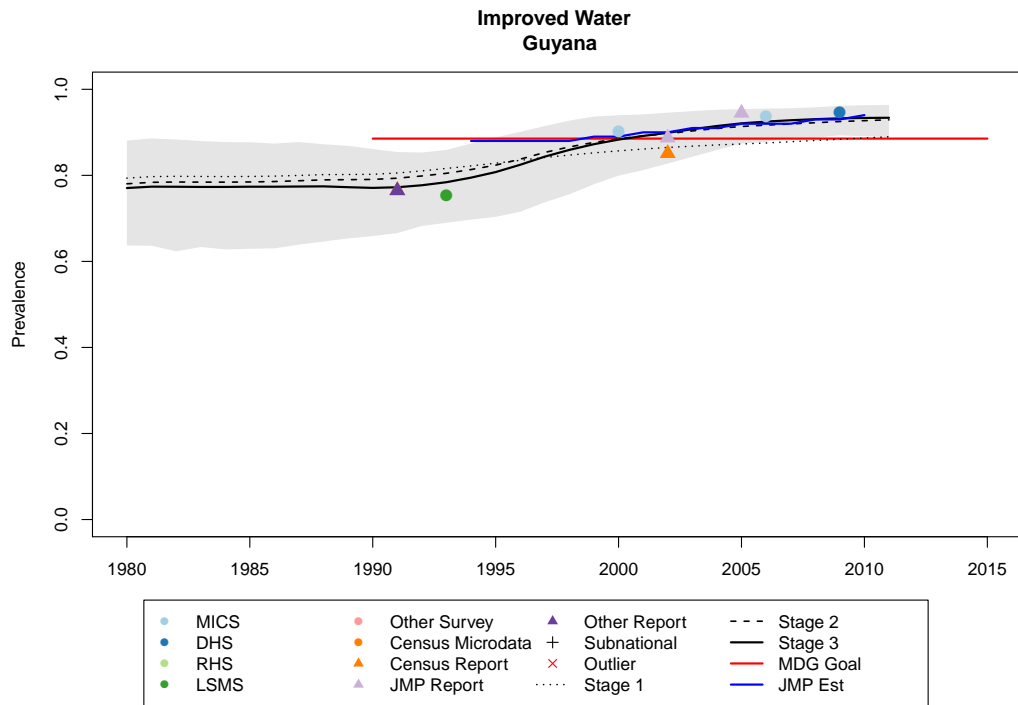


Figure A.52: Prevalence of access to improved water, Guyana

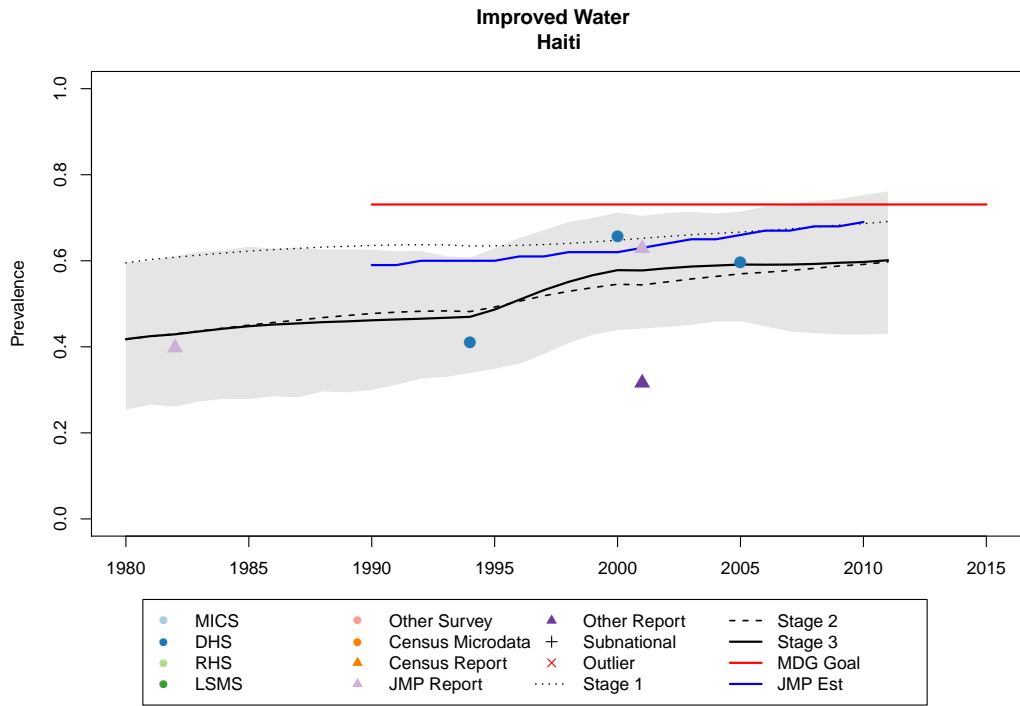


Figure A.53: Prevalence of access to improved water, Haiti

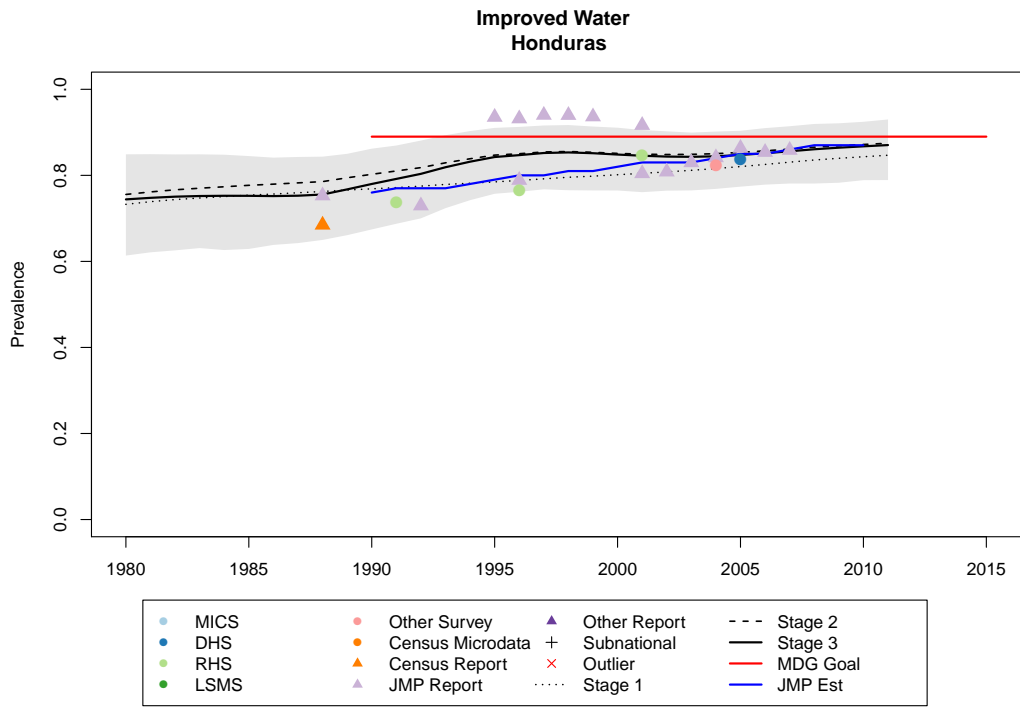


Figure A.54: Prevalence of access to improved water, Honduras

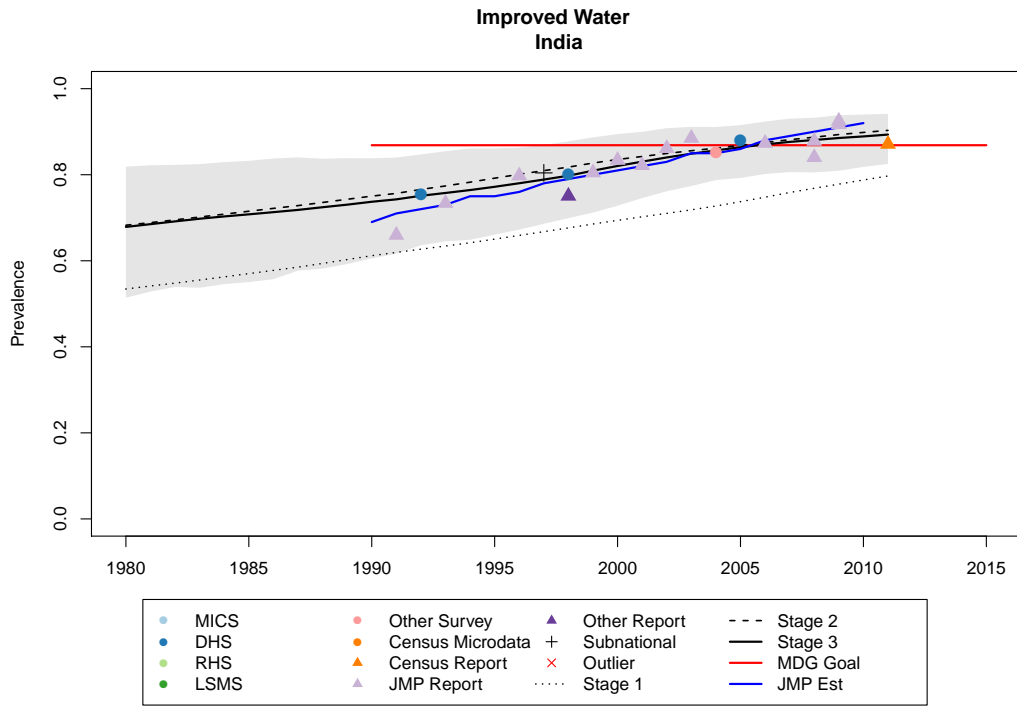


Figure A.55: Prevalence of access to improved water, India

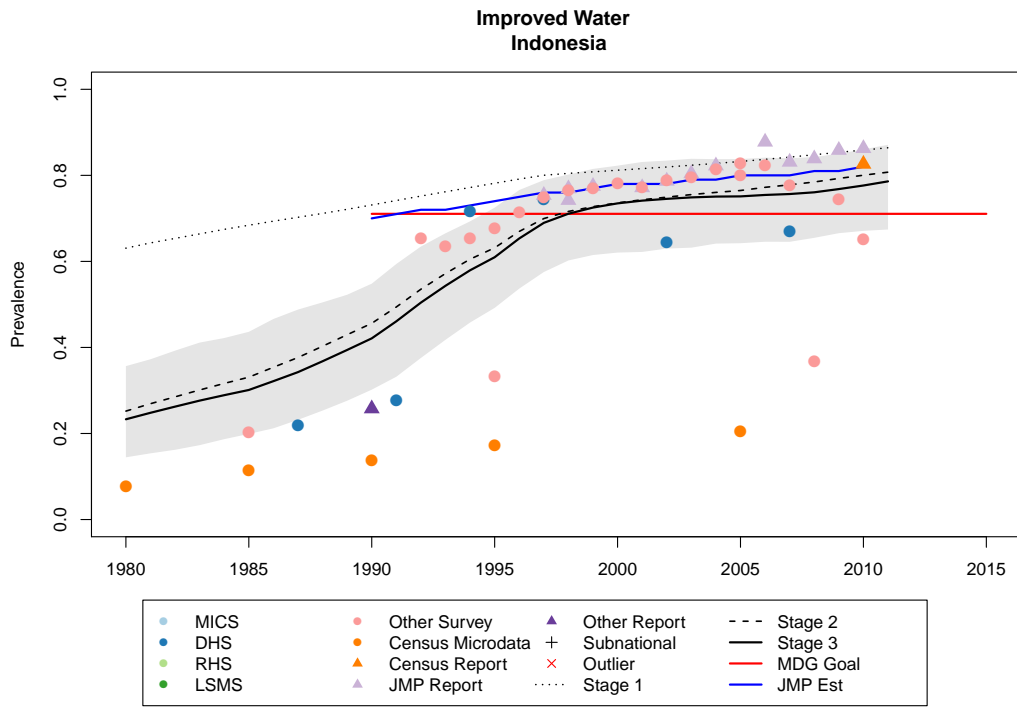


Figure A.56: Prevalence of access to improved water, Indonesia

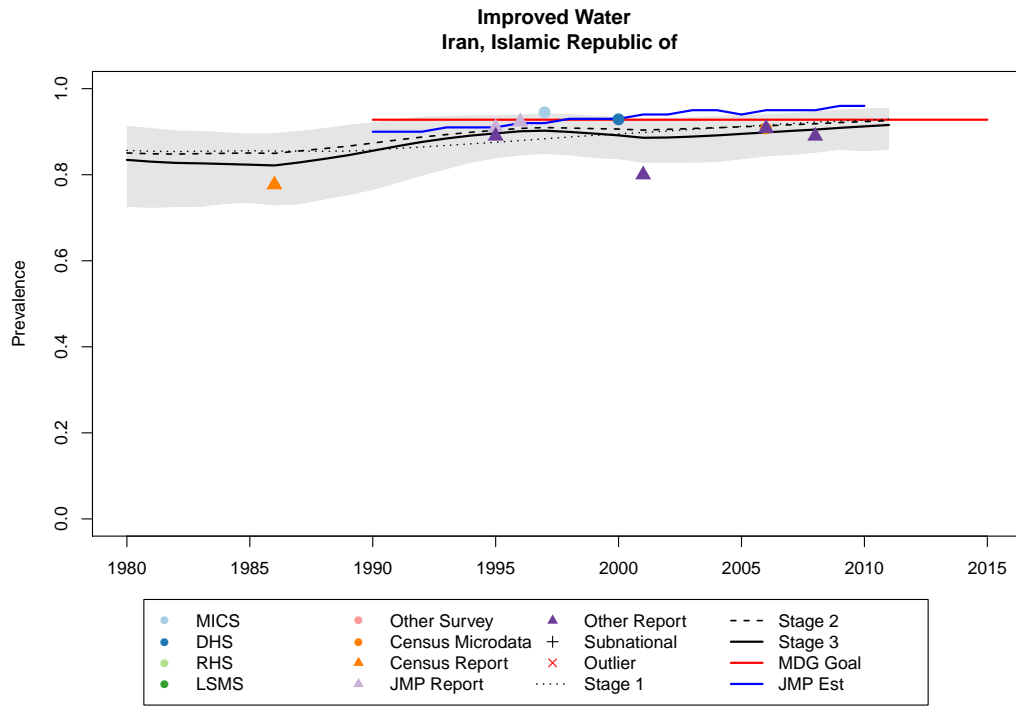


Figure A.57: Prevalence of access to improved water, Iran, Islamic Republic of

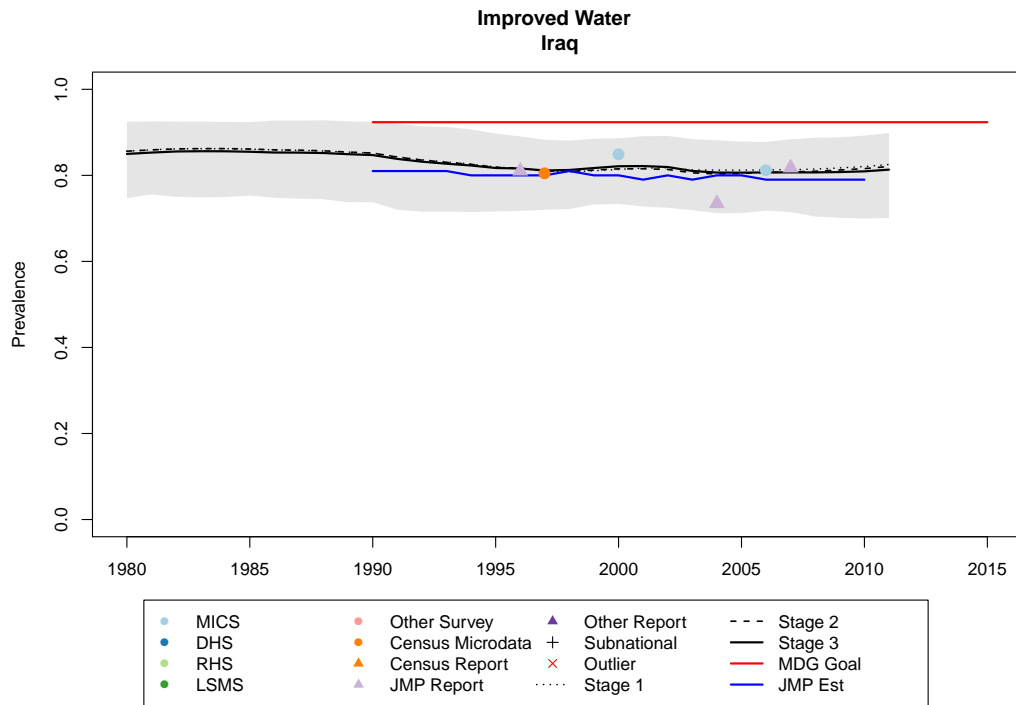


Figure A.58: Prevalence of access to improved water, Iraq

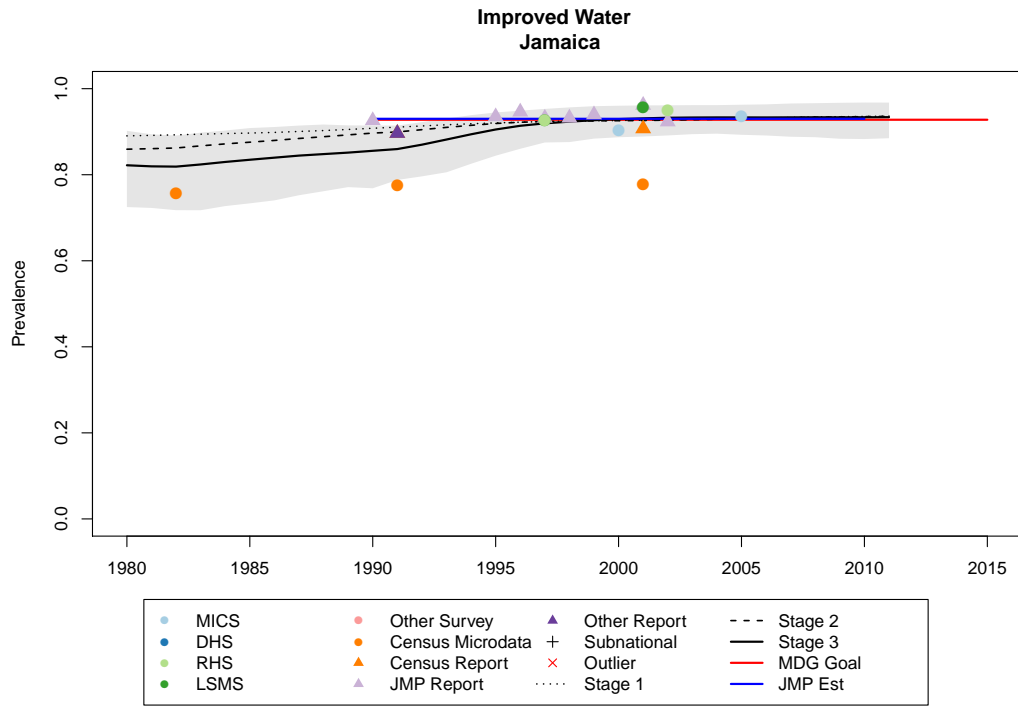


Figure A.59: Prevalence of access to improved water, Jamaica

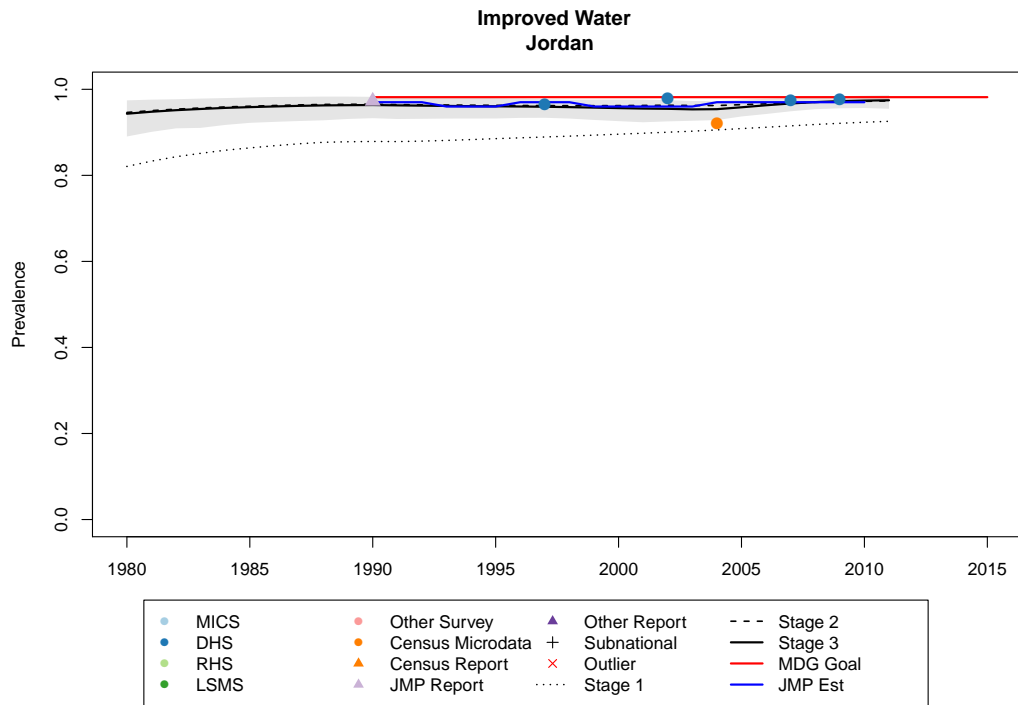


Figure A.60: Prevalence of access to improved water, Jordan

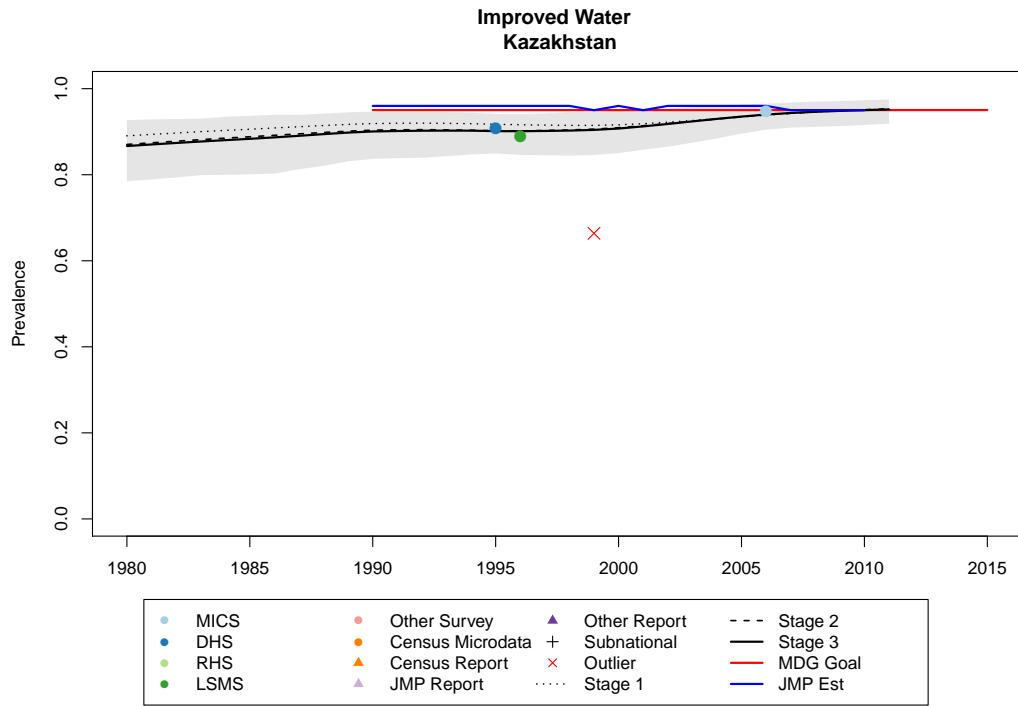


Figure A.61: Prevalence of access to improved water, Kazakhstan

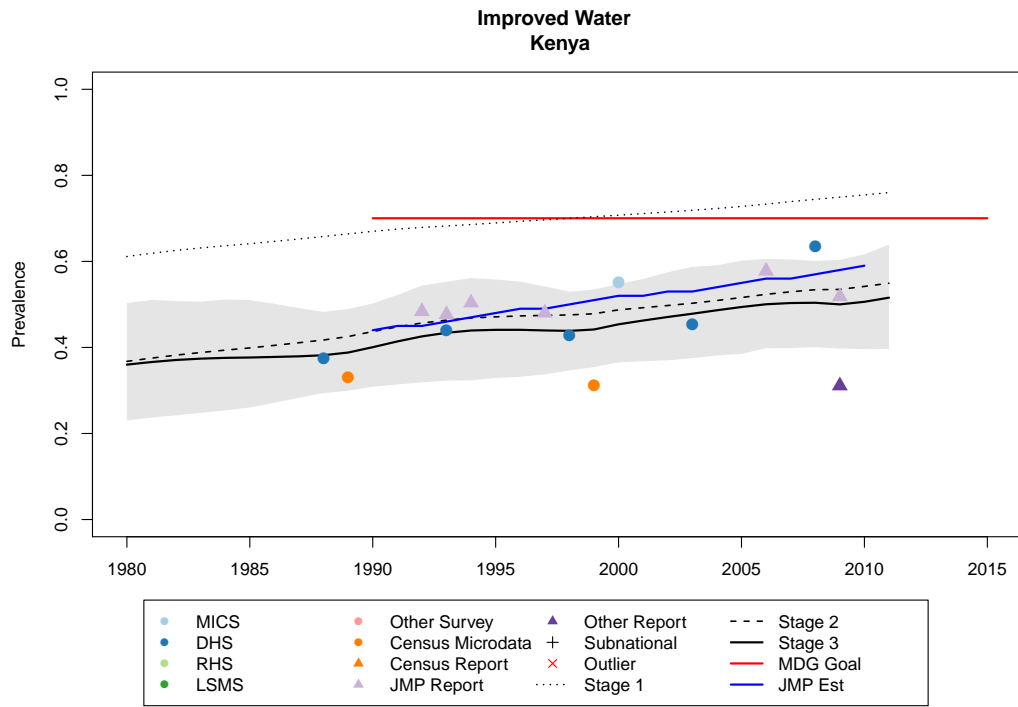


Figure A.62: Prevalence of access to improved water, Kenya

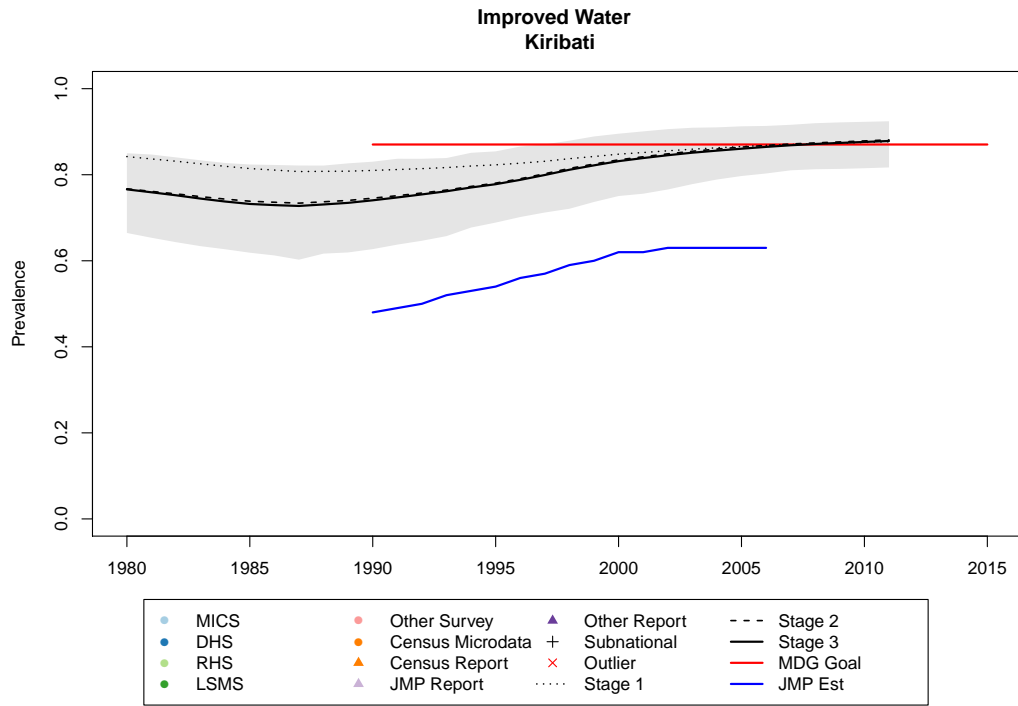


Figure A.63: Prevalence of access to improved water, Kiribati

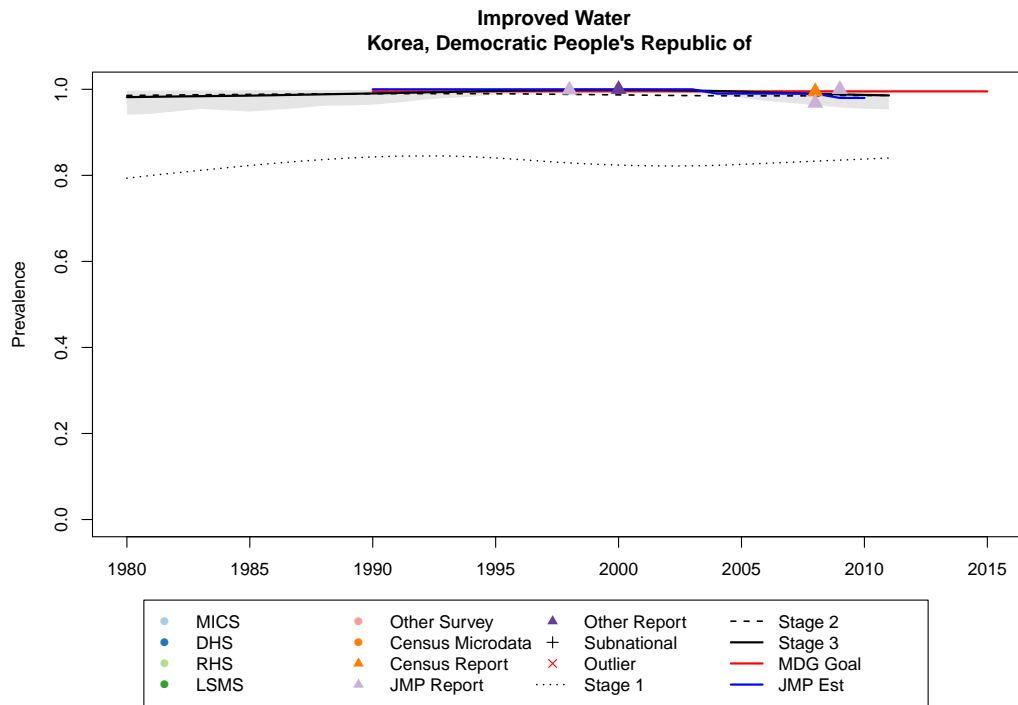


Figure A.64: Prevalence of access to improved water, Korea, Democratic People's Republic of

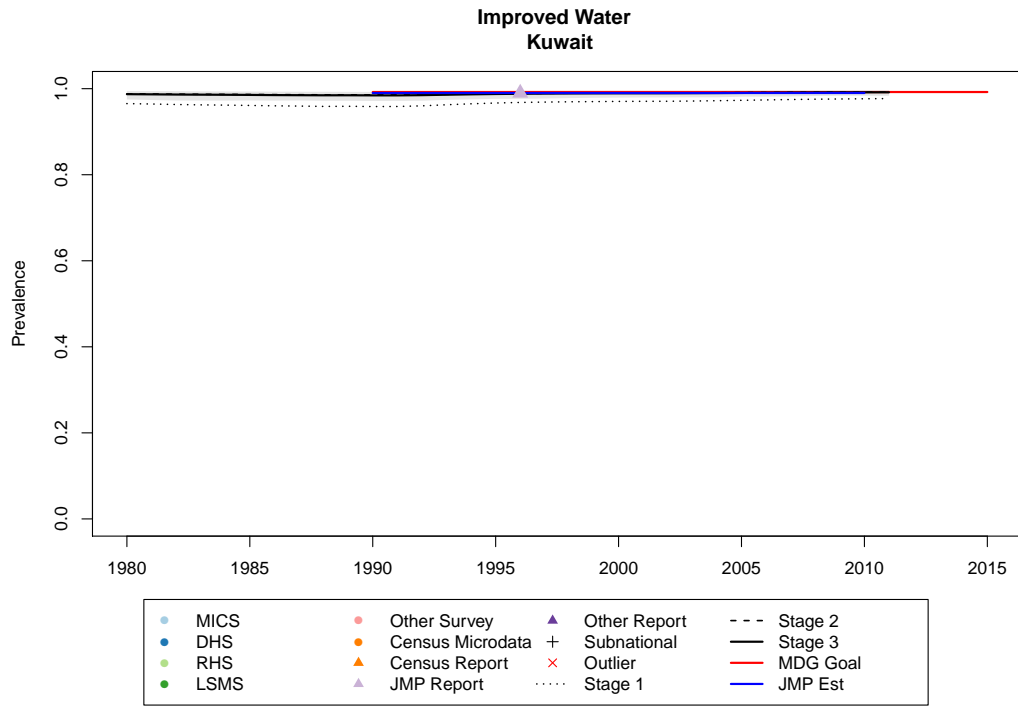


Figure A.65: Prevalence of access to improved water, Kuwait

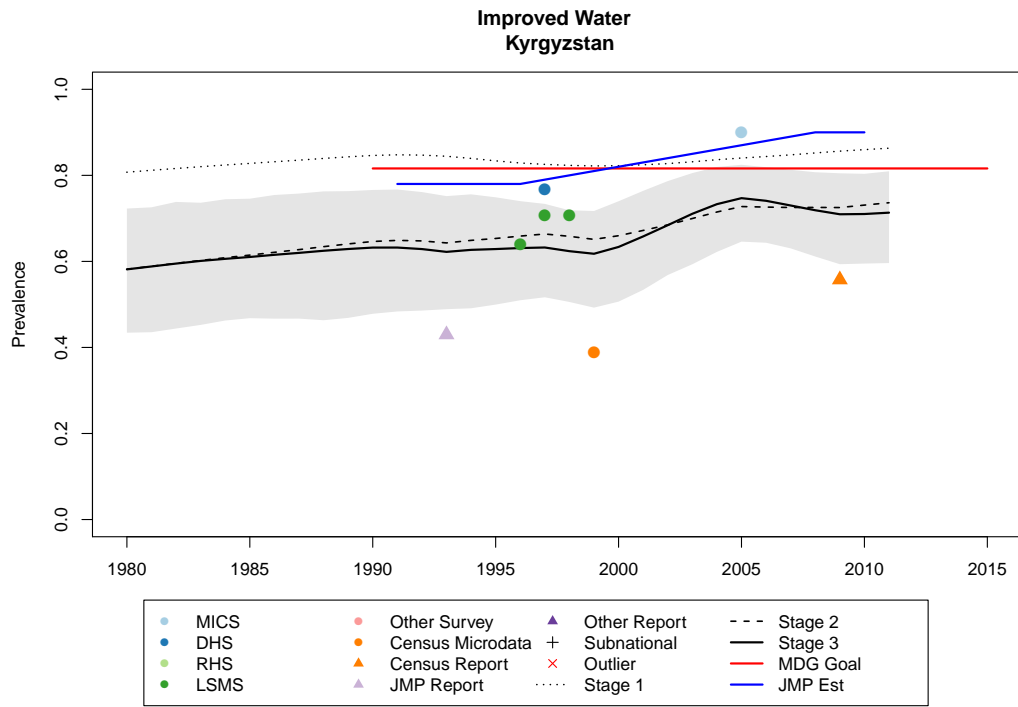


Figure A.66: Prevalence of access to improved water, Kyrgyzstan

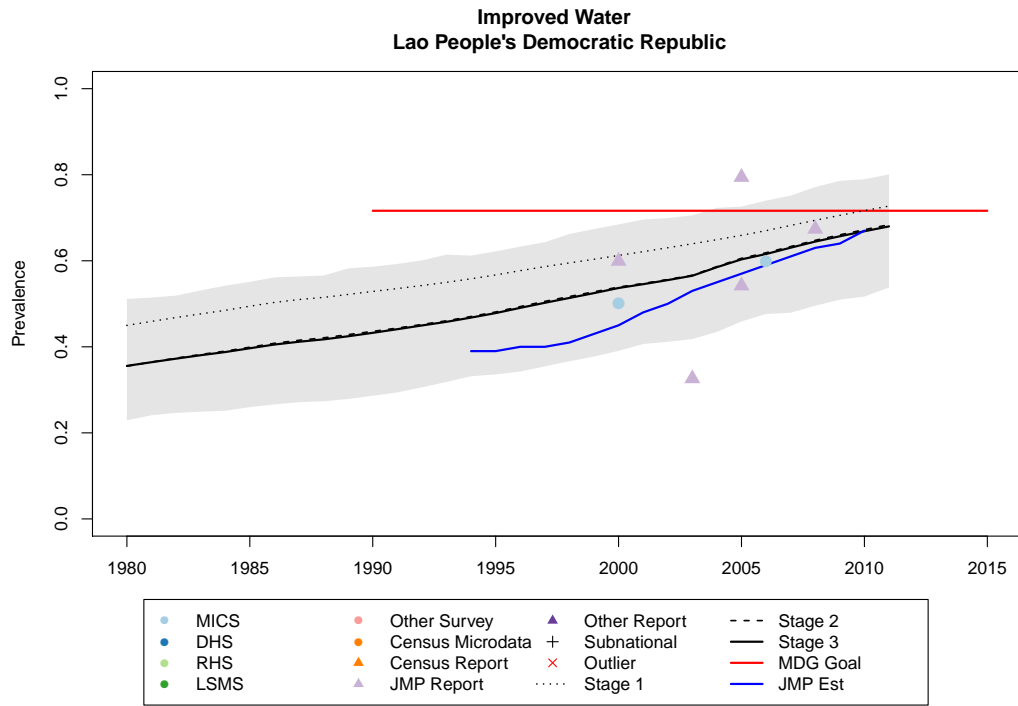


Figure A.67: Prevalence of access to improved water, Lao People’s Democratic Republic

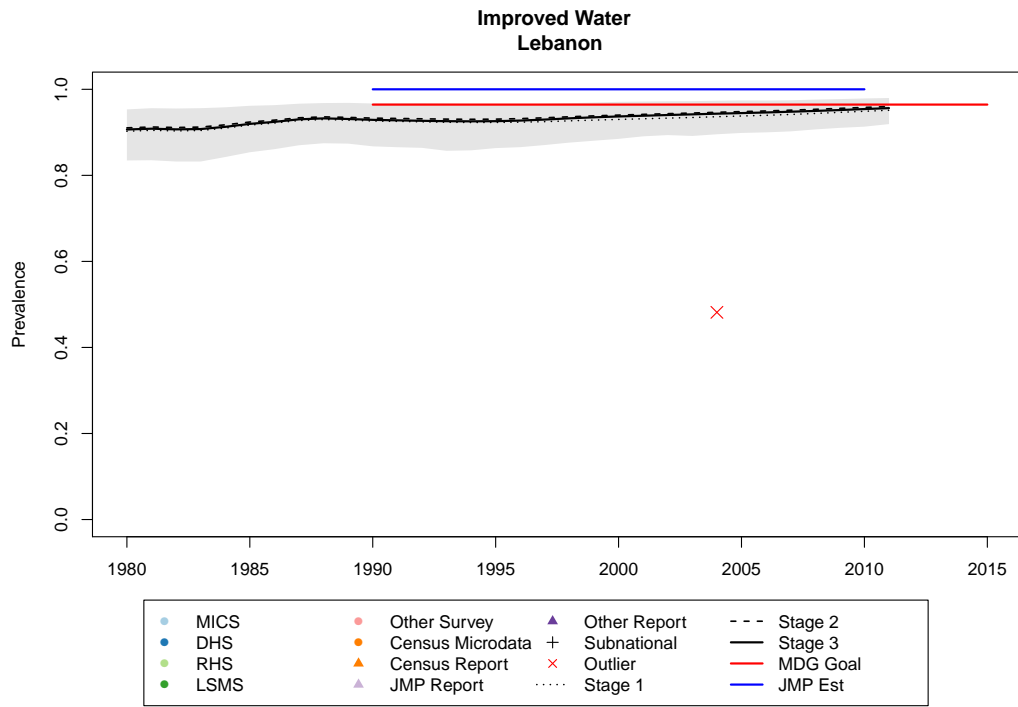


Figure A.68: Prevalence of access to improved water, Lebanon

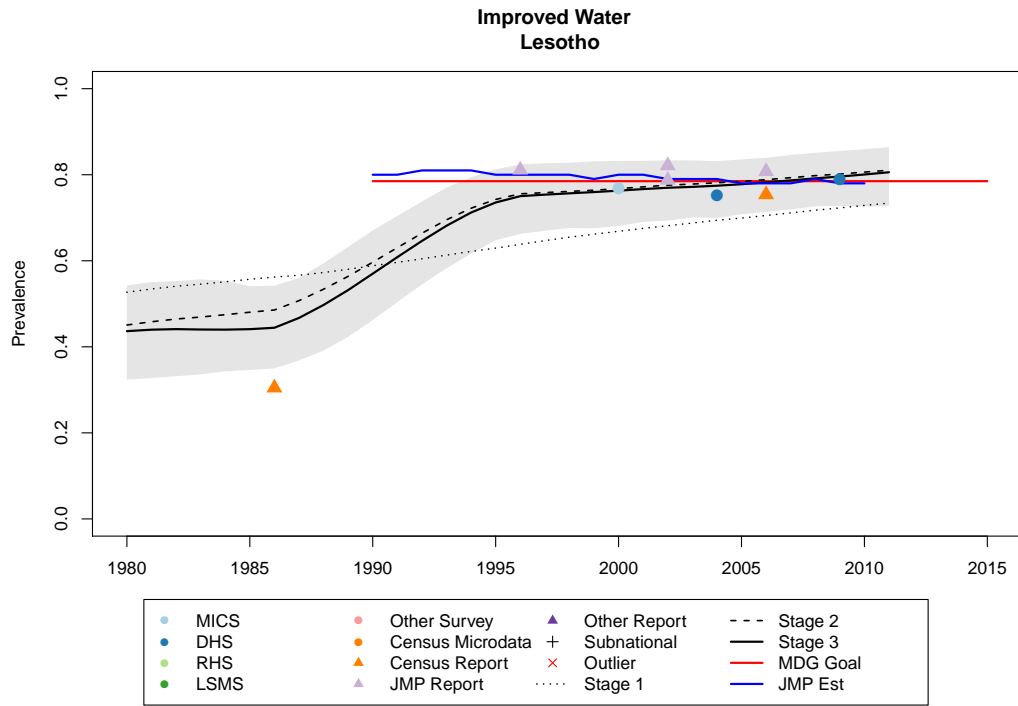


Figure A.69: Prevalence of access to improved water, Lesotho

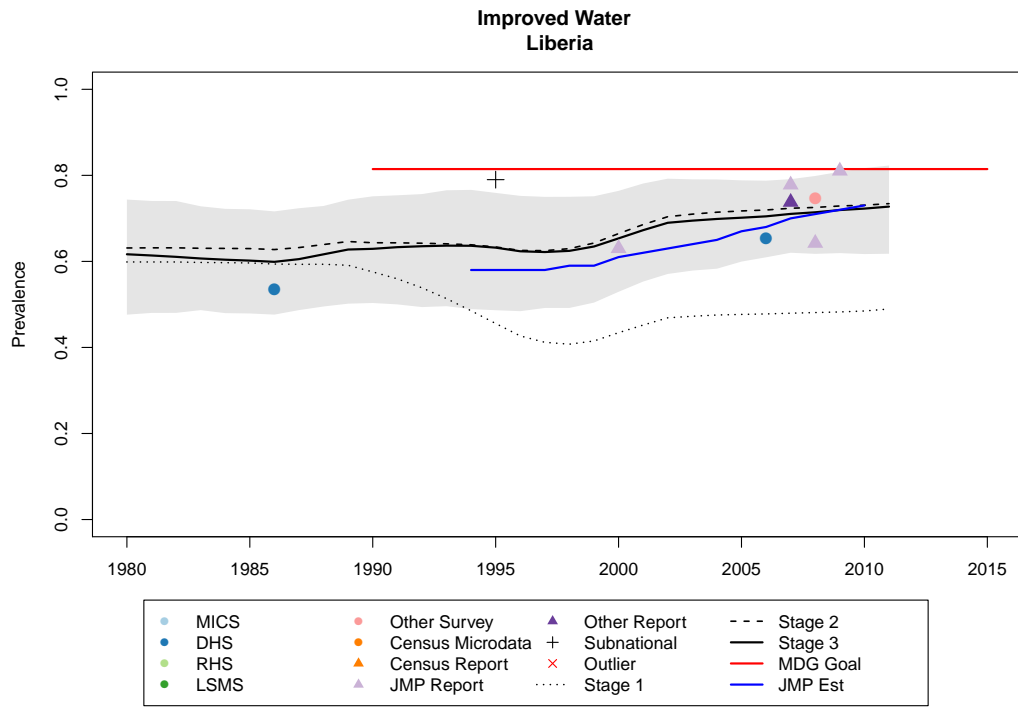


Figure A.70: Prevalence of access to improved water, Liberia

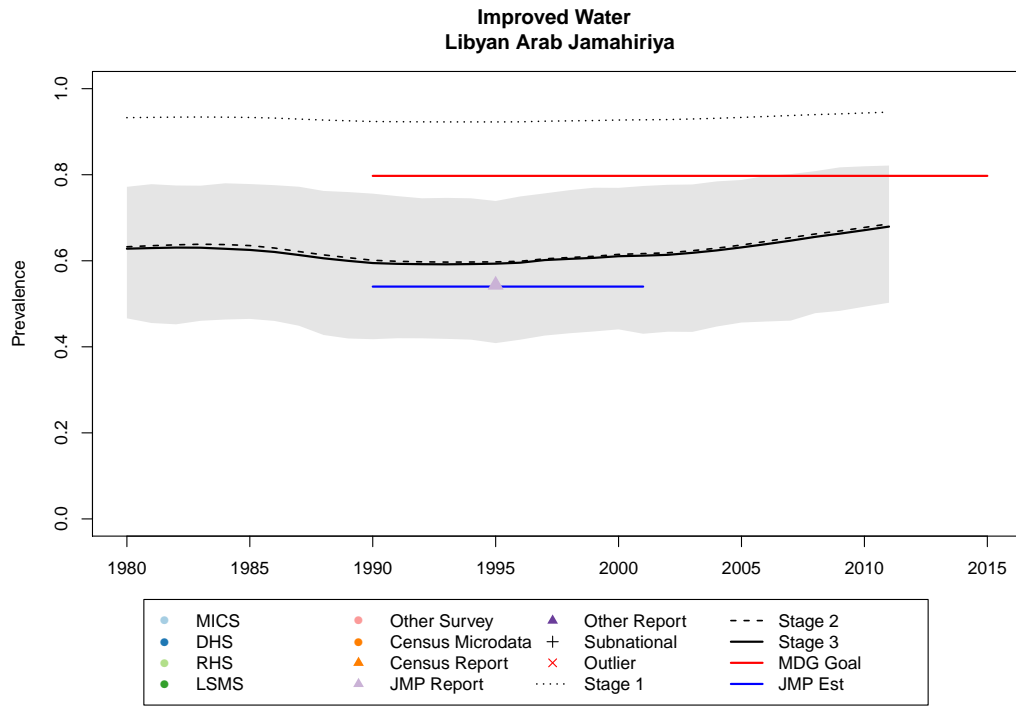


Figure A.71: Prevalence of access to improved water, Libyan Arab Jamahiriya

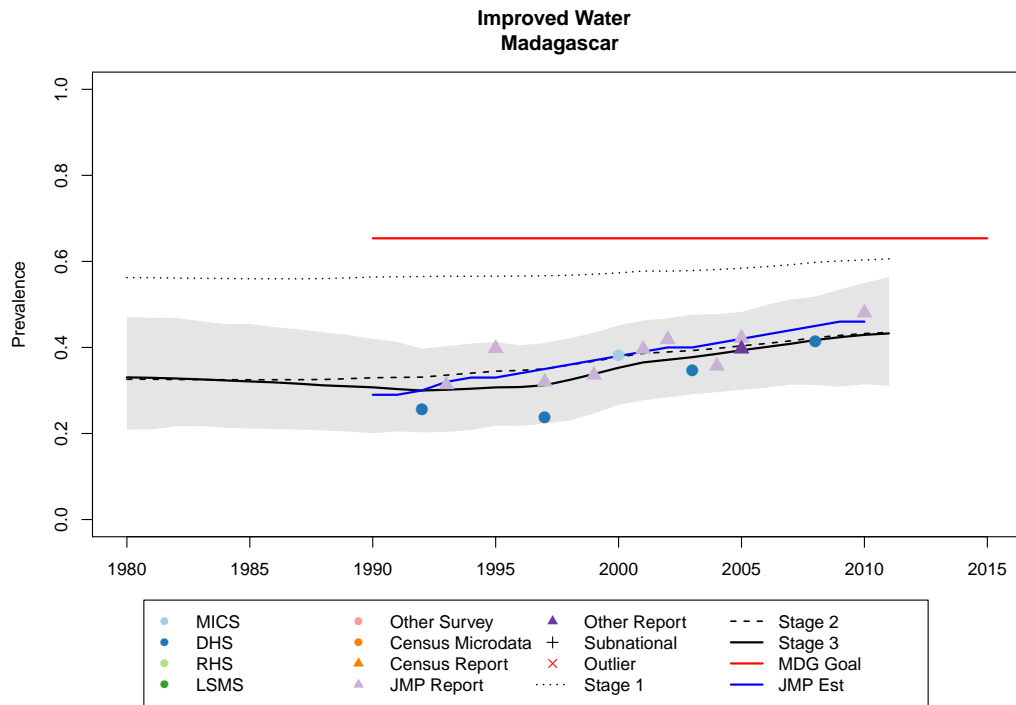


Figure A.72: Prevalence of access to improved water, Madagascar

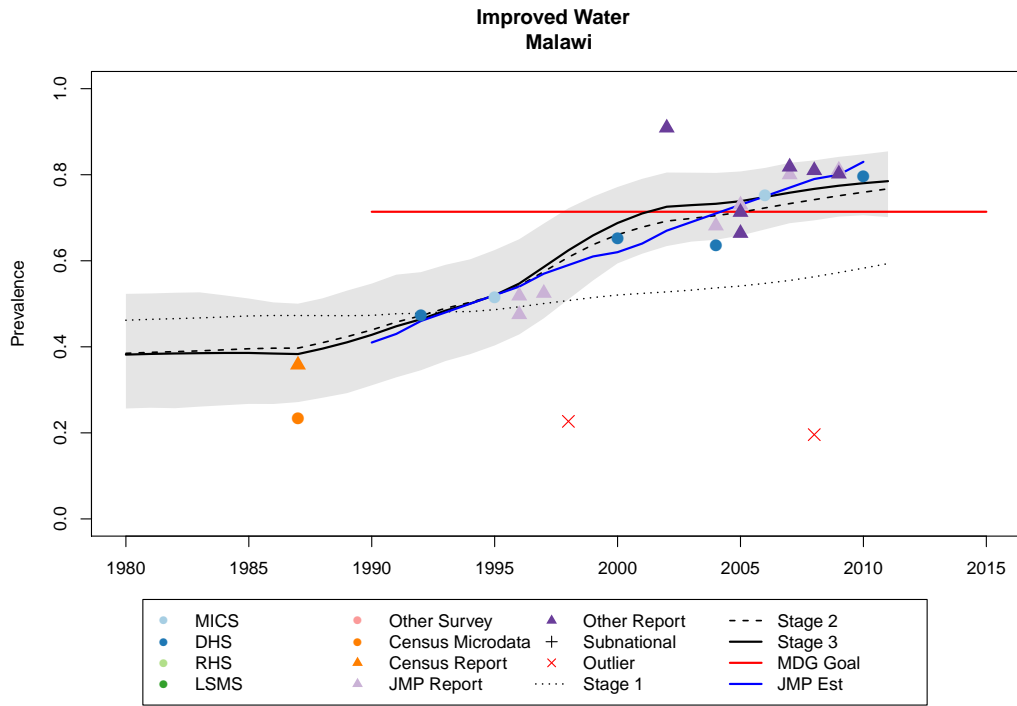


Figure A.73: Prevalence of access to improved water, Malawi

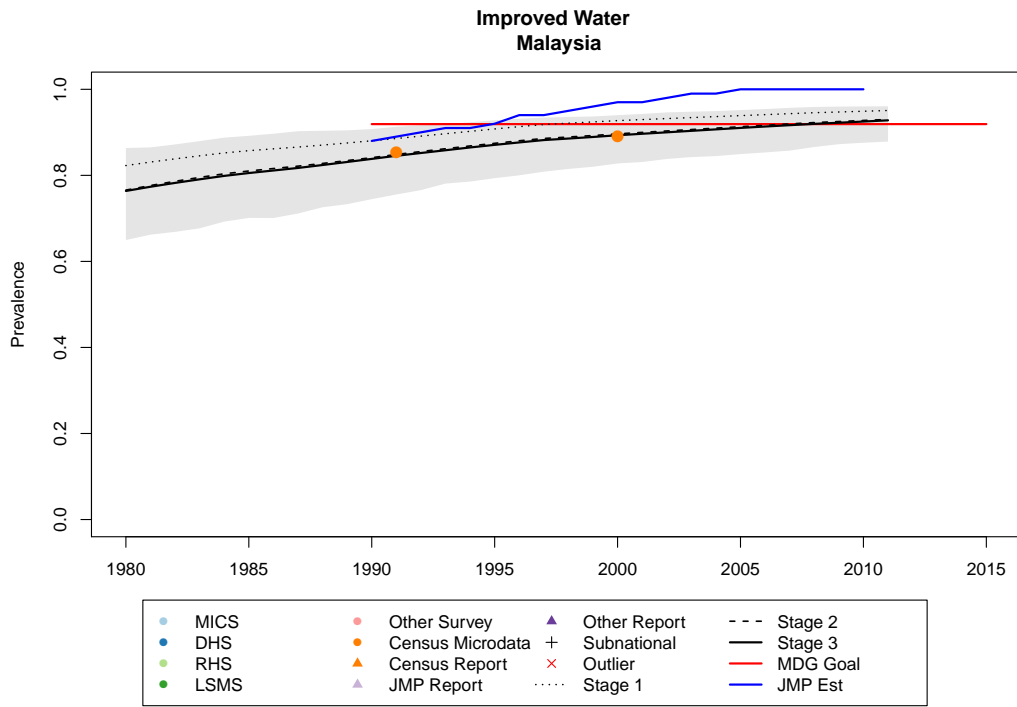


Figure A.74: Prevalence of access to improved water, Malaysia

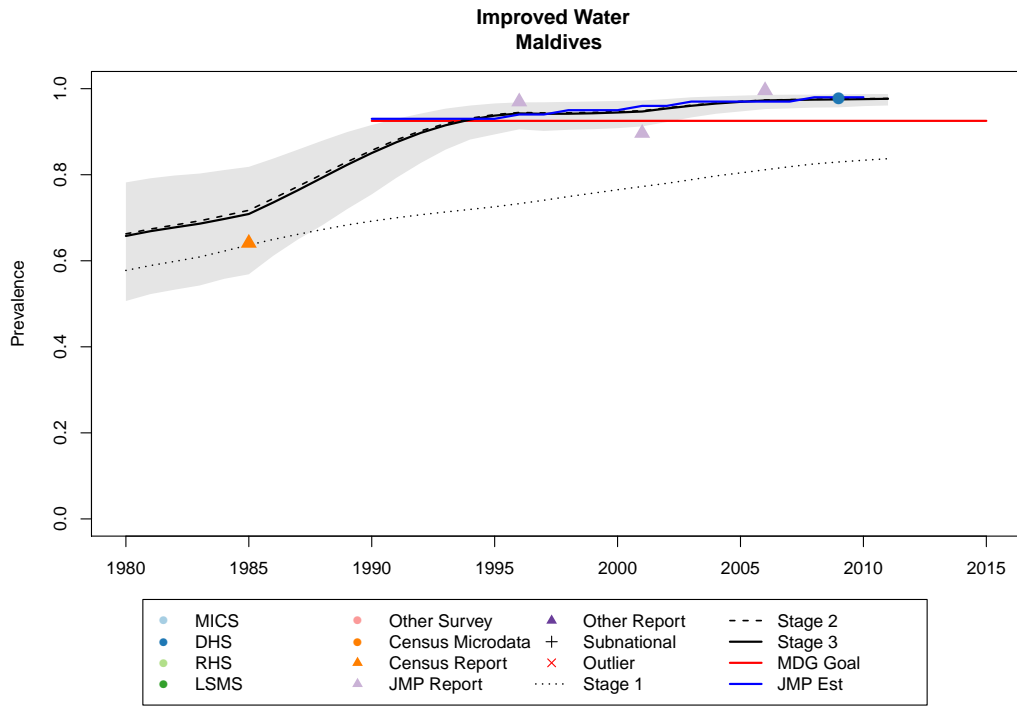


Figure A.75: Prevalence of access to improved water, Maldives

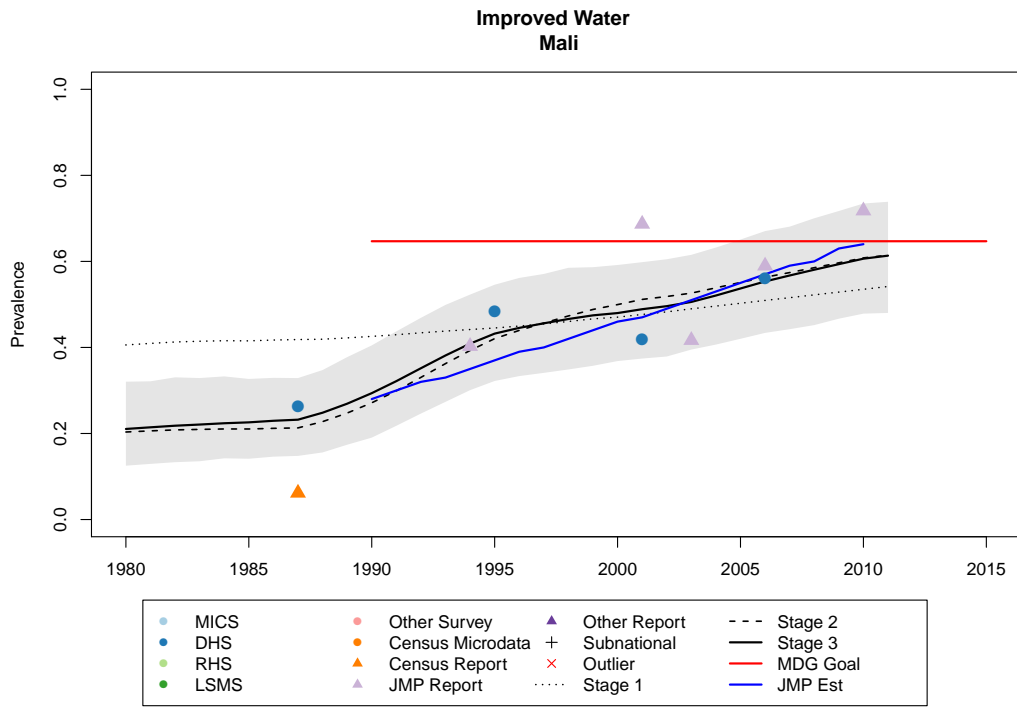


Figure A.76: Prevalence of access to improved water, Mali

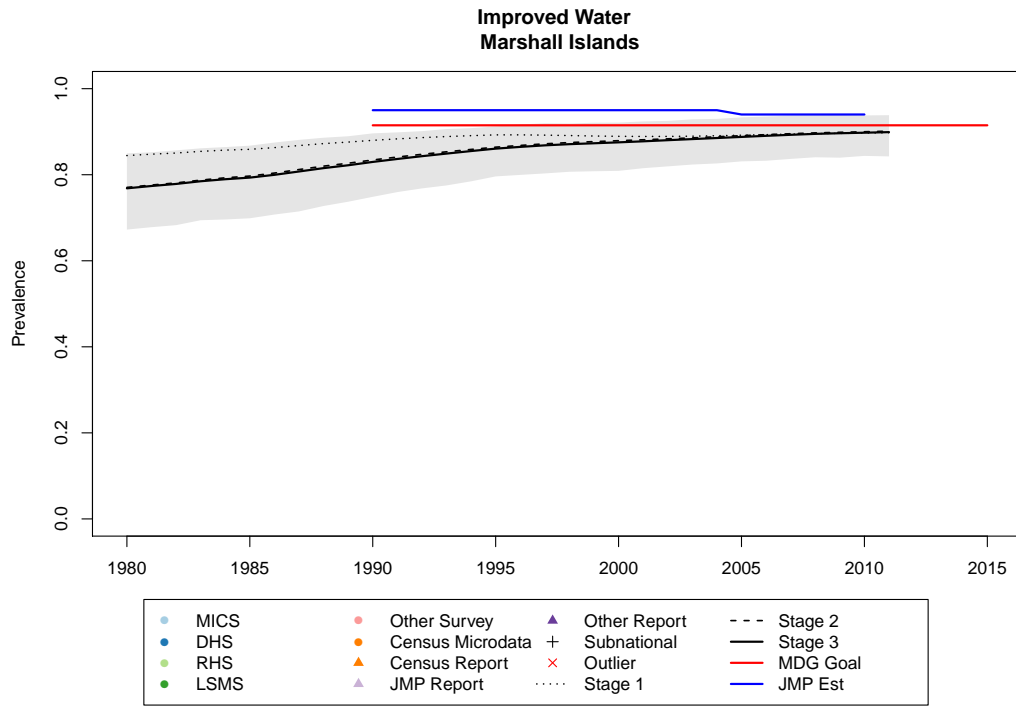


Figure A.77: Prevalence of access to improved water, Marshall Islands

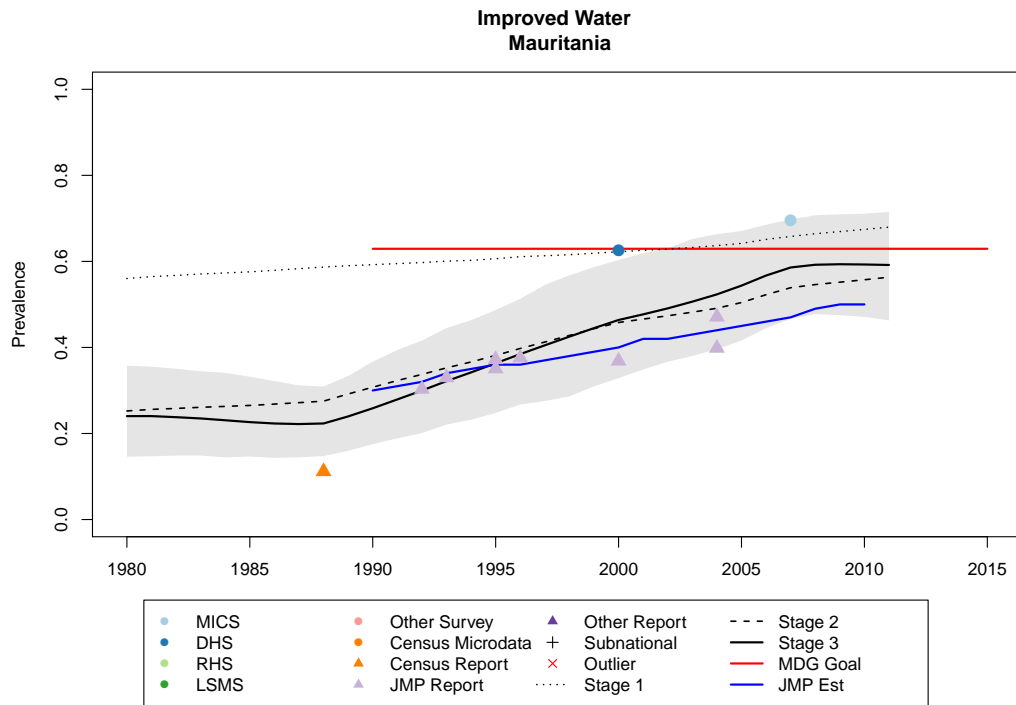


Figure A.78: Prevalence of access to improved water, Mauritania

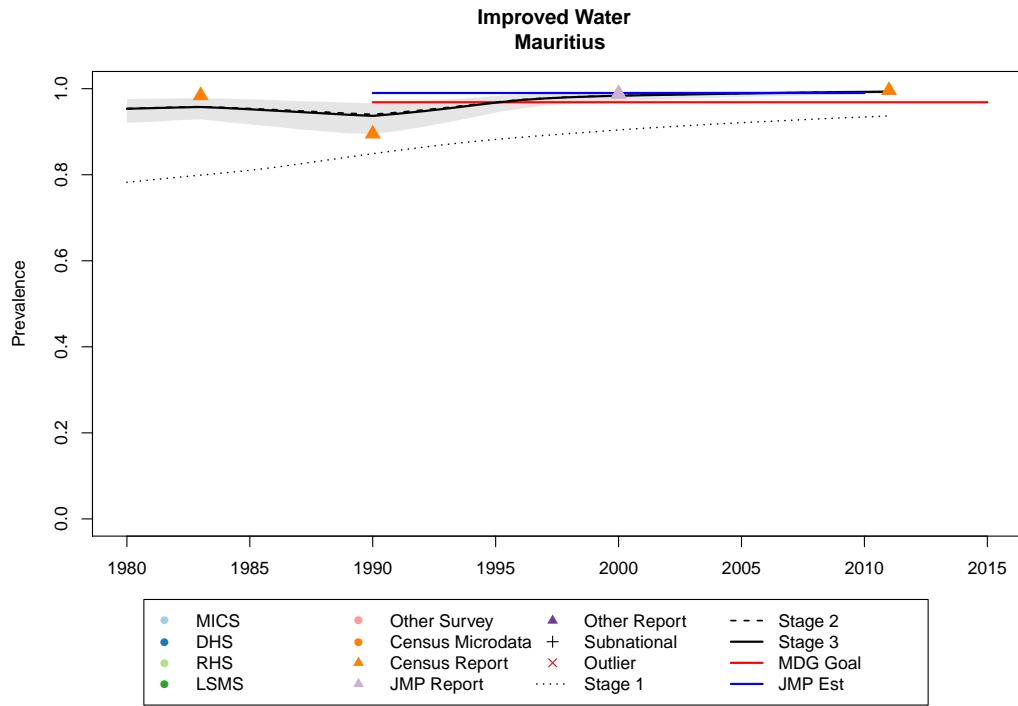


Figure A.79: Prevalence of access to improved water, Mauritius

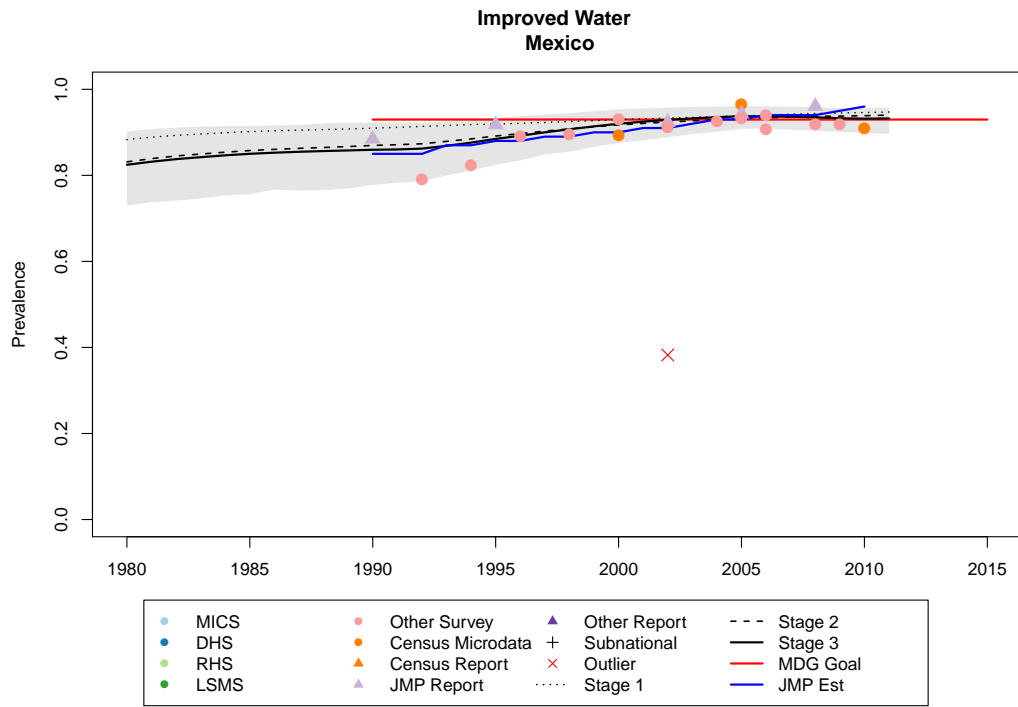


Figure A.80: Prevalence of access to improved water, Mexico

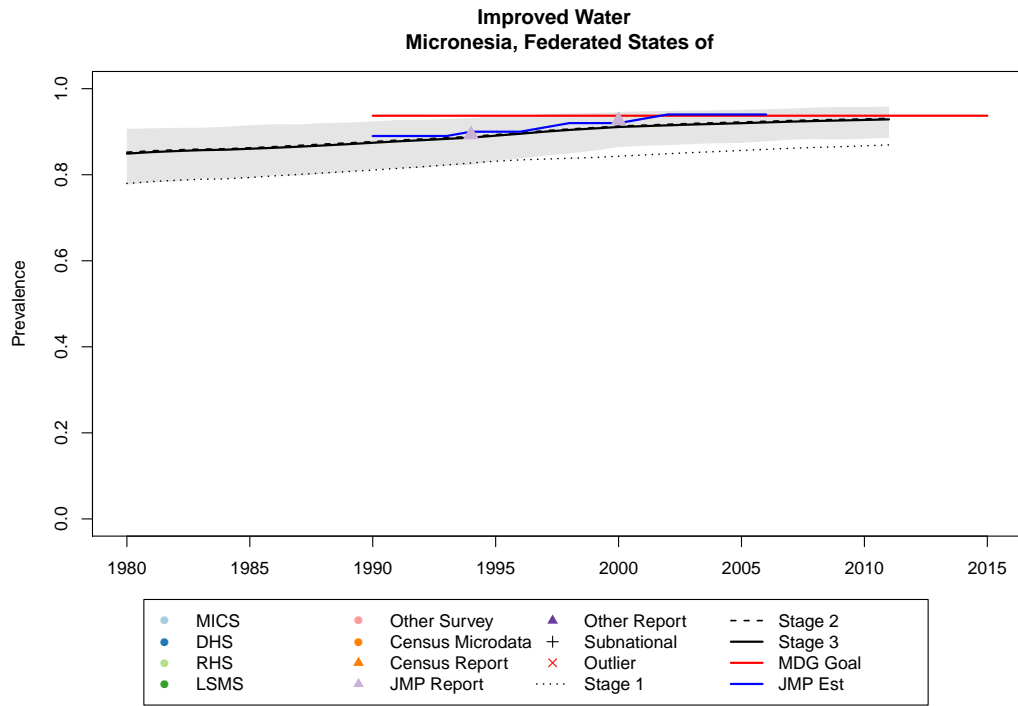


Figure A.81: Prevalence of access to improved water, Micronesia, Federated States of

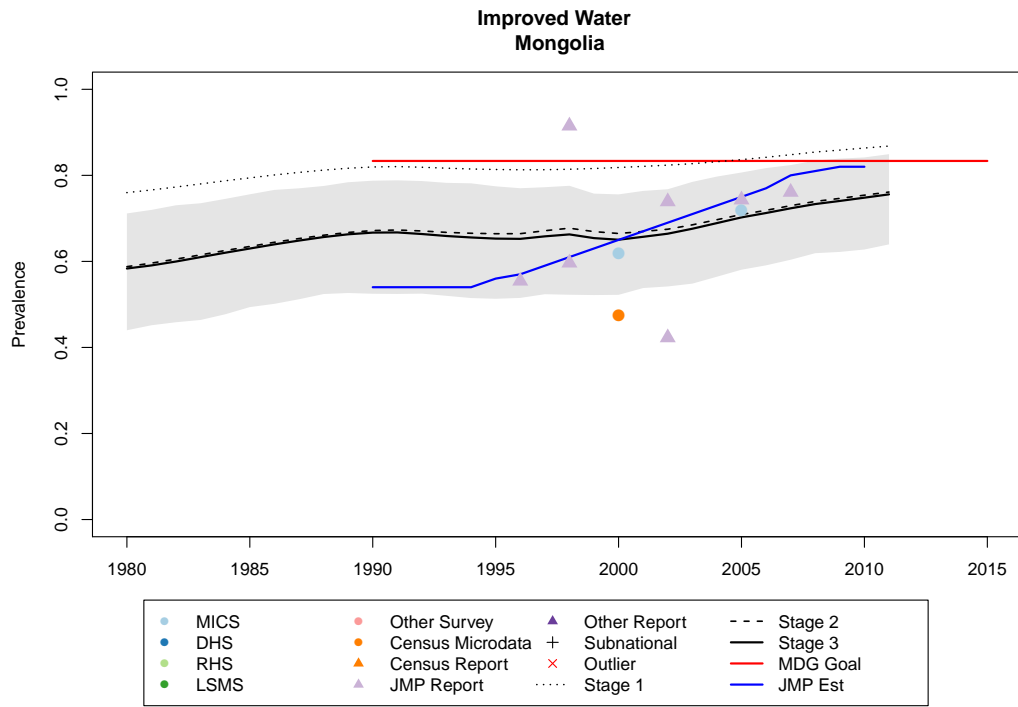


Figure A.82: Prevalence of access to improved water, Mongolia

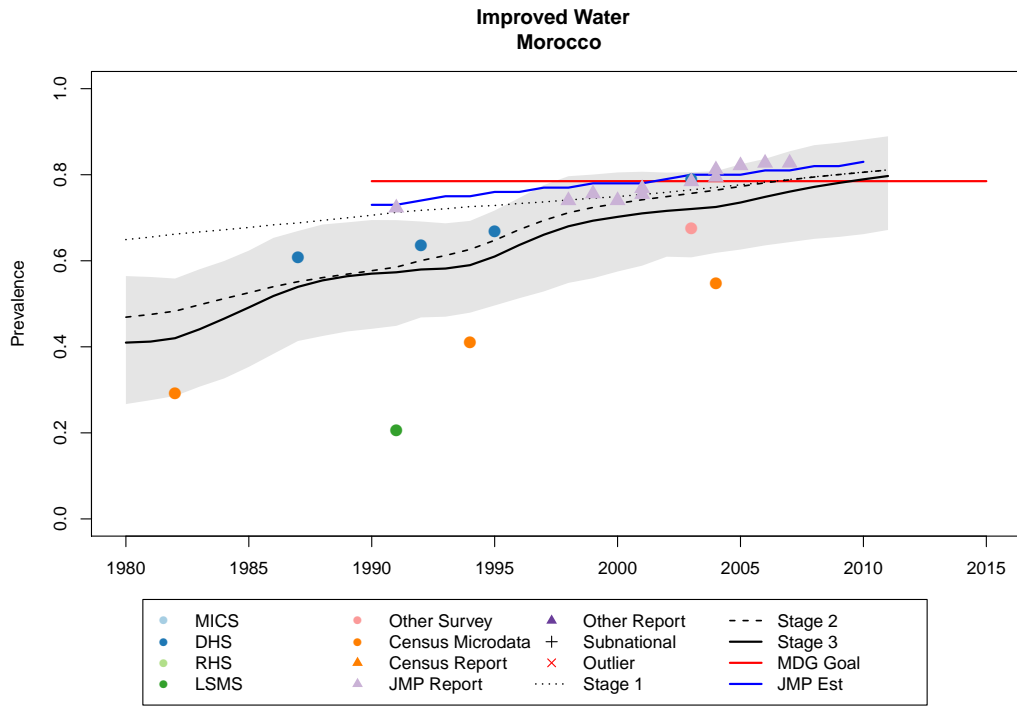


Figure A.83: Prevalence of access to improved water, Morocco

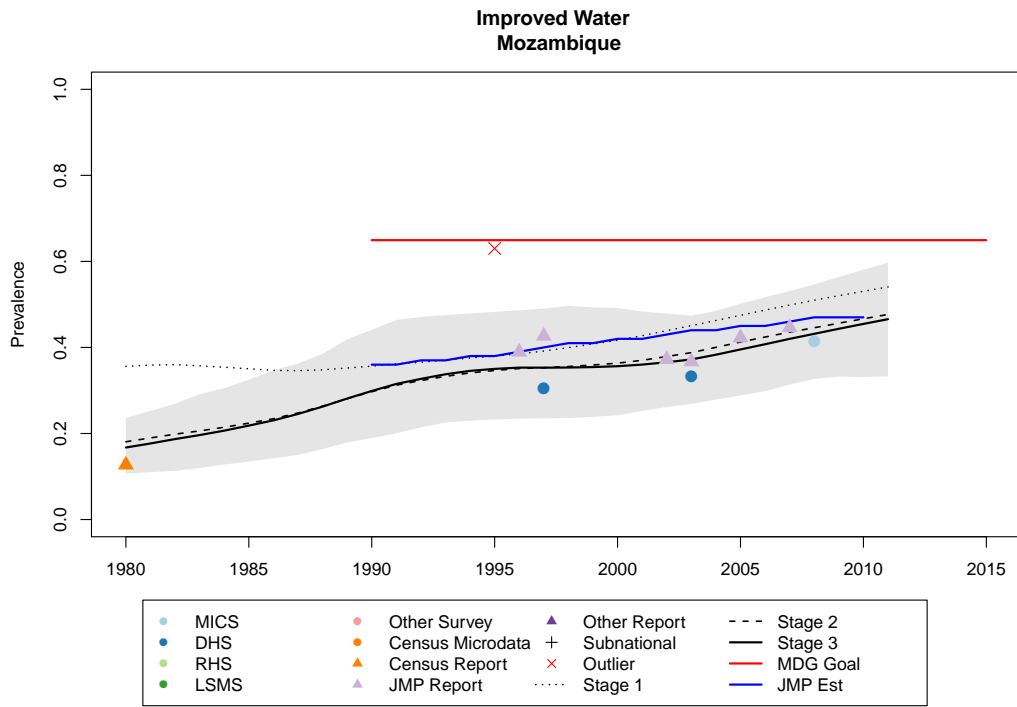


Figure A.84: Prevalence of access to improved water, Mozambique

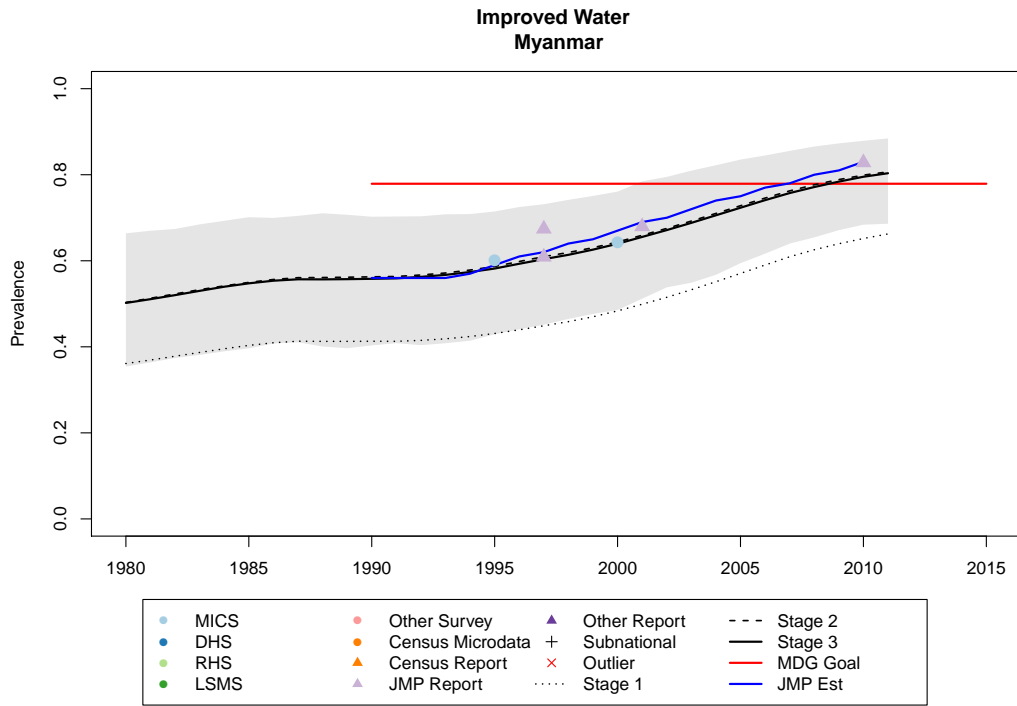


Figure A.85: Prevalence of access to improved water, Myanmar

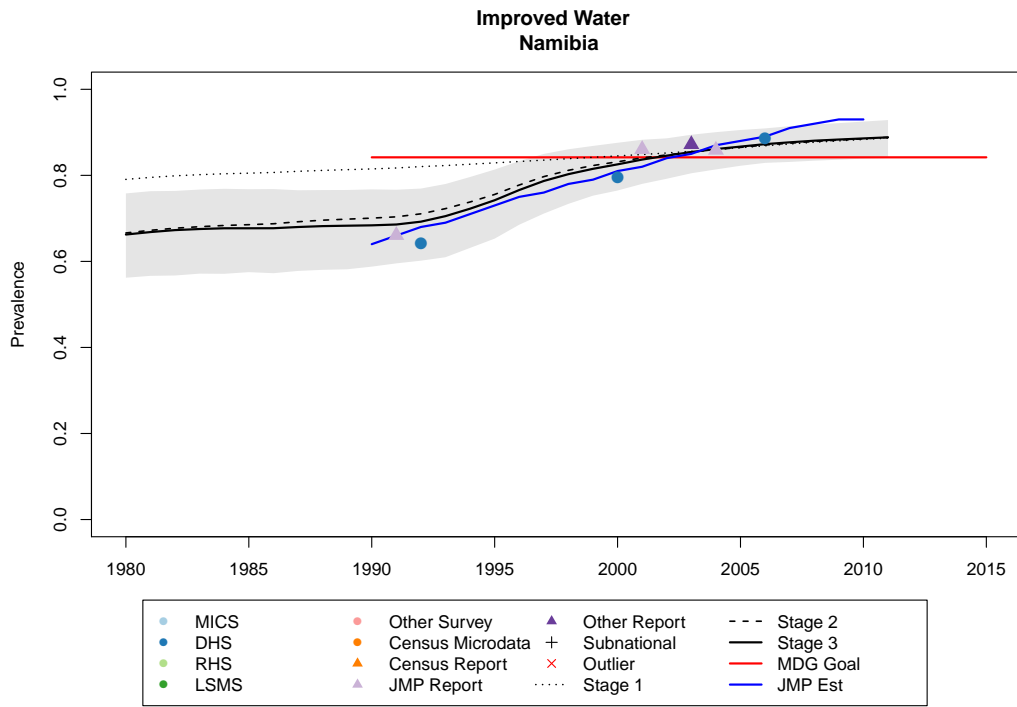


Figure A.86: Prevalence of access to improved water, Namibia

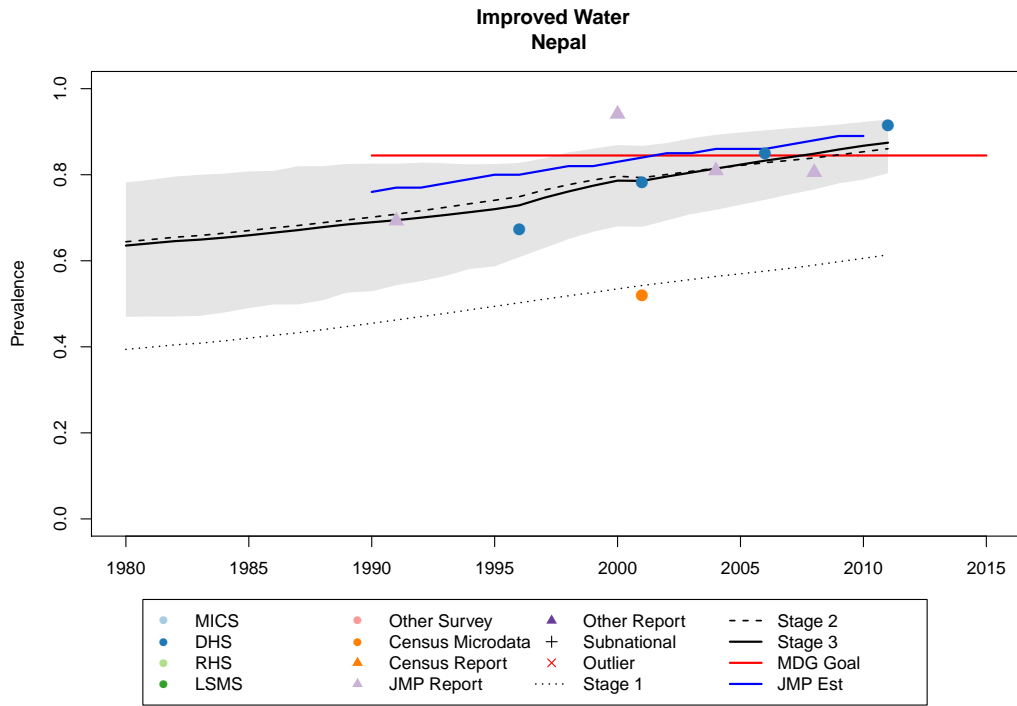


Figure A.87: Prevalence of access to improved water, Nepal

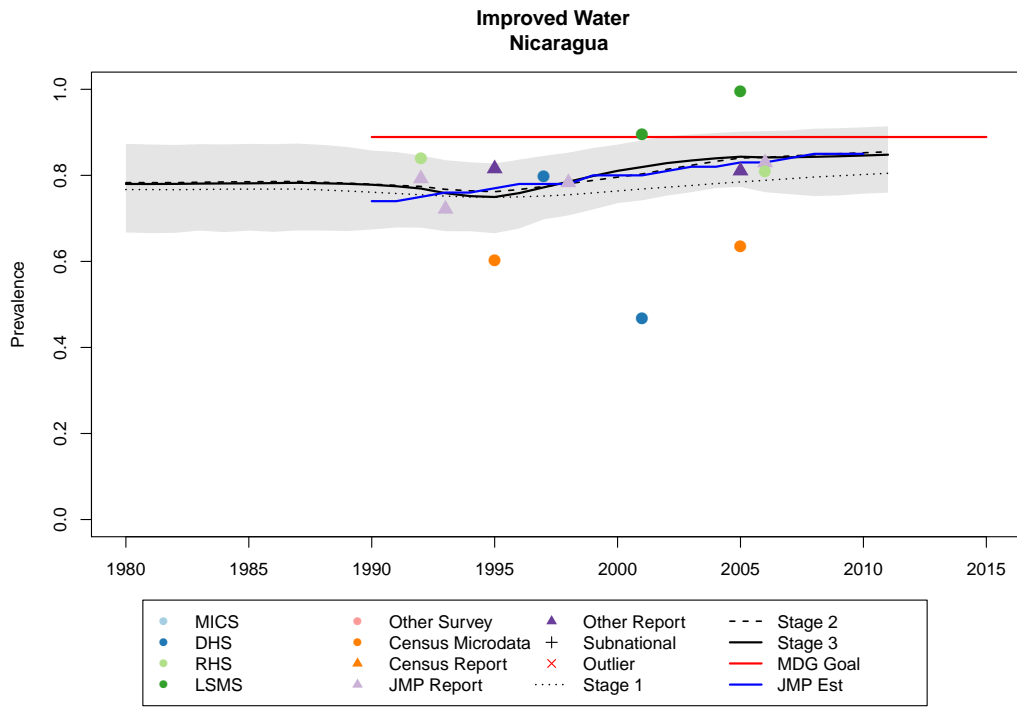


Figure A.88: Prevalence of access to improved water, Nicaragua

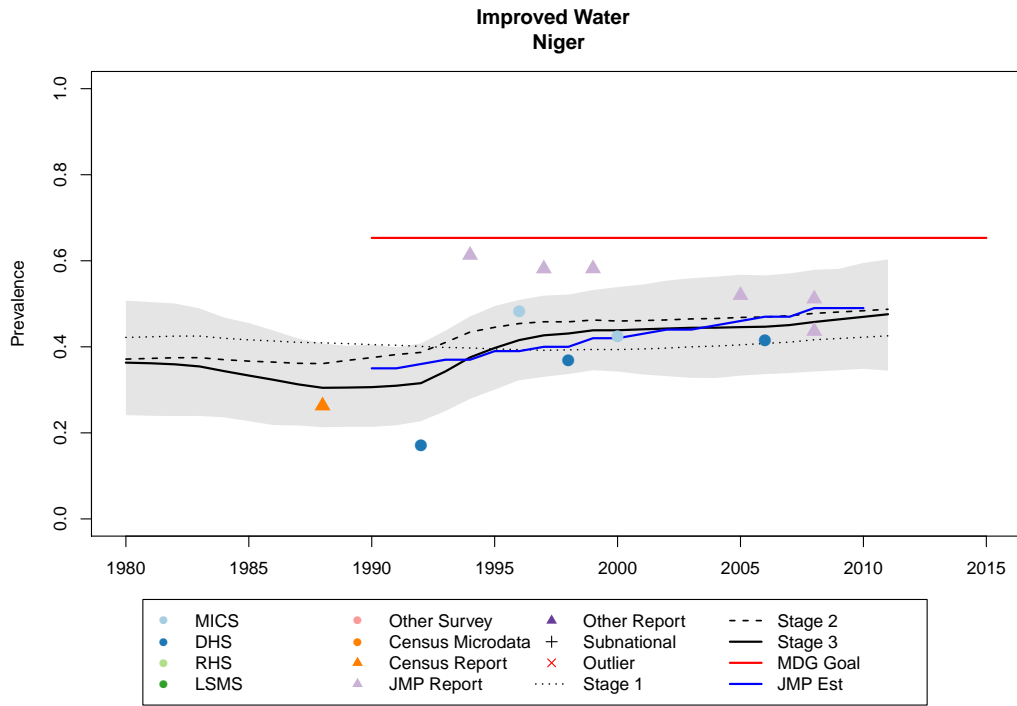


Figure A.89: Prevalence of access to improved water, Niger

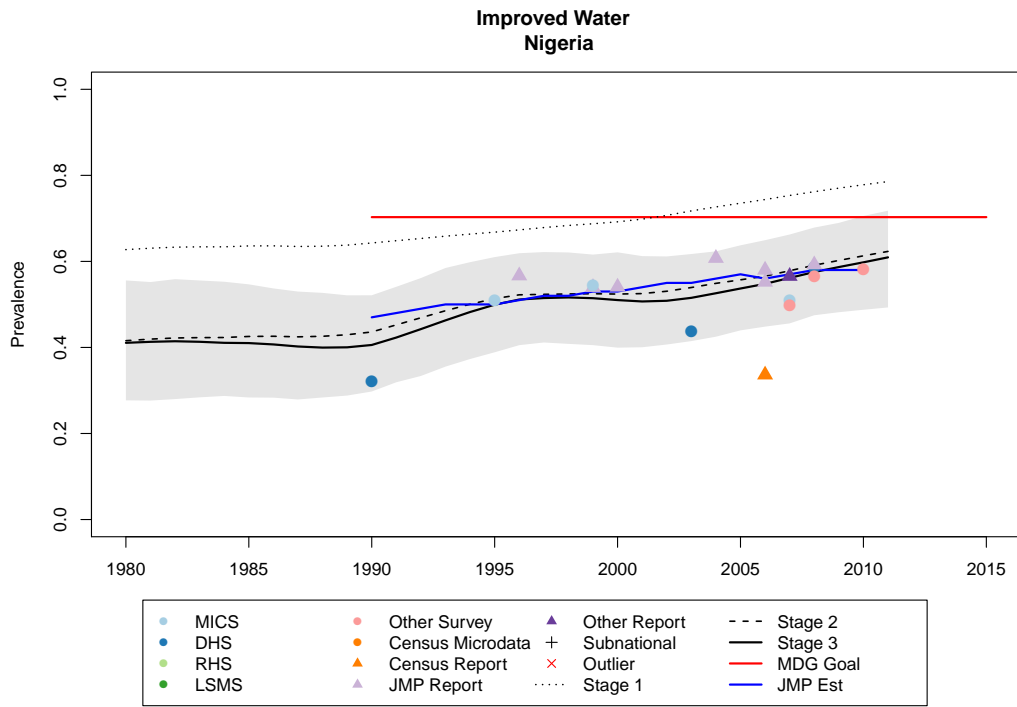


Figure A.90: Prevalence of access to improved water, Nigeria

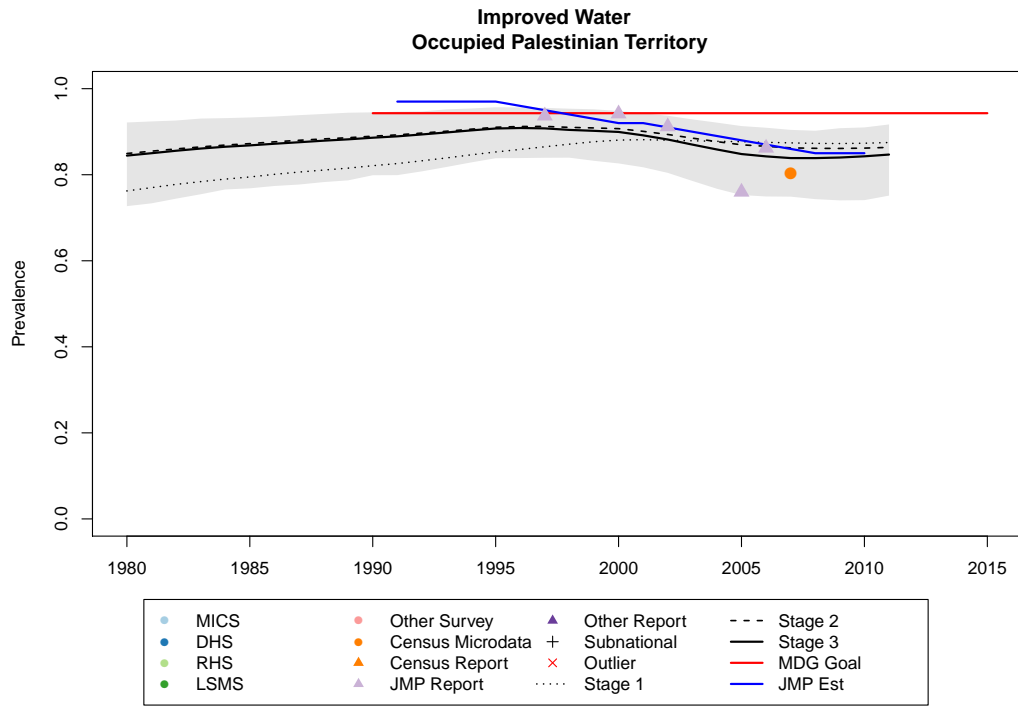


Figure A.91: Prevalence of access to improved water, Occupied Palestinian Territory

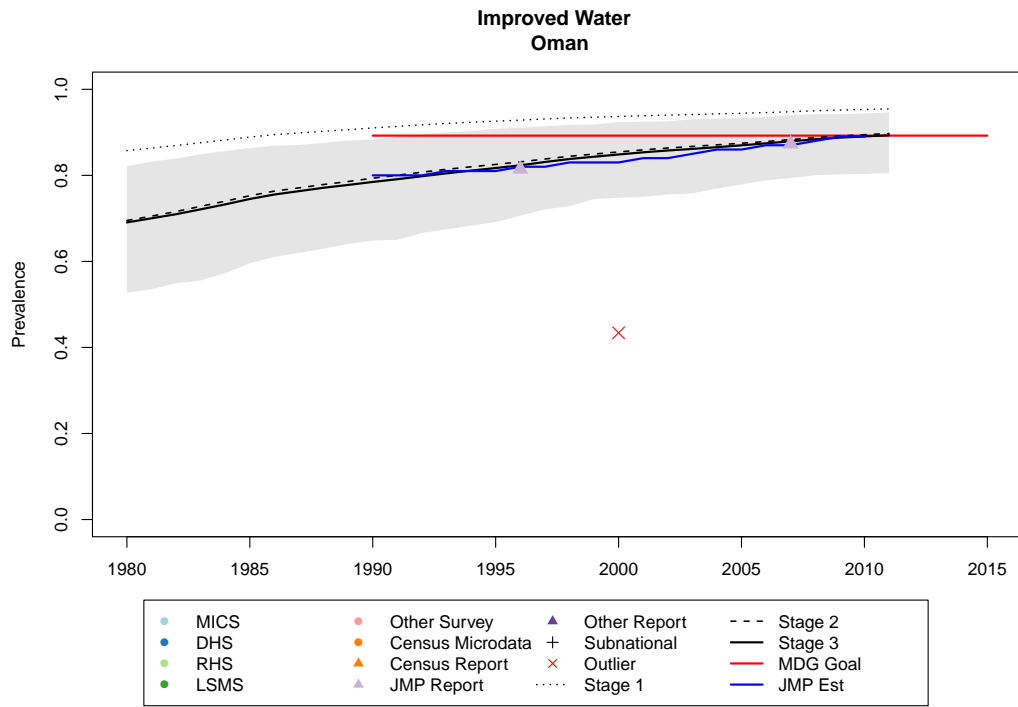


Figure A.92: Prevalence of access to improved water, Oman

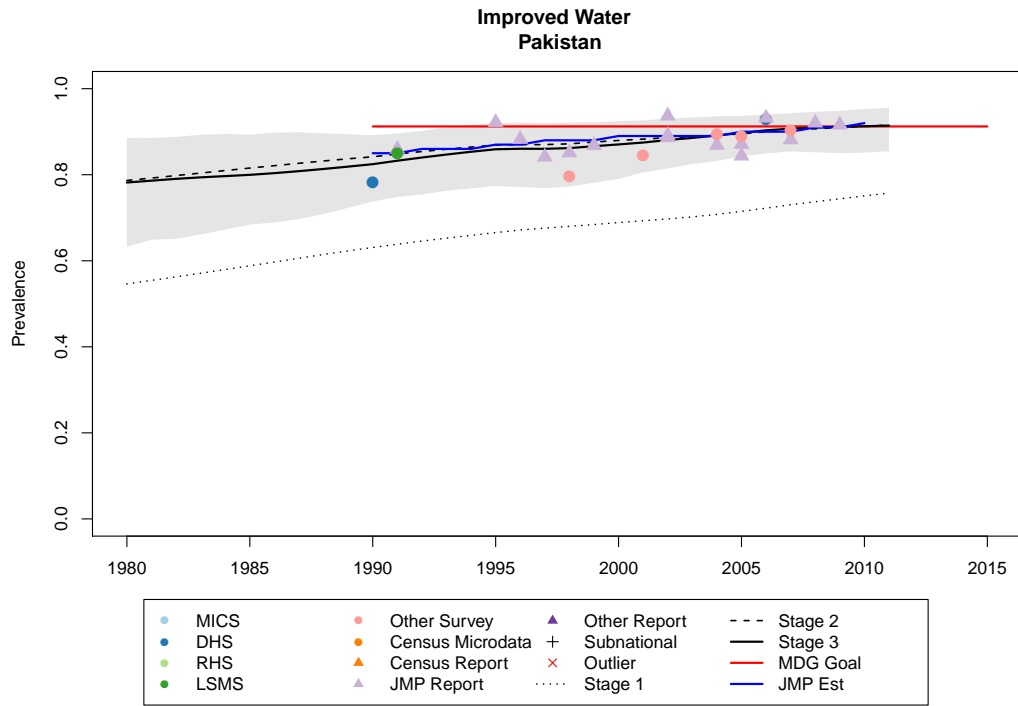


Figure A.93: Prevalence of access to improved water, Pakistan

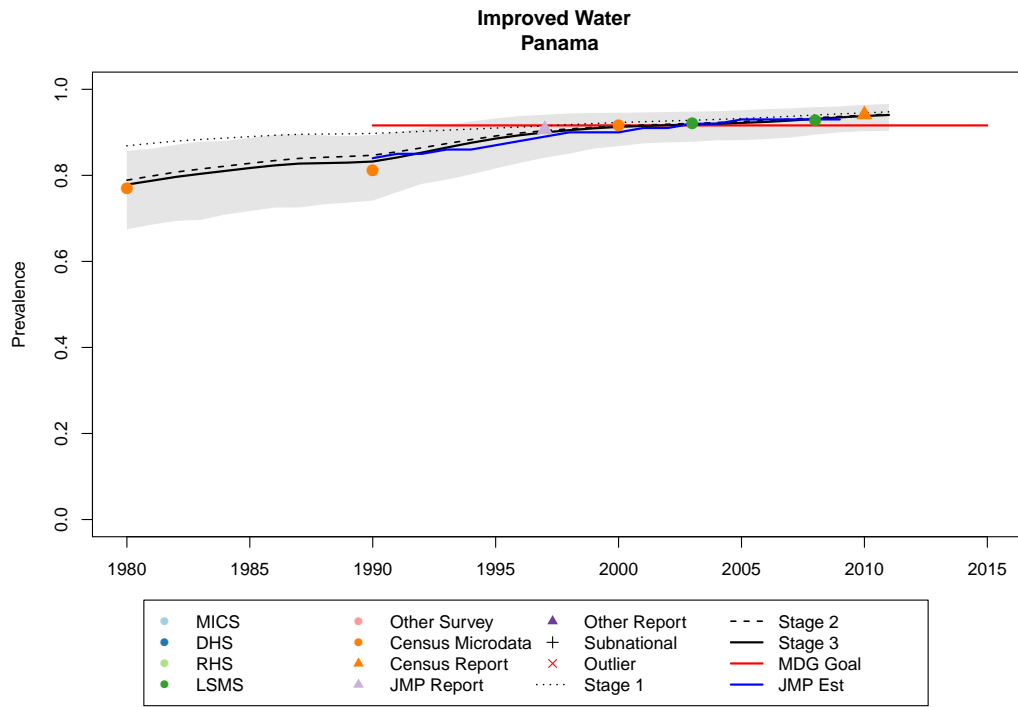


Figure A.94: Prevalence of access to improved water, Panama

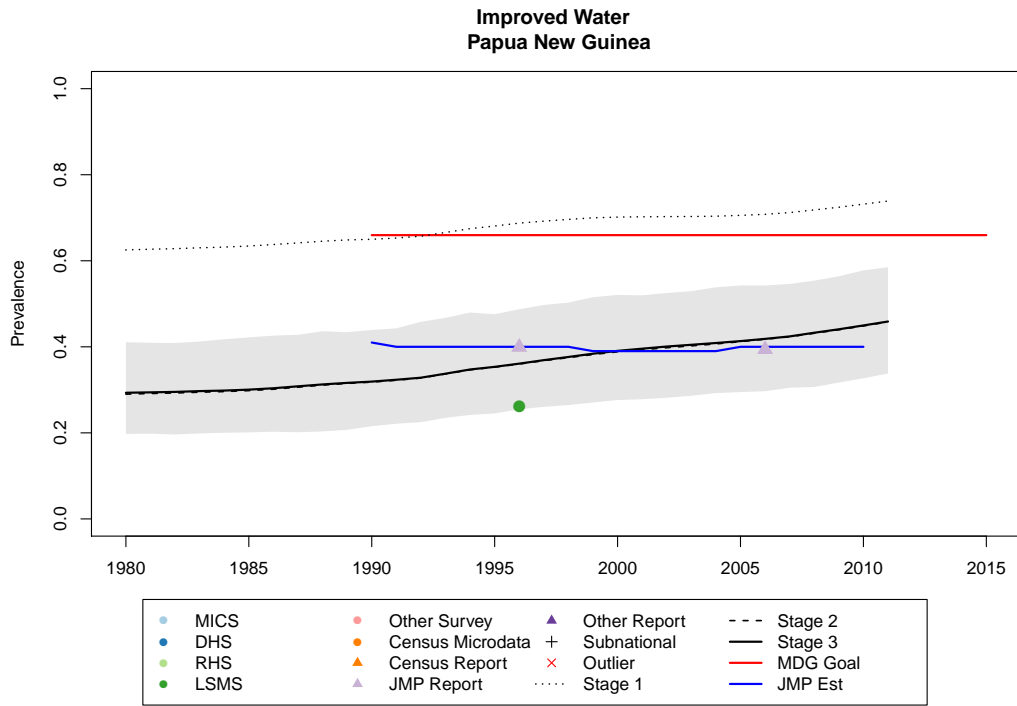


Figure A.95: Prevalence of access to improved water, Papua New Guinea

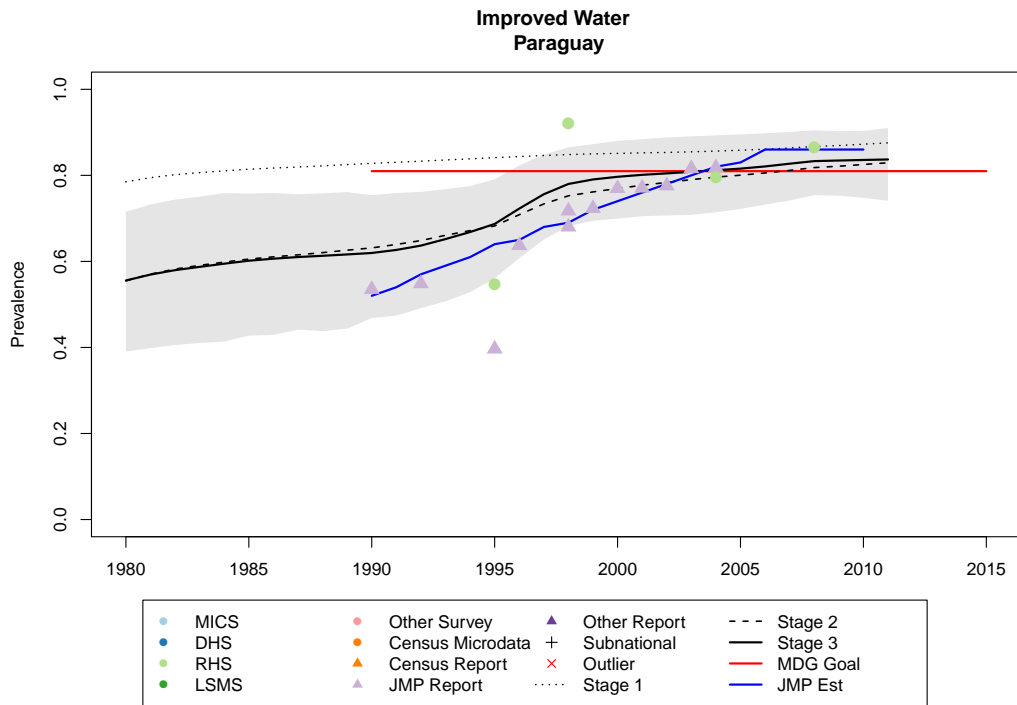


Figure A.96: Prevalence of access to improved water, Paraguay

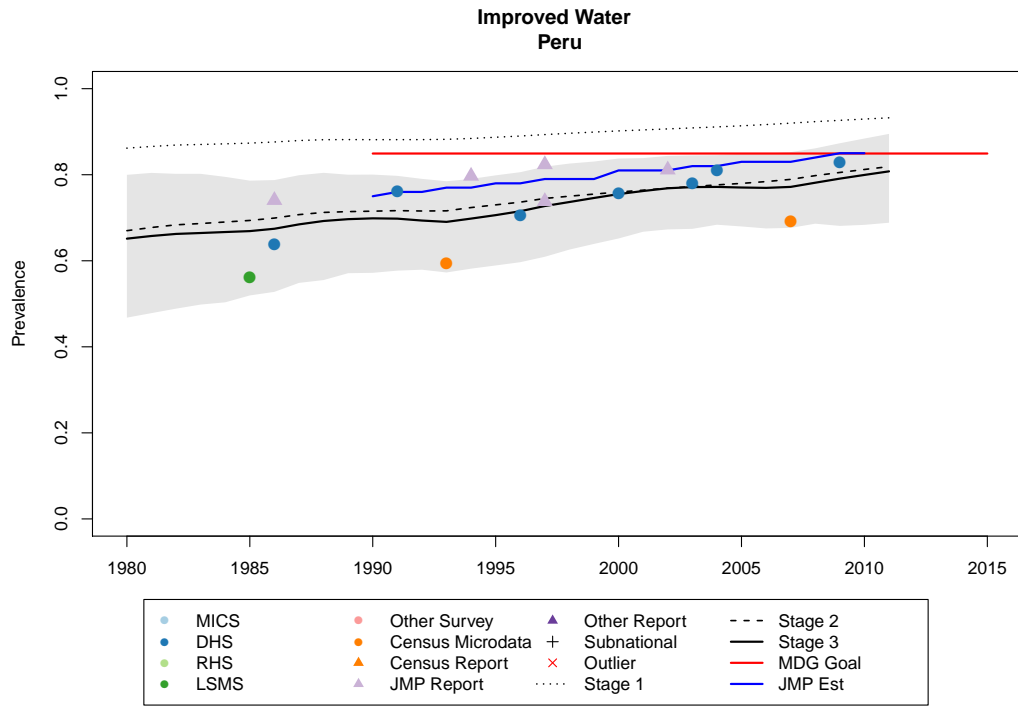


Figure A.97: Prevalence of access to improved water, Peru

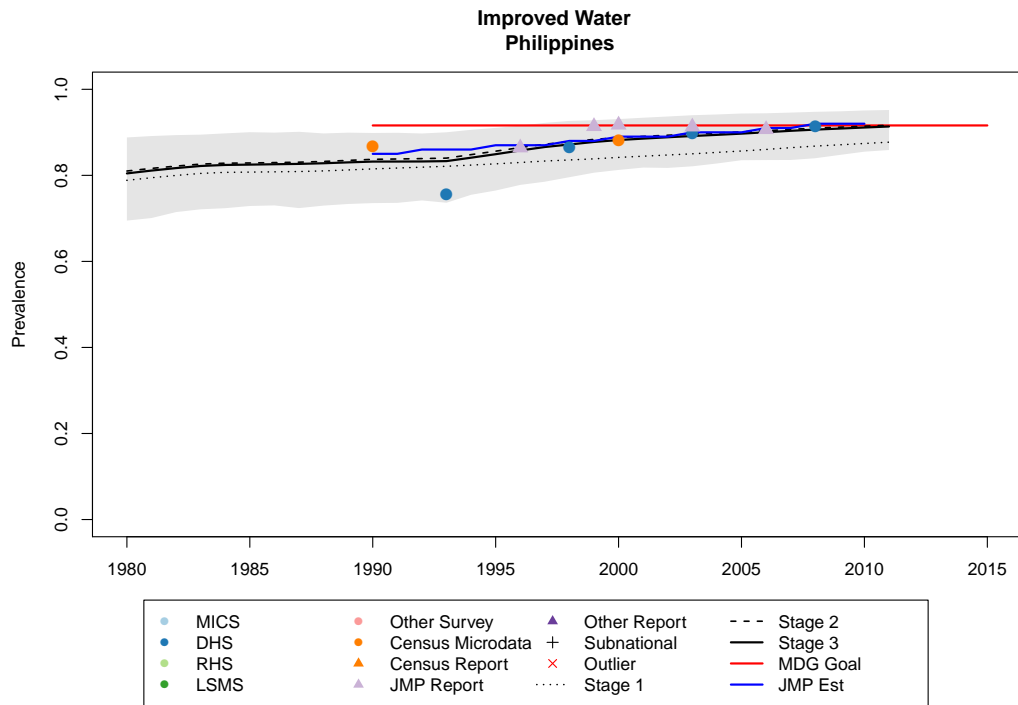


Figure A.98: Prevalence of access to improved water, Philippines

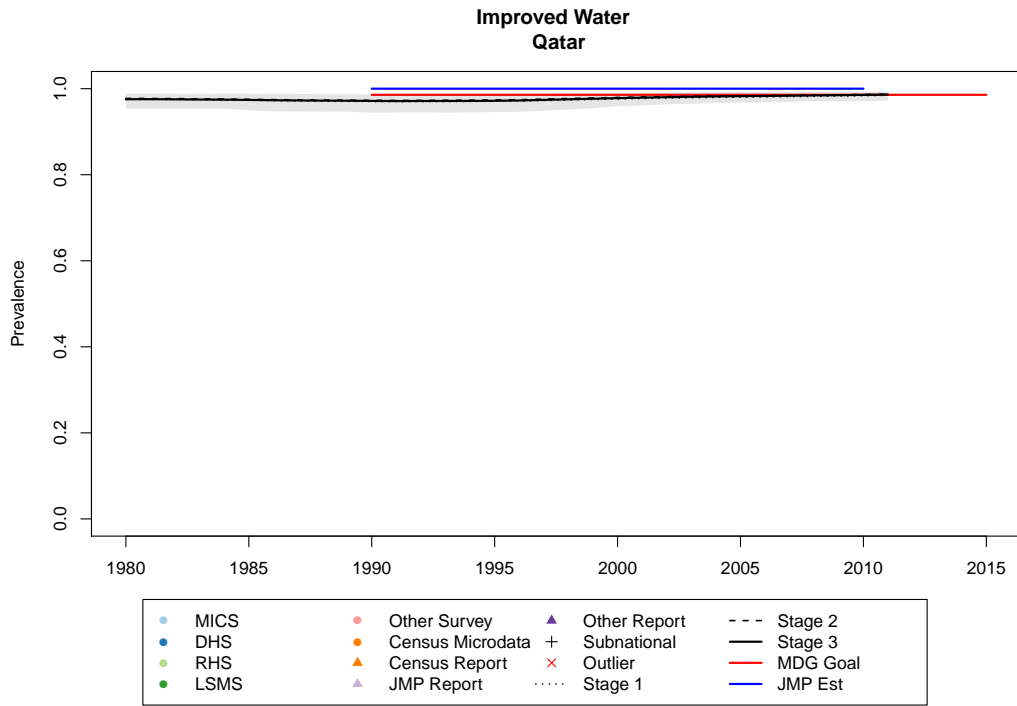


Figure A.99: Prevalence of access to improved water, Qatar

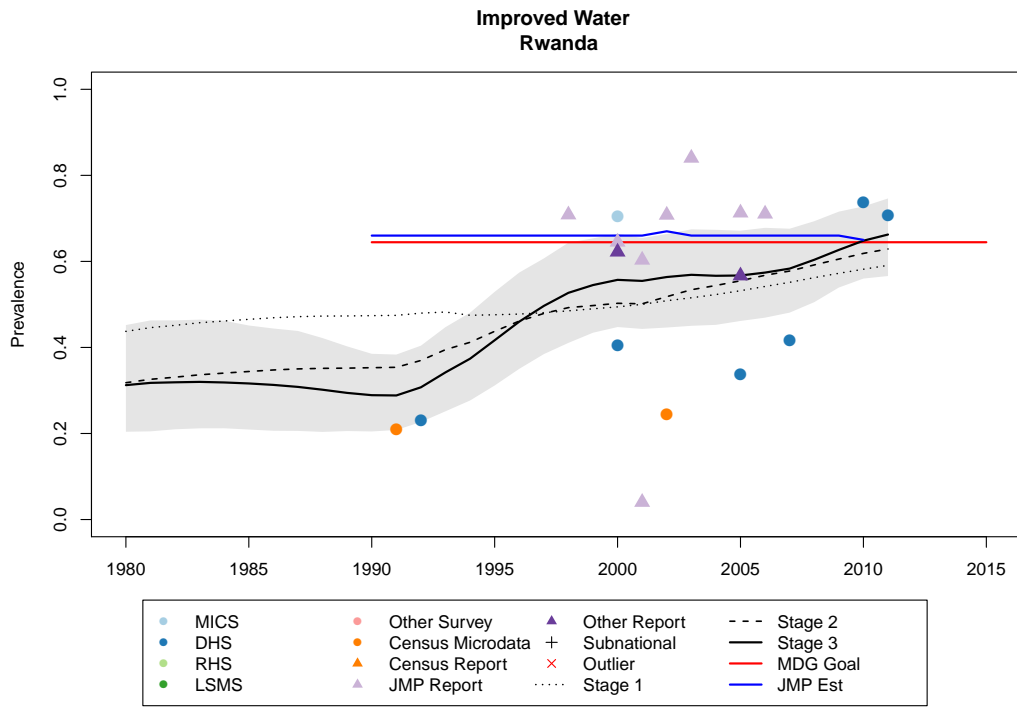


Figure A.100: Prevalence of access to improved water, Rwanda

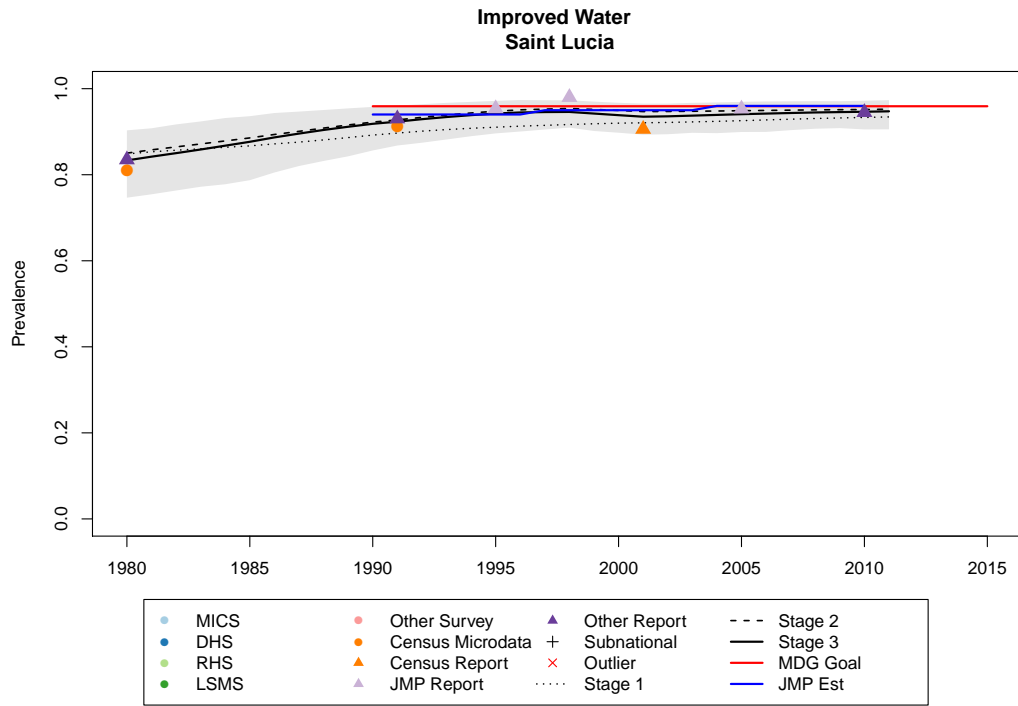


Figure A.101: Prevalence of access to improved water, Saint Lucia

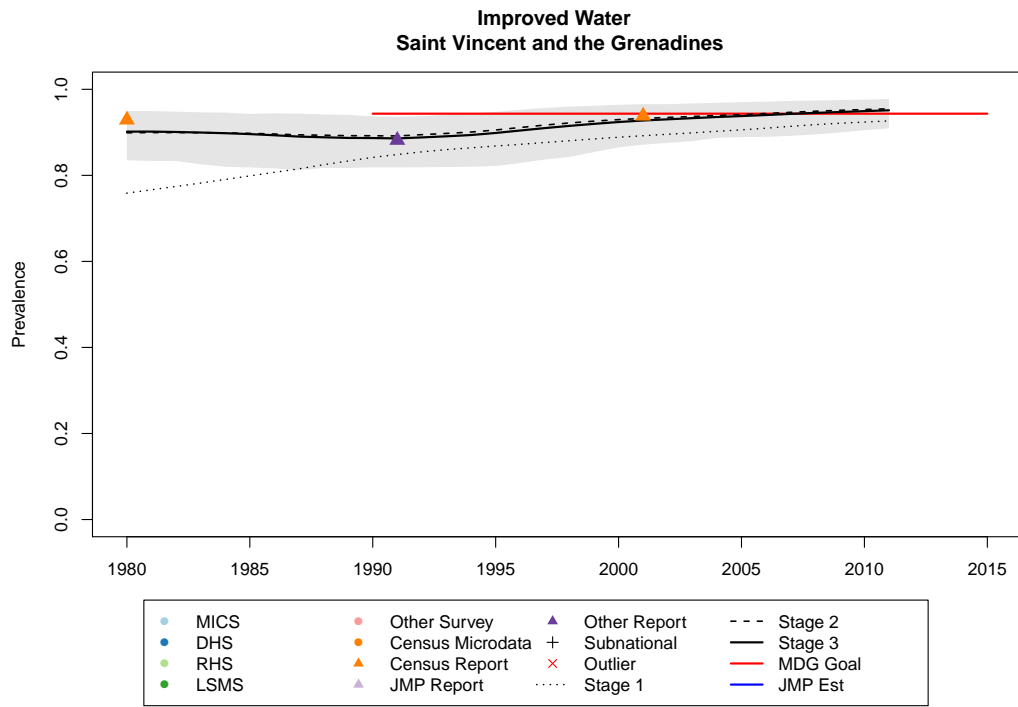


Figure A.102: Prevalence of access to improved water, Saint Vincent and the Grenadines

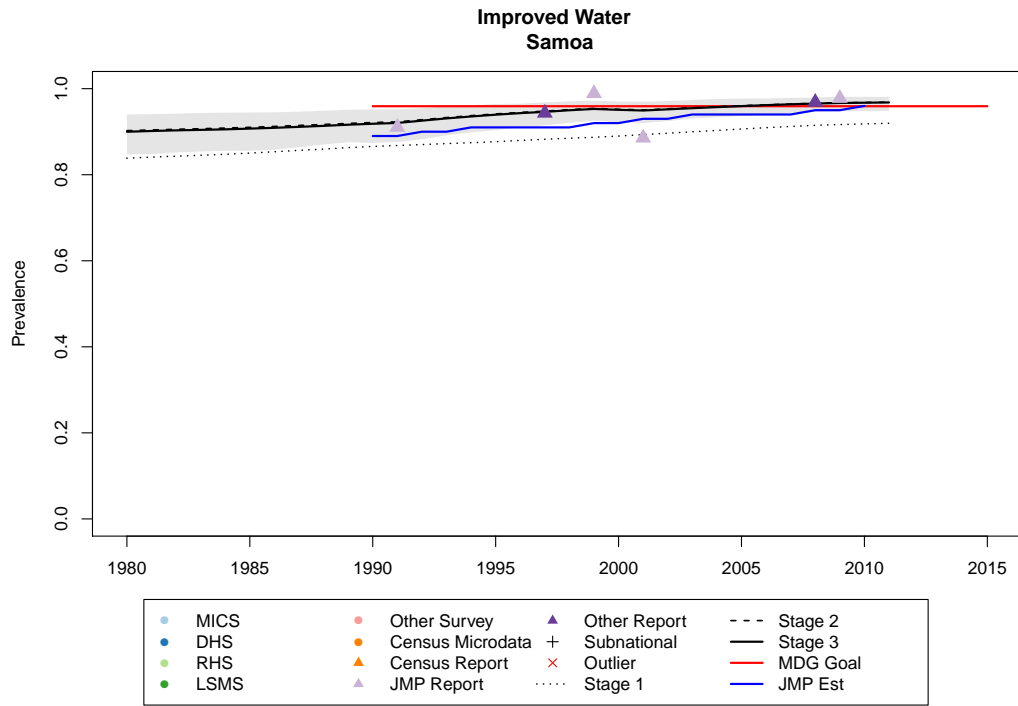


Figure A.103: Prevalence of access to improved water, Samoa

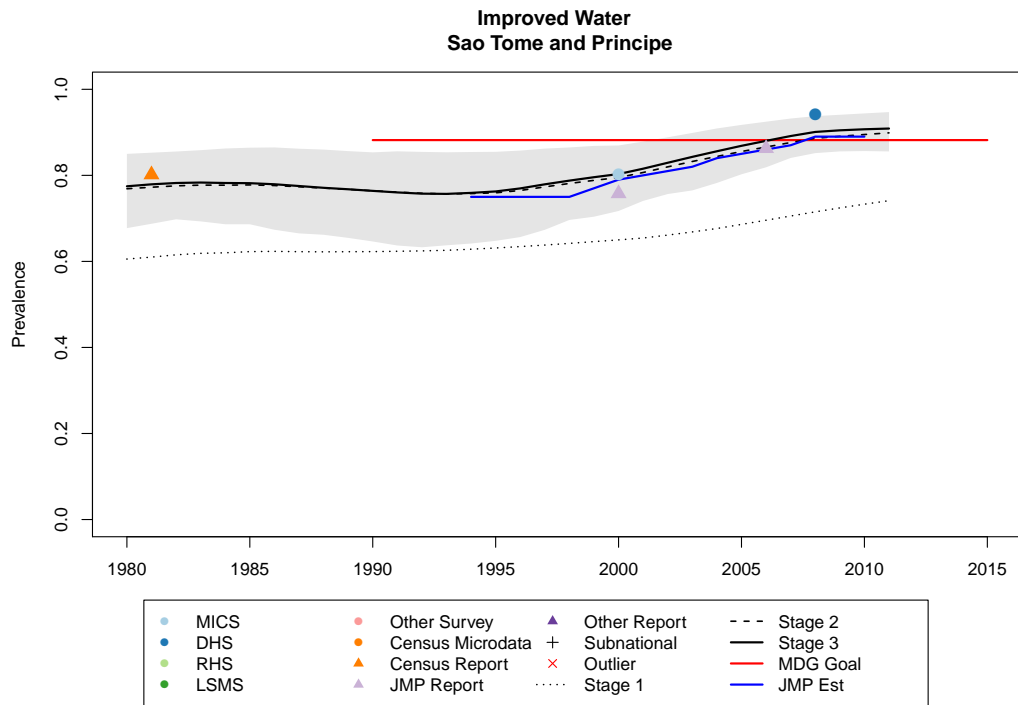


Figure A.104: Prevalence of access to improved water, Sao Tome and Principe

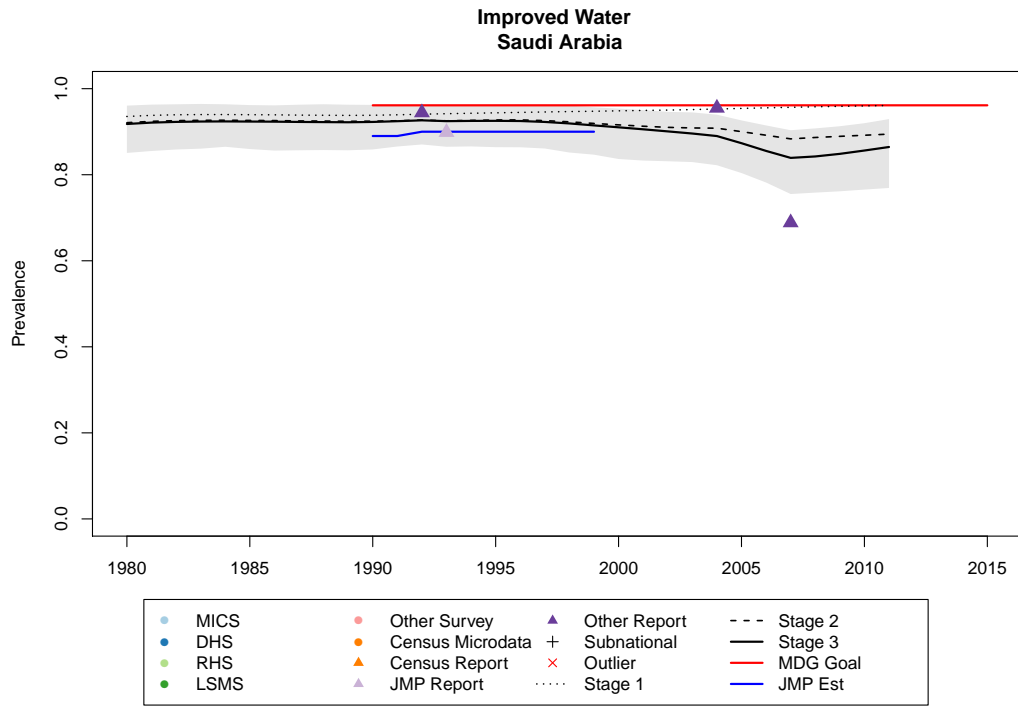


Figure A.105: Prevalence of access to improved water, Saudi Arabia

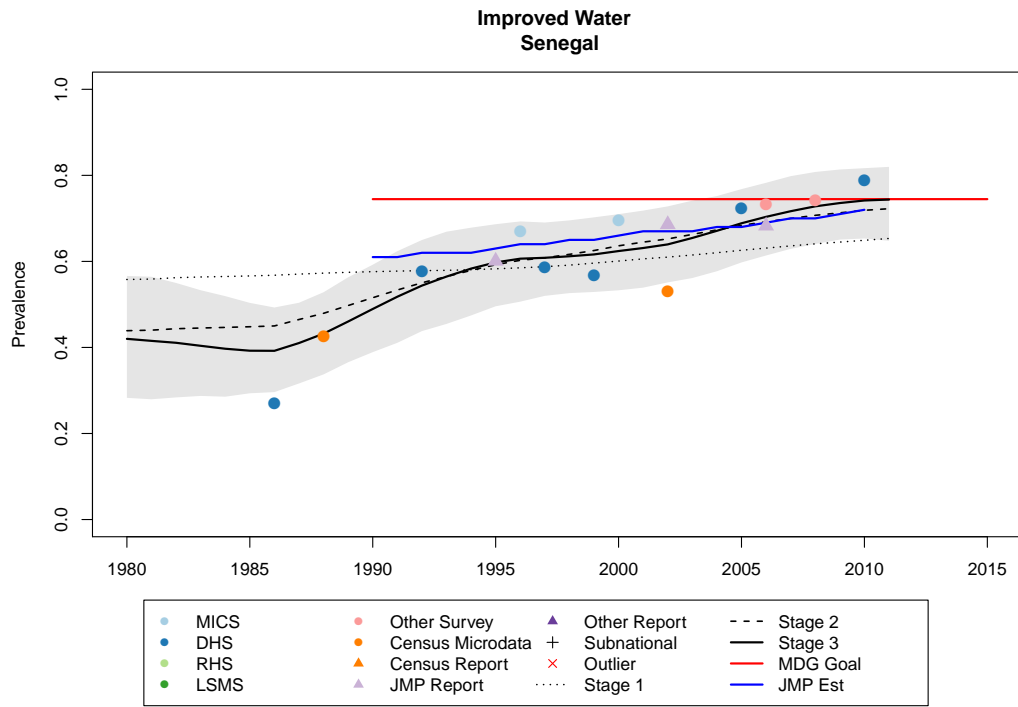


Figure A.106: Prevalence of access to improved water, Senegal

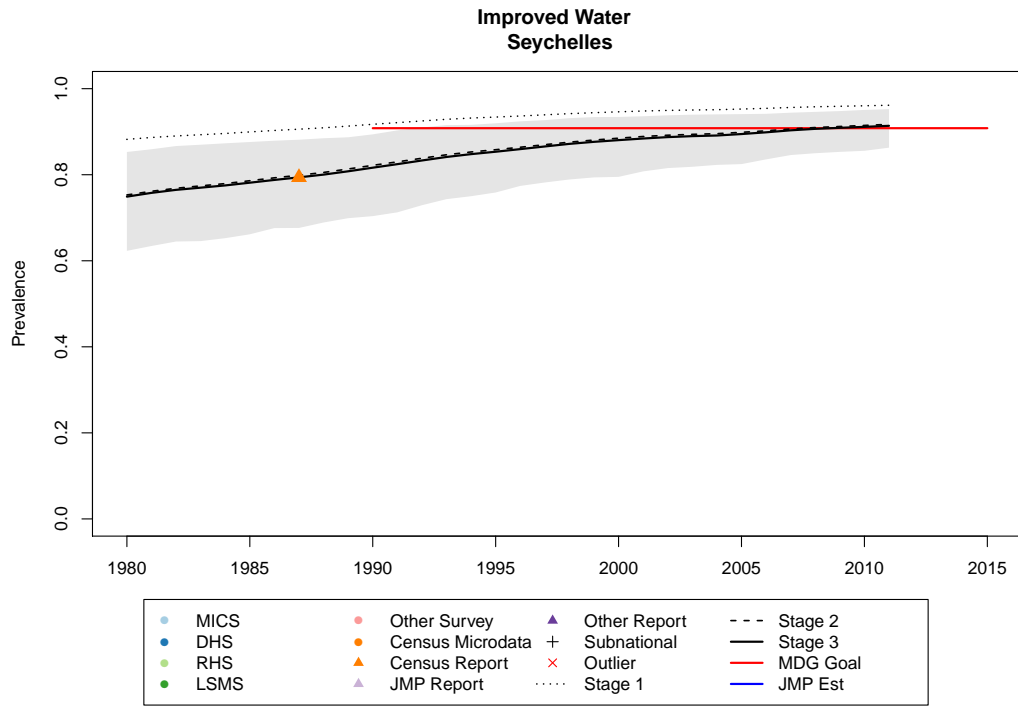


Figure A.107: Prevalence of access to improved water, Seychelles

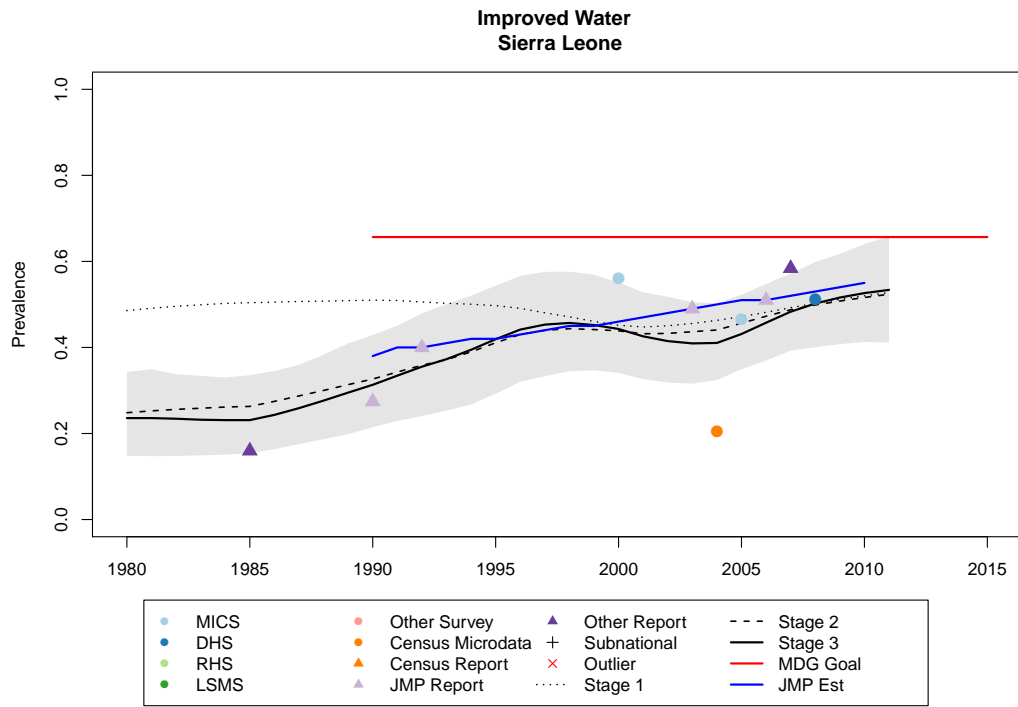


Figure A.108: Prevalence of access to improved water, Sierra Leone

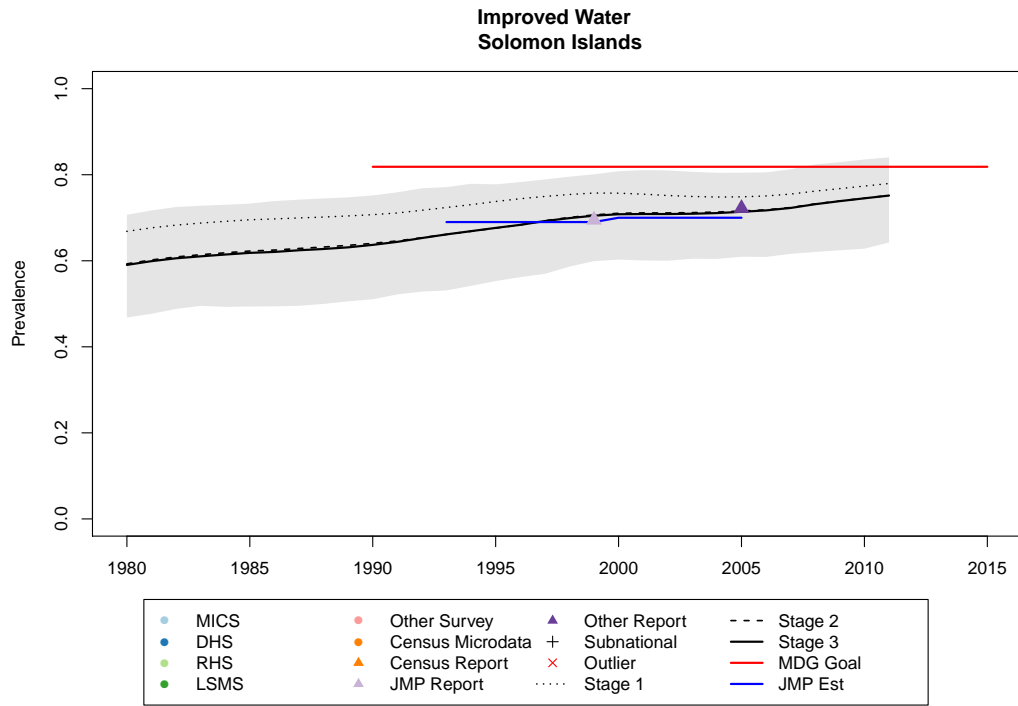


Figure A.109: Prevalence of access to improved water, Solomon Islands

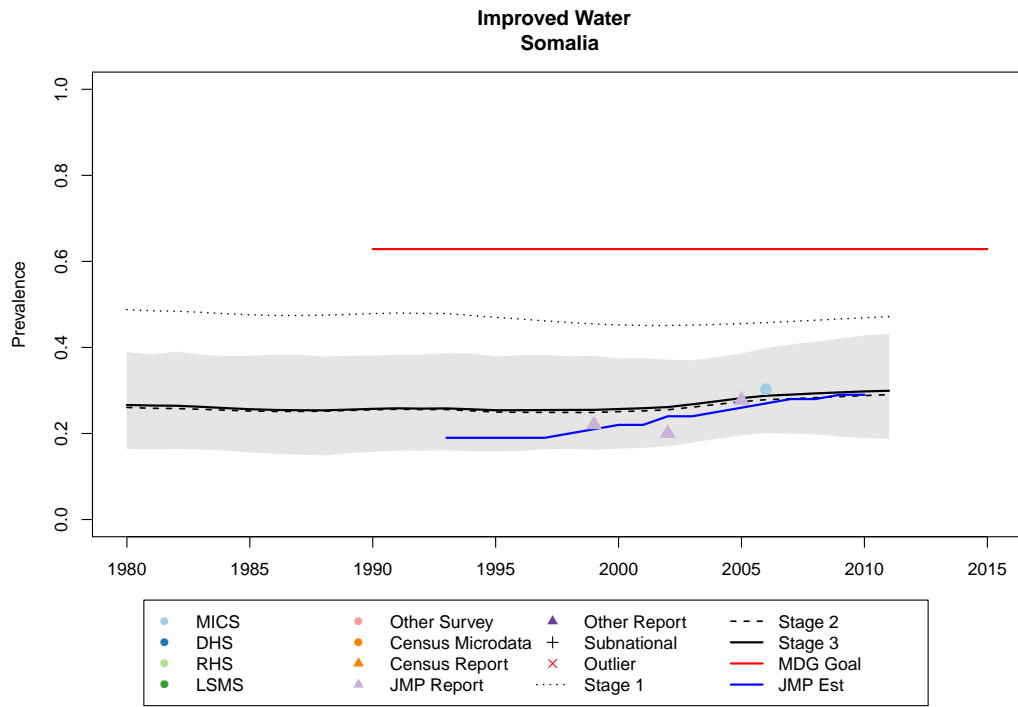


Figure A.110: Prevalence of access to improved water, Somalia

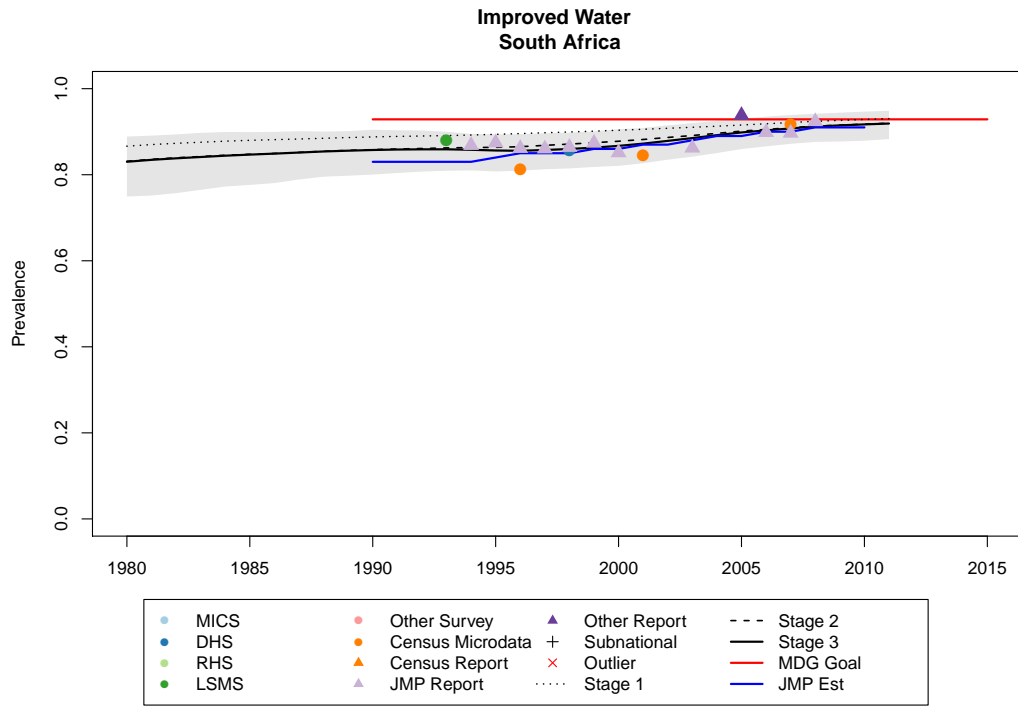


Figure A.111: Prevalence of access to improved water, South Africa

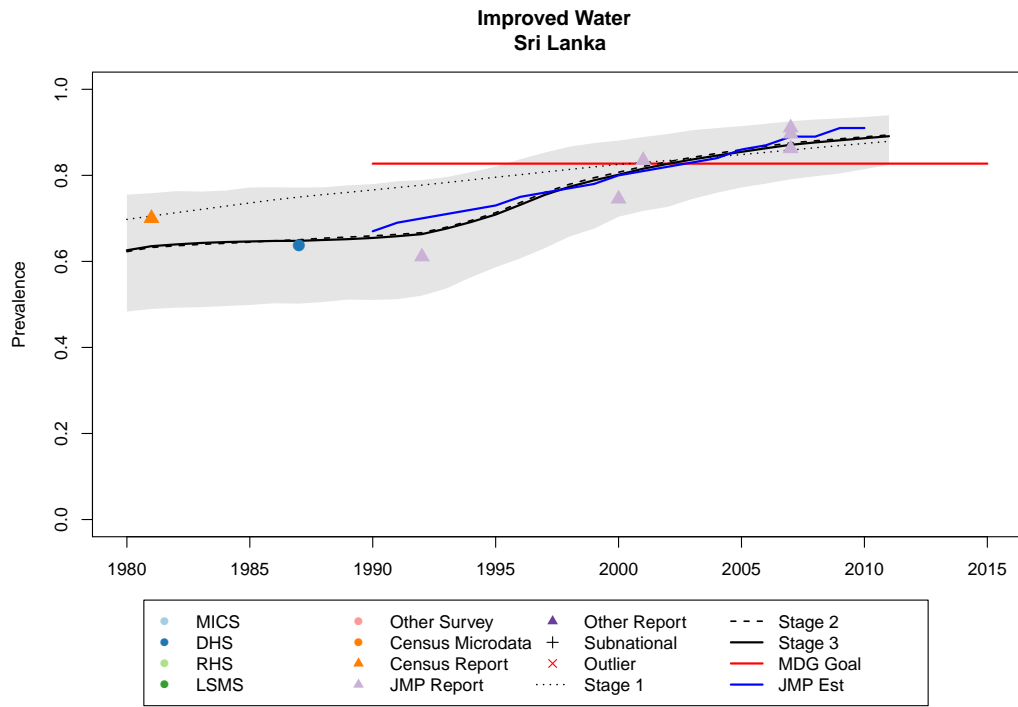


Figure A.112: Prevalence of access to improved water, Sri Lanka

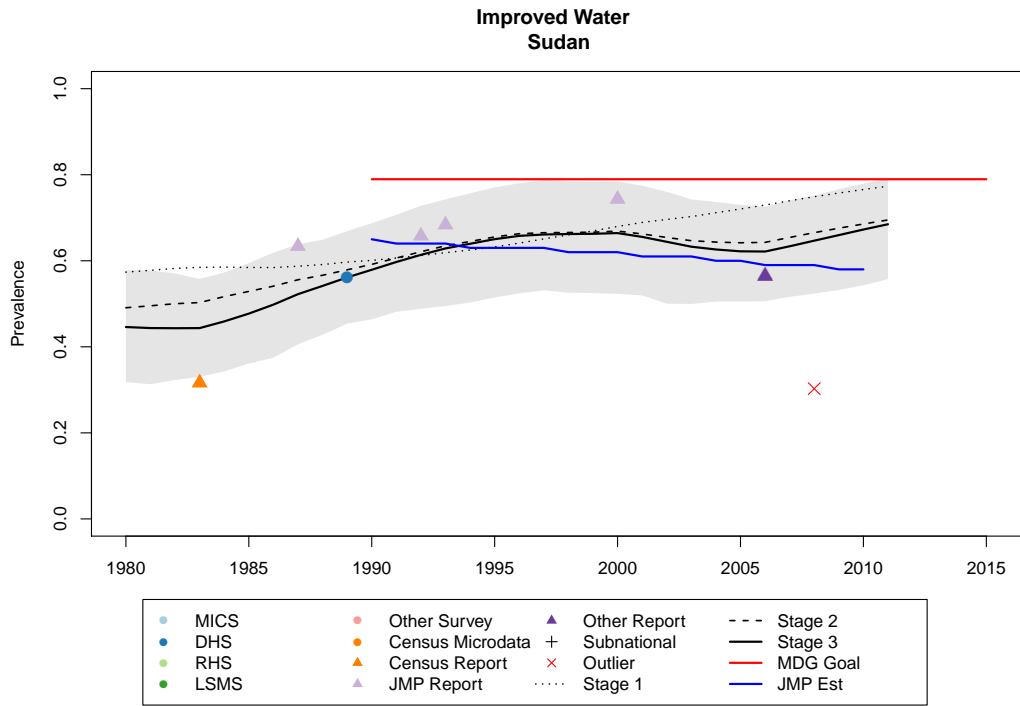


Figure A.113: Prevalence of access to improved water, Sudan

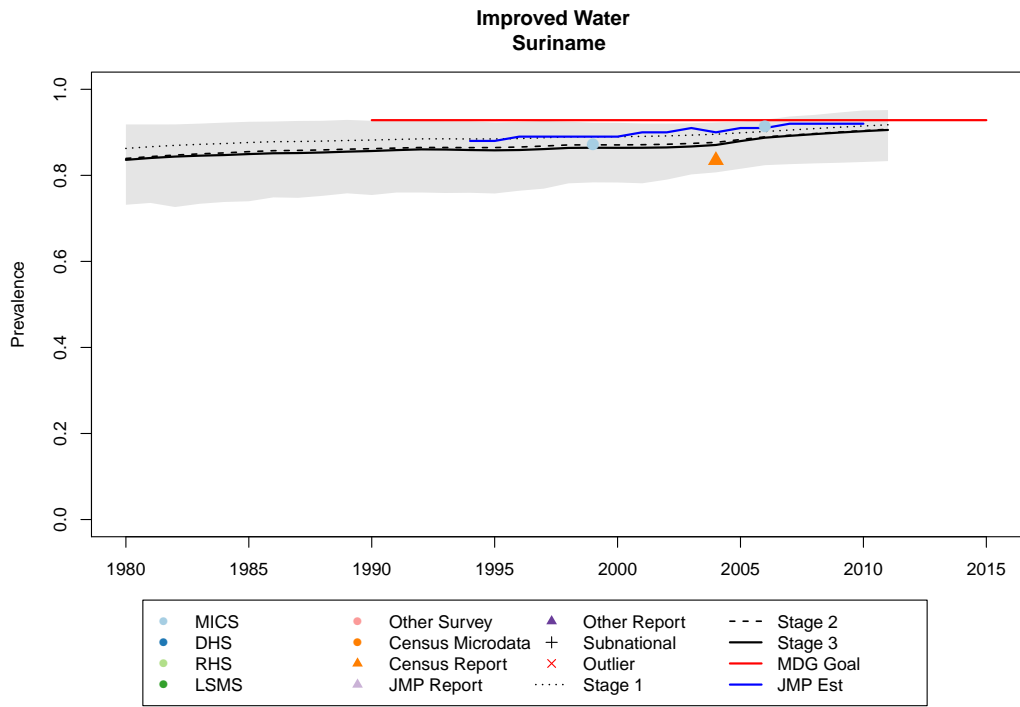


Figure A.114: Prevalence of access to improved water, Suriname

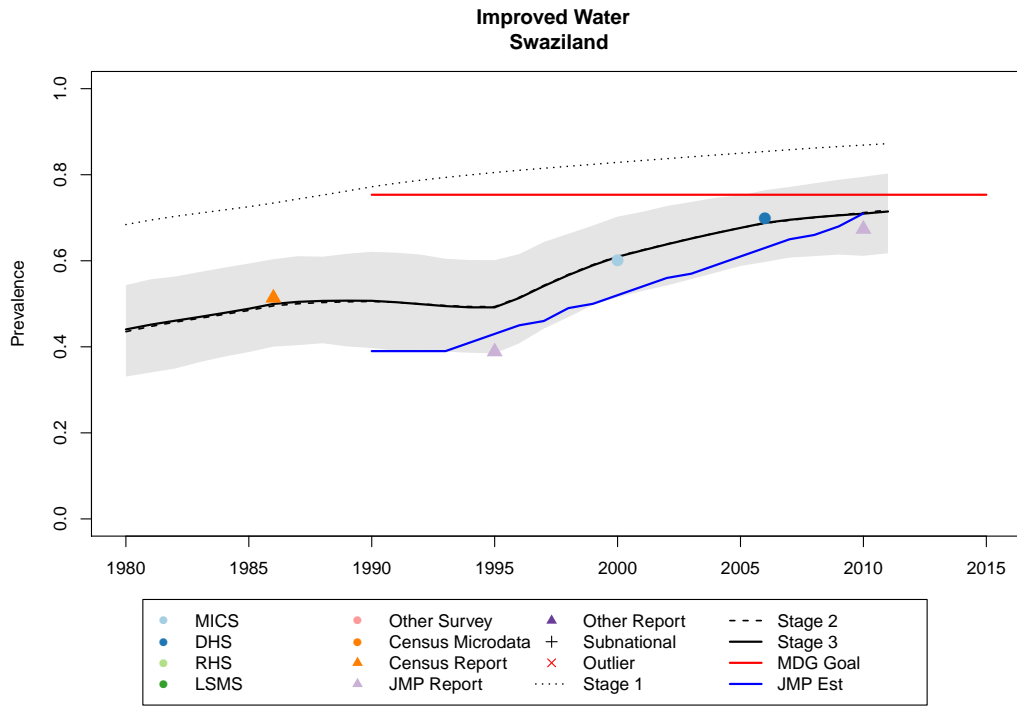


Figure A.115: Prevalence of access to improved water, Swaziland

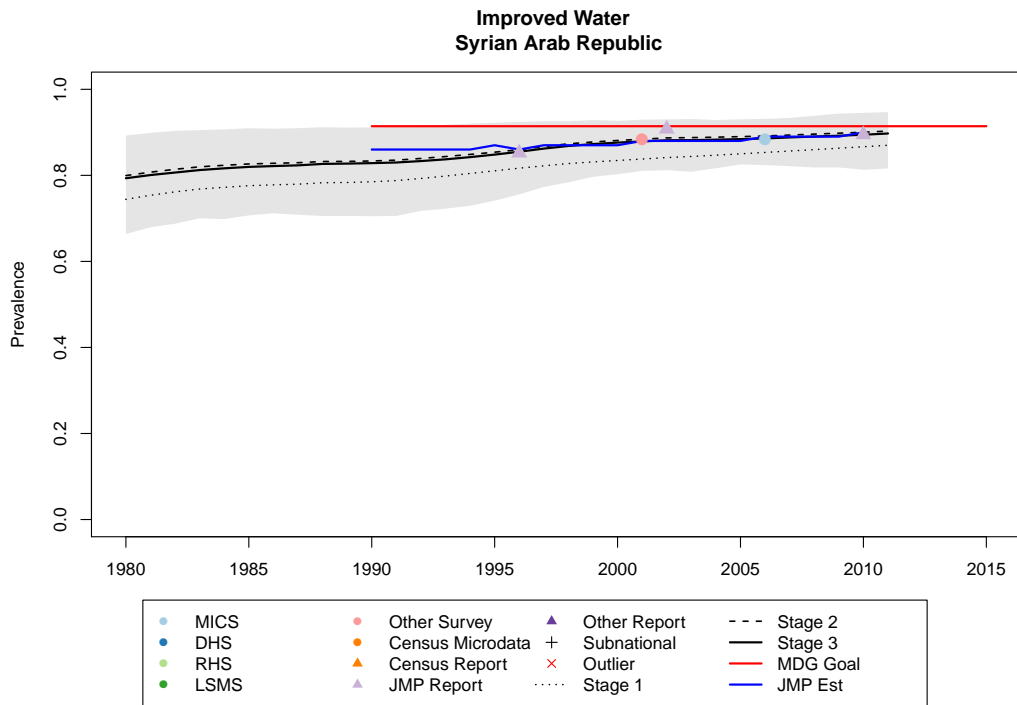


Figure A.116: Prevalence of access to improved water, Syrian Arab Republic

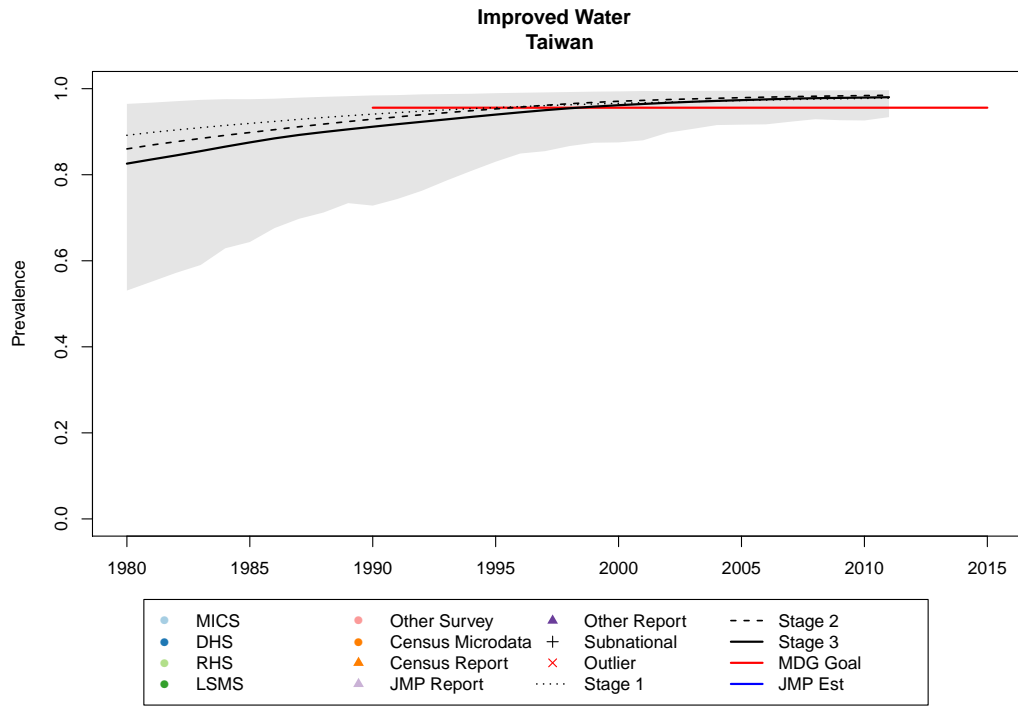


Figure A.117: Prevalence of access to improved water, Taiwan

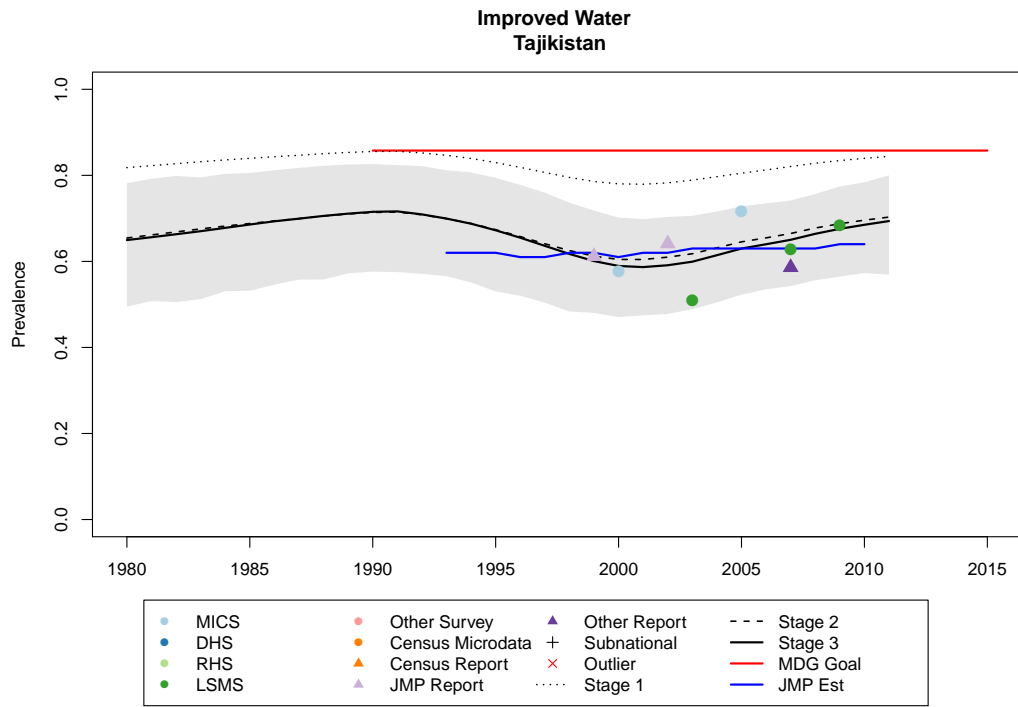


Figure A.118: Prevalence of access to improved water, Tajikistan

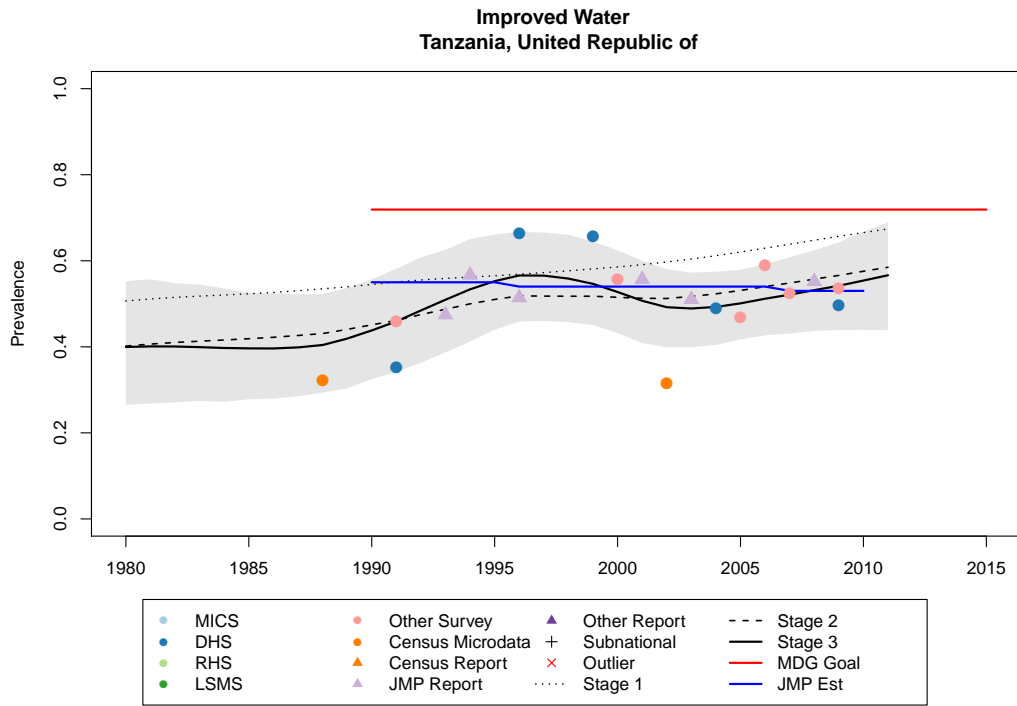


Figure A.119: Prevalence of access to improved water, Tanzania, United Republic of

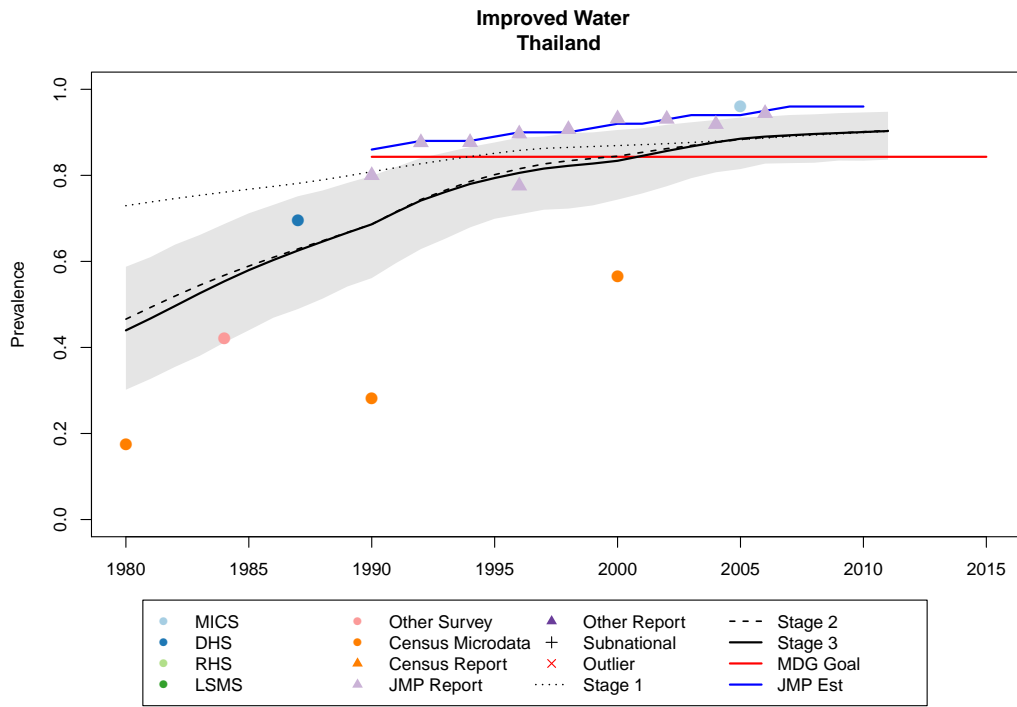


Figure A.120: Prevalence of access to improved water, Thailand

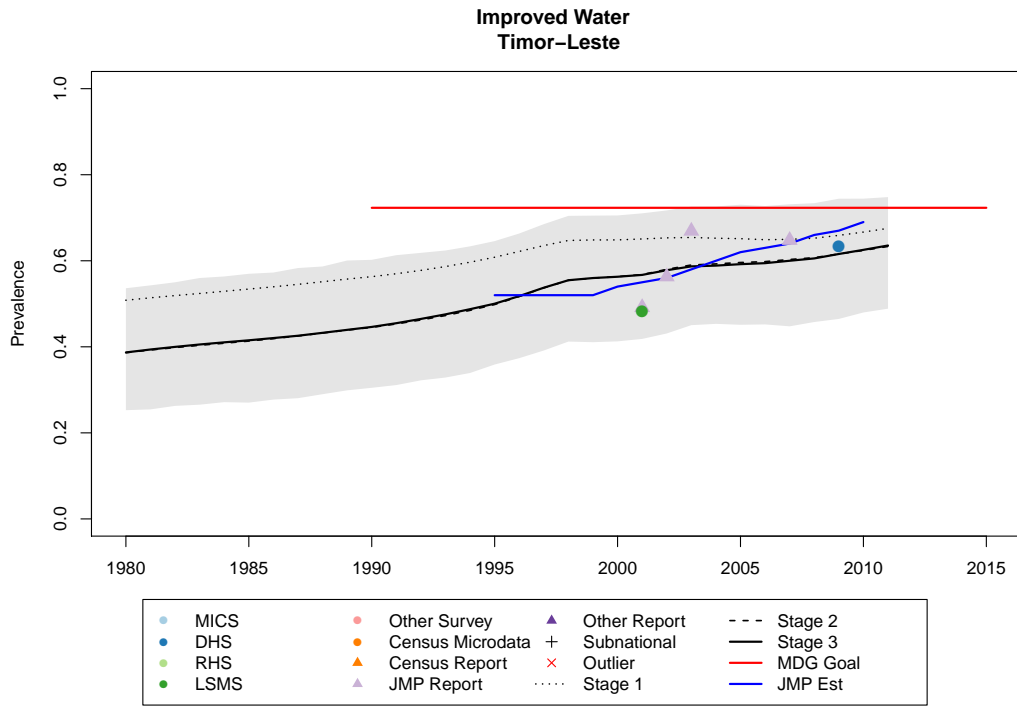


Figure A.121: Prevalence of access to improved water, Timor-Leste

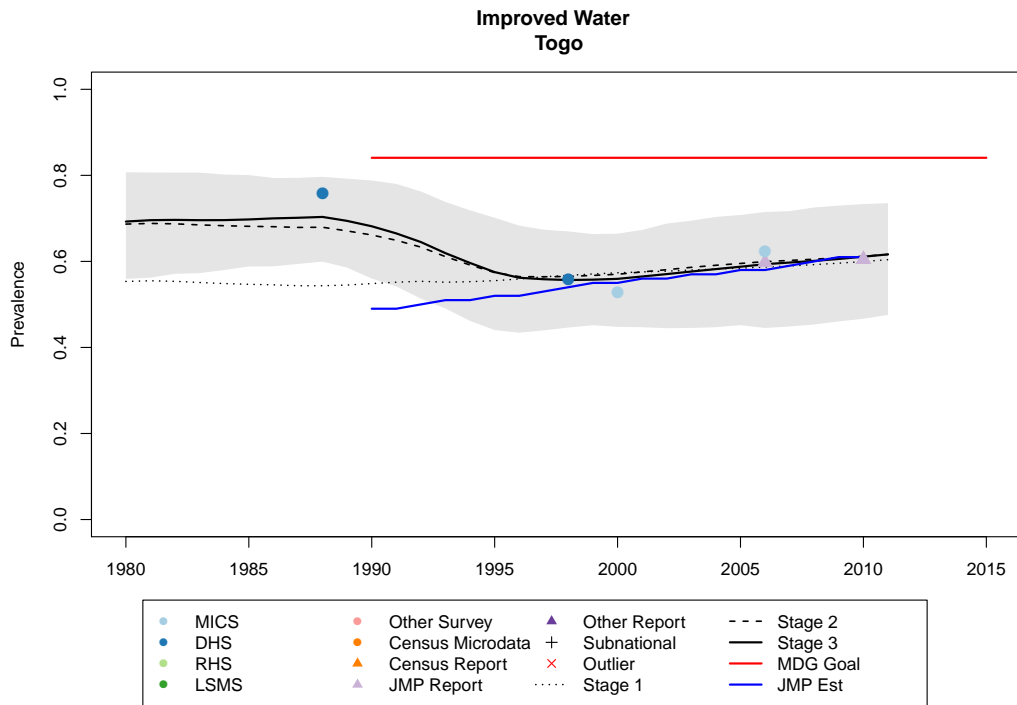


Figure A.122: Prevalence of access to improved water, Togo

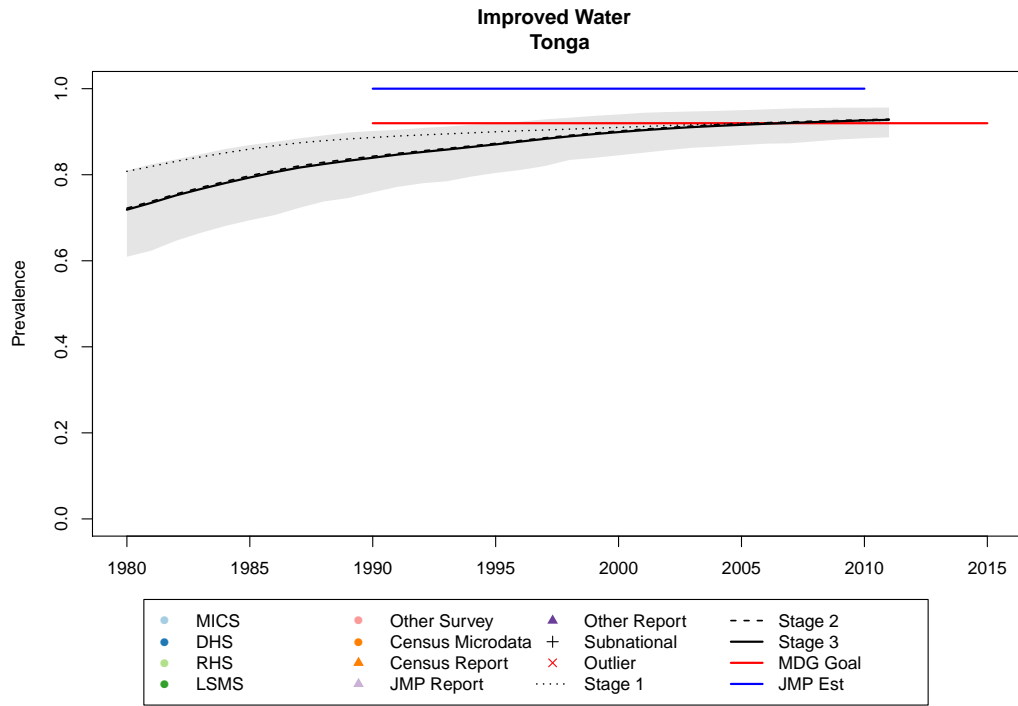


Figure A.123: Prevalence of access to improved water, Tonga

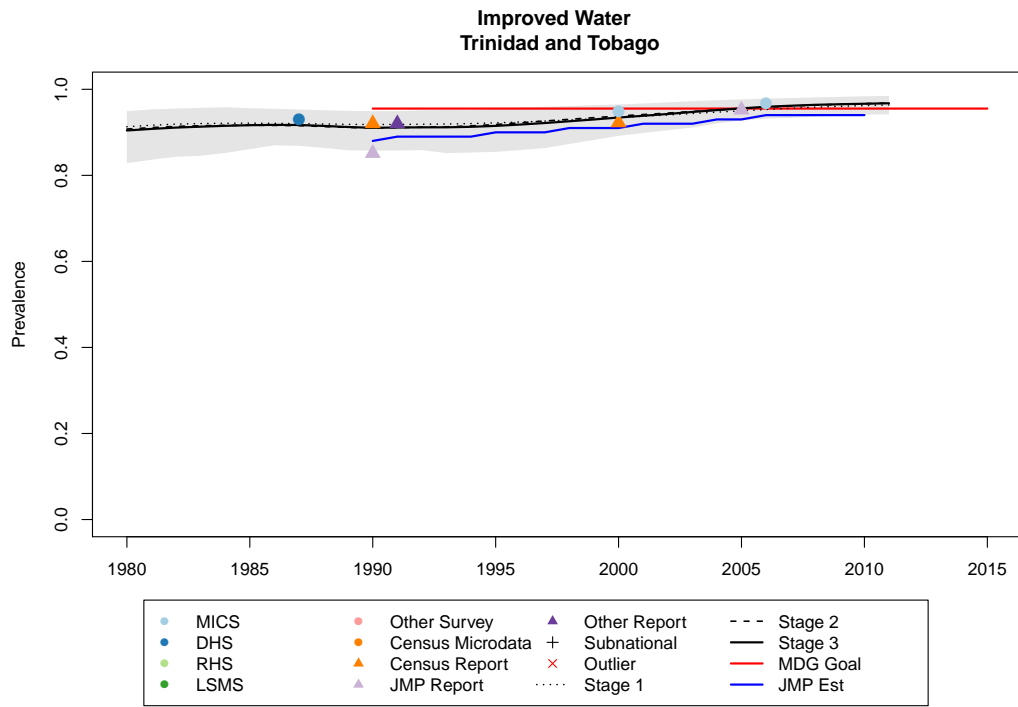


Figure A.124: Prevalence of access to improved water, Trinidad and Tobago

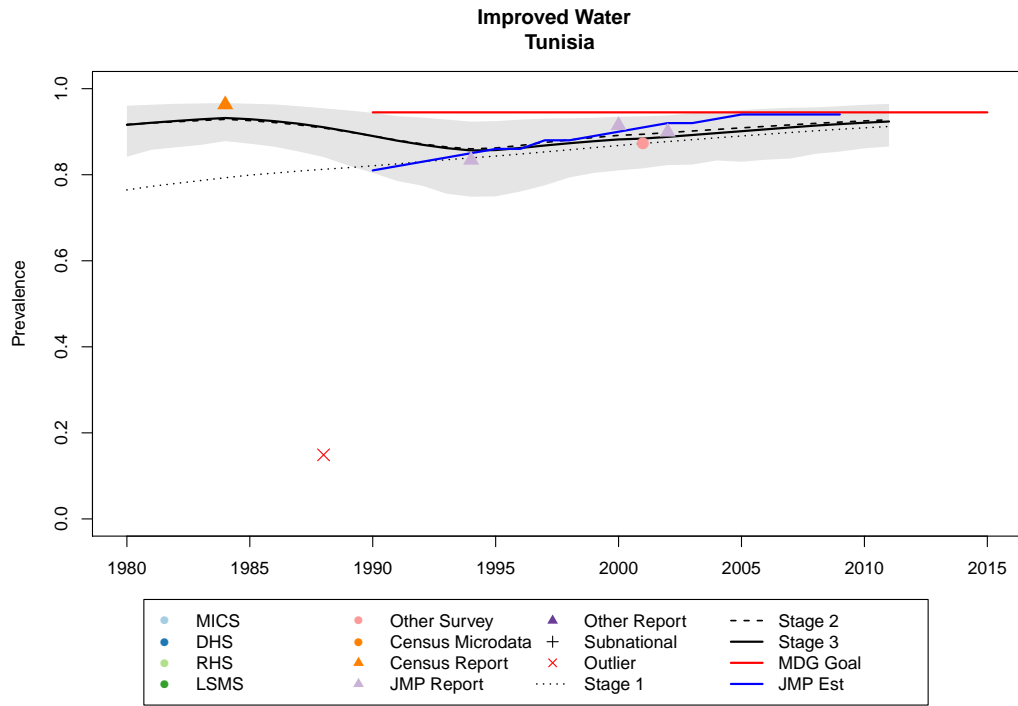


Figure A.125: Prevalence of access to improved water, Tunisia

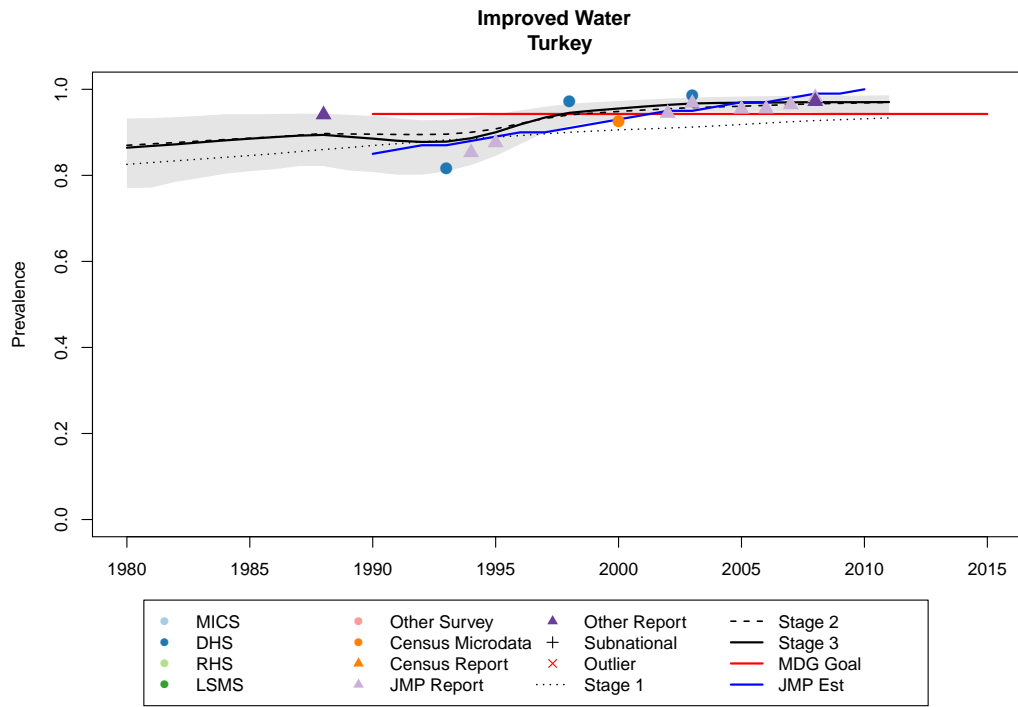


Figure A.126: Prevalence of access to improved water, Turkey

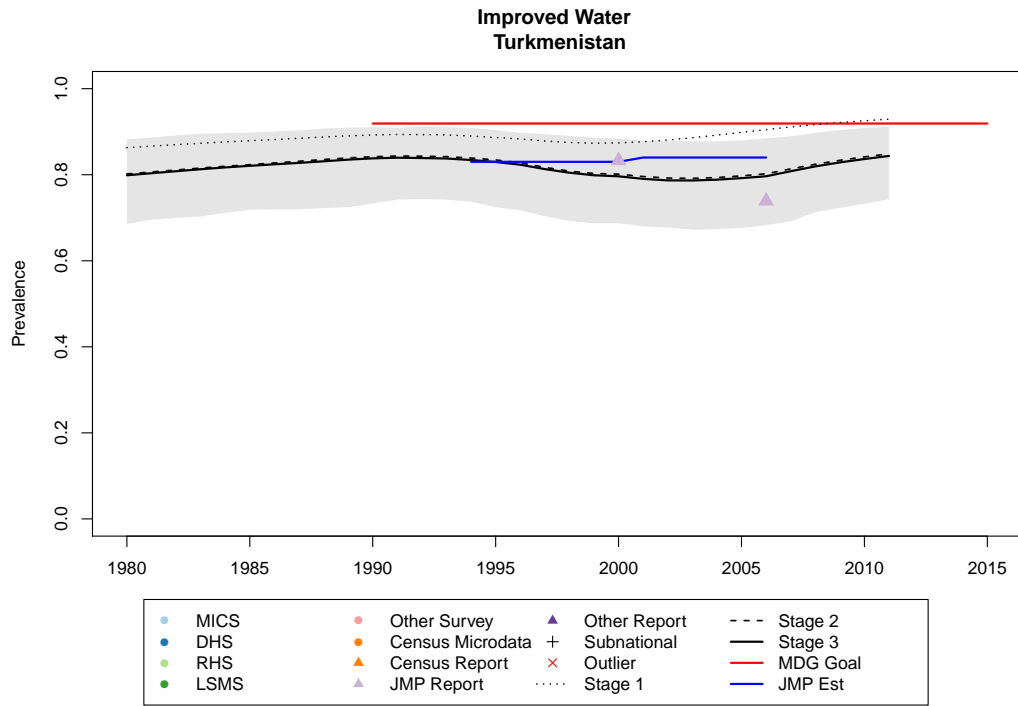


Figure A.127: Prevalence of access to improved water, Turkmenistan

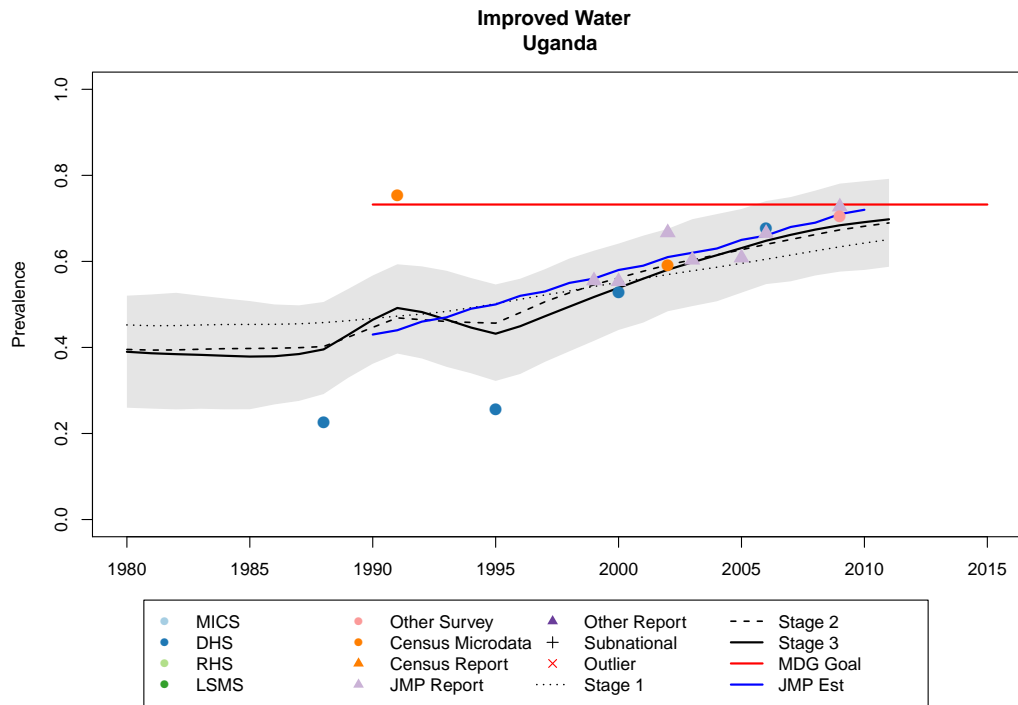


Figure A.128: Prevalence of access to improved water, Uganda

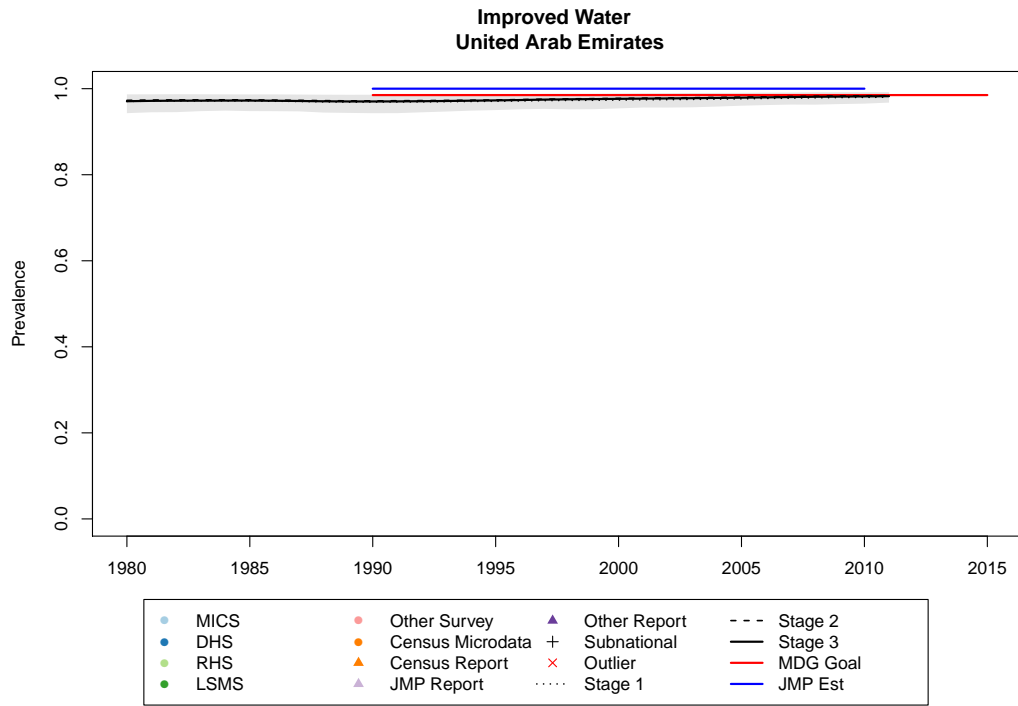


Figure A.129: Prevalence of access to improved water, United Arab Emirates

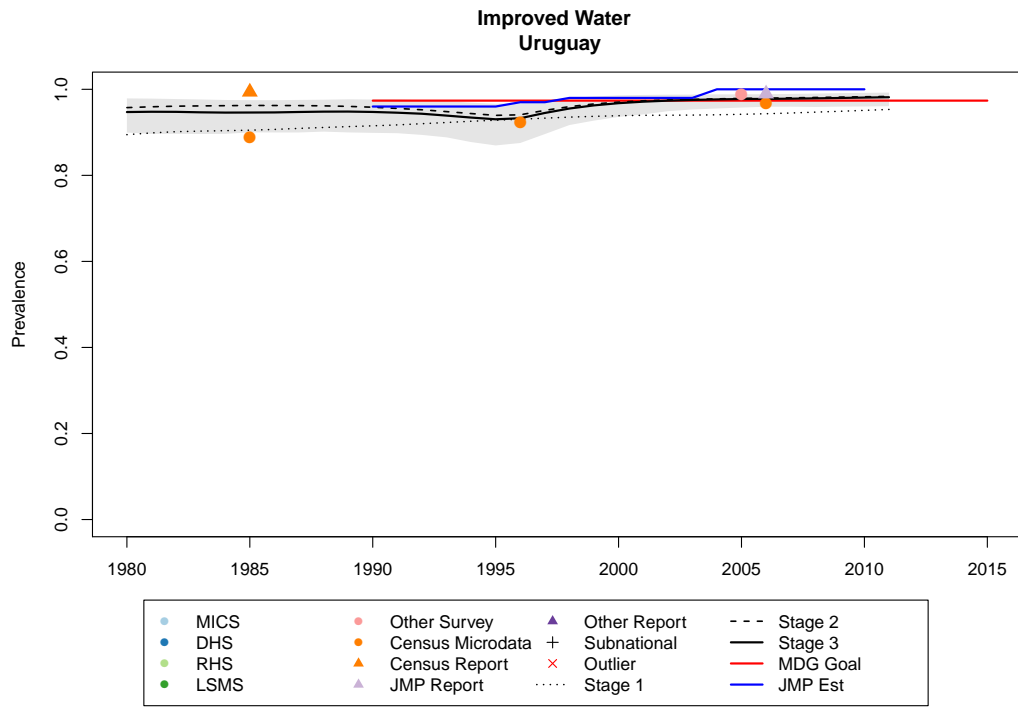


Figure A.130: Prevalence of access to improved water, Uruguay

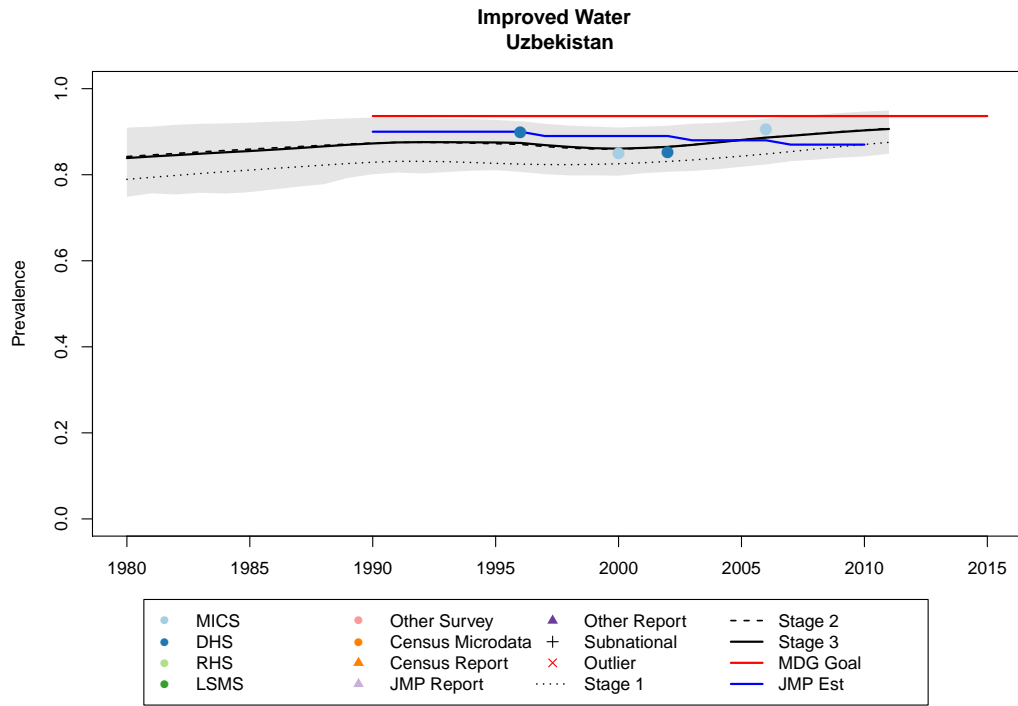


Figure A.131: Prevalence of access to improved water, Uzbekistan

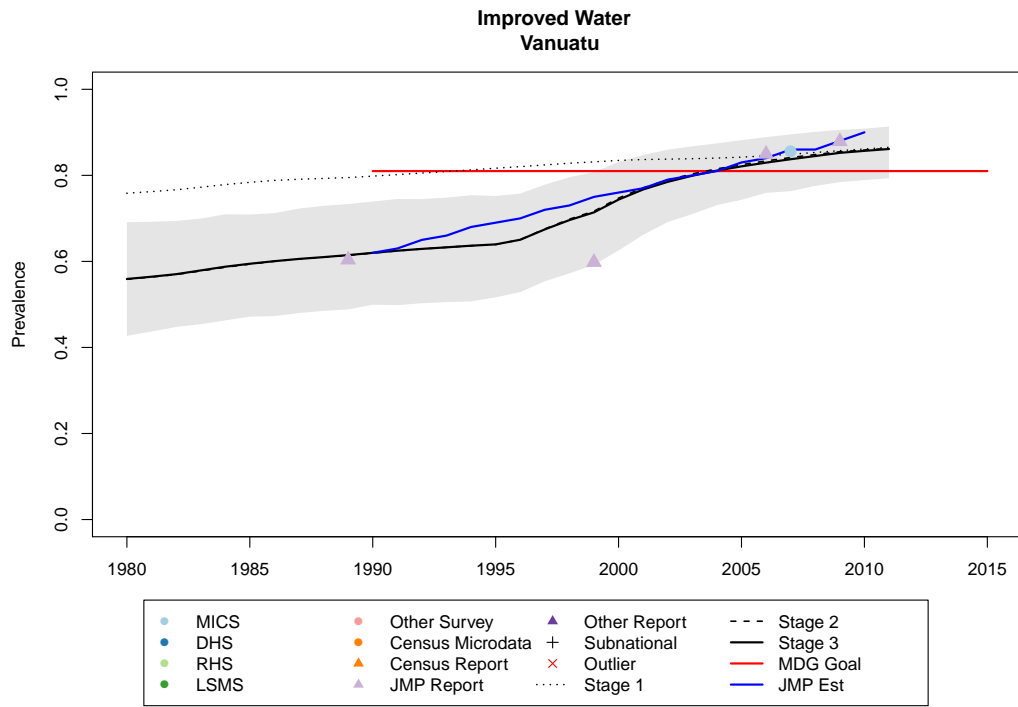


Figure A.132: Prevalence of access to improved water, Vanuatu

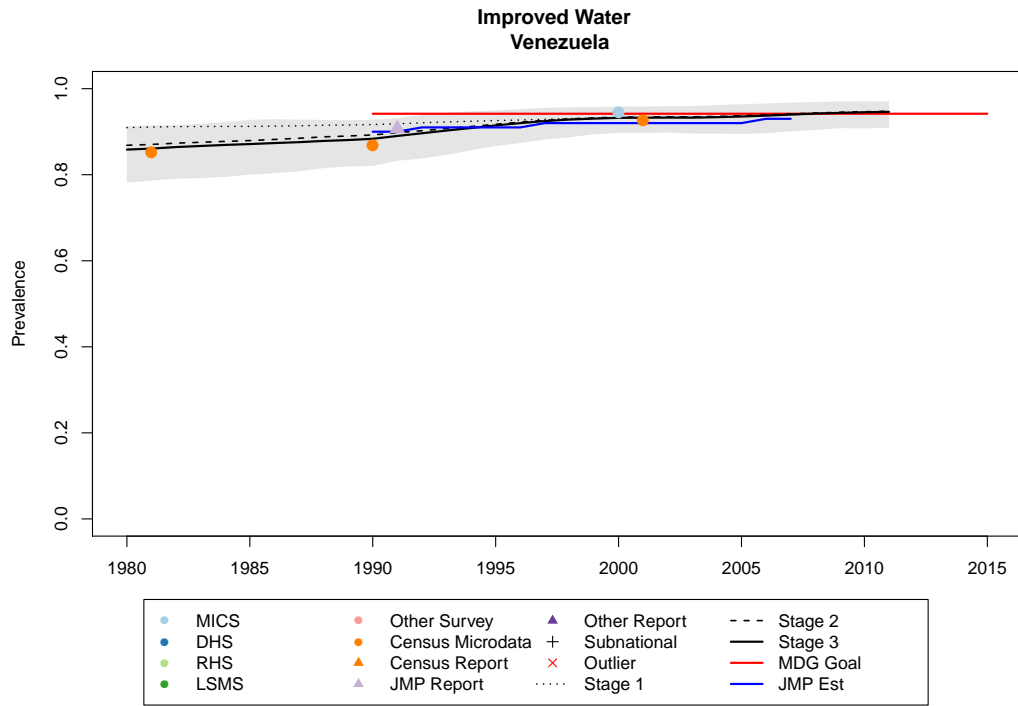


Figure A.133: Prevalence of access to improved water, Venezuela

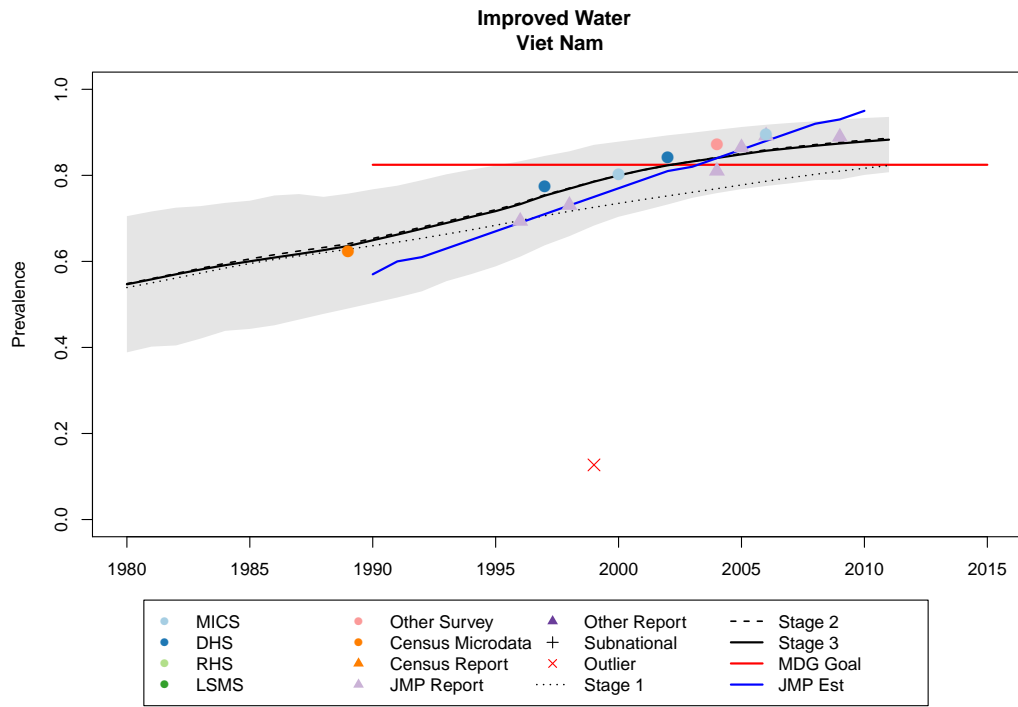


Figure A.134: Prevalence of access to improved water, Viet Nam

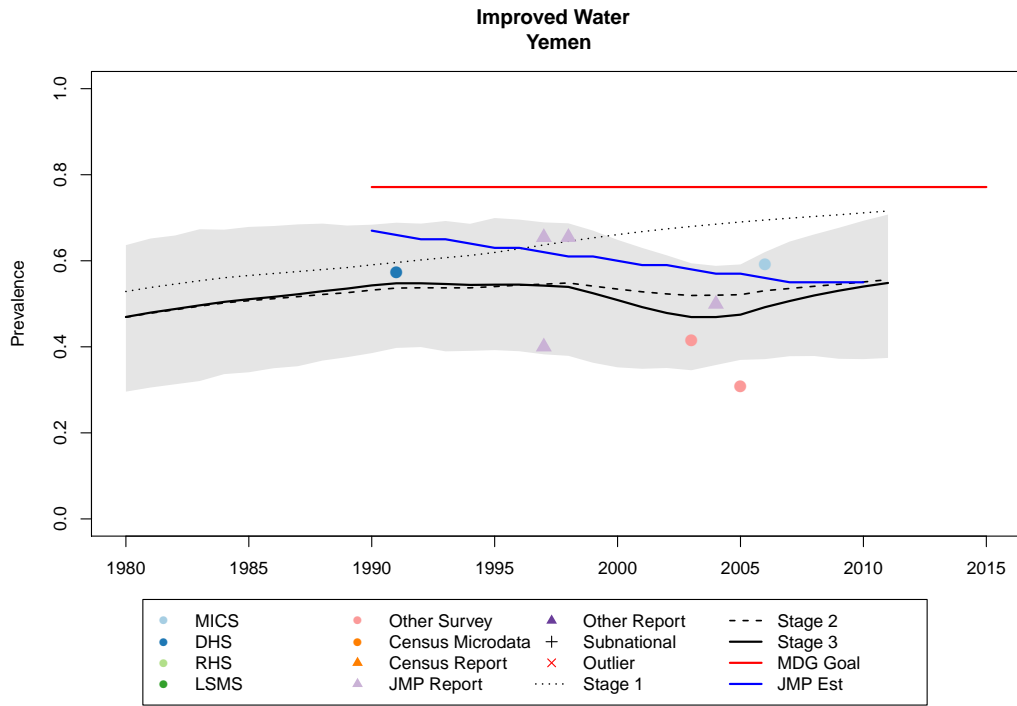


Figure A.135: Prevalence of access to improved water, Yemen

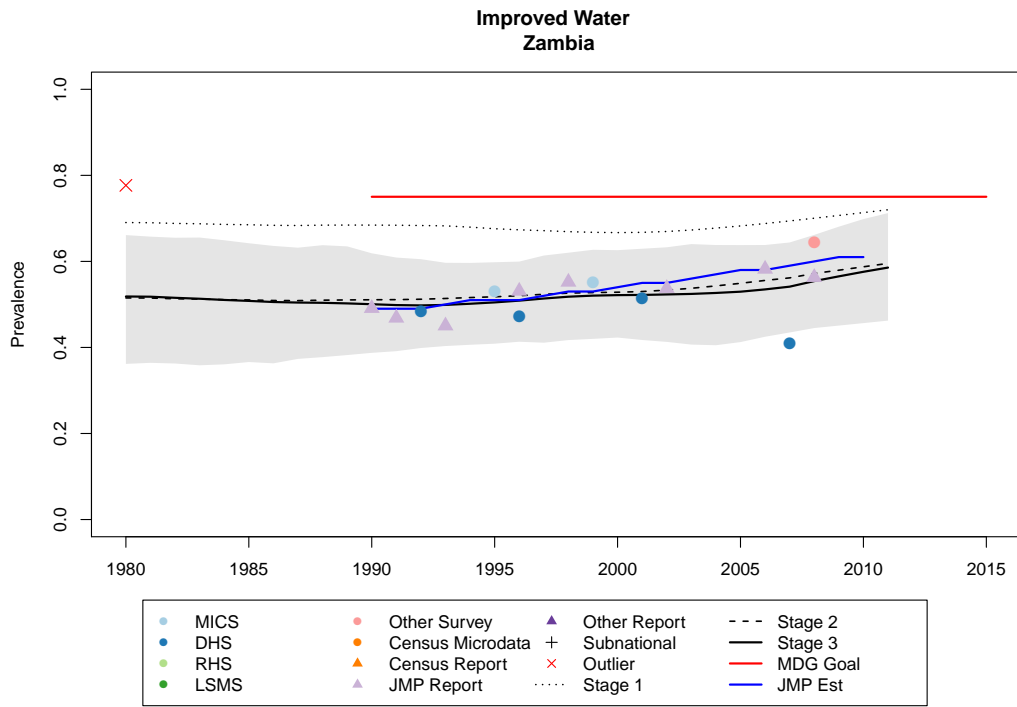


Figure A.136: Prevalence of access to improved water, Zambia

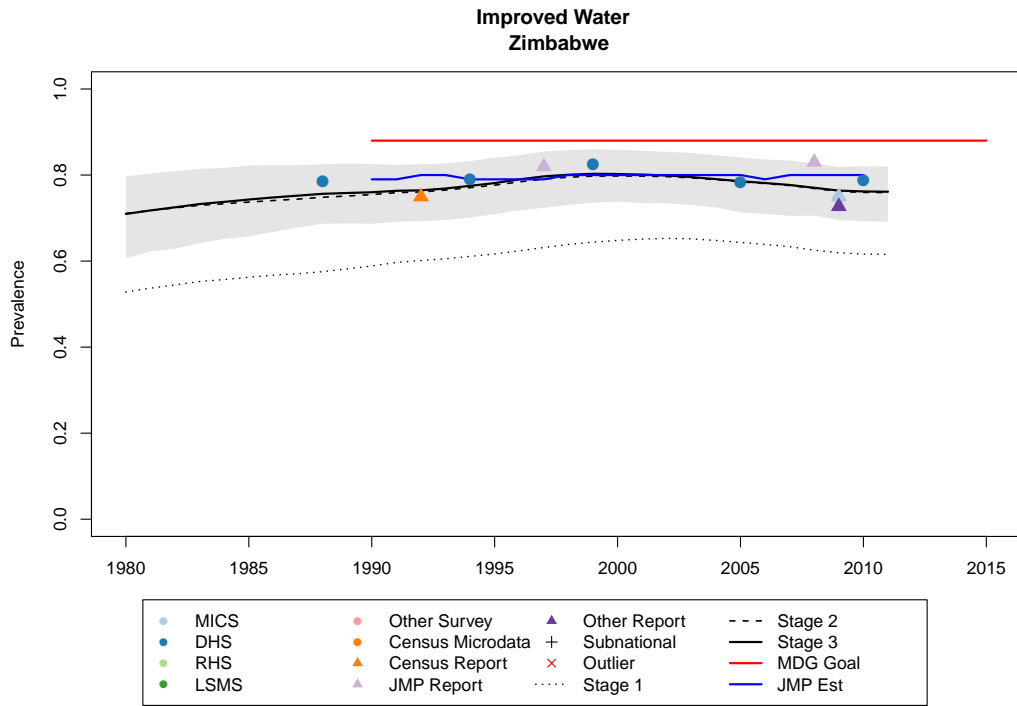


Figure A.137: Prevalence of access to improved water, Zimbabwe

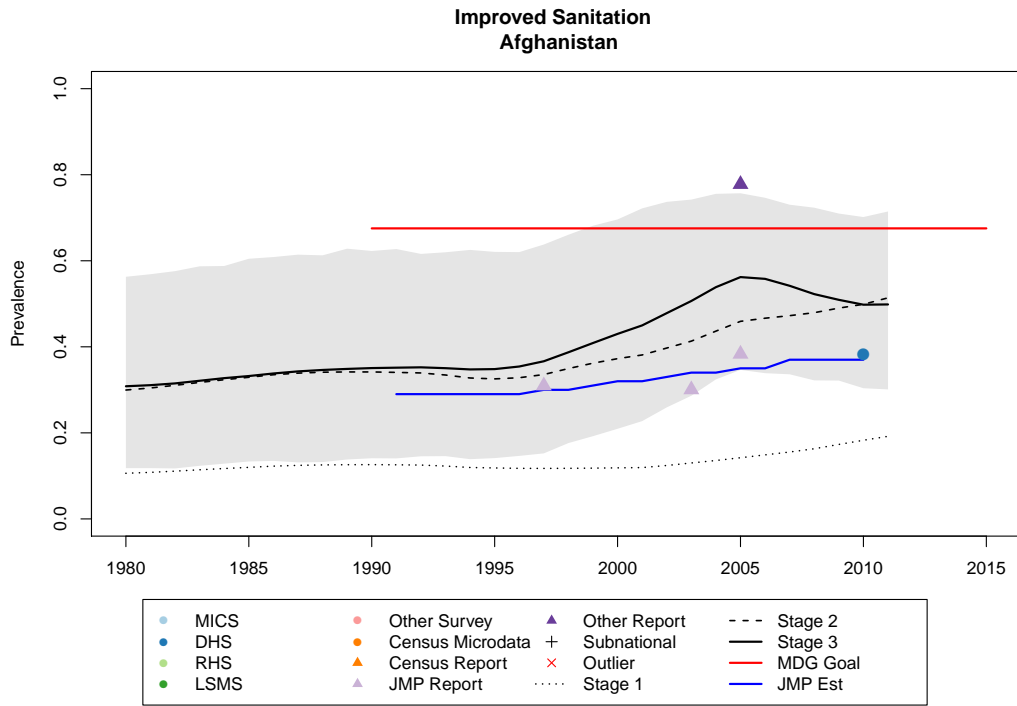


Figure A.138: Prevalence of access to improved sanitation, Afghanistan

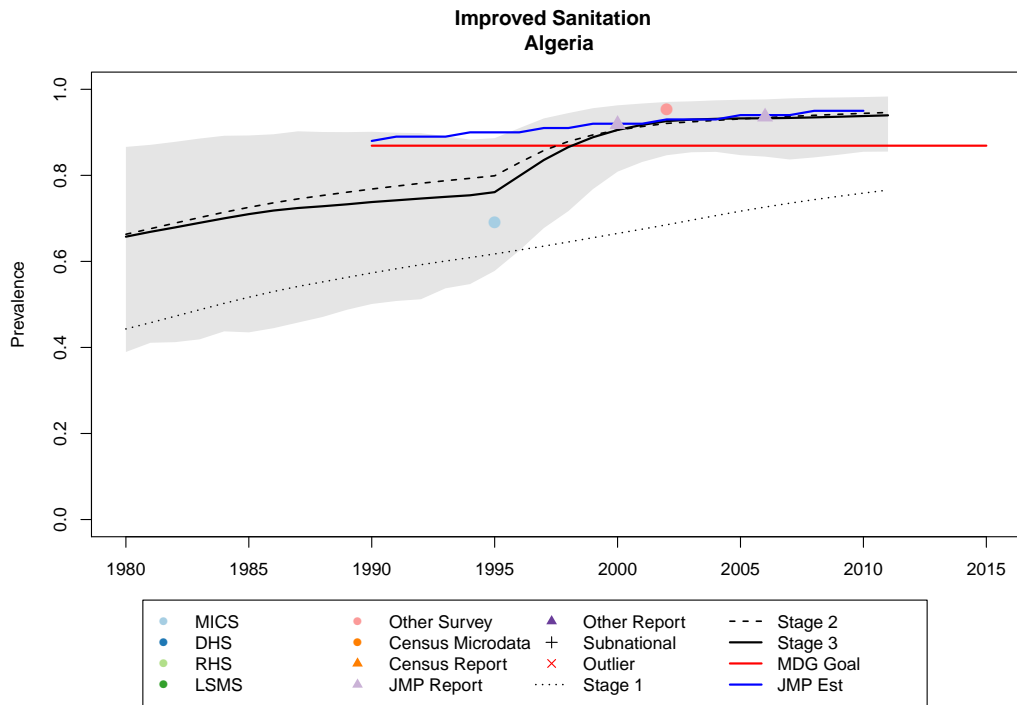


Figure A.139: Prevalence of access to improved sanitation, Algeria

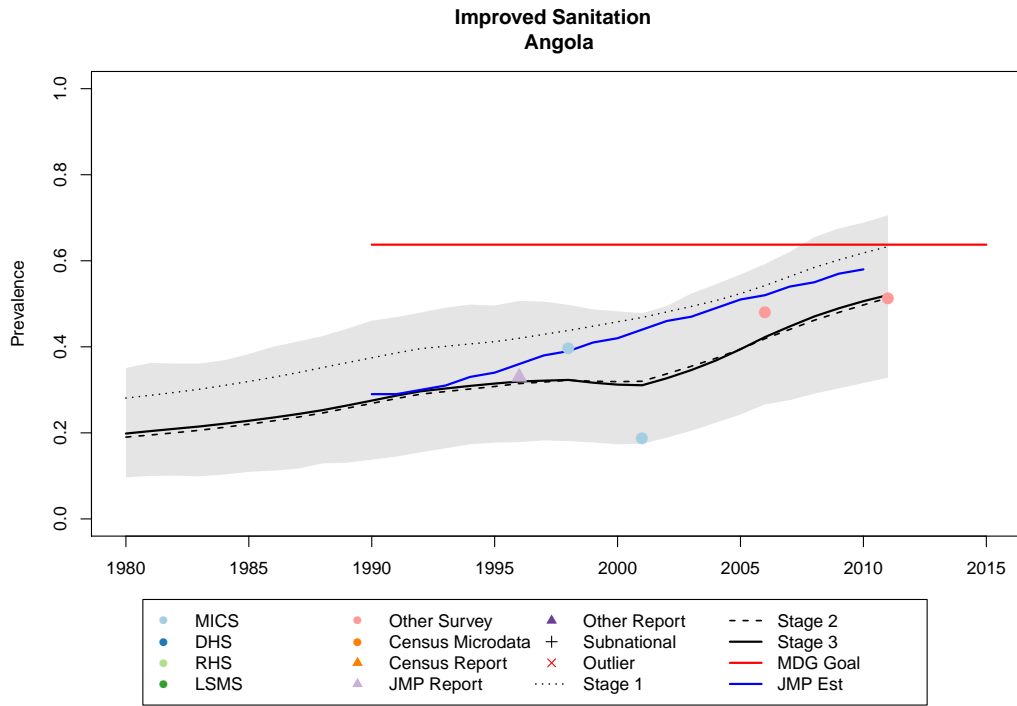


Figure A.140: Prevalence of access to improved sanitation, Angola

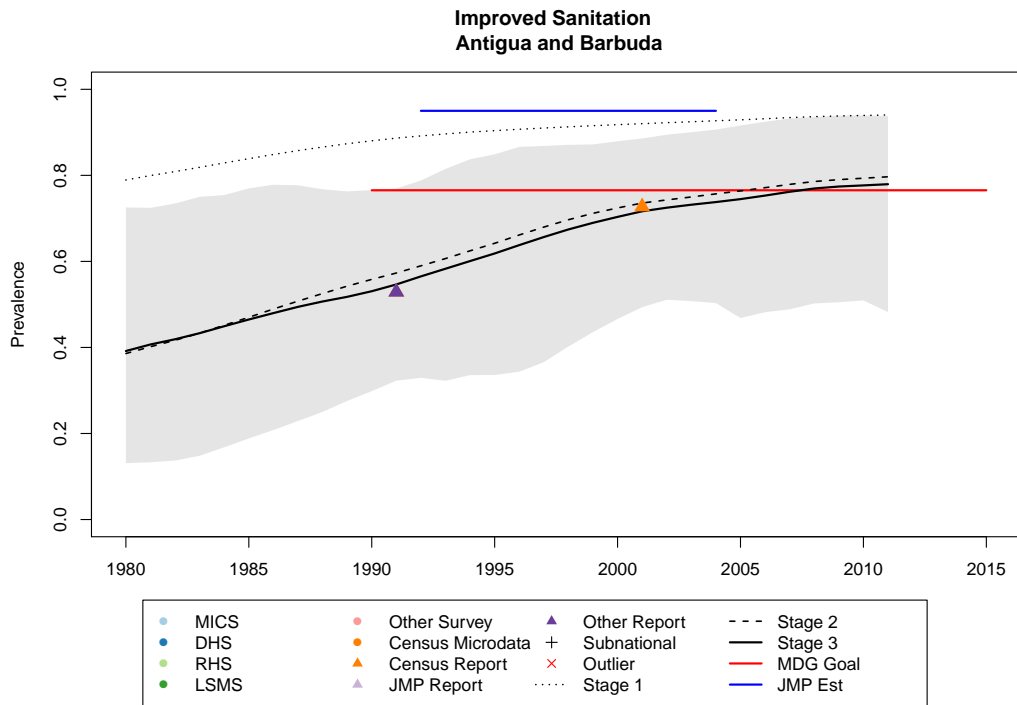


Figure A.141: Prevalence of access to improved sanitation, Antigua and Barbuda

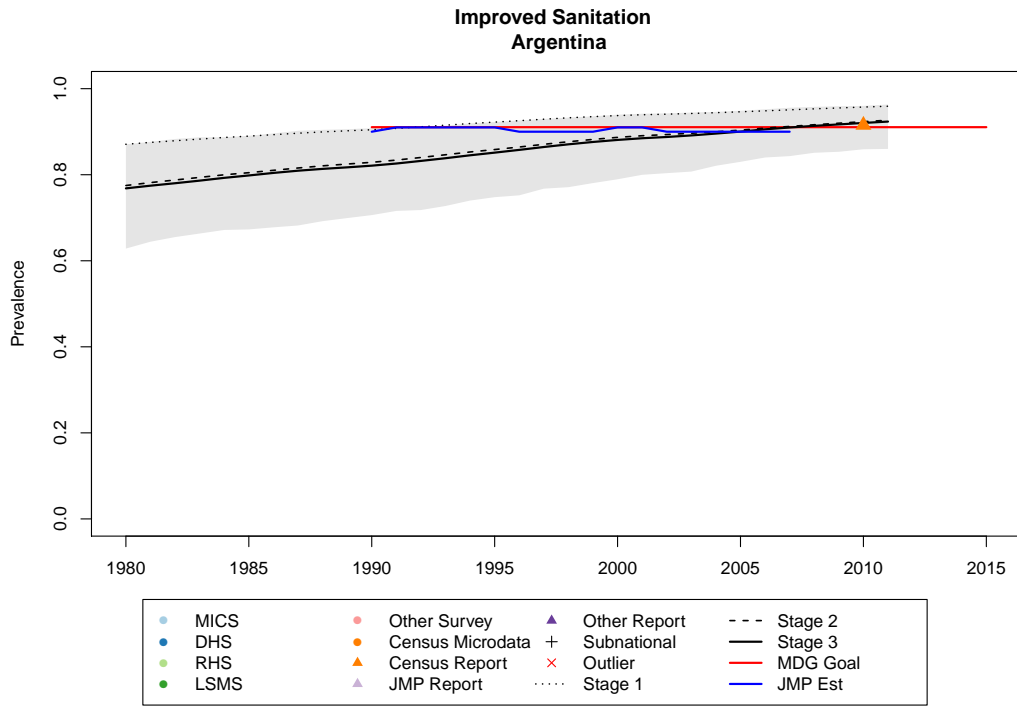


Figure A.142: Prevalence of access to improved sanitation, Argentina

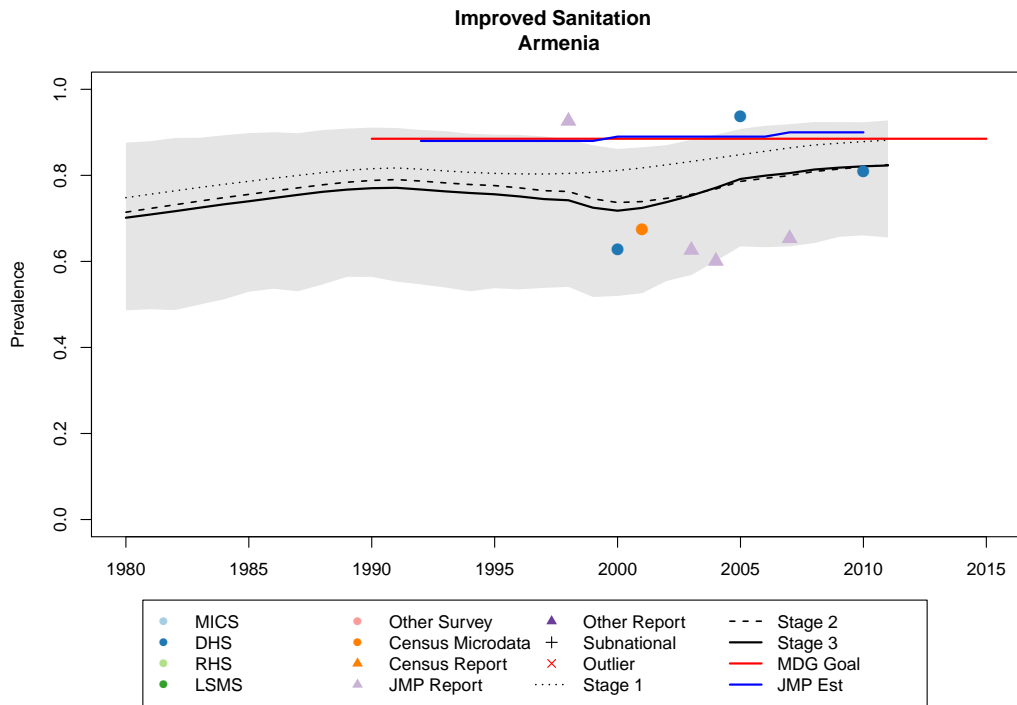


Figure A.143: Prevalence of access to improved sanitation, Armenia

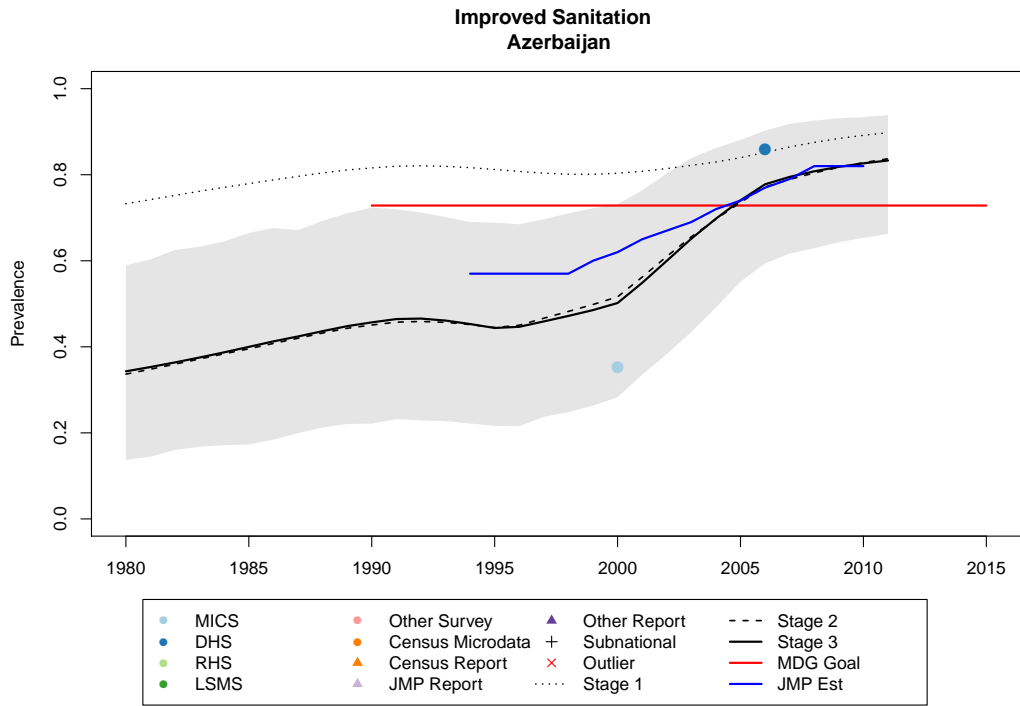


Figure A.144: Prevalence of access to improved sanitation, Azerbaijan

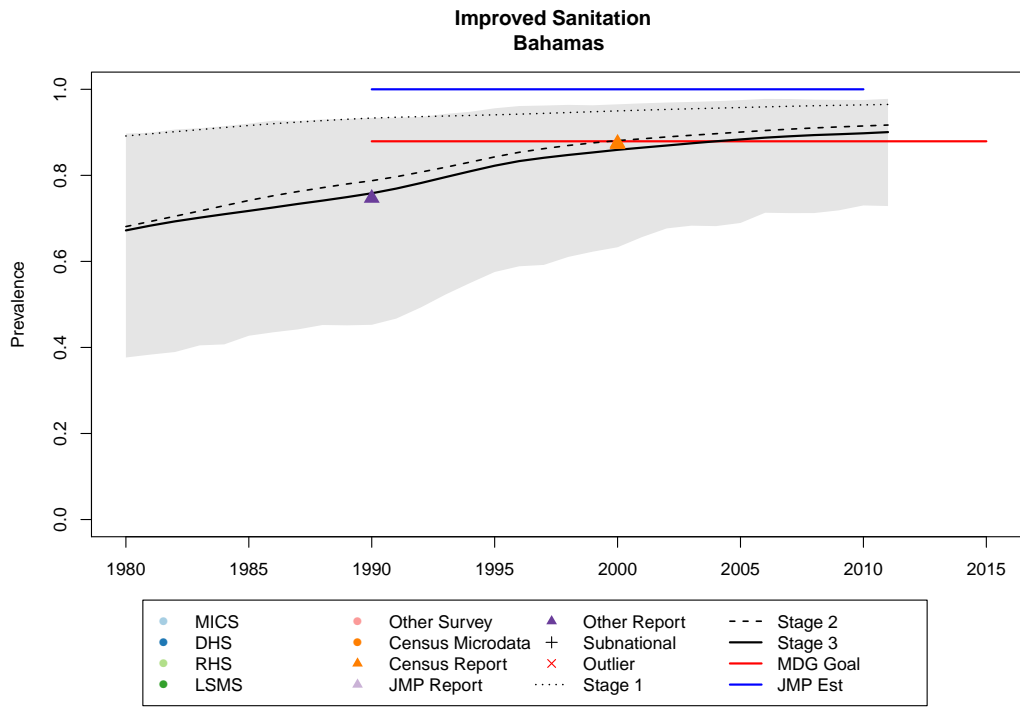


Figure A.145: Prevalence of access to improved sanitation, Bahamas

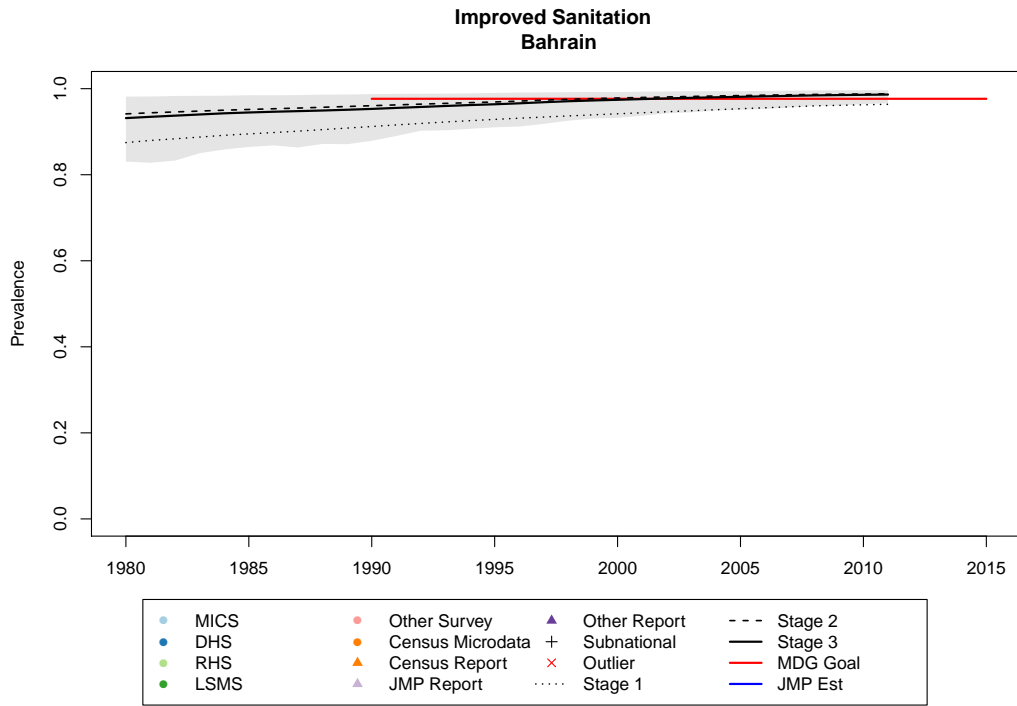


Figure A.146: Prevalence of access to improved sanitation, Bahrain

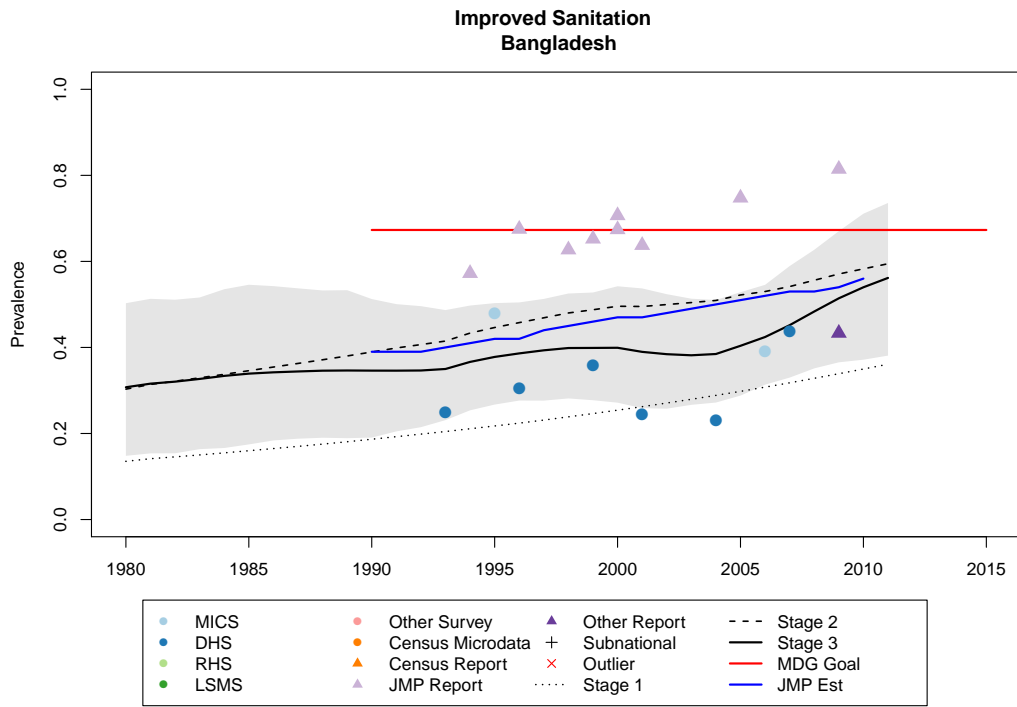


Figure A.147: Prevalence of access to improved sanitation, Bangladesh

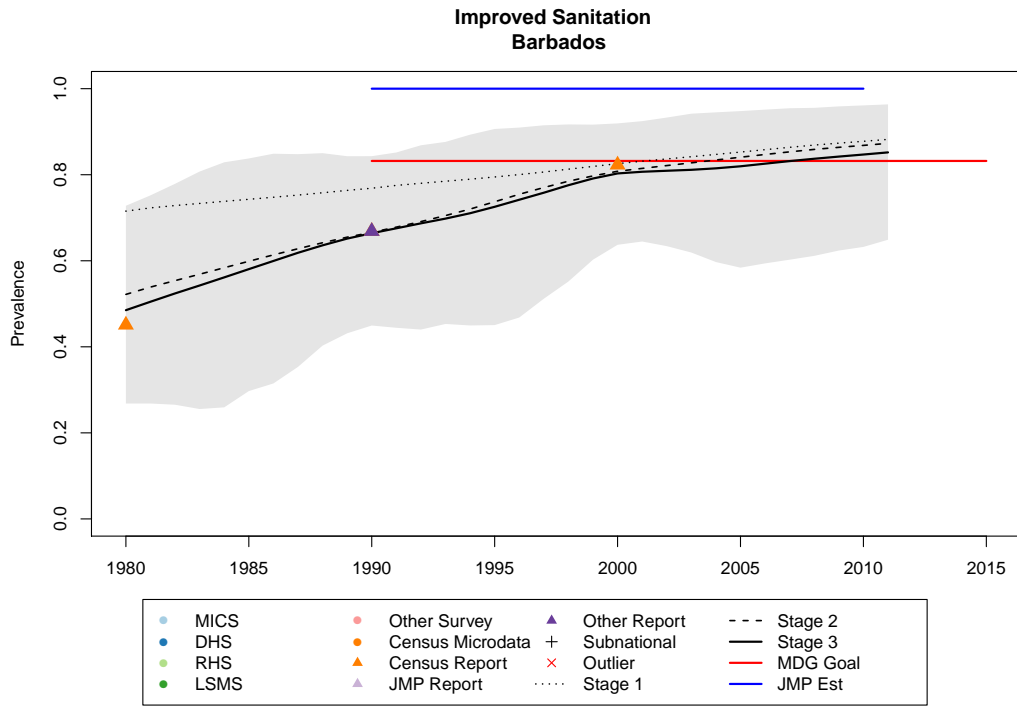


Figure A.148: Prevalence of access to improved sanitation, Barbados

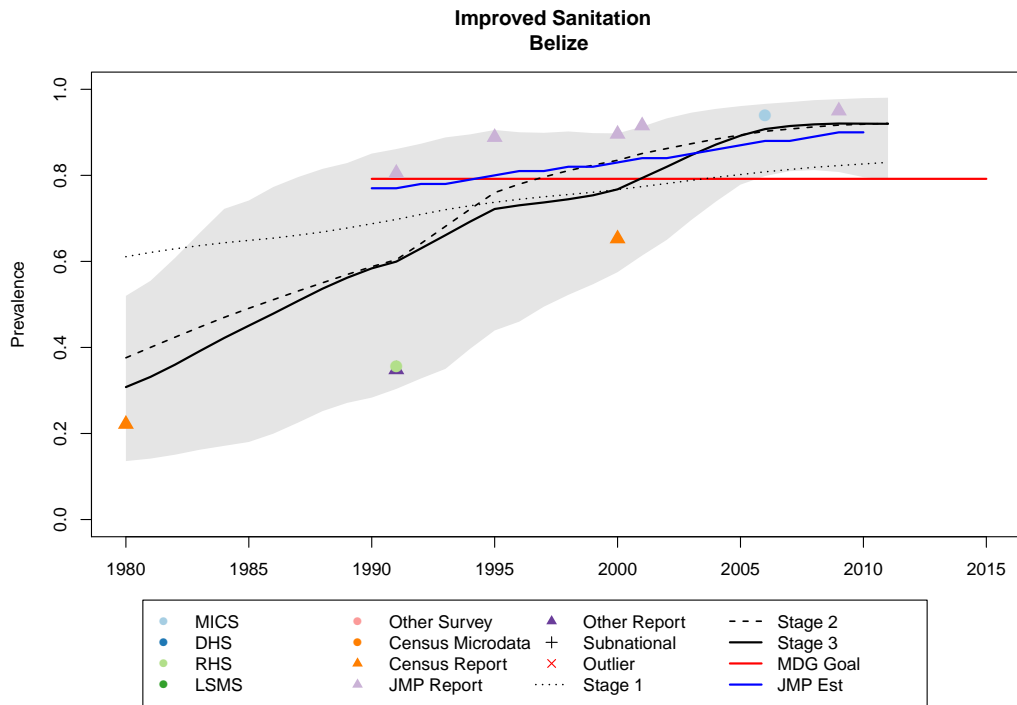


Figure A.149: Prevalence of access to improved sanitation, Belize

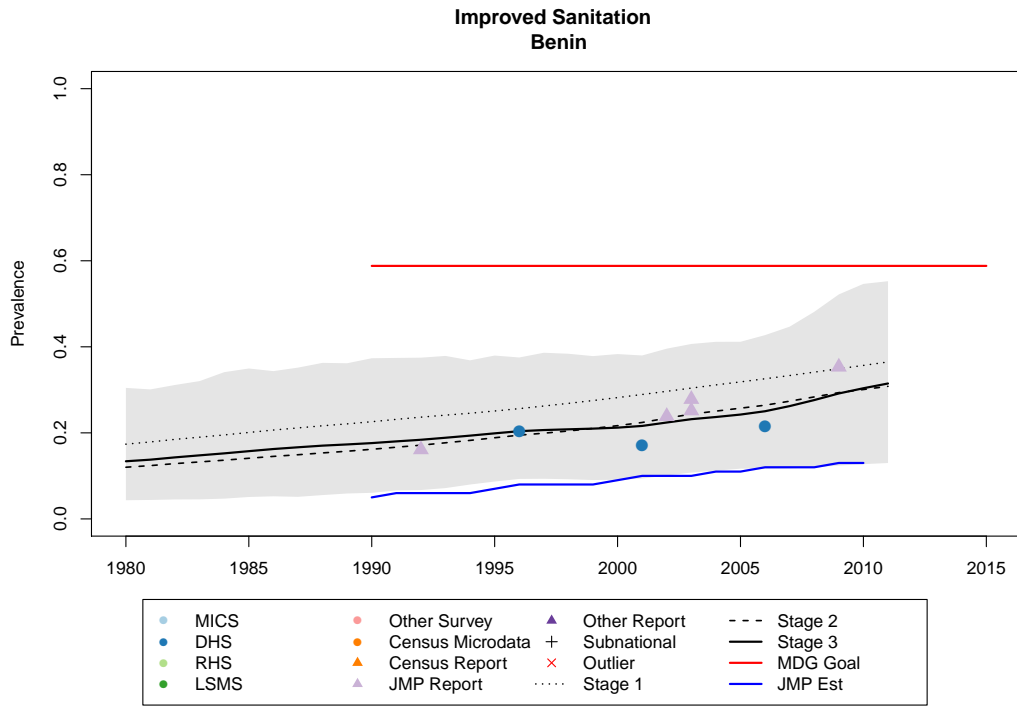


Figure A.150: Prevalence of access to improved sanitation, Benin

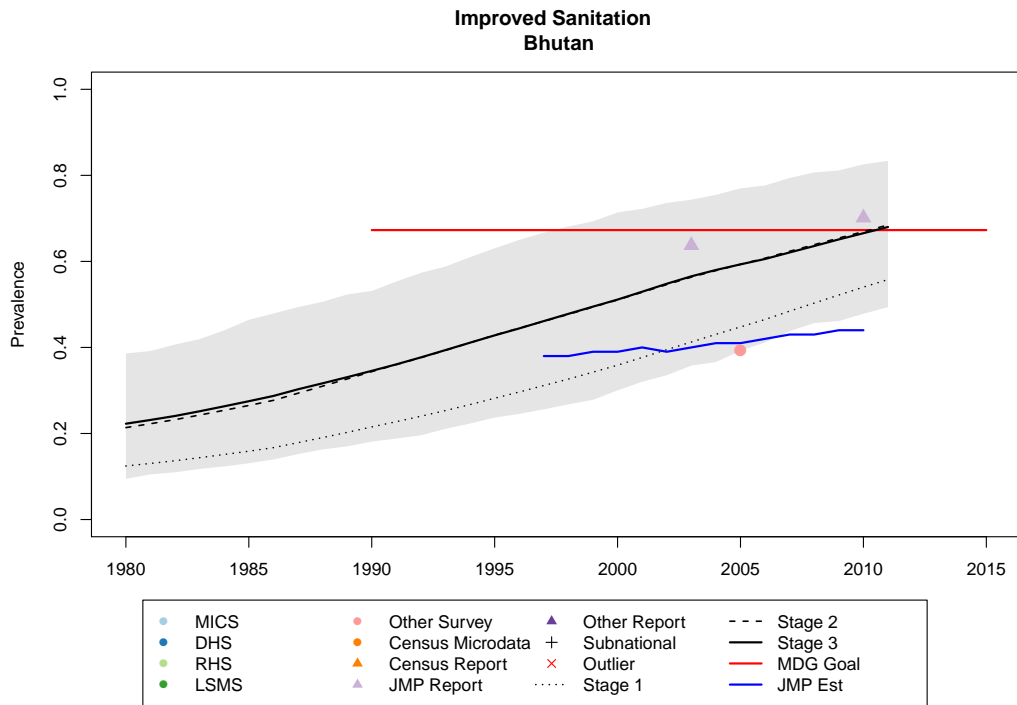


Figure A.151: Prevalence of access to improved sanitation, Bhutan

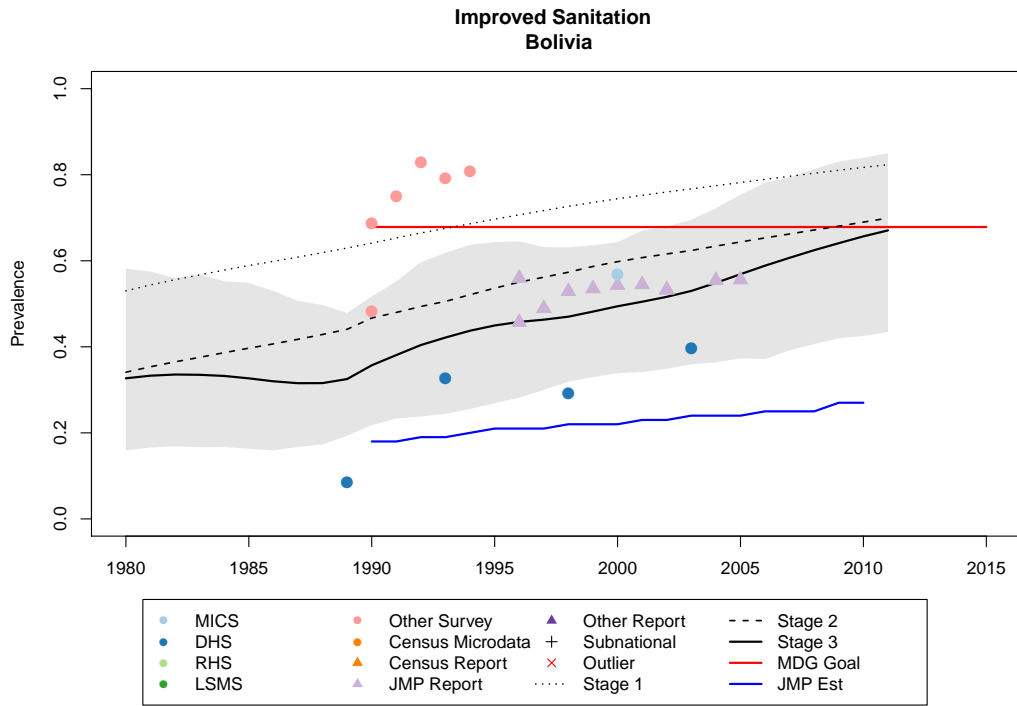


Figure A.152: Prevalence of access to improved sanitation, Bolivia

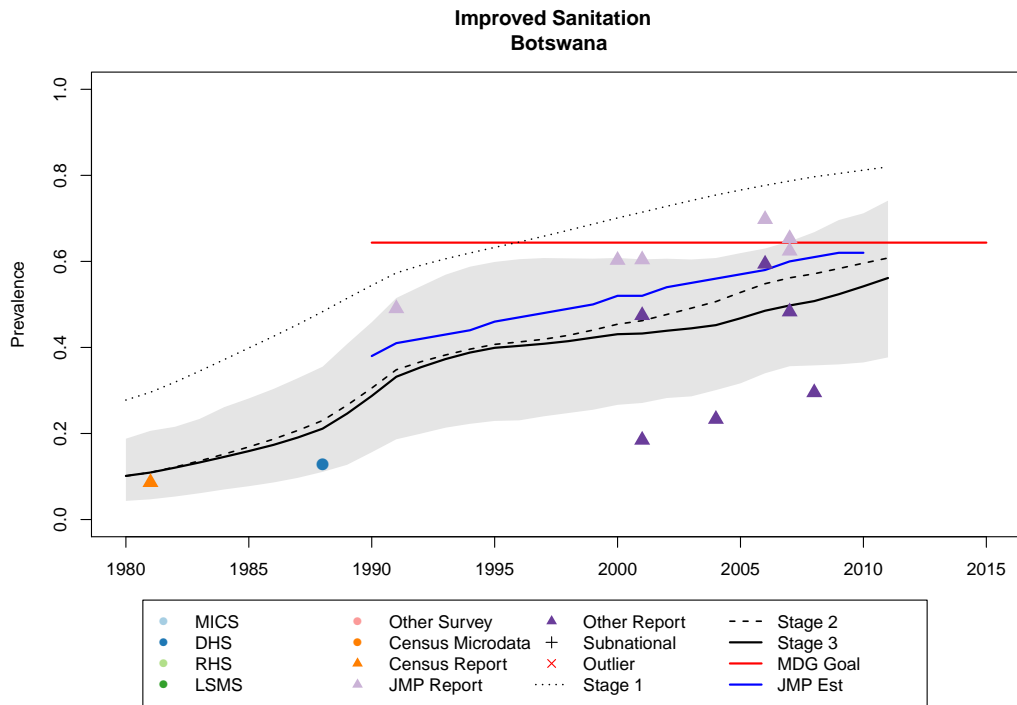


Figure A.153: Prevalence of access to improved sanitation, Botswana

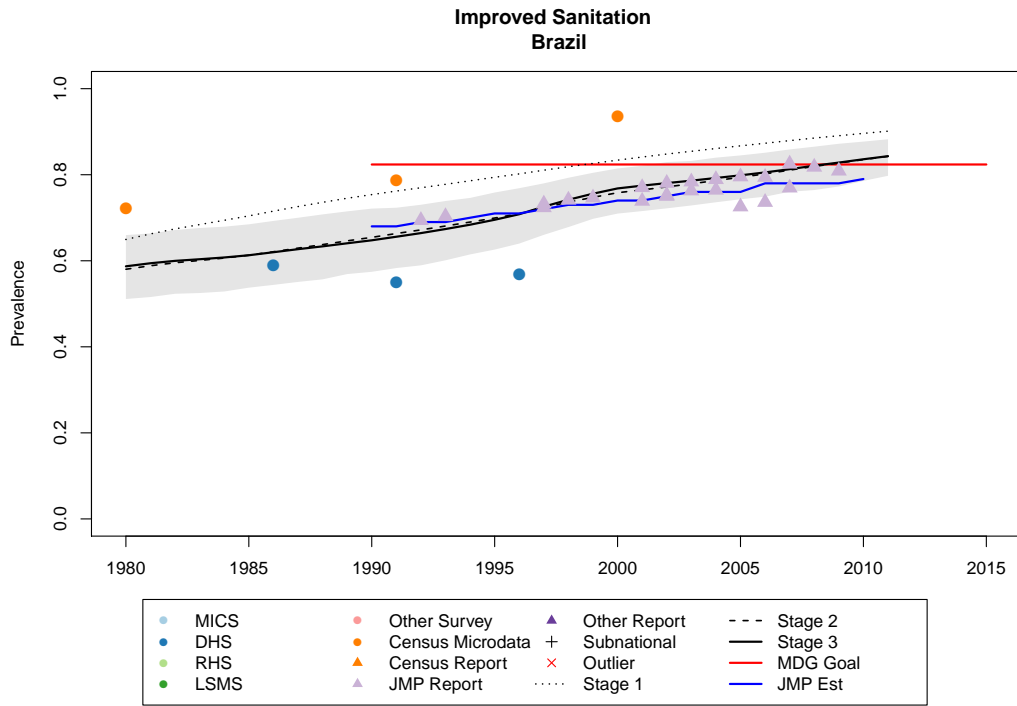


Figure A.154: Prevalence of access to improved sanitation, Brazil

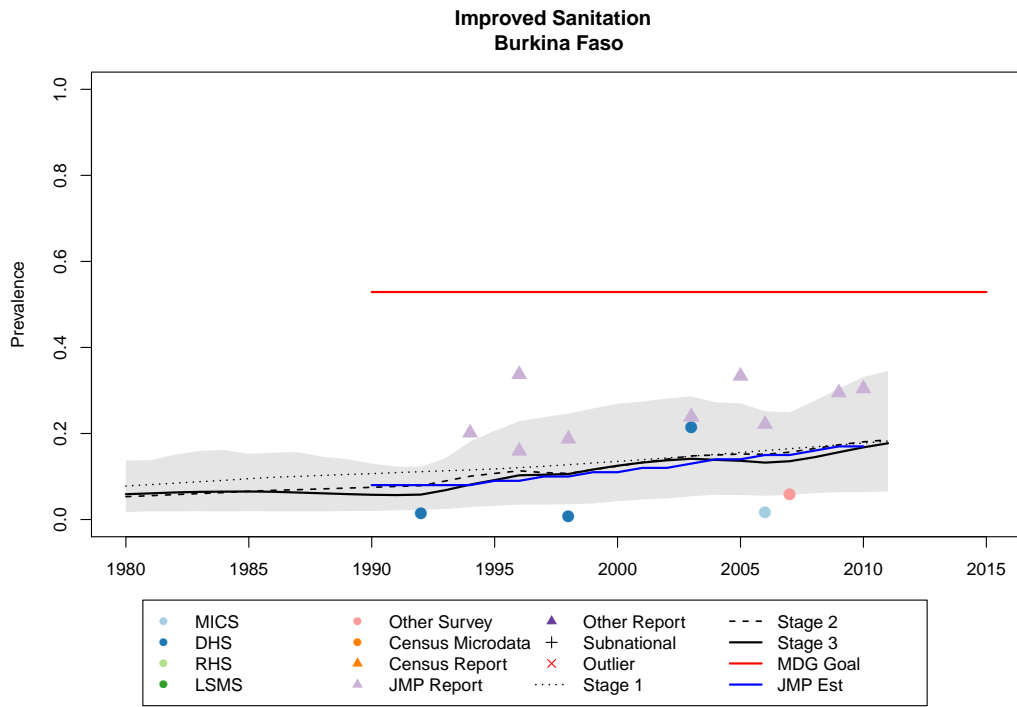


Figure A.155: Prevalence of access to improved sanitation, Burkina Faso

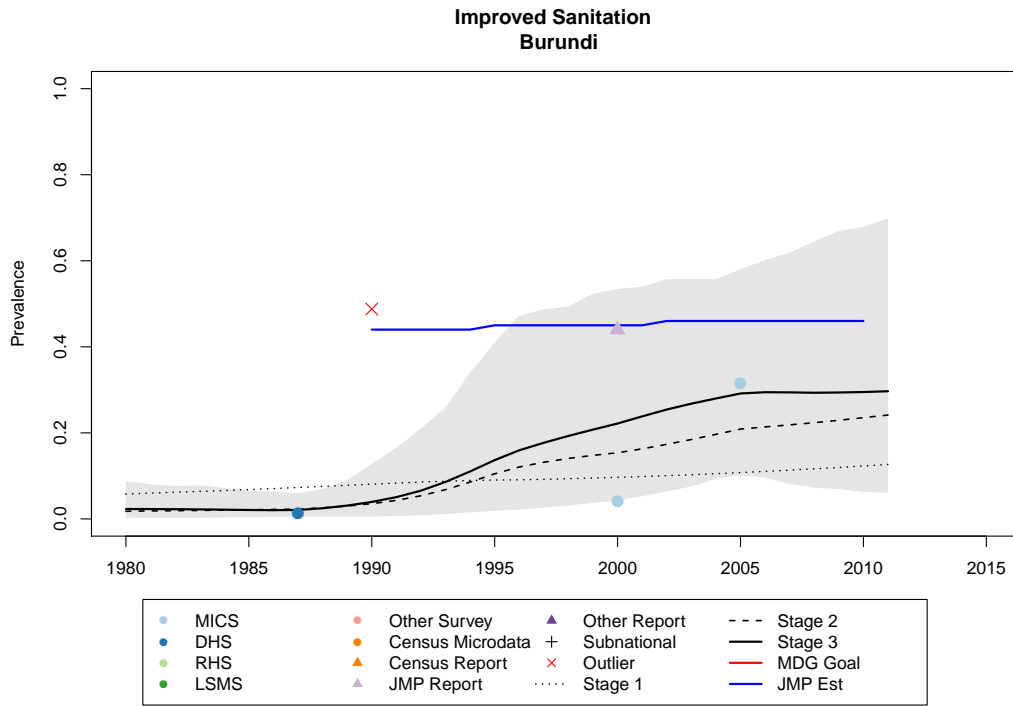


Figure A.156: Prevalence of access to improved sanitation, Burundi

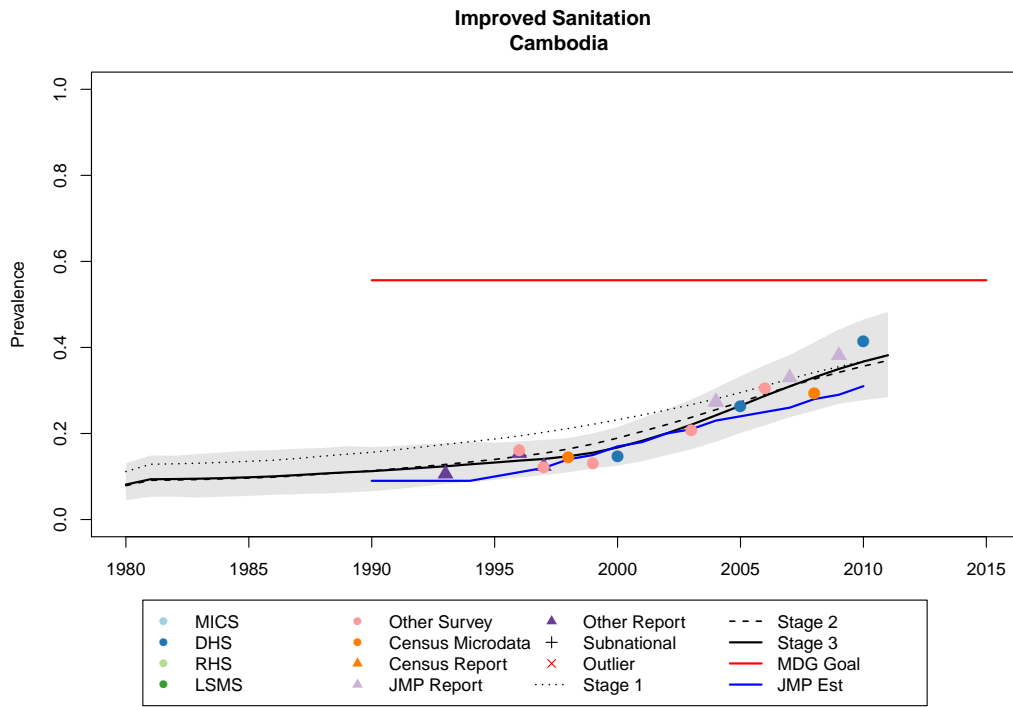


Figure A.157: Prevalence of access to improved sanitation, Cambodia

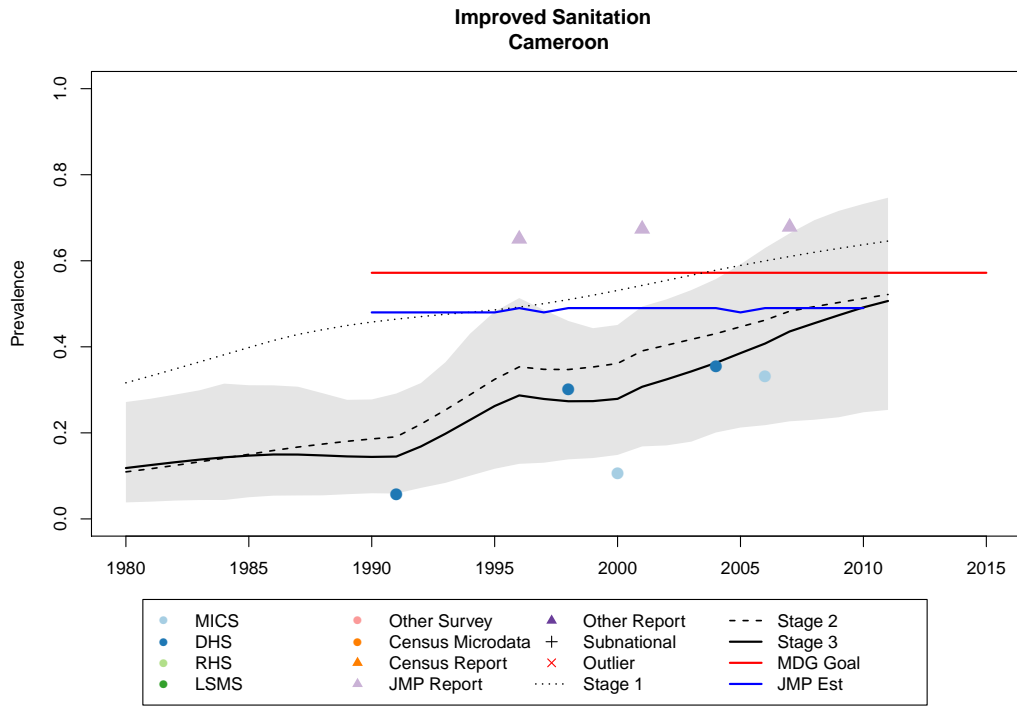


Figure A.158: Prevalence of access to improved sanitation, Cameroon

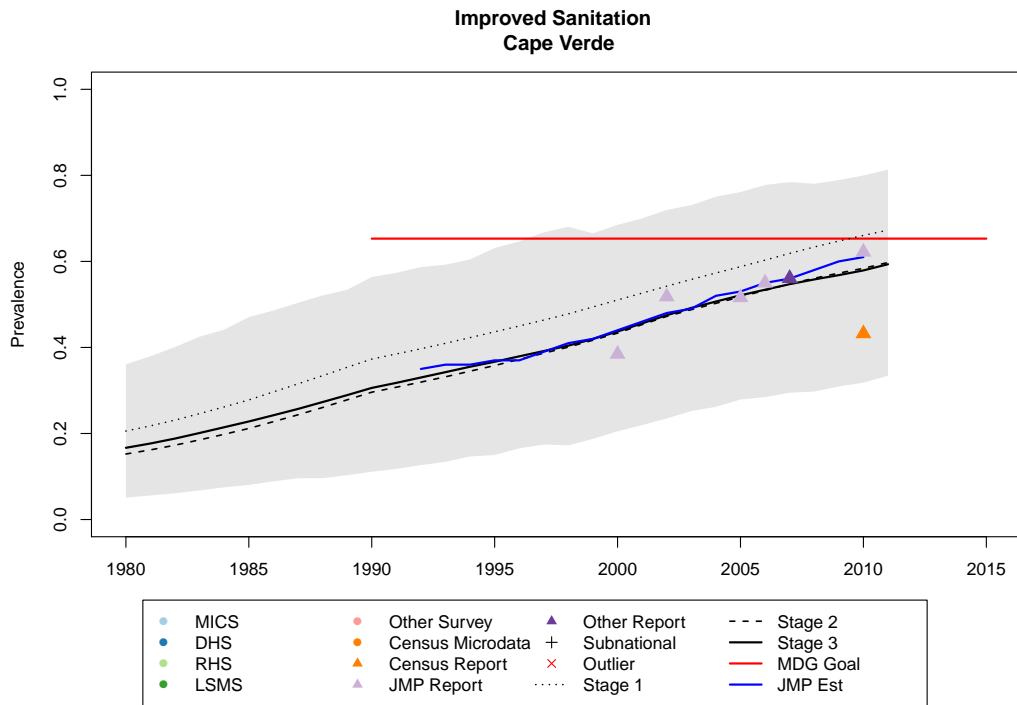


Figure A.159: Prevalence of access to improved sanitation, Cape Verde

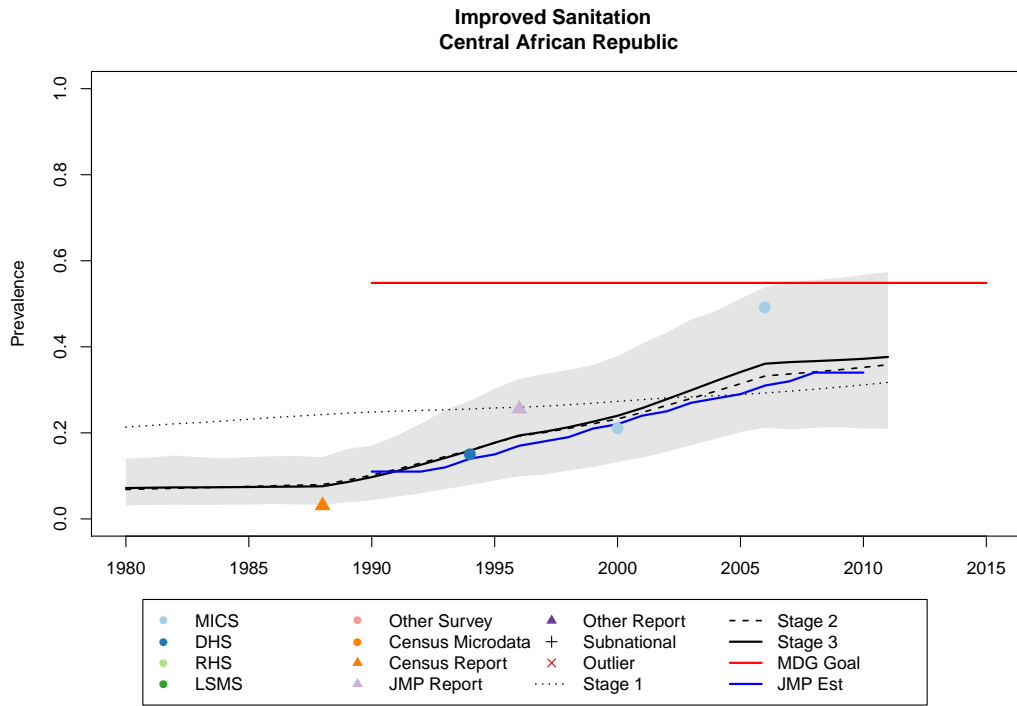


Figure A.160: Prevalence of access to improved sanitation, Central African Republic

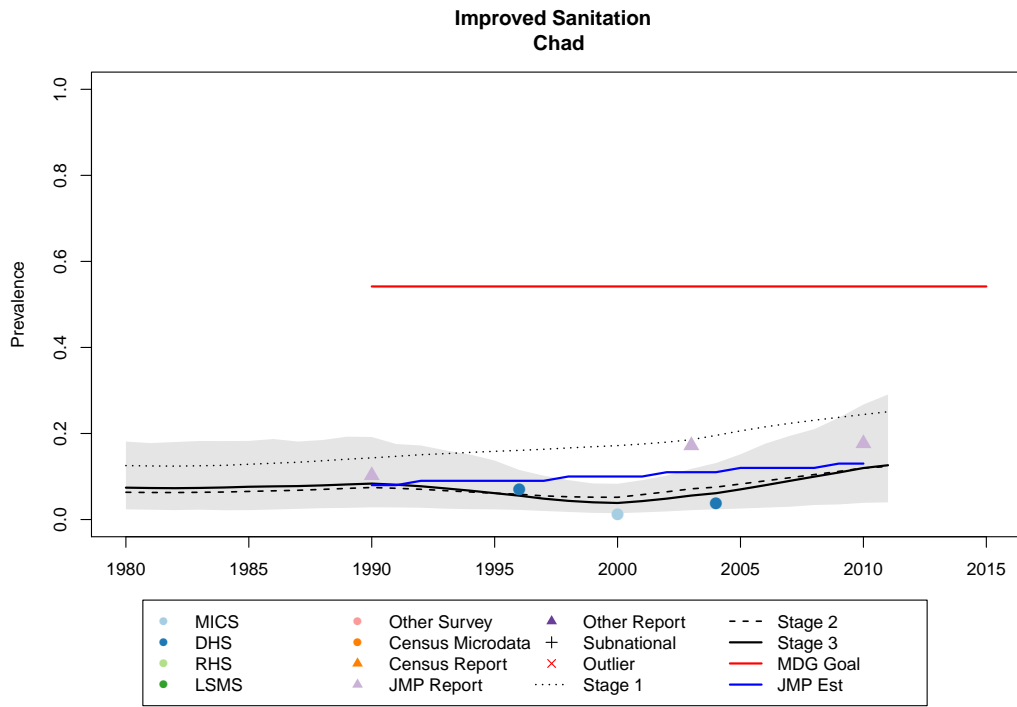


Figure A.161: Prevalence of access to improved sanitation, Chad

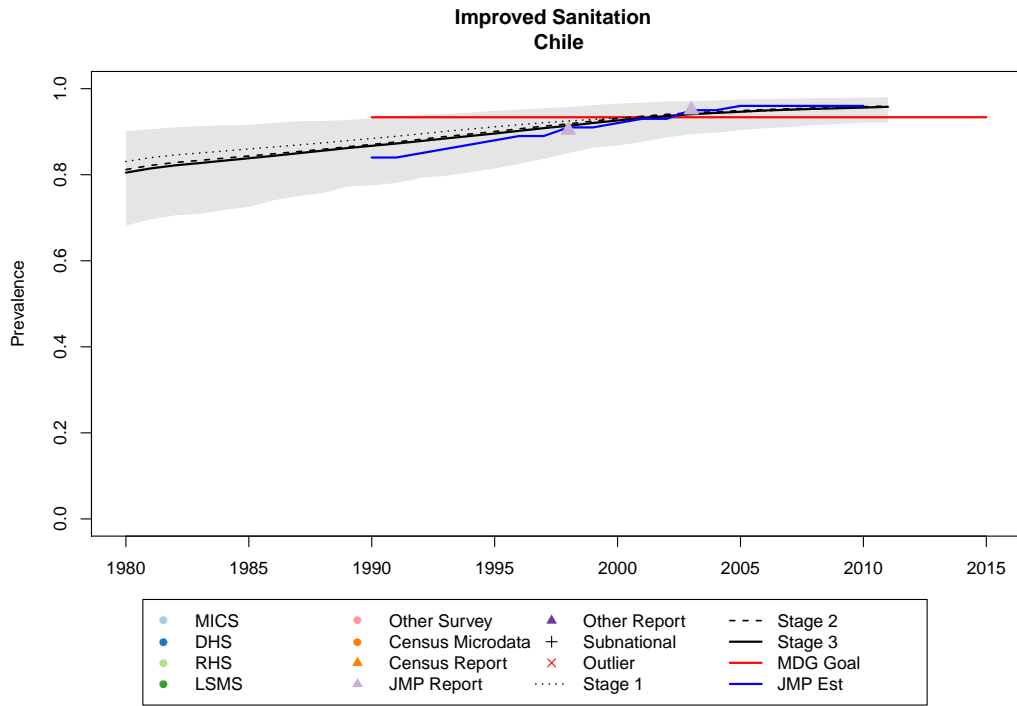


Figure A.162: Prevalence of access to improved sanitation, Chile

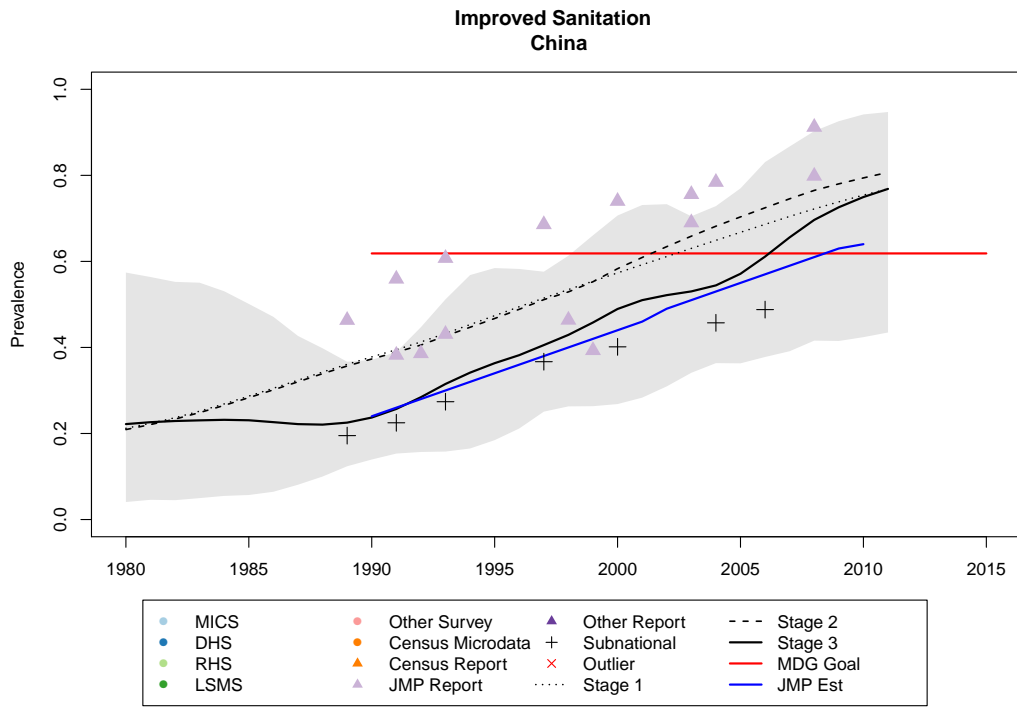


Figure A.163: Prevalence of access to improved sanitation, China

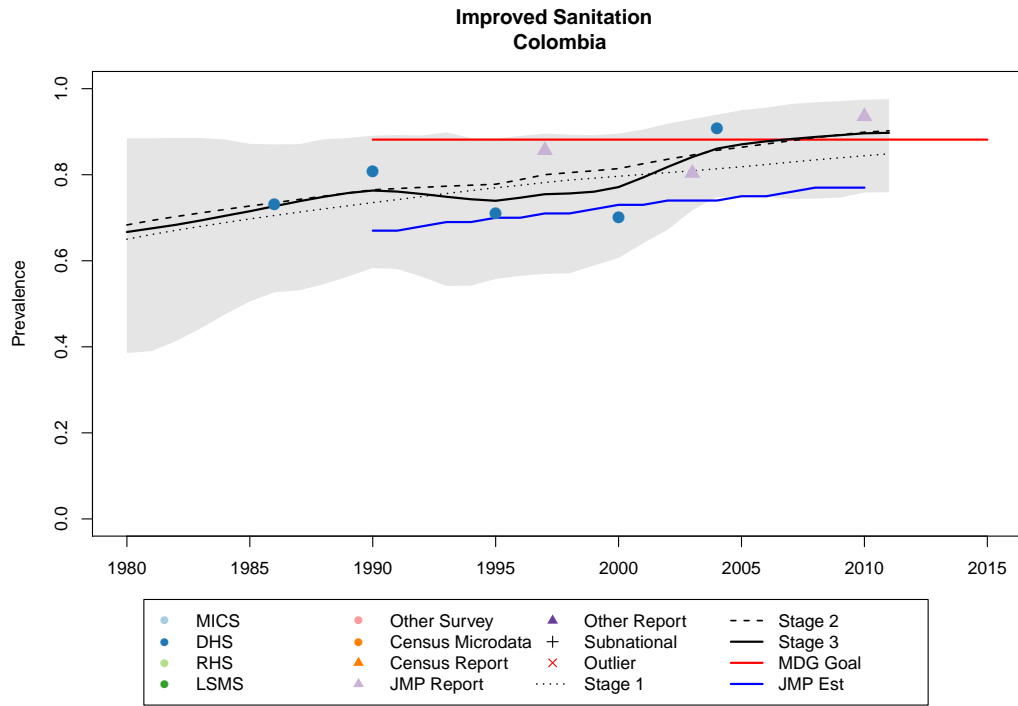


Figure A.164: Prevalence of access to improved sanitation, Colombia

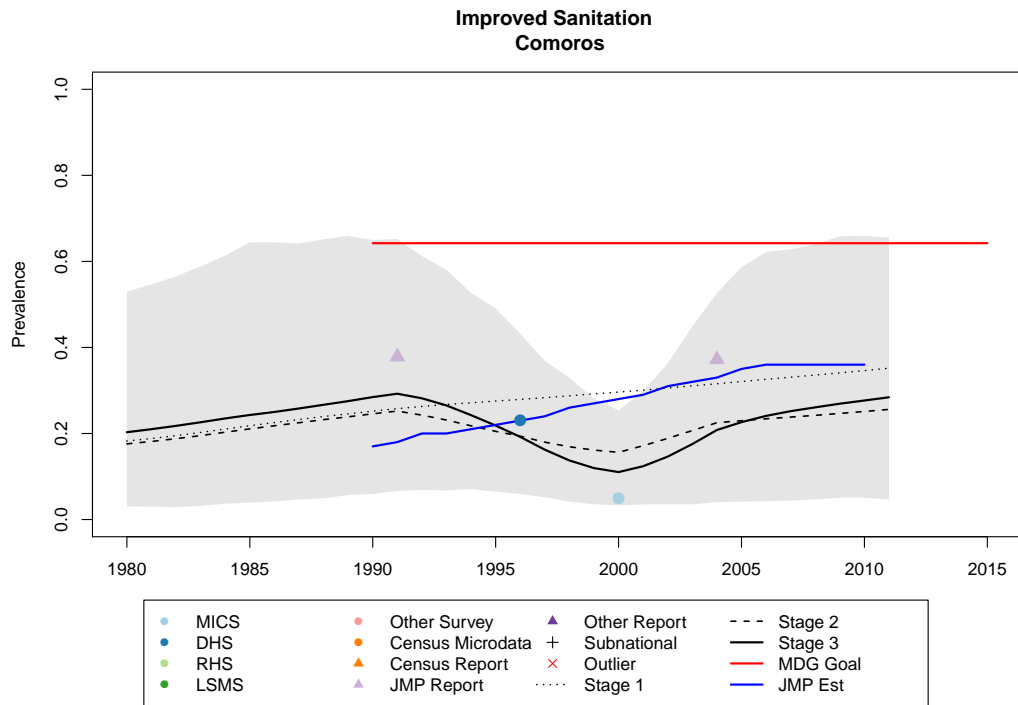


Figure A.165: Prevalence of access to improved sanitation, Comoros

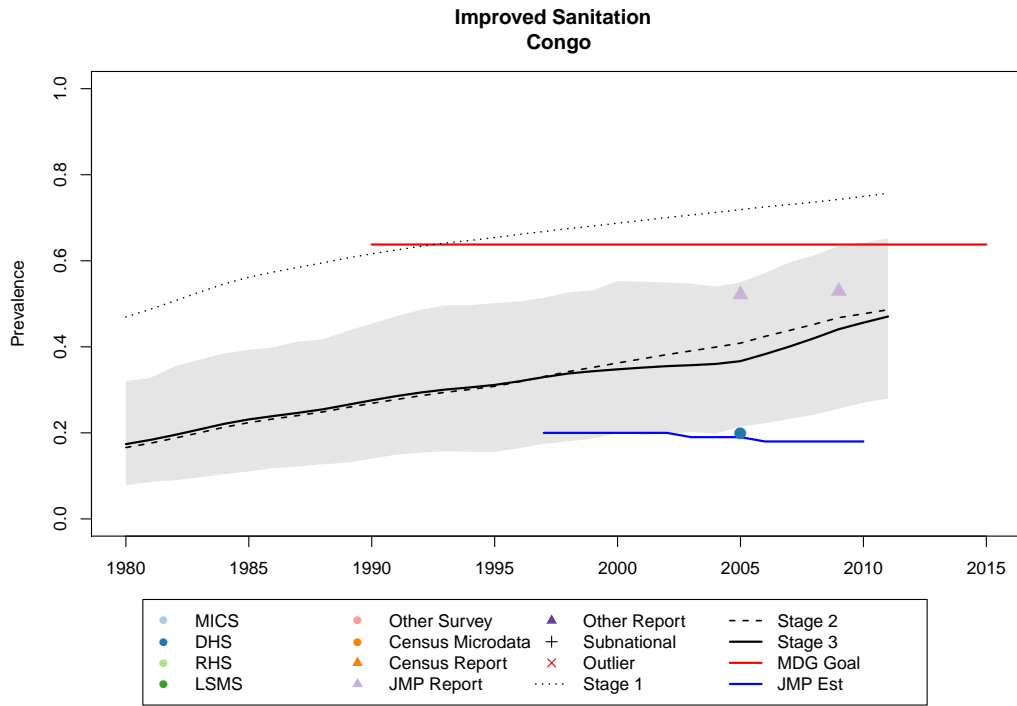


Figure A.166: Prevalence of access to improved sanitation, Congo

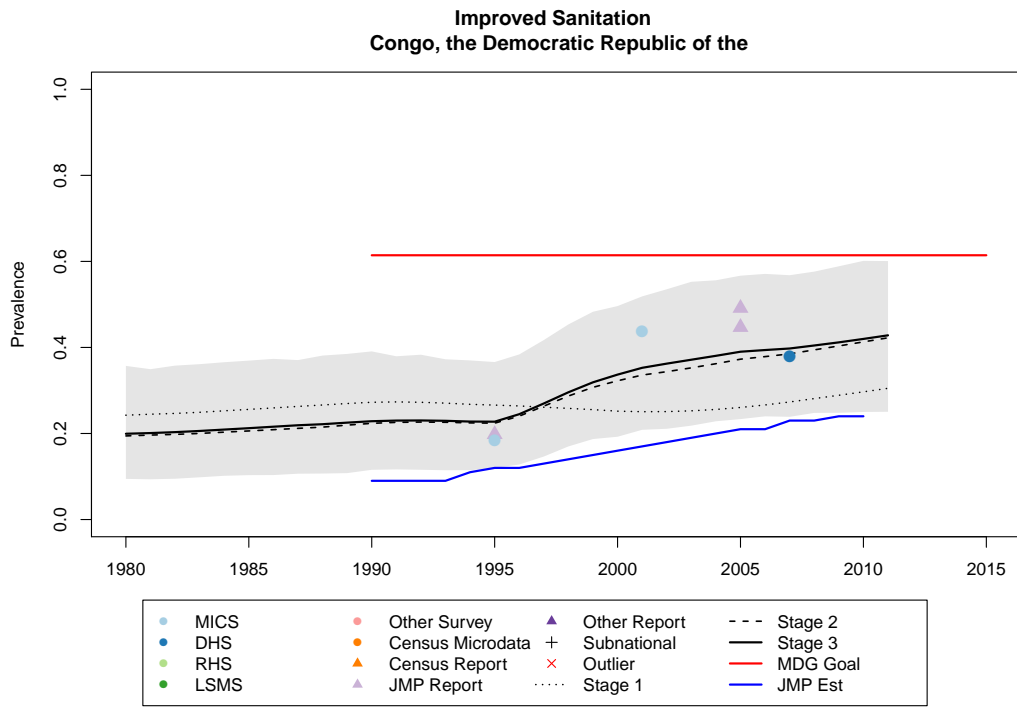


Figure A.167: Prevalence of access to improved sanitation, Congo, the Democratic Republic of the

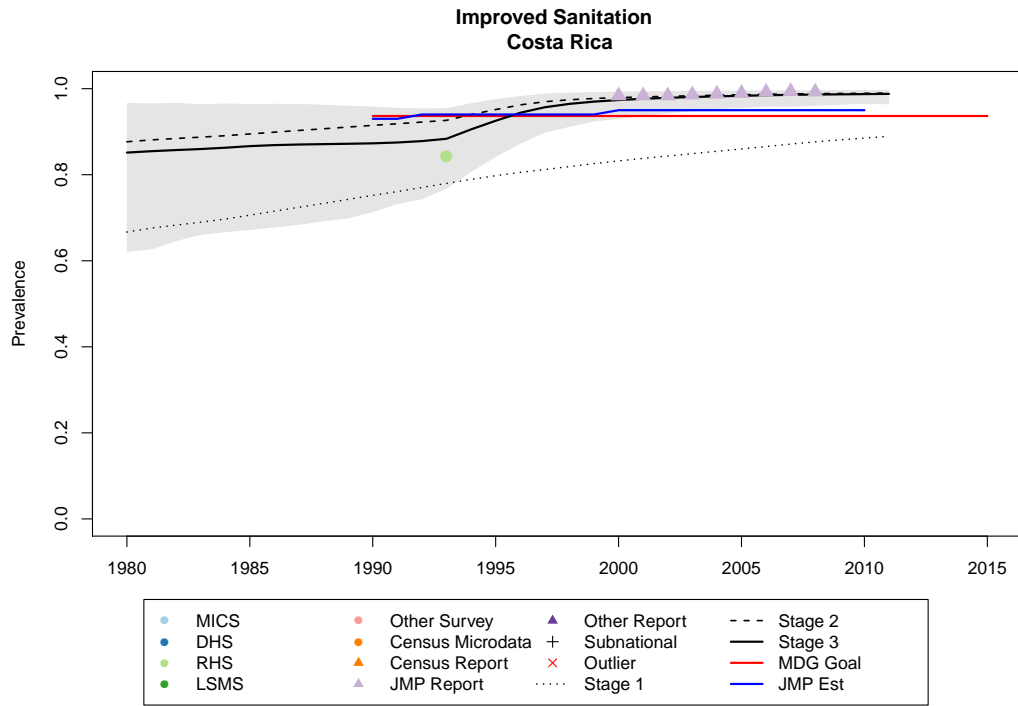


Figure A.168: Prevalence of access to improved sanitation, Costa Rica

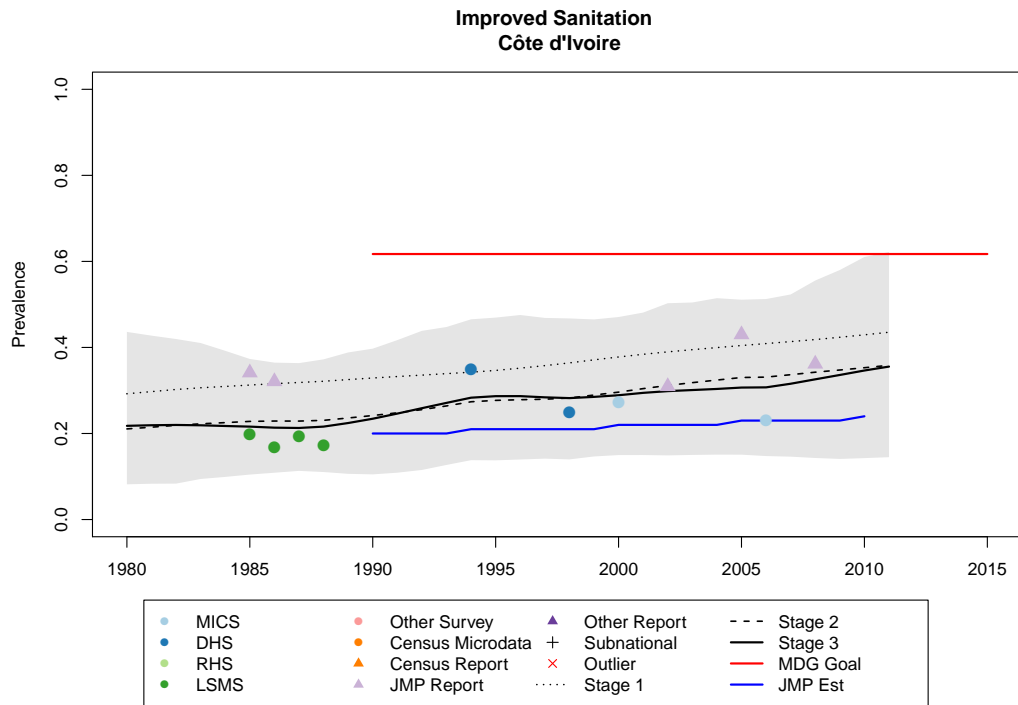


Figure A.169: Prevalence of access to improved sanitation, Cte d'Ivoire

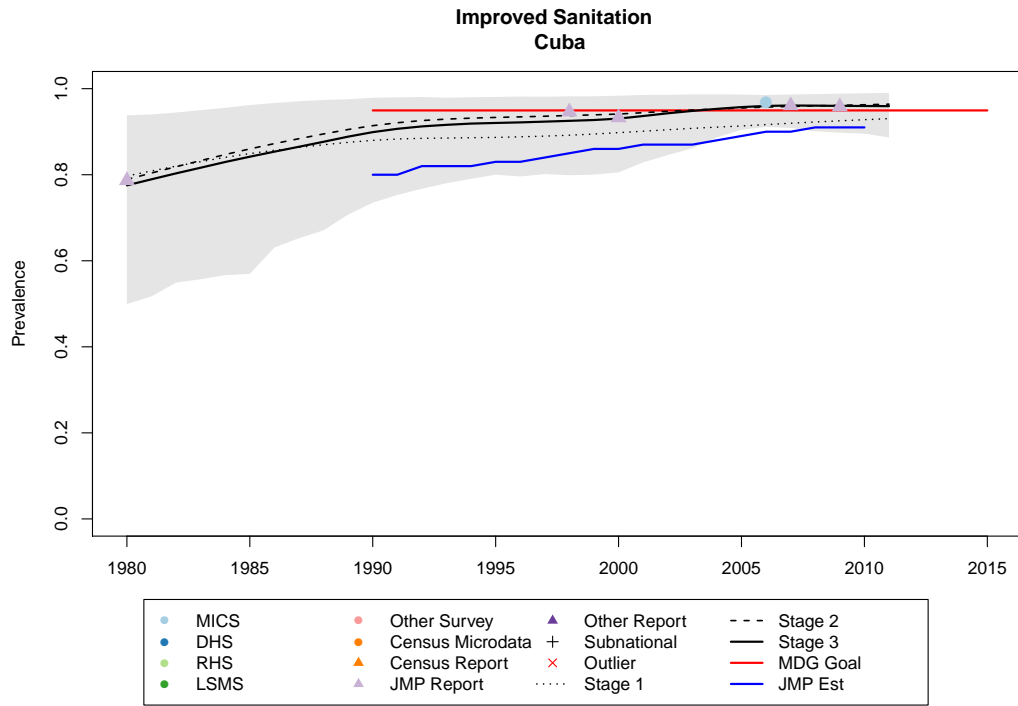


Figure A.170: Prevalence of access to improved sanitation, Cuba

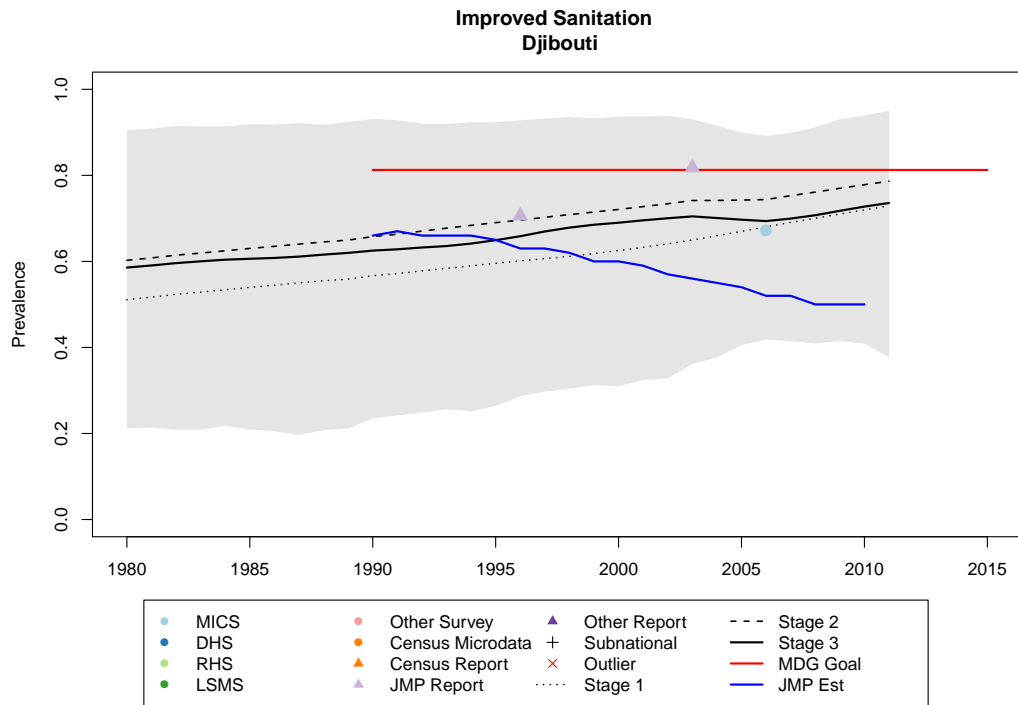


Figure A.171: Prevalence of access to improved sanitation, Djibouti

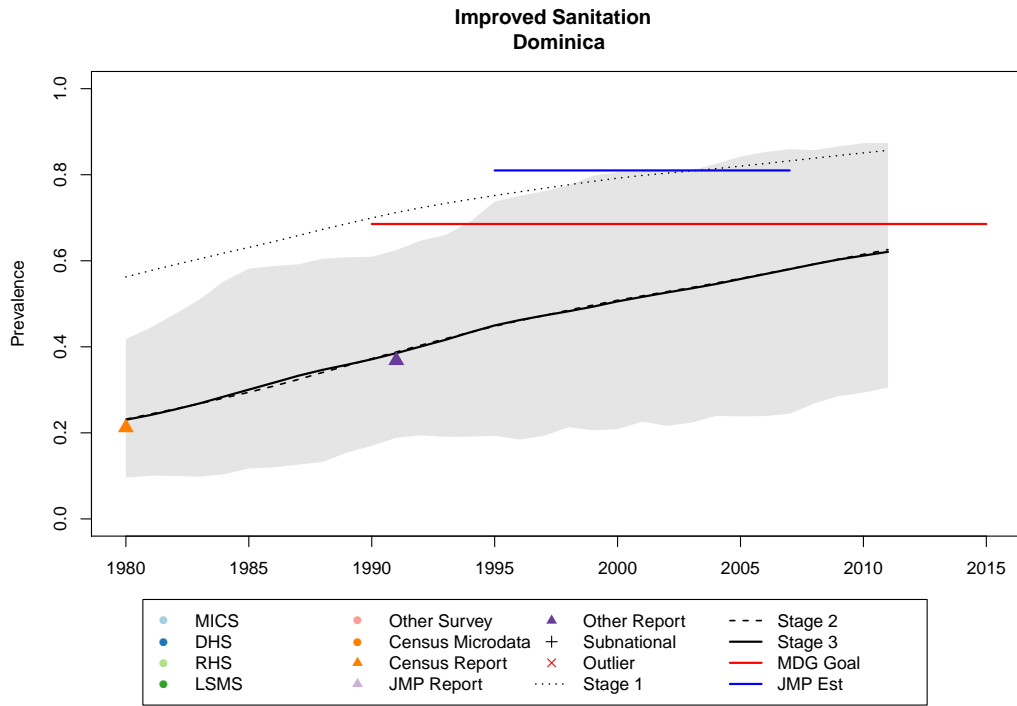


Figure A.172: Prevalence of access to improved sanitation, Dominica

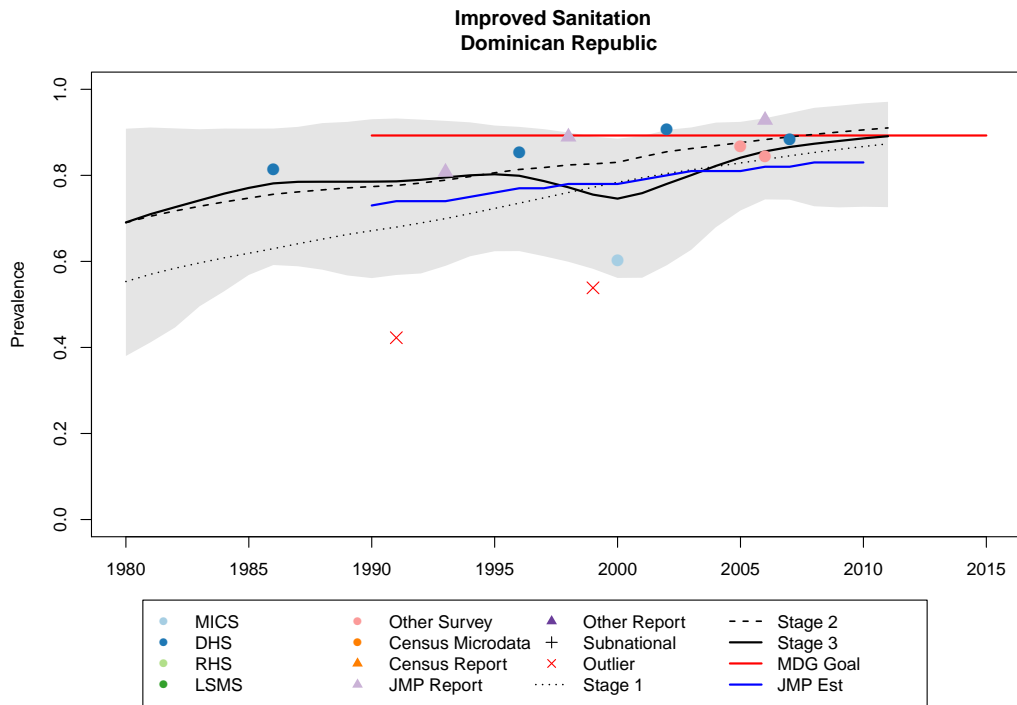


Figure A.173: Prevalence of access to improved sanitation, Dominican Republic

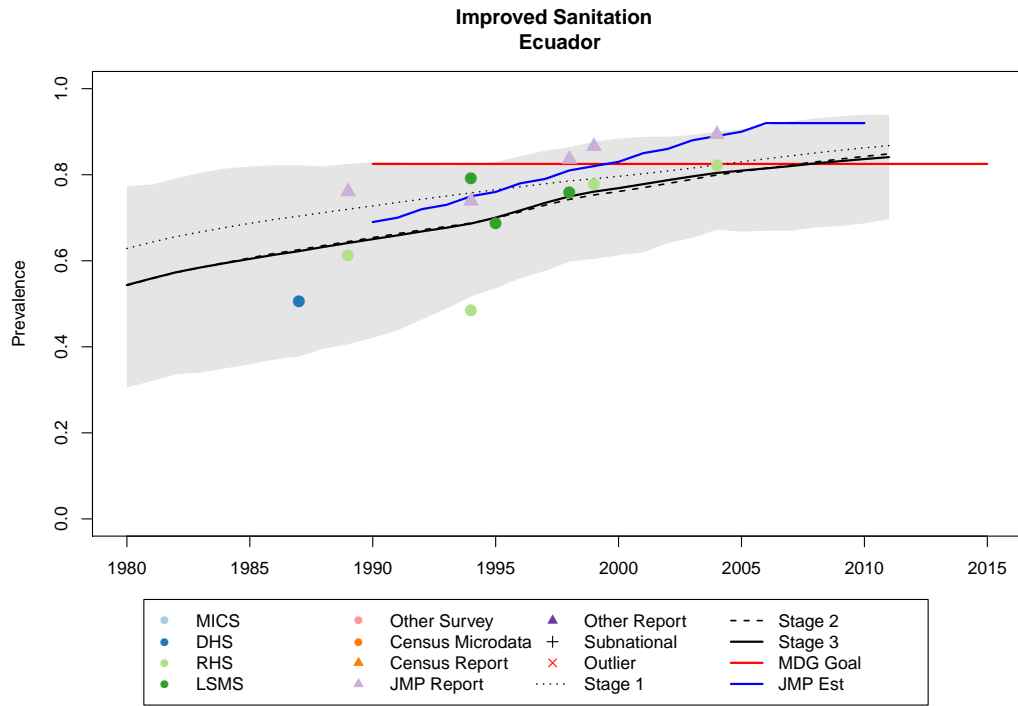


Figure A.174: Prevalence of access to improved sanitation, Ecuador

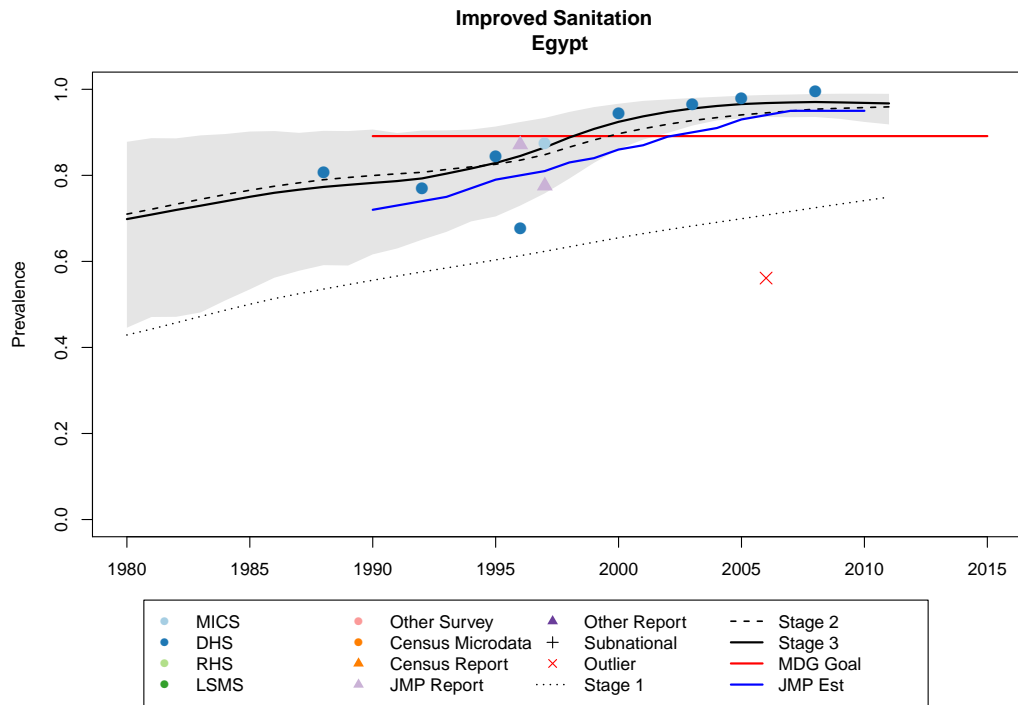


Figure A.175: Prevalence of access to improved sanitation, Egypt

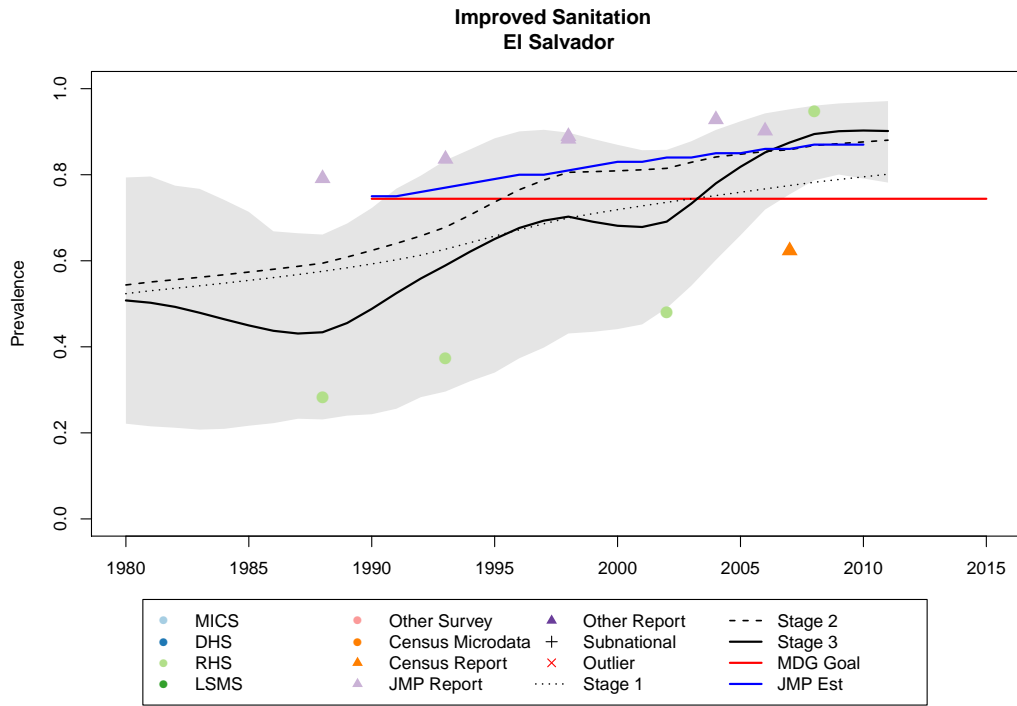


Figure A.176: Prevalence of access to improved sanitation, El Salvador

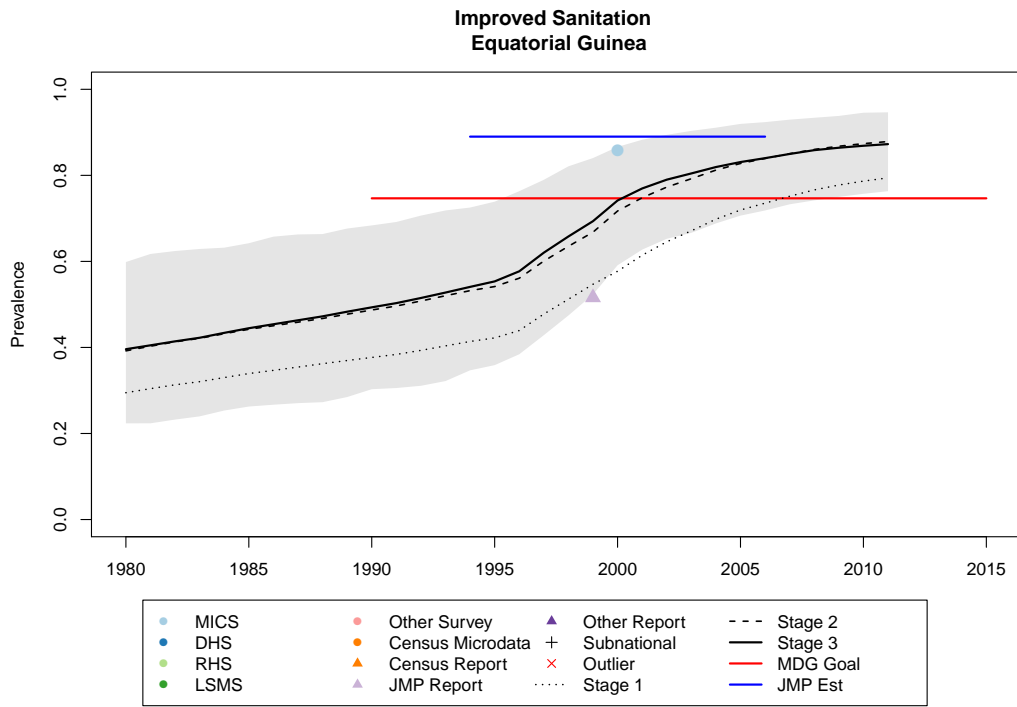


Figure A.177: Prevalence of access to improved sanitation, Equatorial Guinea

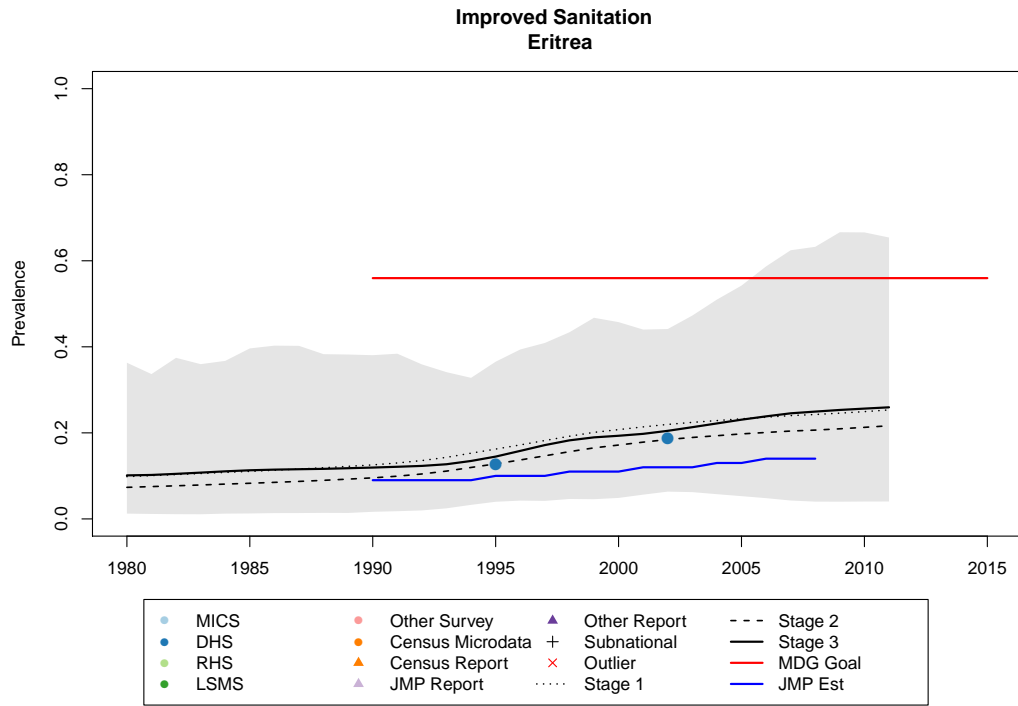


Figure A.178: Prevalence of access to improved sanitation, Eritrea

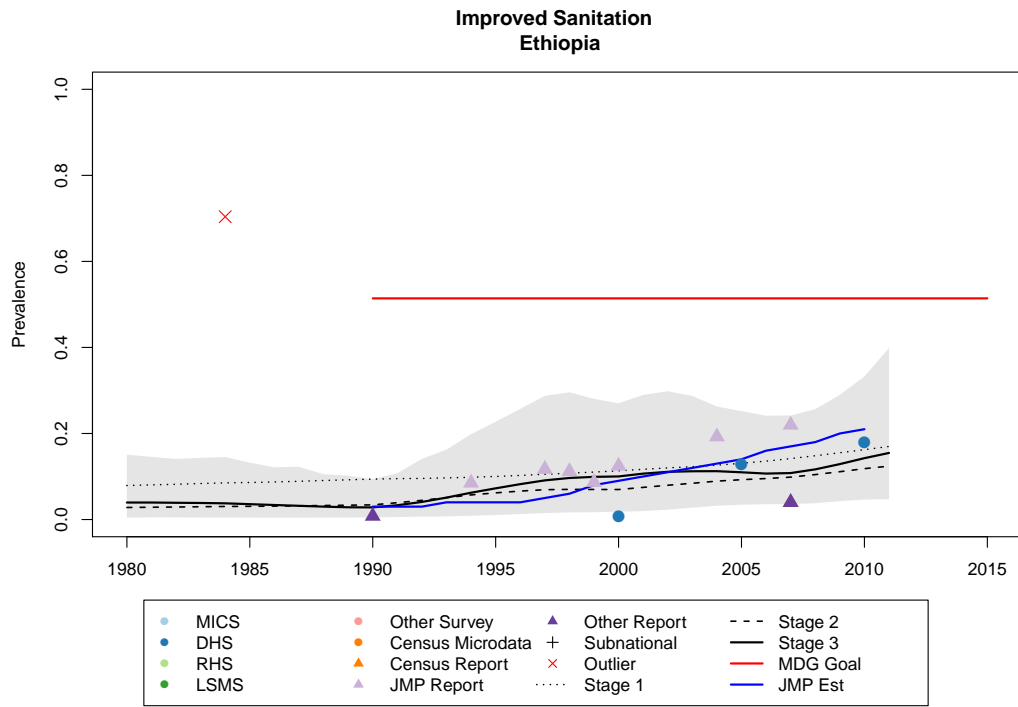


Figure A.179: Prevalence of access to improved sanitation, Ethiopia

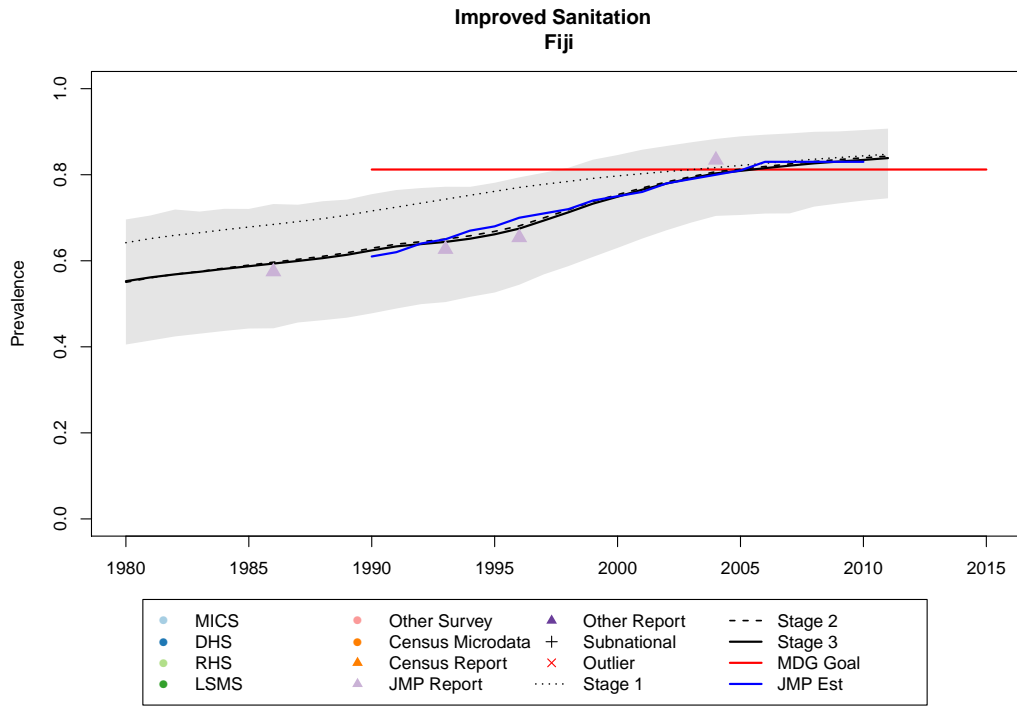


Figure A.180: Prevalence of access to improved sanitation, Fiji

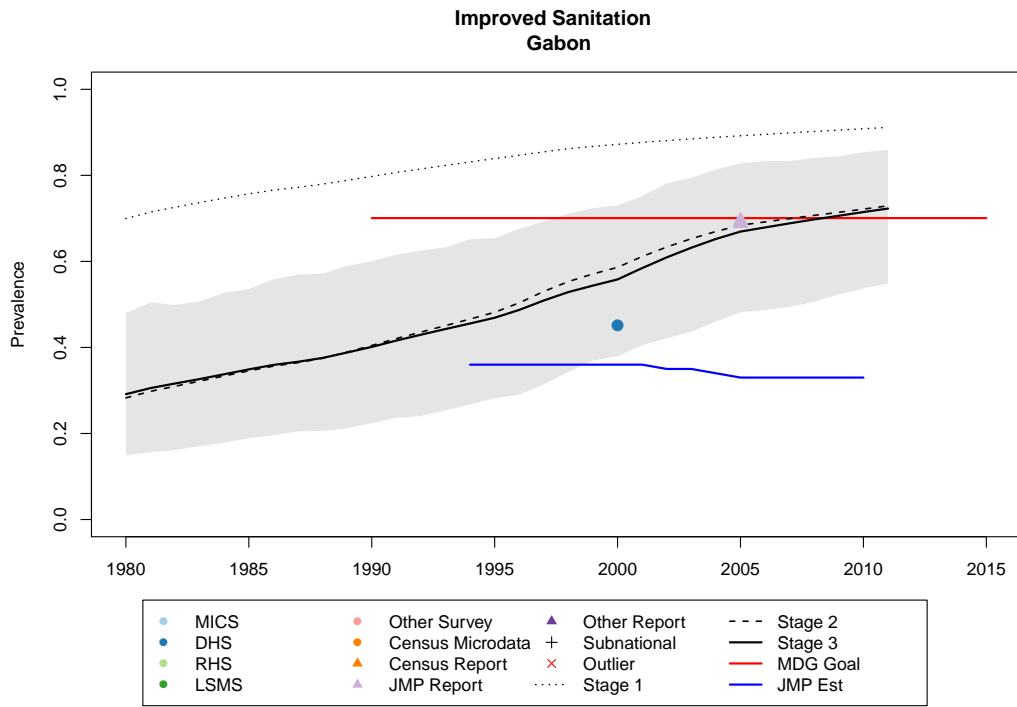


Figure A.181: Prevalence of access to improved sanitation, Gabon

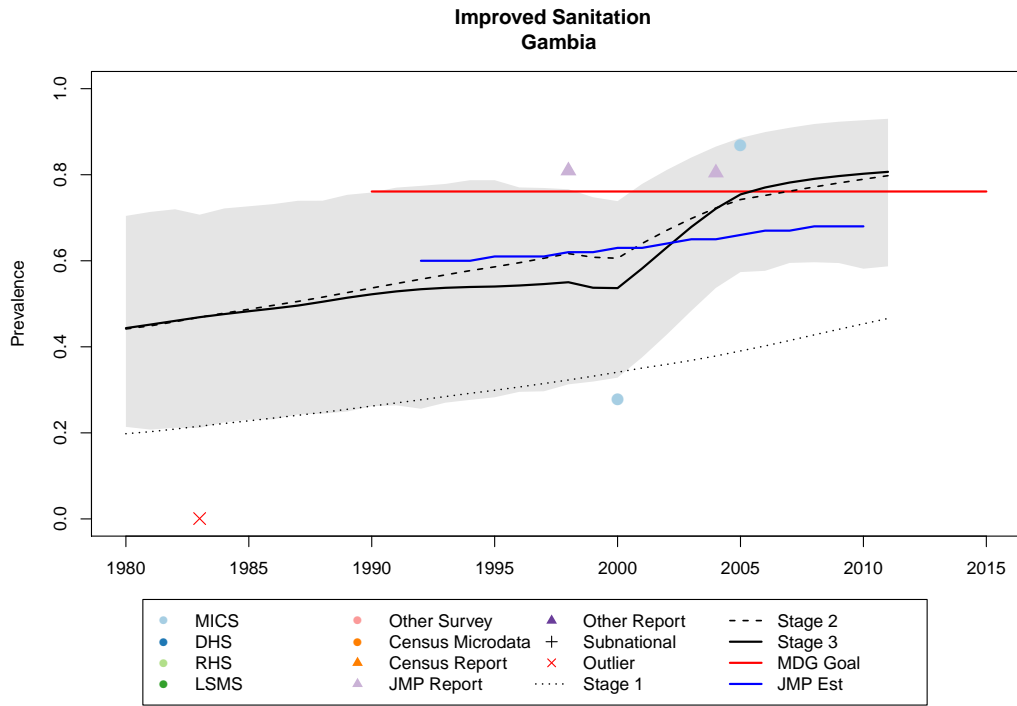


Figure A.182: Prevalence of access to improved sanitation, Gambia

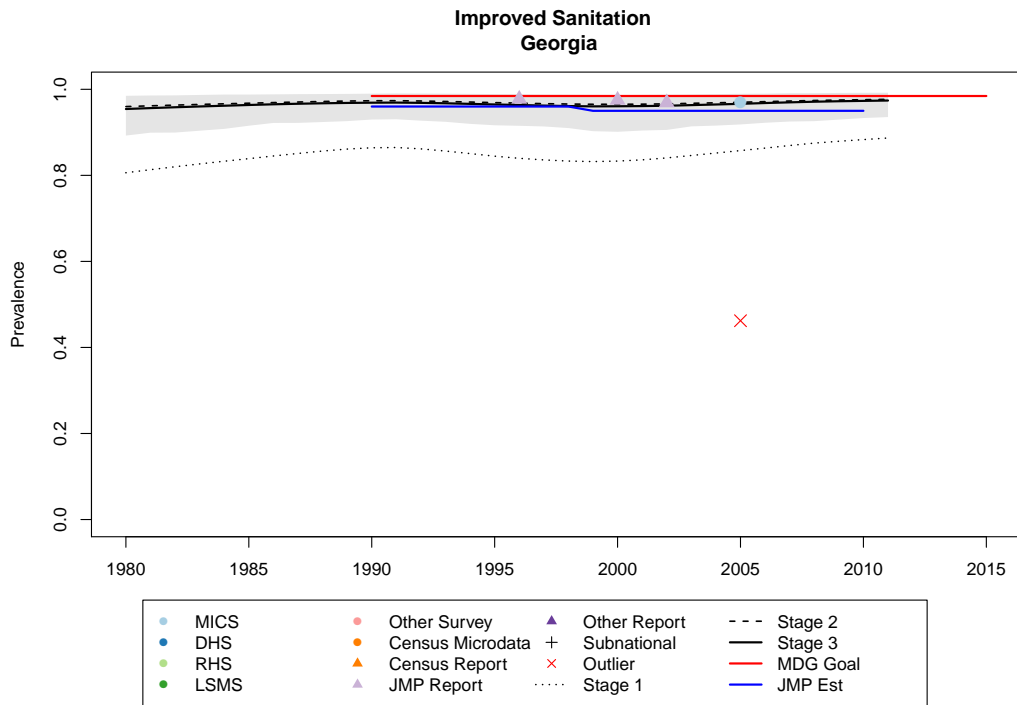


Figure A.183: Prevalence of access to improved sanitation, Georgia

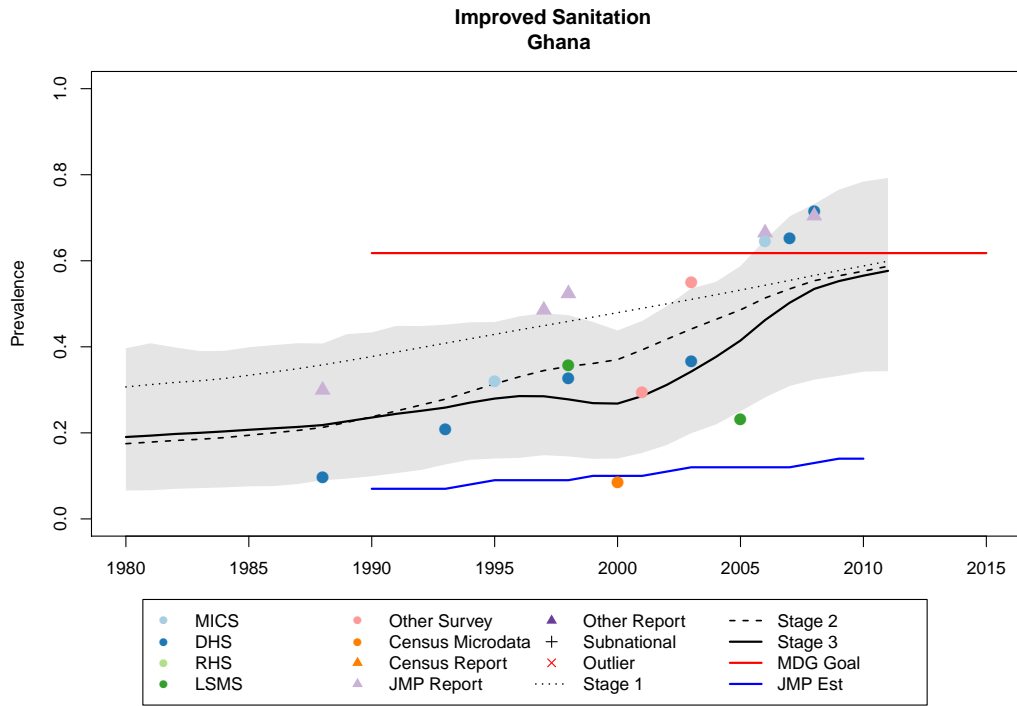


Figure A.184: Prevalence of access to improved sanitation, Ghana

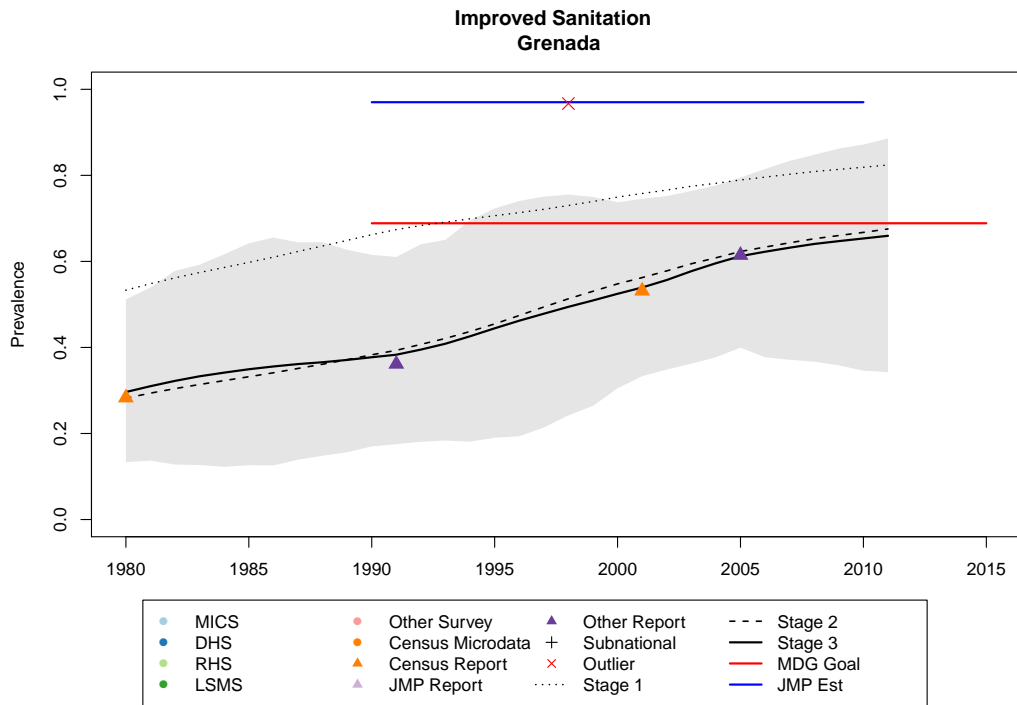


Figure A.185: Prevalence of access to improved sanitation, Grenada

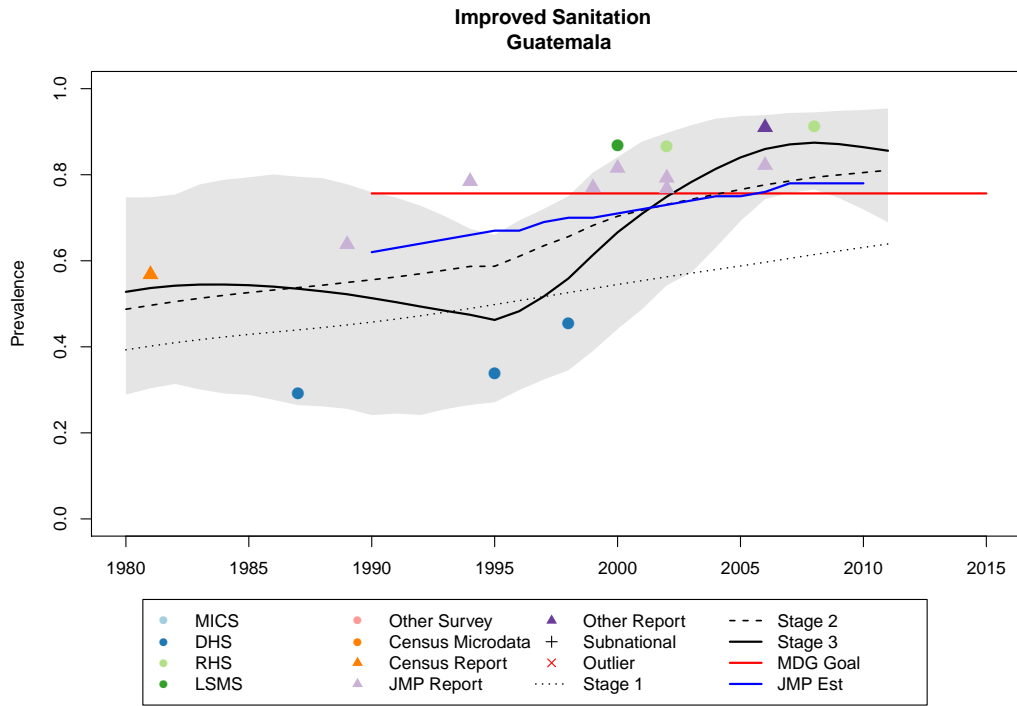


Figure A.186: Prevalence of access to improved sanitation, Guatemala

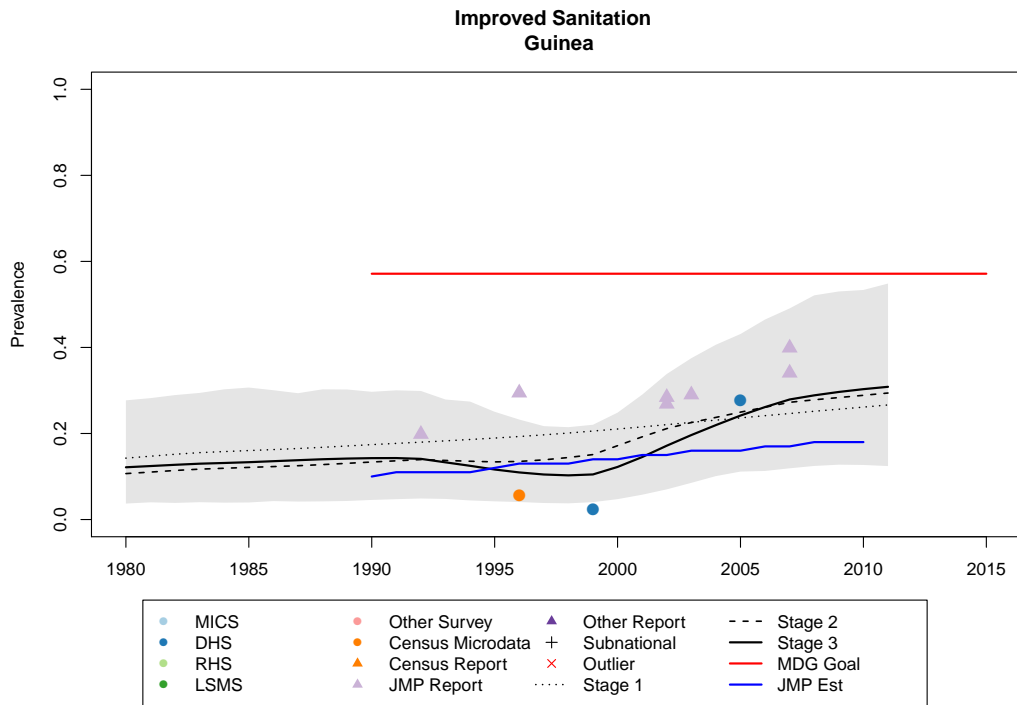


Figure A.187: Prevalence of access to improved sanitation, Guinea

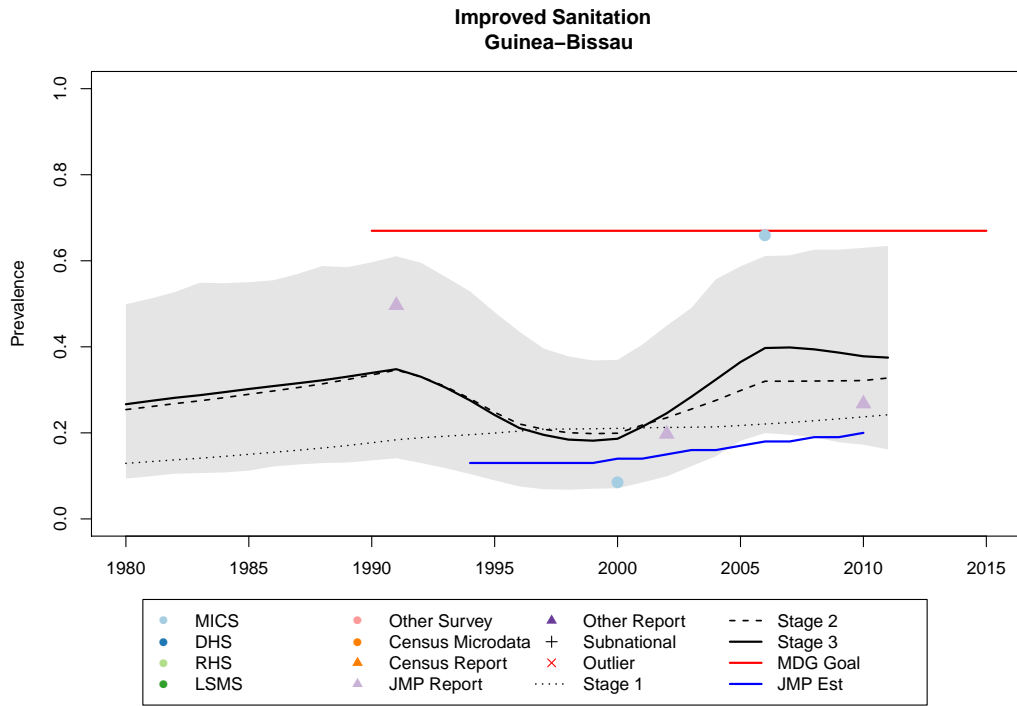


Figure A.188: Prevalence of access to improved sanitation, Guinea-Bissau

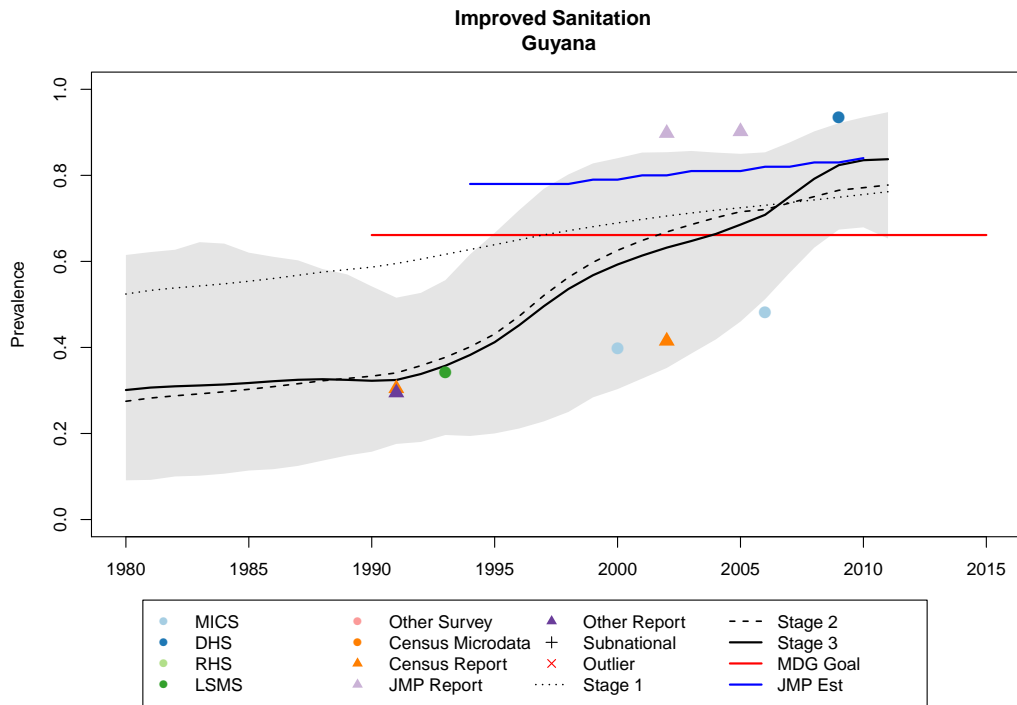


Figure A.189: Prevalence of access to improved sanitation, Guyana

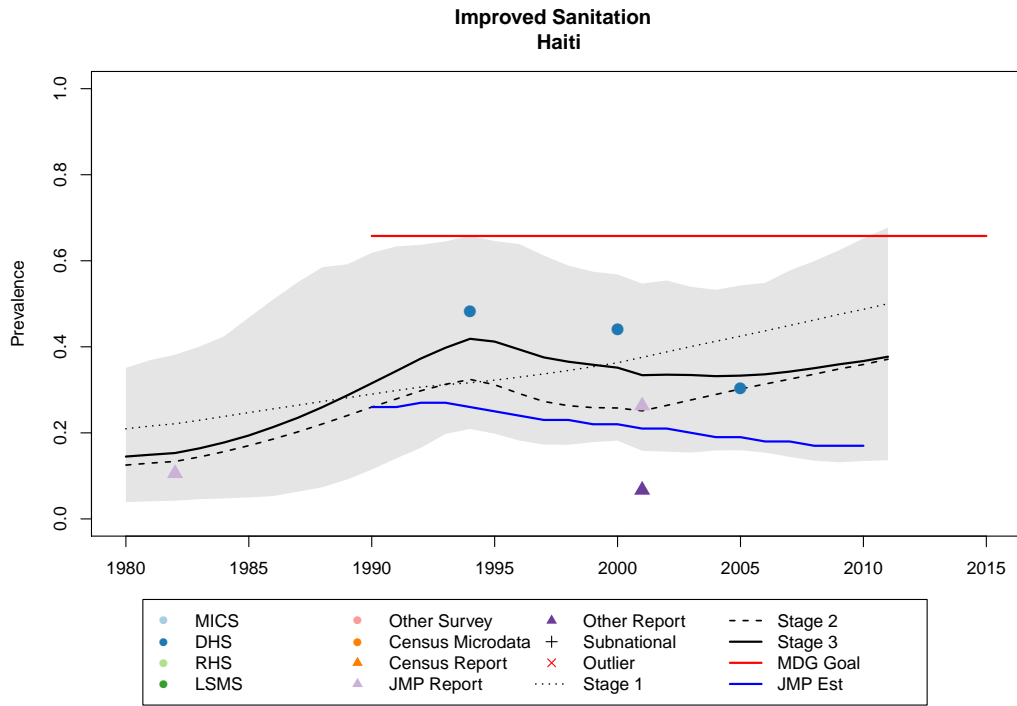


Figure A.190: Prevalence of access to improved sanitation, Haiti

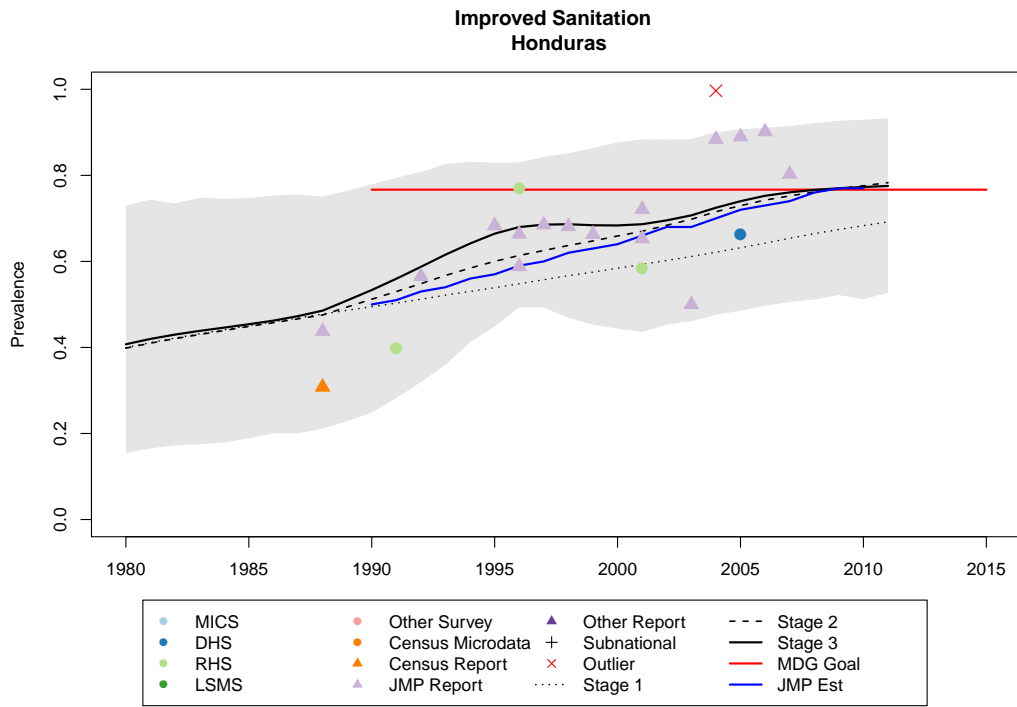


Figure A.191: Prevalence of access to improved sanitation, Honduras

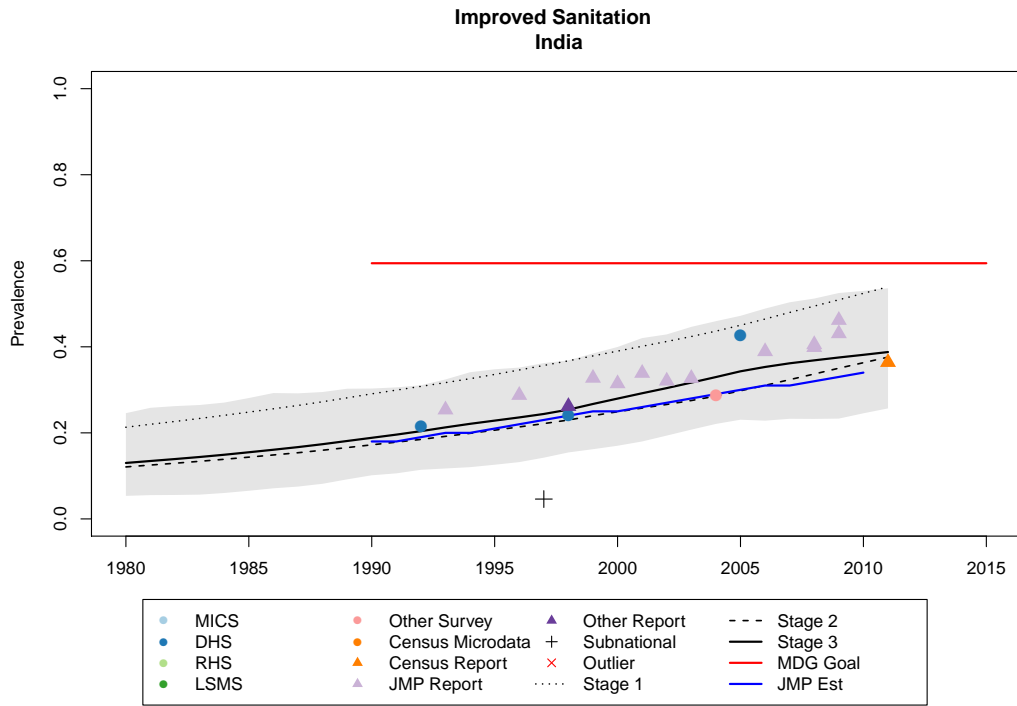


Figure A.192: Prevalence of access to improved sanitation, India

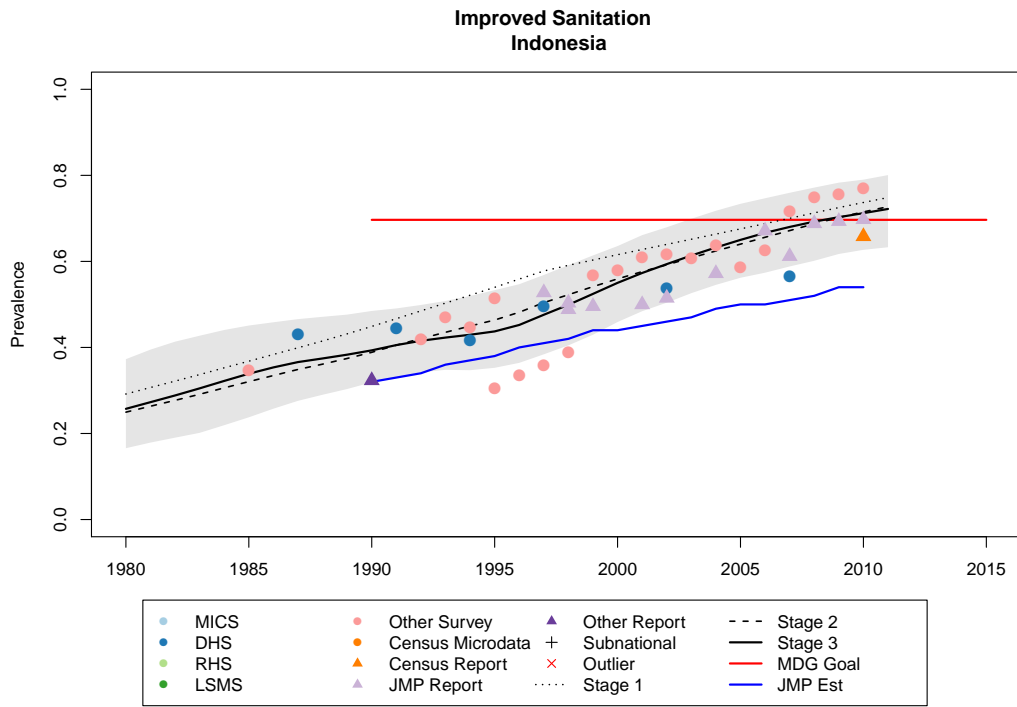


Figure A.193: Prevalence of access to improved sanitation, Indonesia

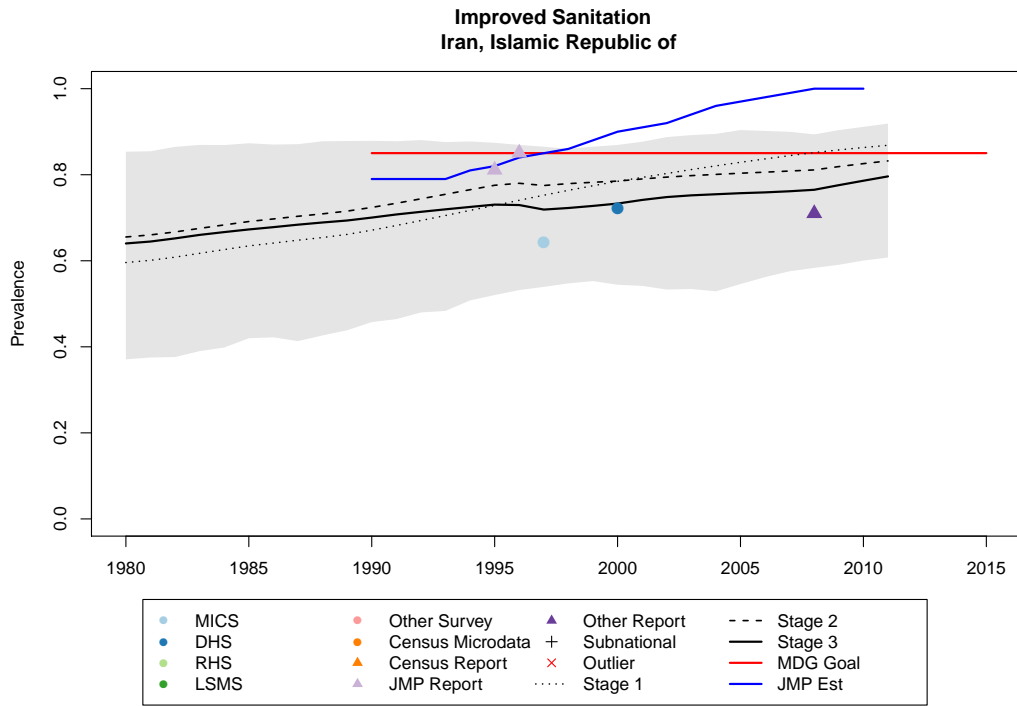


Figure A.194: Prevalence of access to improved sanitation, Iran, Islamic Republic of

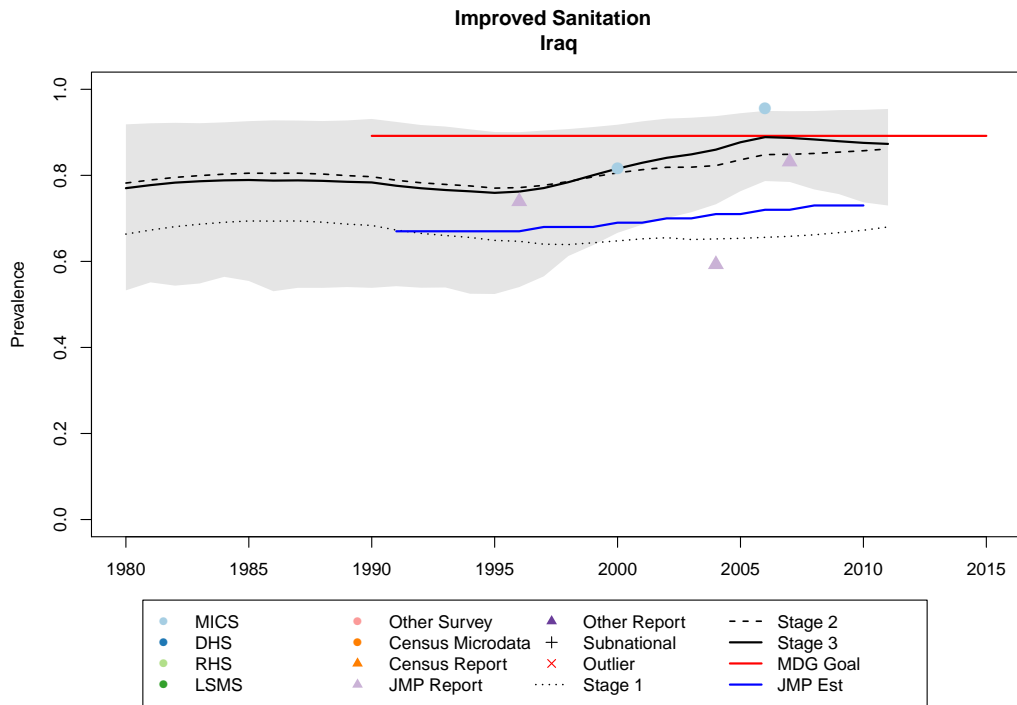


Figure A.195: Prevalence of access to improved sanitation, Iraq

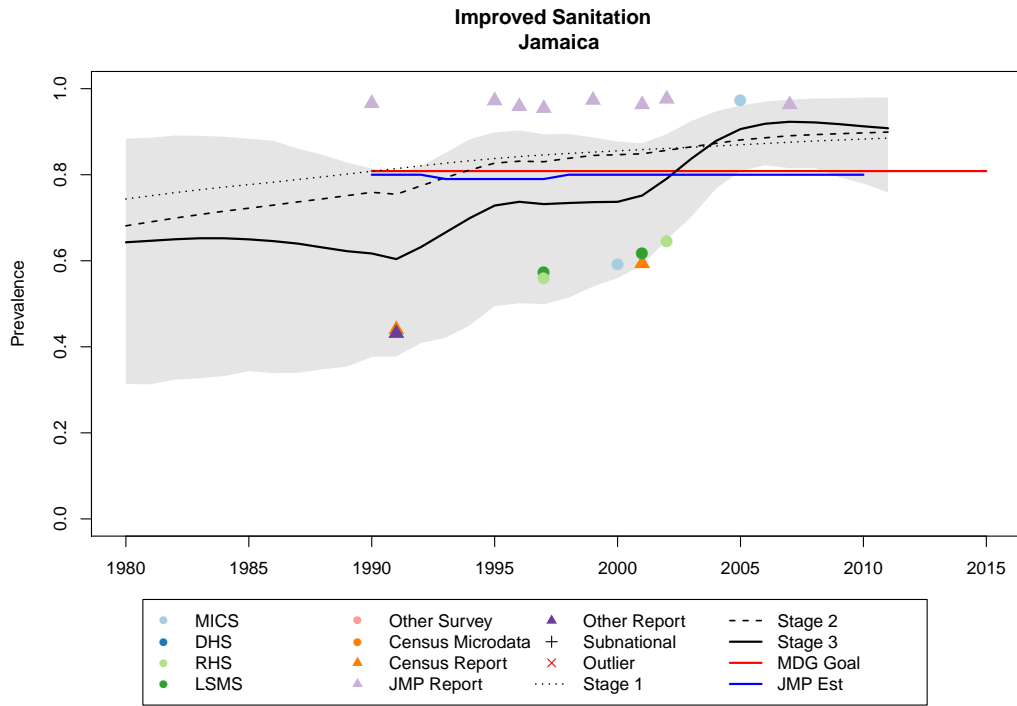


Figure A.196: Prevalence of access to improved sanitation, Jamaica

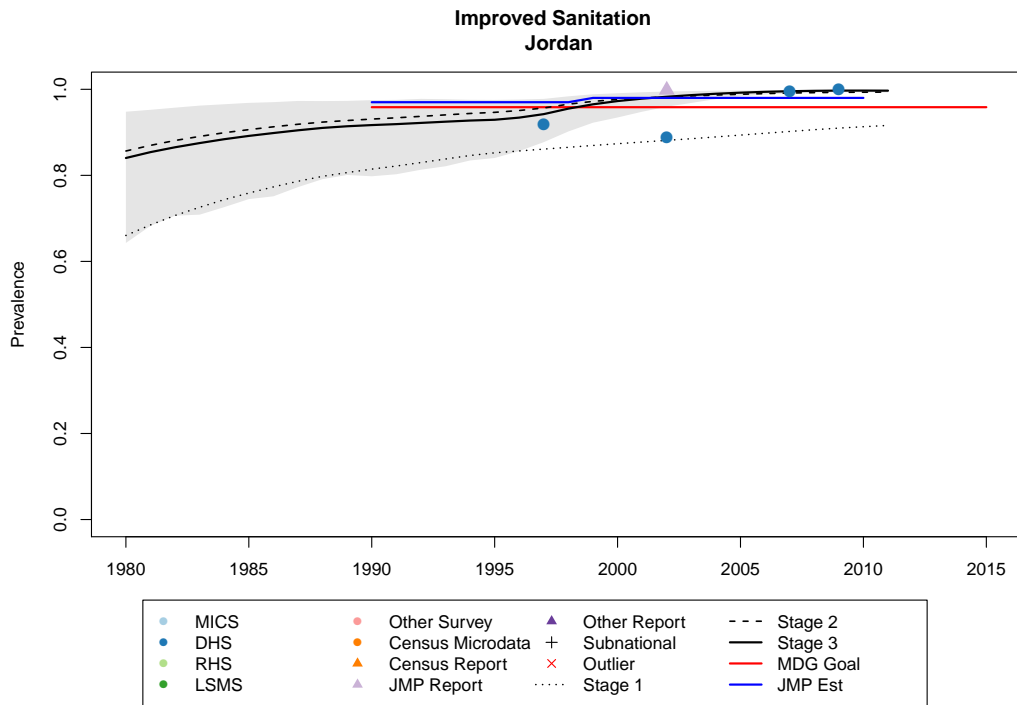


Figure A.197: Prevalence of access to improved sanitation, Jordan

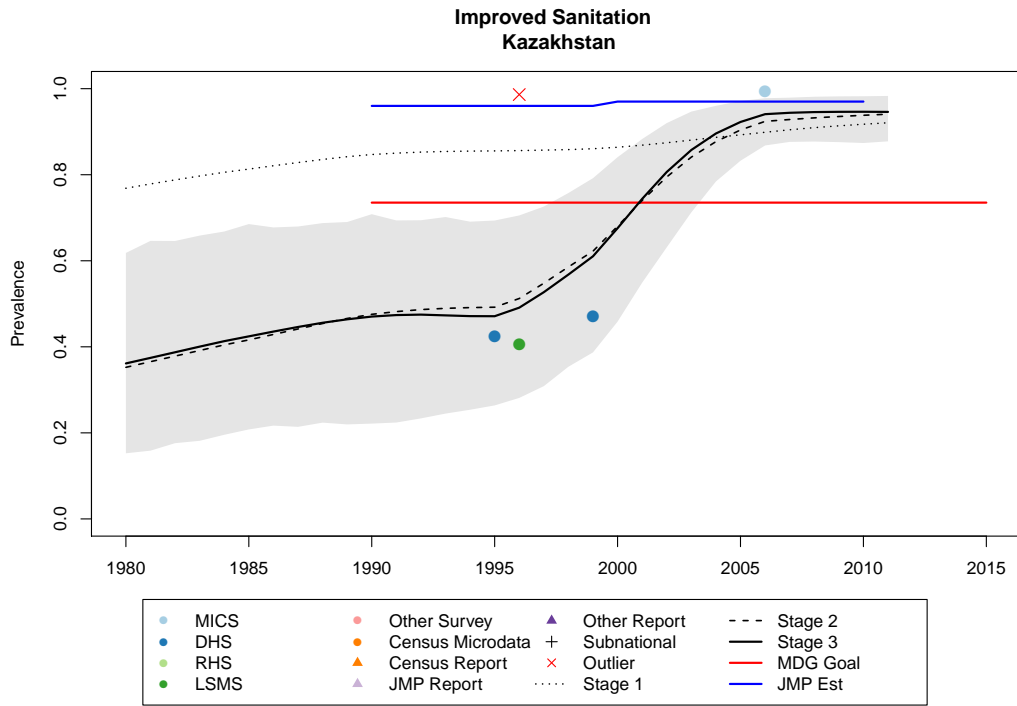


Figure A.198: Prevalence of access to improved sanitation, Kazakhstan

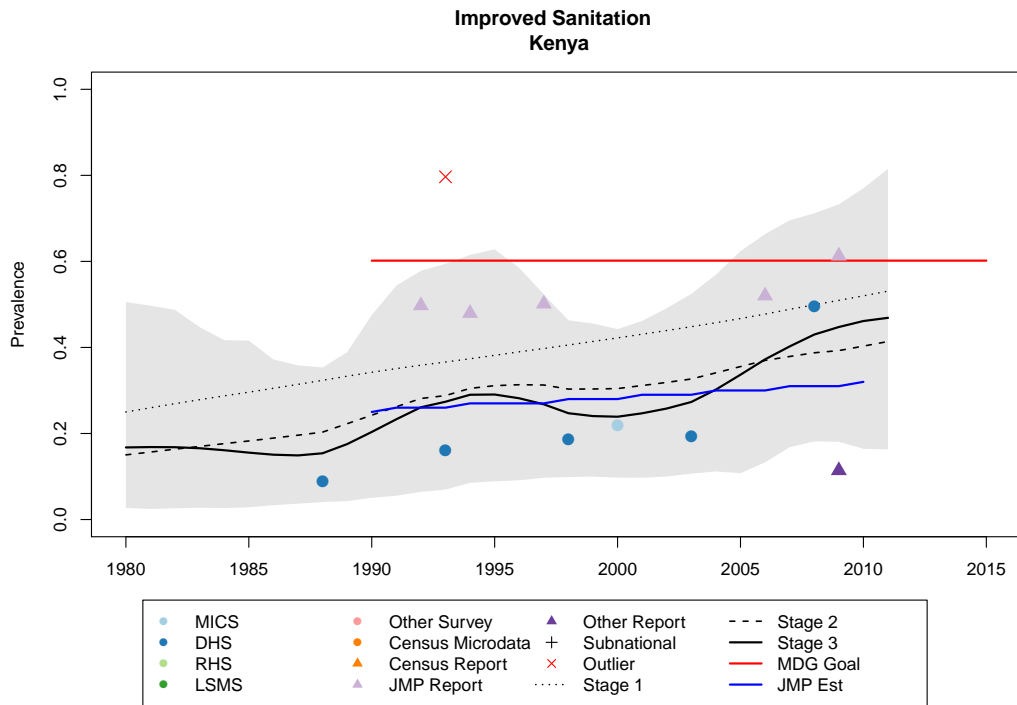


Figure A.199: Prevalence of access to improved sanitation, Kenya

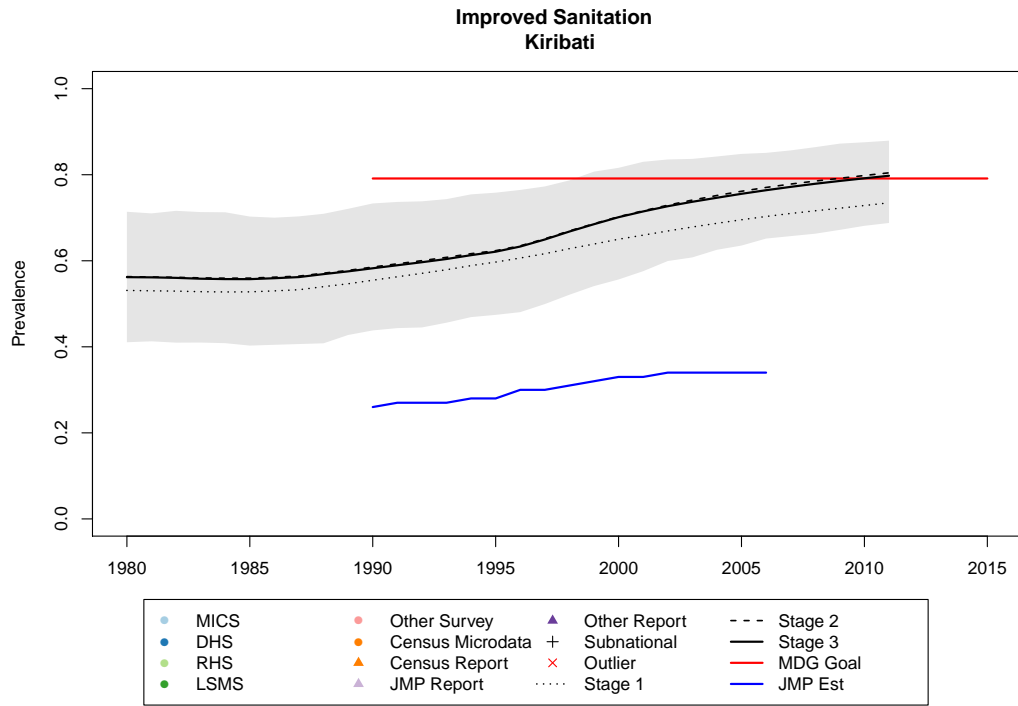


Figure A.200: Prevalence of access to improved sanitation, Kiribati

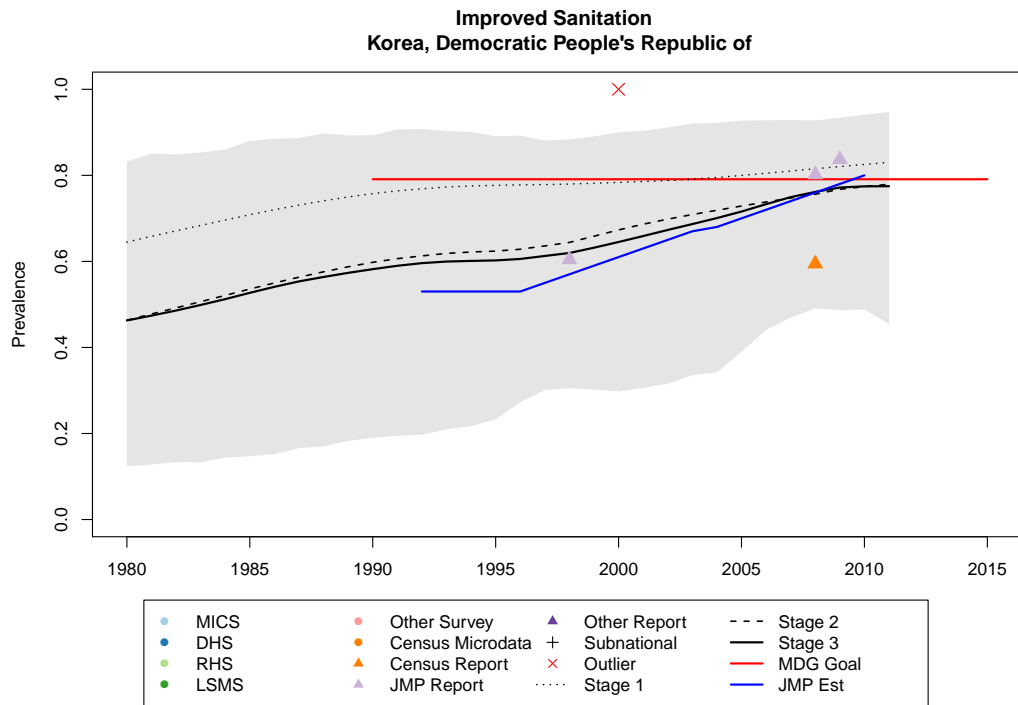


Figure A.201: Prevalence of access to improved sanitation, Korea, Democratic People's Republic of

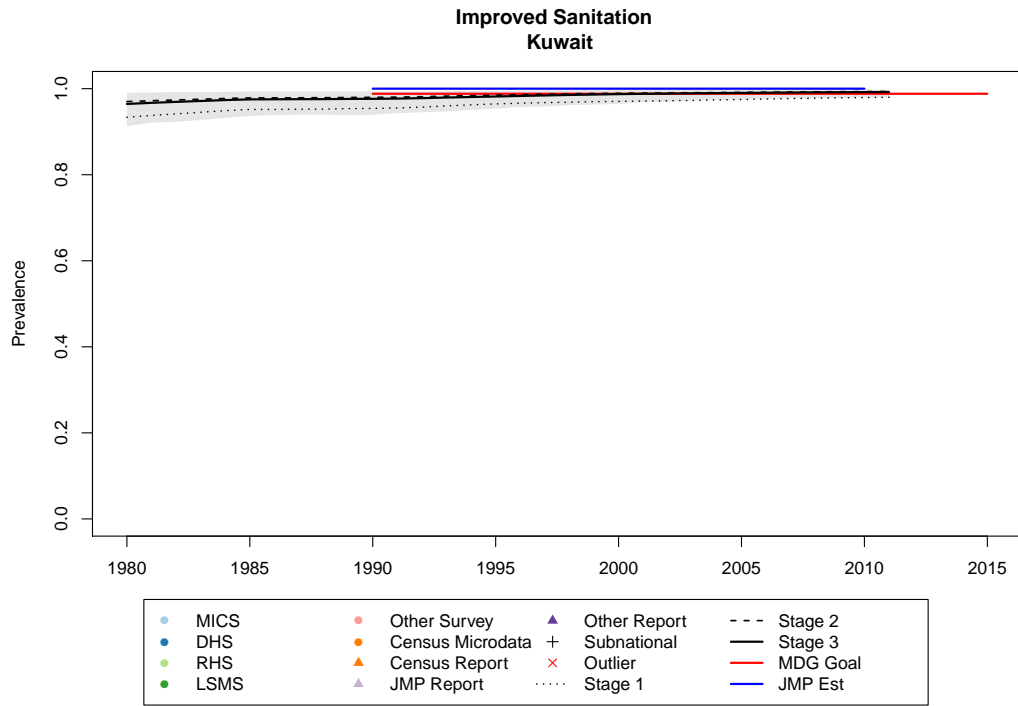


Figure A.202: Prevalence of access to improved sanitation, Kuwait

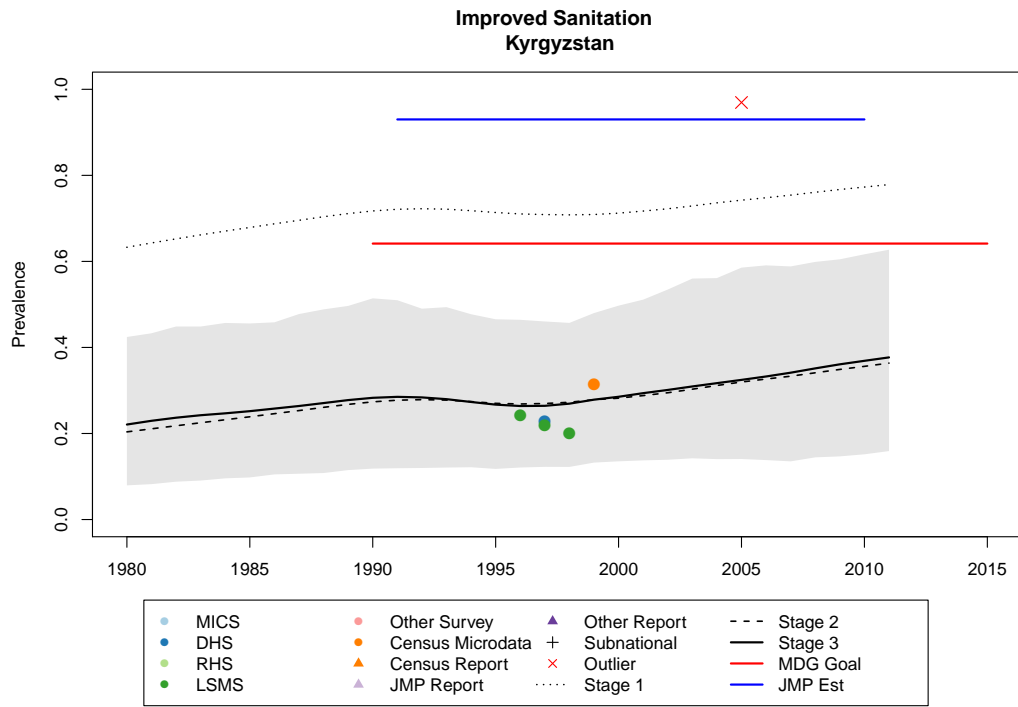


Figure A.203: Prevalence of access to improved sanitation, Kyrgyzstan

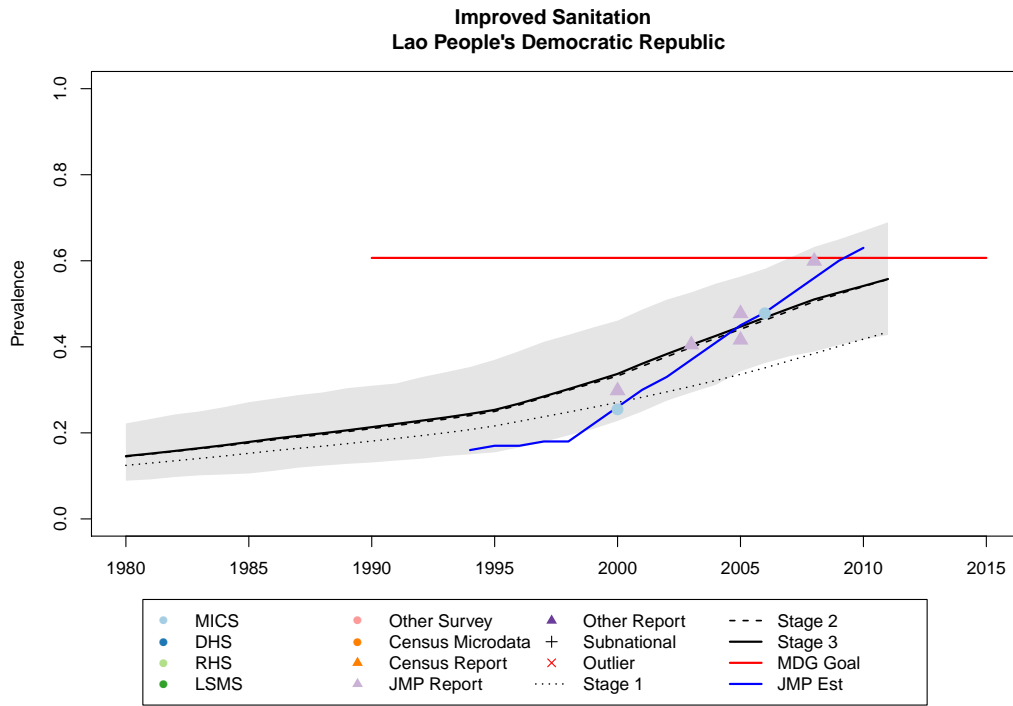


Figure A.204: Prevalence of access to improved sanitation, Lao People's Democratic Republic

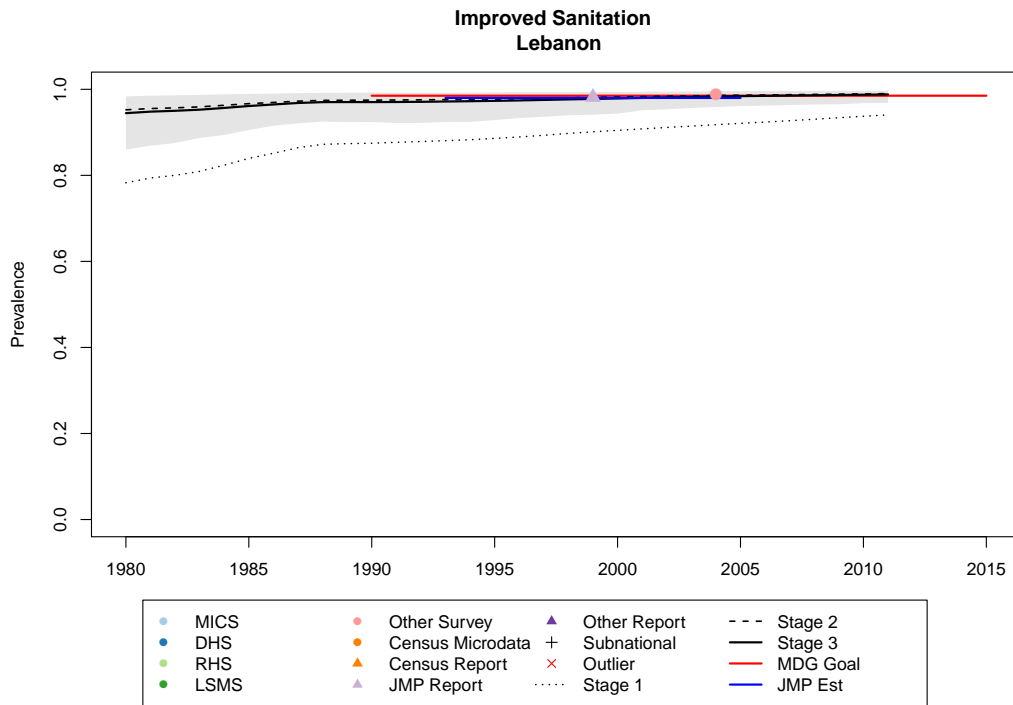


Figure A.205: Prevalence of access to improved sanitation, Lebanon

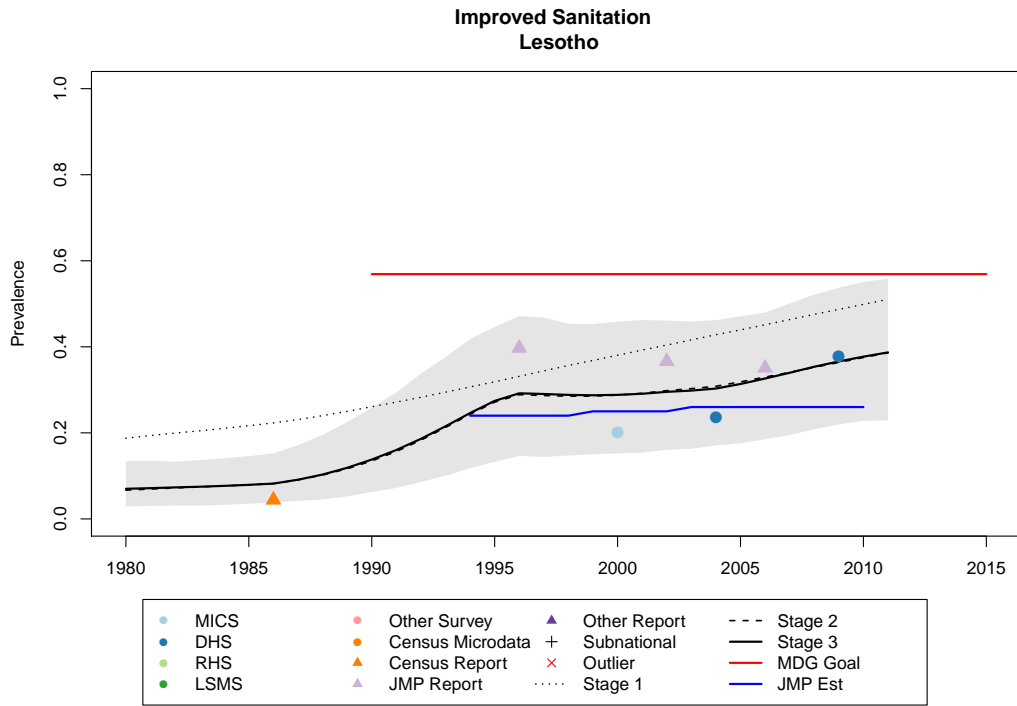


Figure A.206: Prevalence of access to improved sanitation, Lesotho

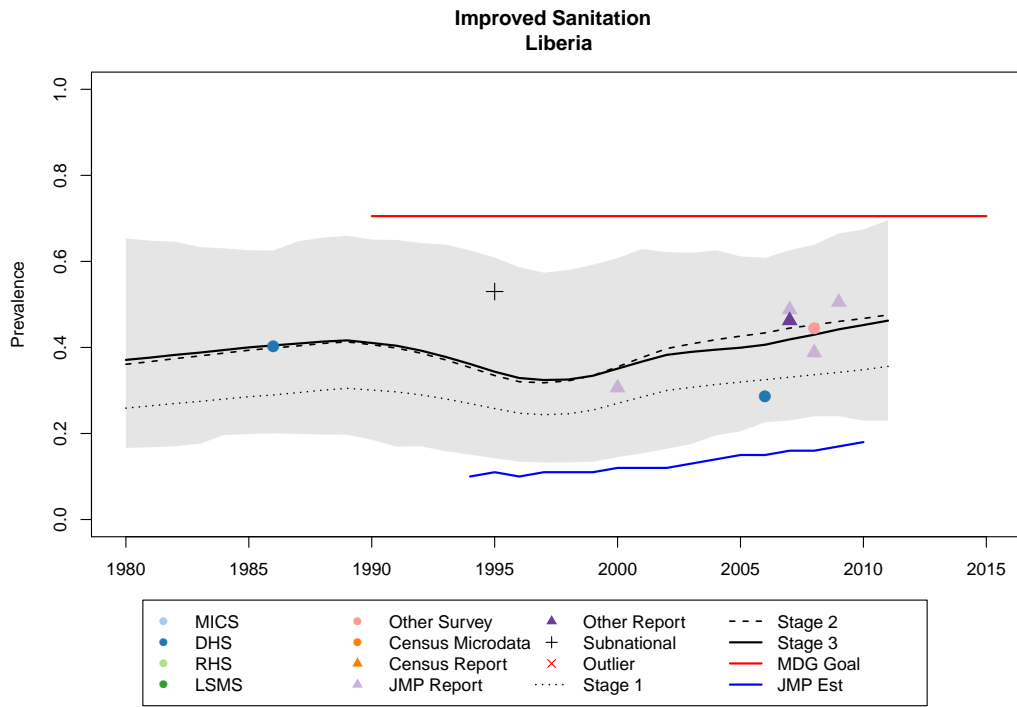


Figure A.207: Prevalence of access to improved sanitation, Liberia

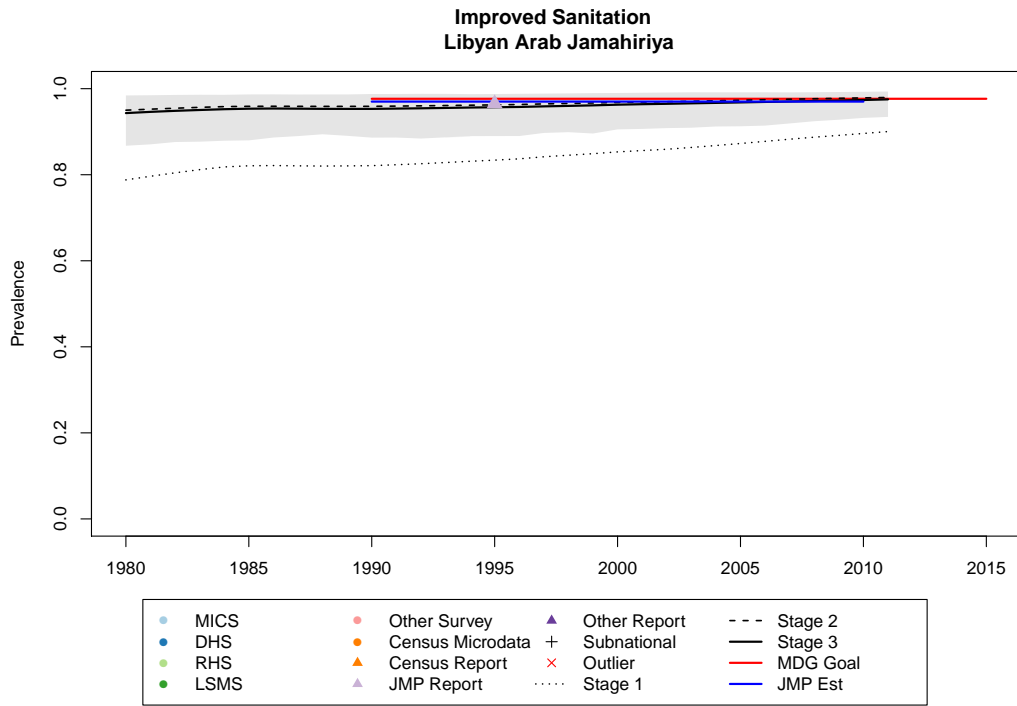


Figure A.208: Prevalence of access to improved sanitation, Libyan Arab Jamahiriya

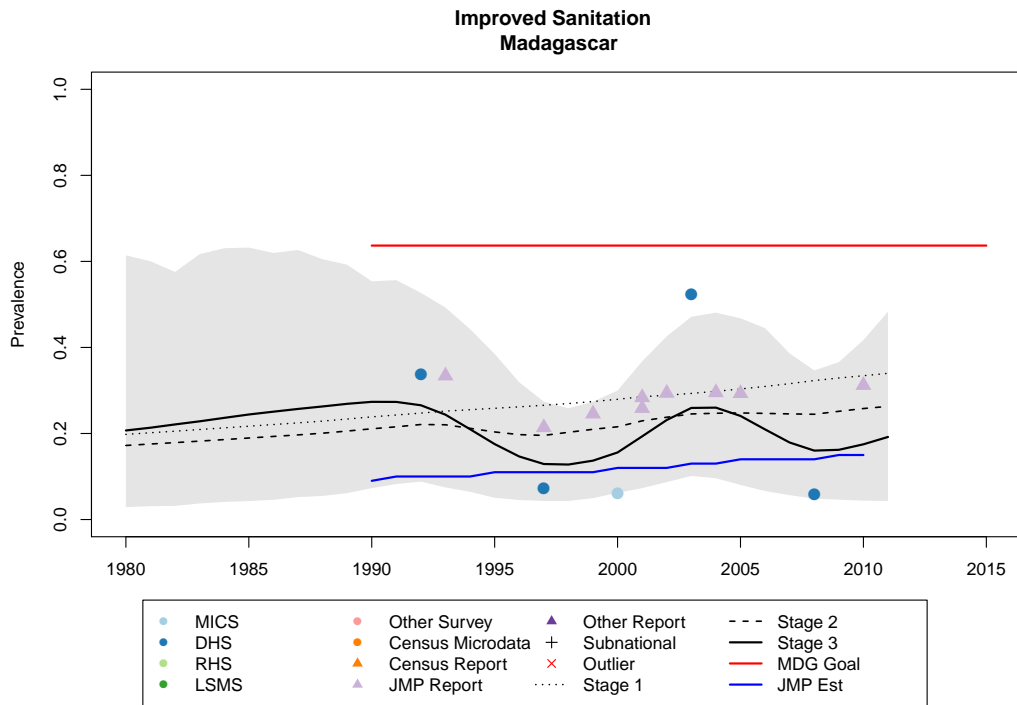


Figure A.209: Prevalence of access to improved sanitation, Madagascar

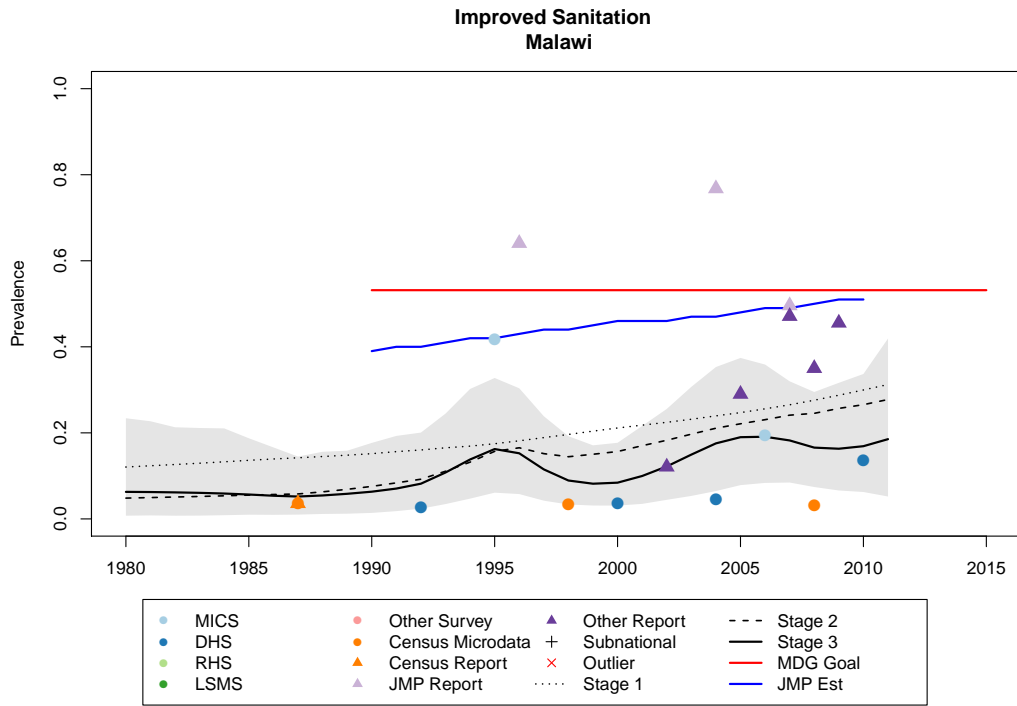


Figure A.210: Prevalence of access to improved sanitation, Malawi

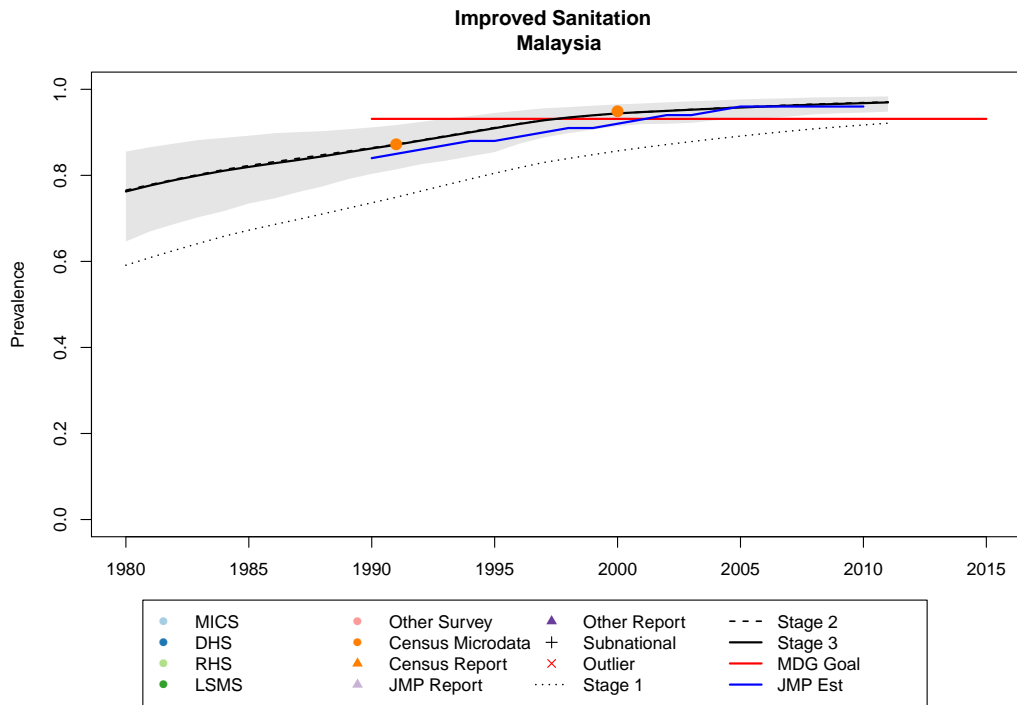


Figure A.211: Prevalence of access to improved sanitation, Malaysia

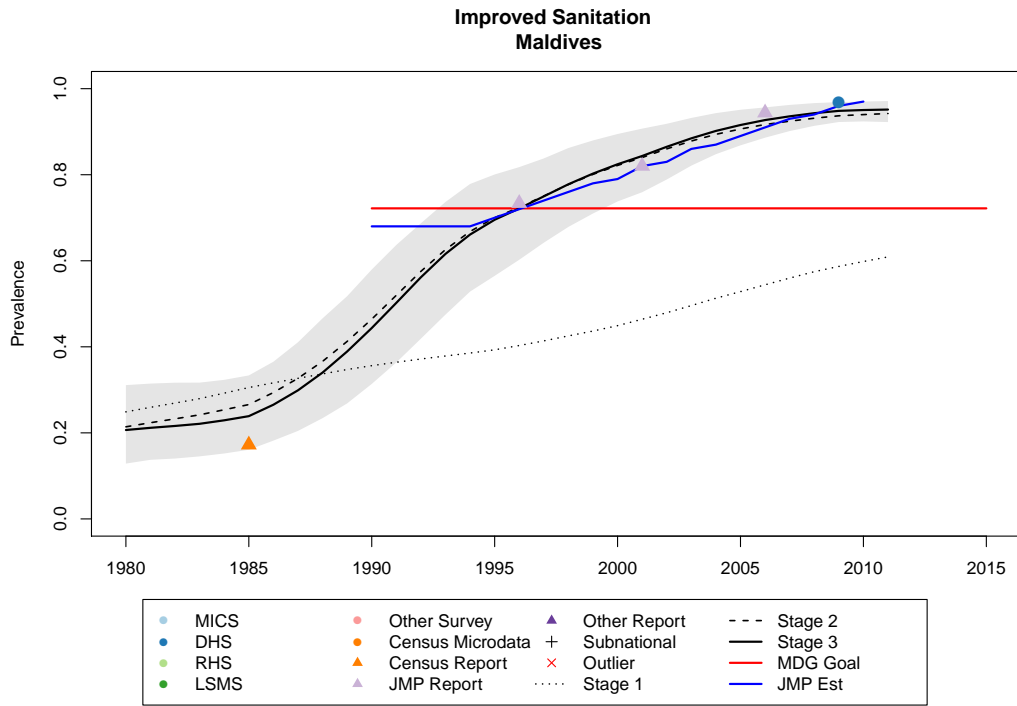


Figure A.212: Prevalence of access to improved sanitation, Maldives

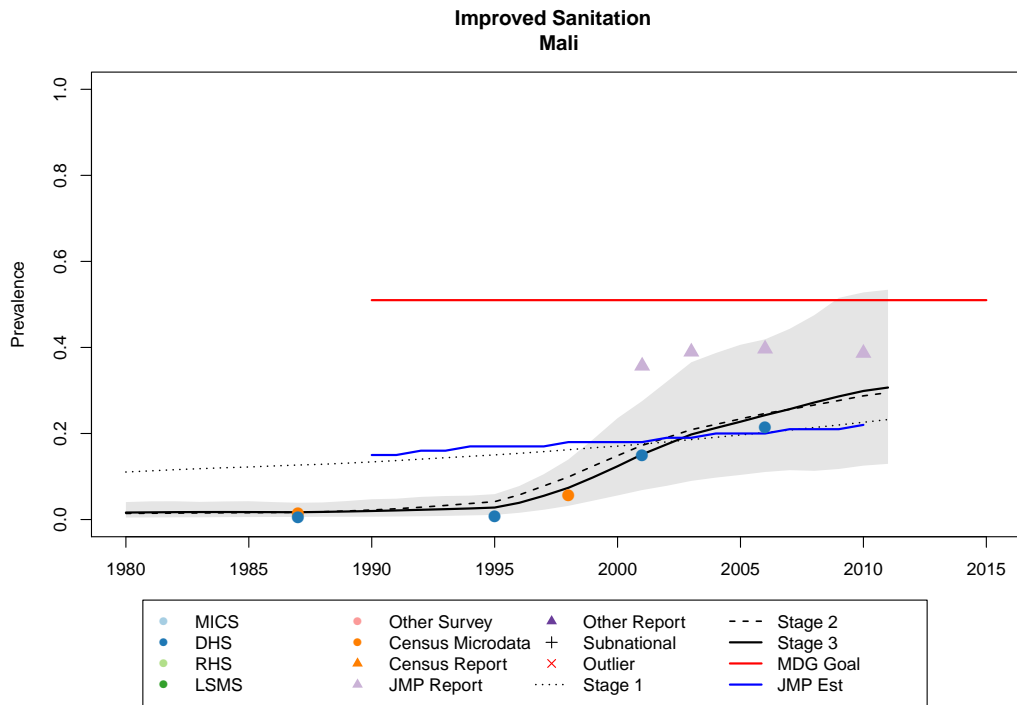


Figure A.213: Prevalence of access to improved sanitation, Mali

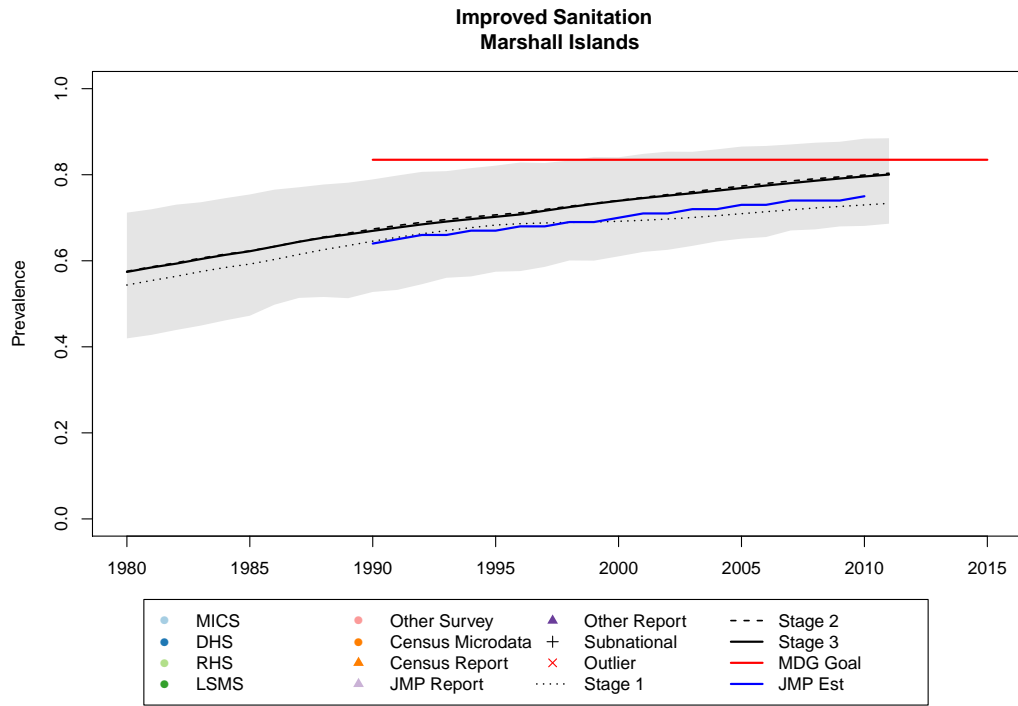


Figure A.214: Prevalence of access to improved sanitation, Marshall Islands

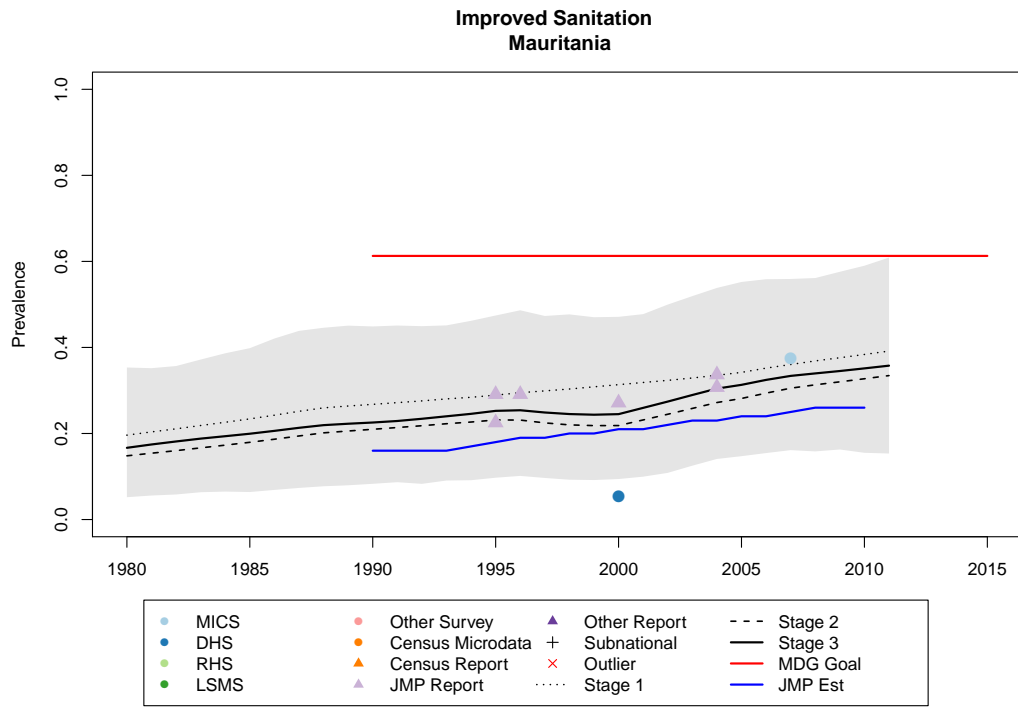


Figure A.215: Prevalence of access to improved sanitation, Mauritania

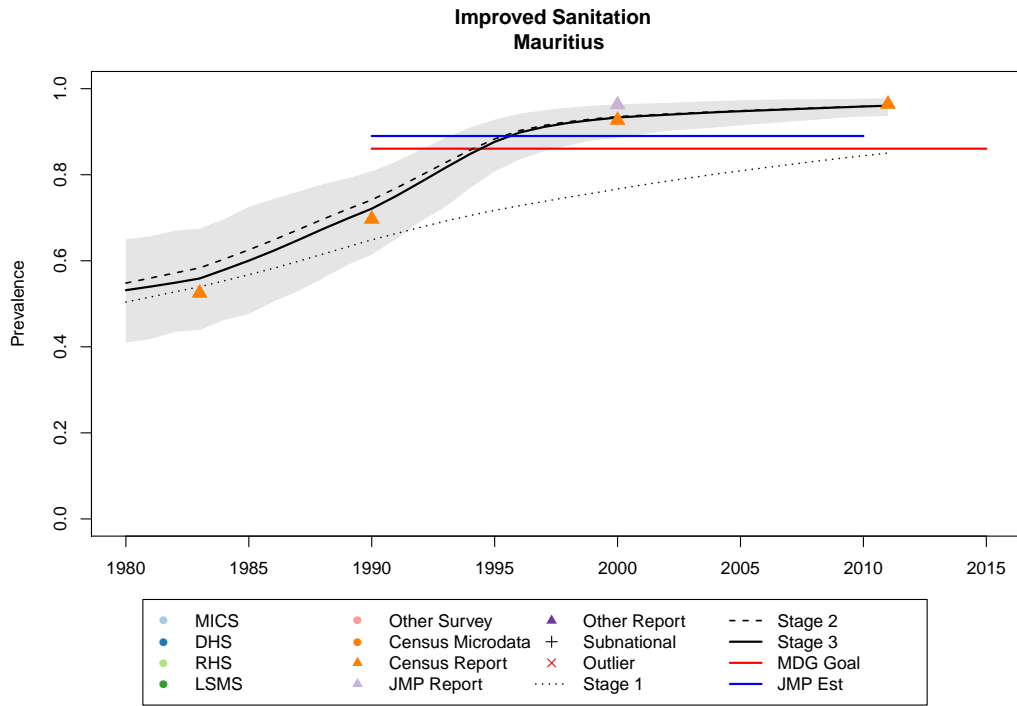


Figure A.216: Prevalence of access to improved sanitation, Mauritius

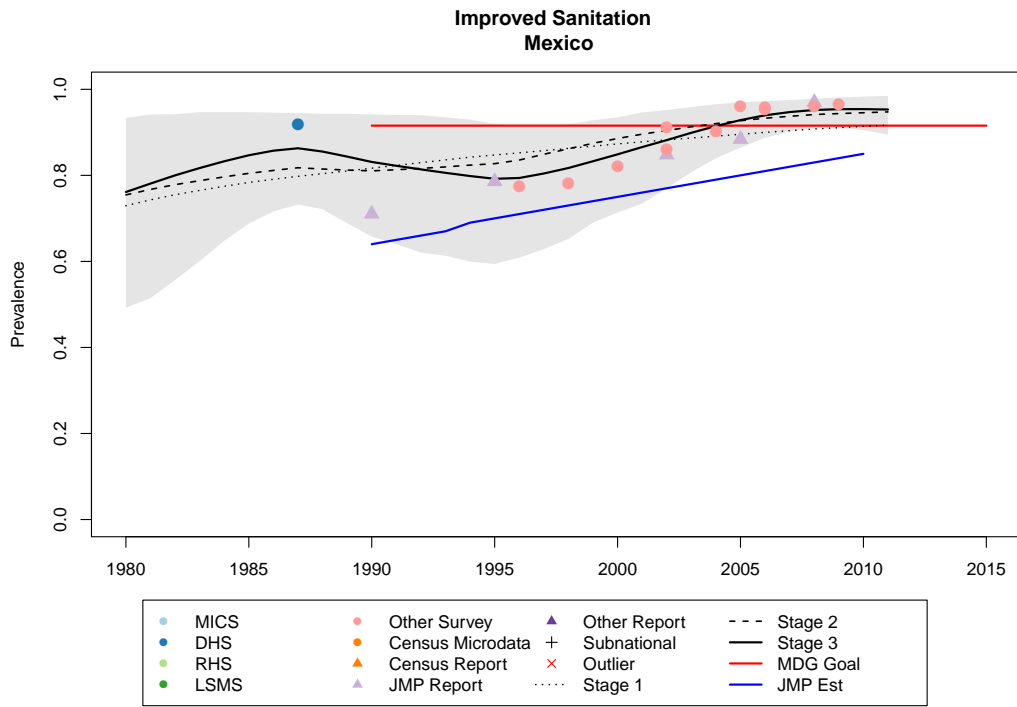


Figure A.217: Prevalence of access to improved sanitation, Mexico

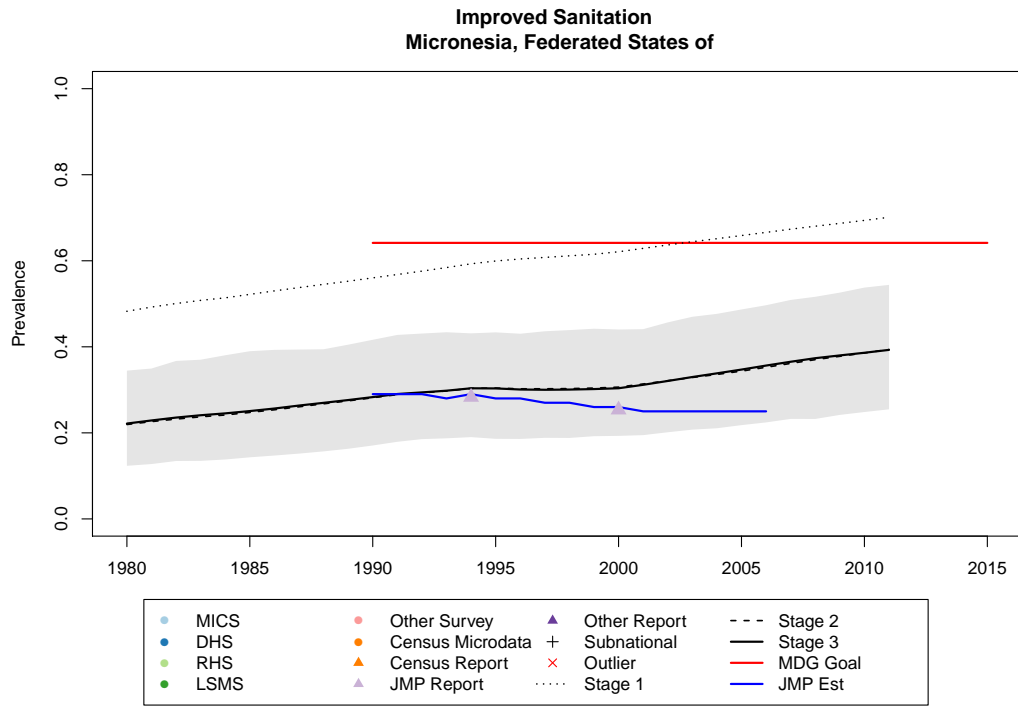


Figure A.218: Prevalence of access to improved sanitation, Micronesia, Federated States of

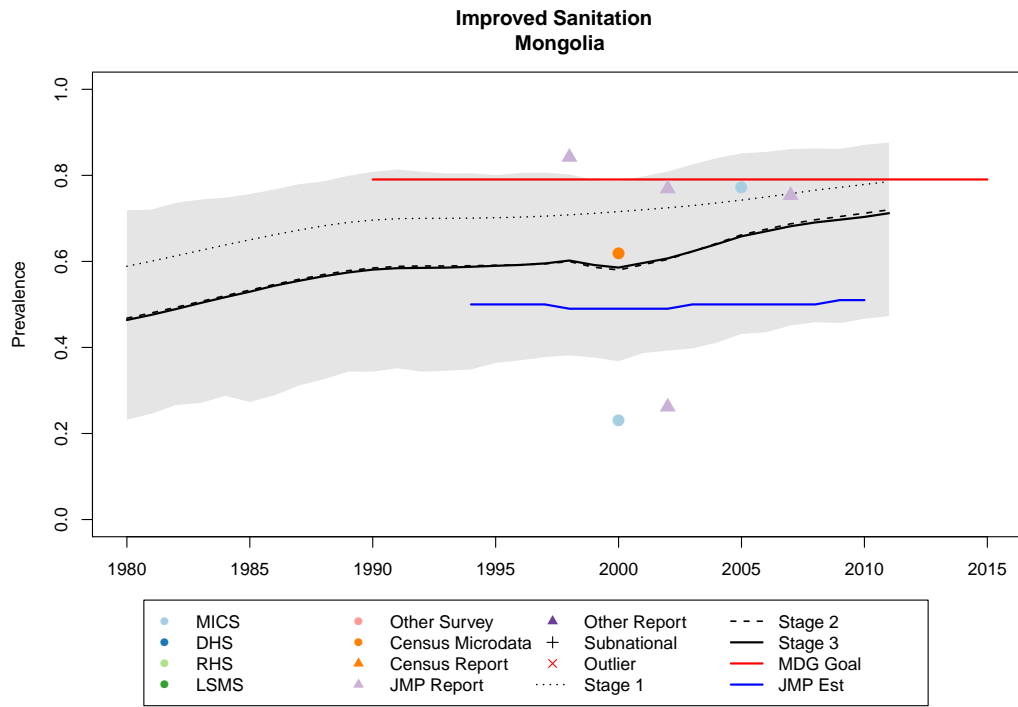


Figure A.219: Prevalence of access to improved sanitation, Mongolia

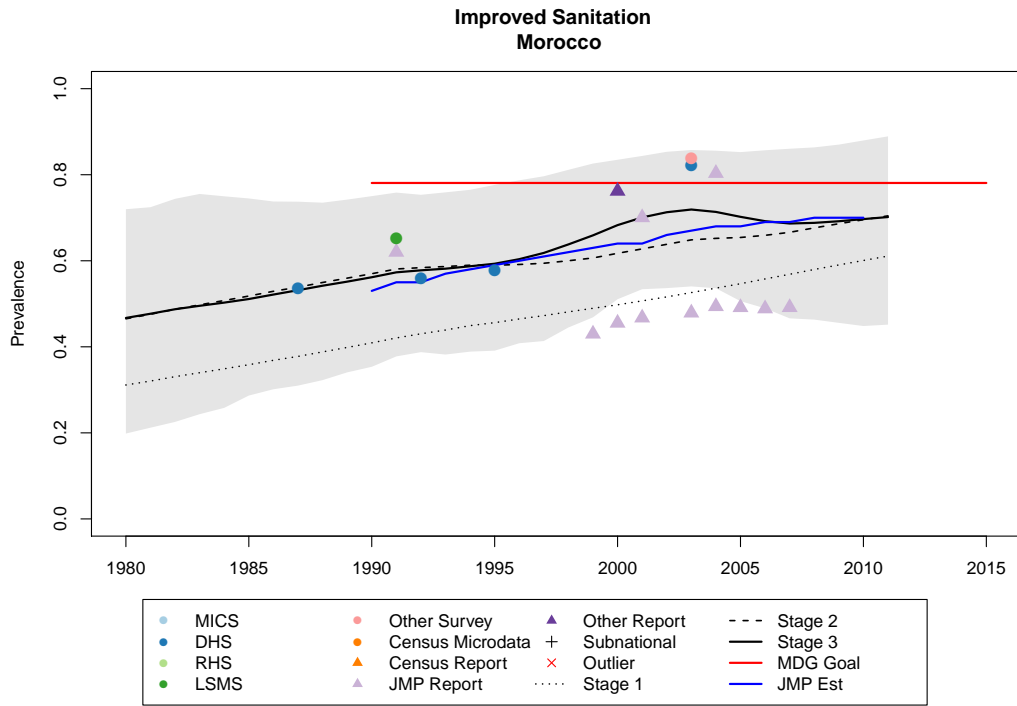


Figure A.220: Prevalence of access to improved sanitation, Morocco

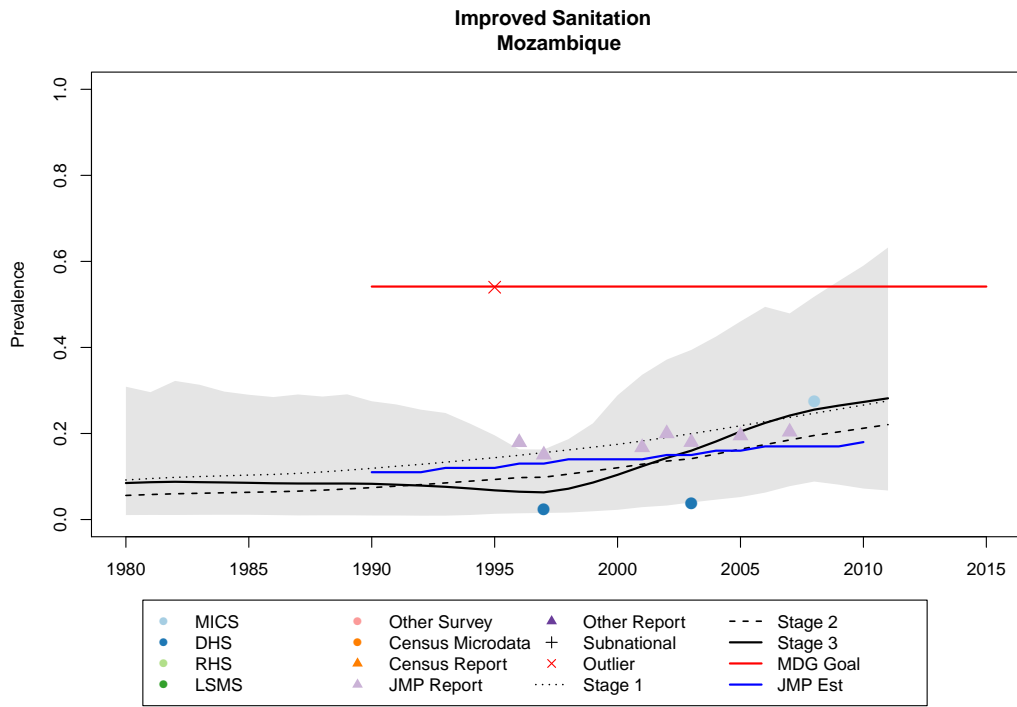


Figure A.221: Prevalence of access to improved sanitation, Mozambique

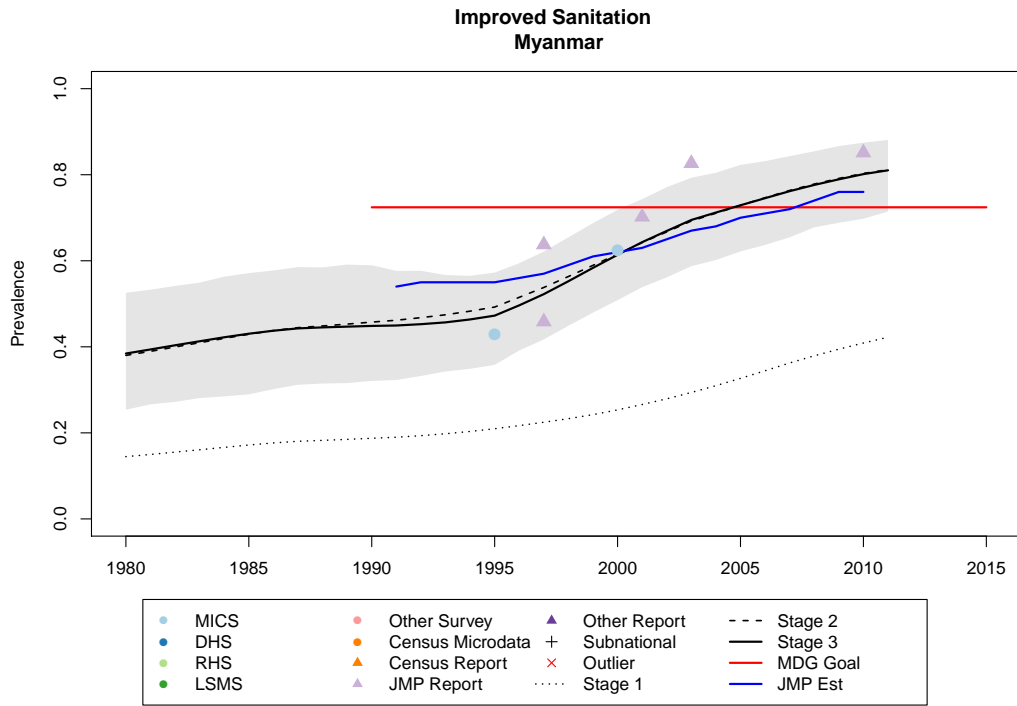


Figure A.222: Prevalence of access to improved sanitation, Myanmar

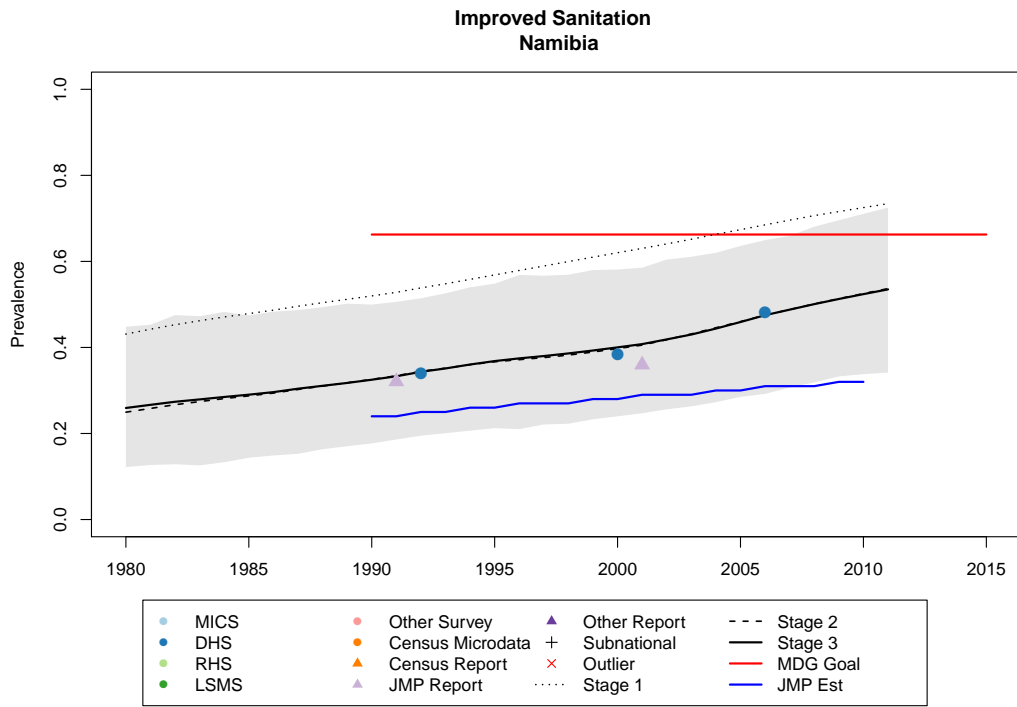


Figure A.223: Prevalence of access to improved sanitation, Namibia

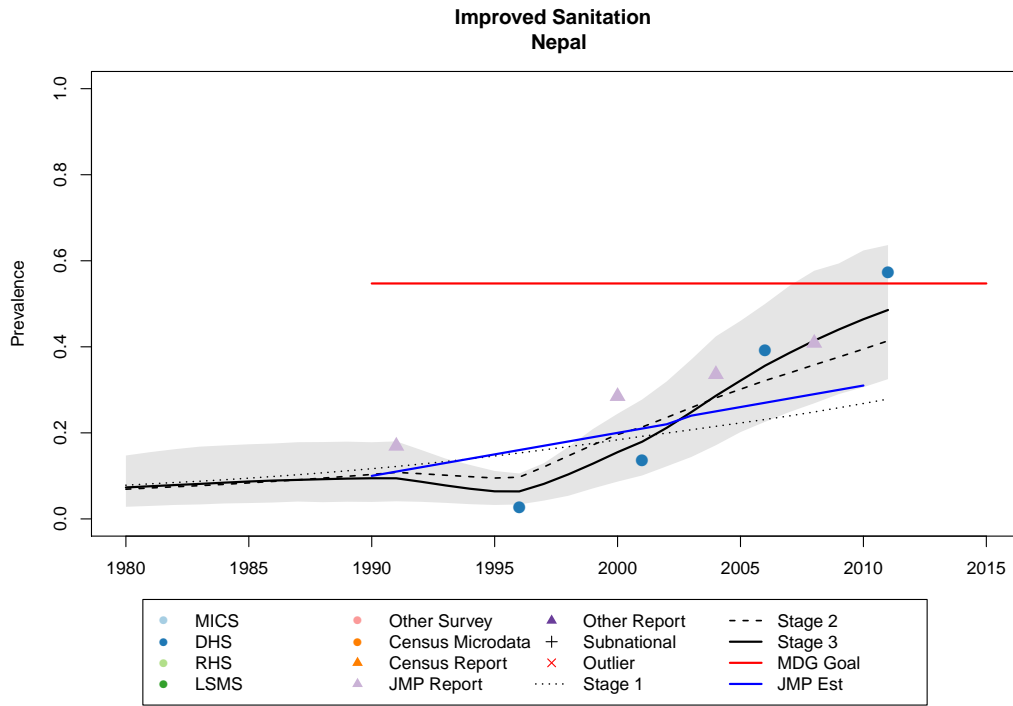


Figure A.224: Prevalence of access to improved sanitation, Nepal

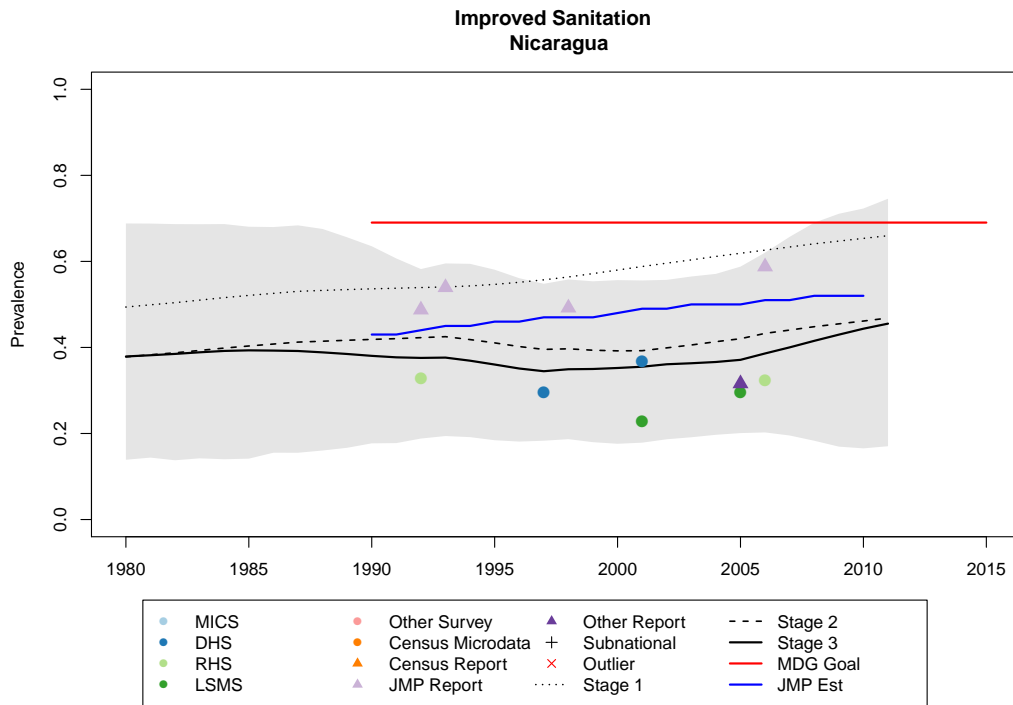


Figure A.225: Prevalence of access to improved sanitation, Nicaragua

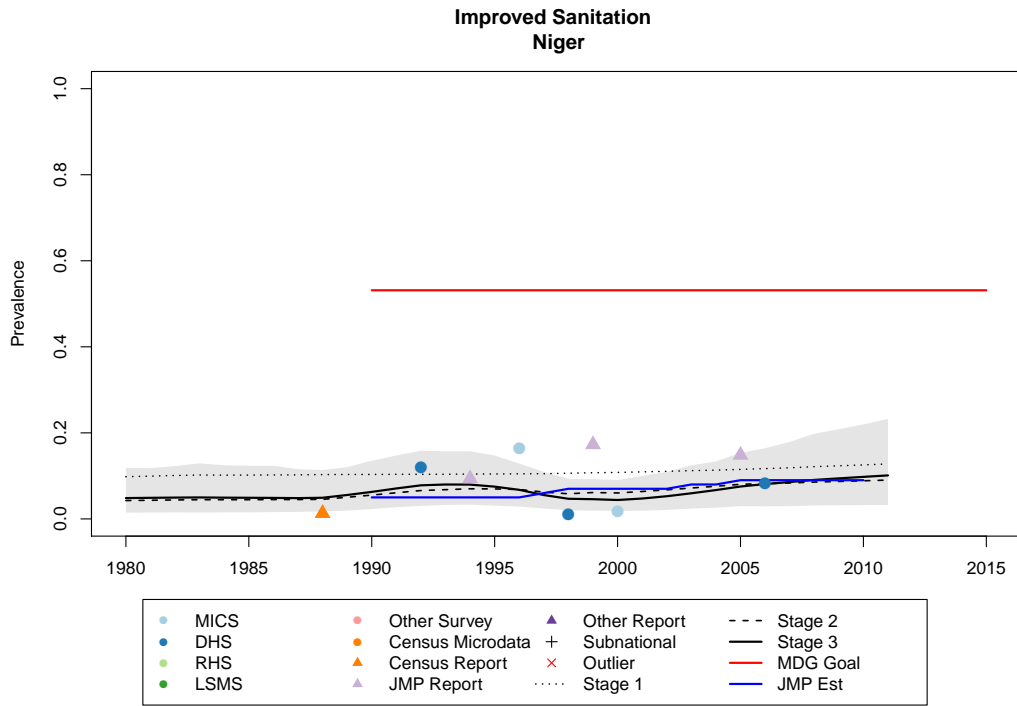


Figure A.226: Prevalence of access to improved sanitation, Niger

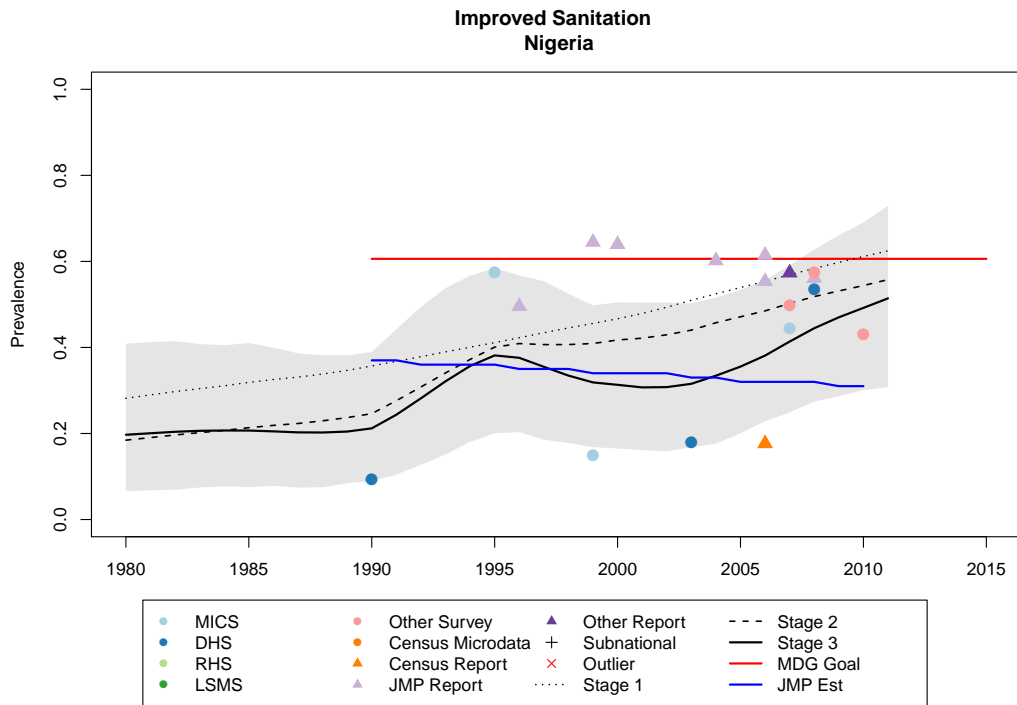


Figure A.227: Prevalence of access to improved sanitation, Nigeria

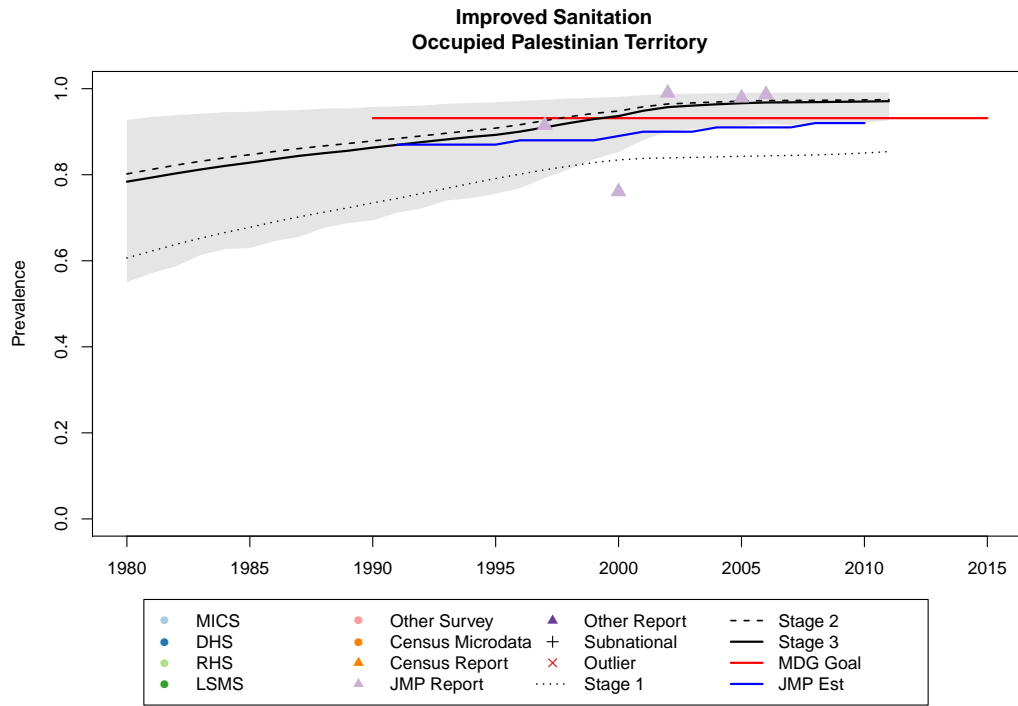


Figure A.228: Prevalence of access to improved sanitation, Occupied Palestinian Territory

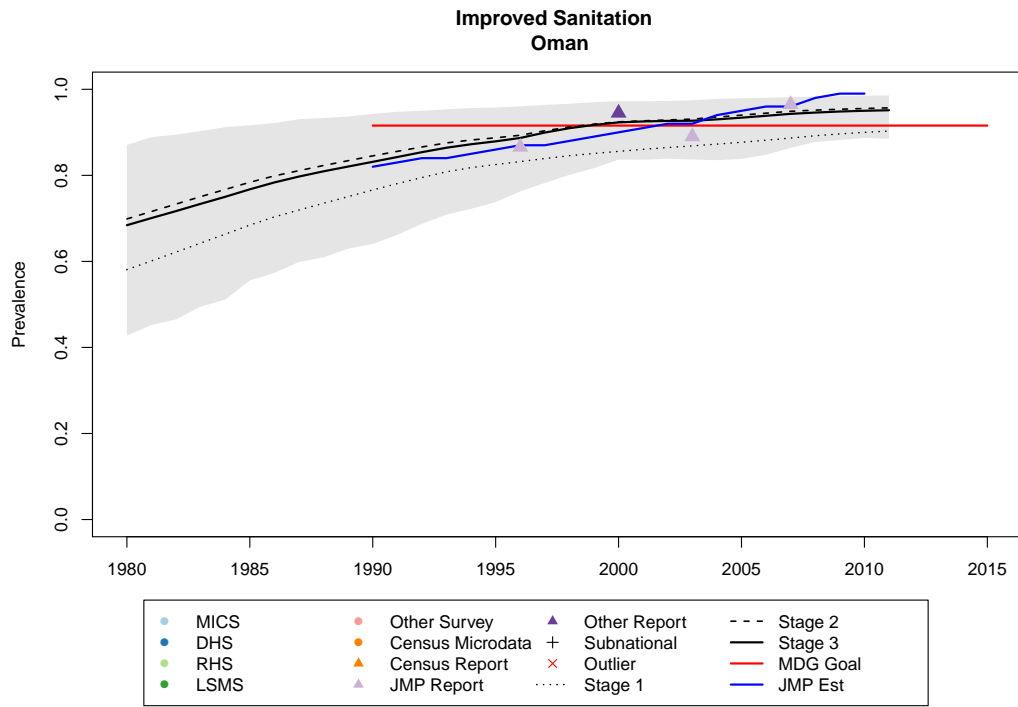


Figure A.229: Prevalence of access to improved sanitation, Oman

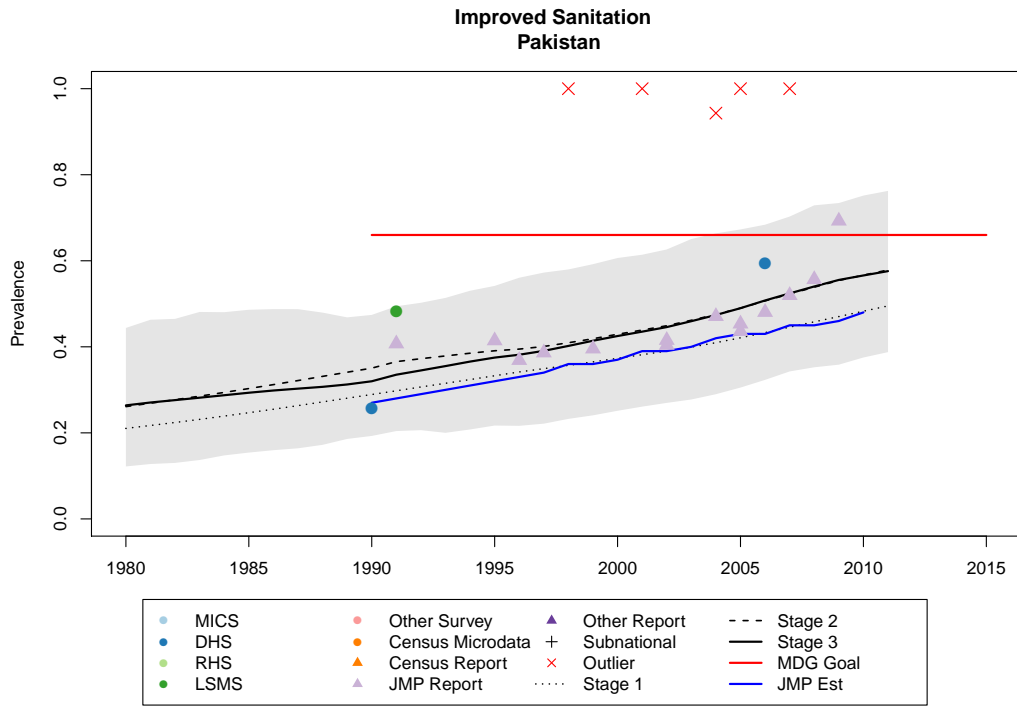


Figure A.230: Prevalence of access to improved sanitation, Pakistan

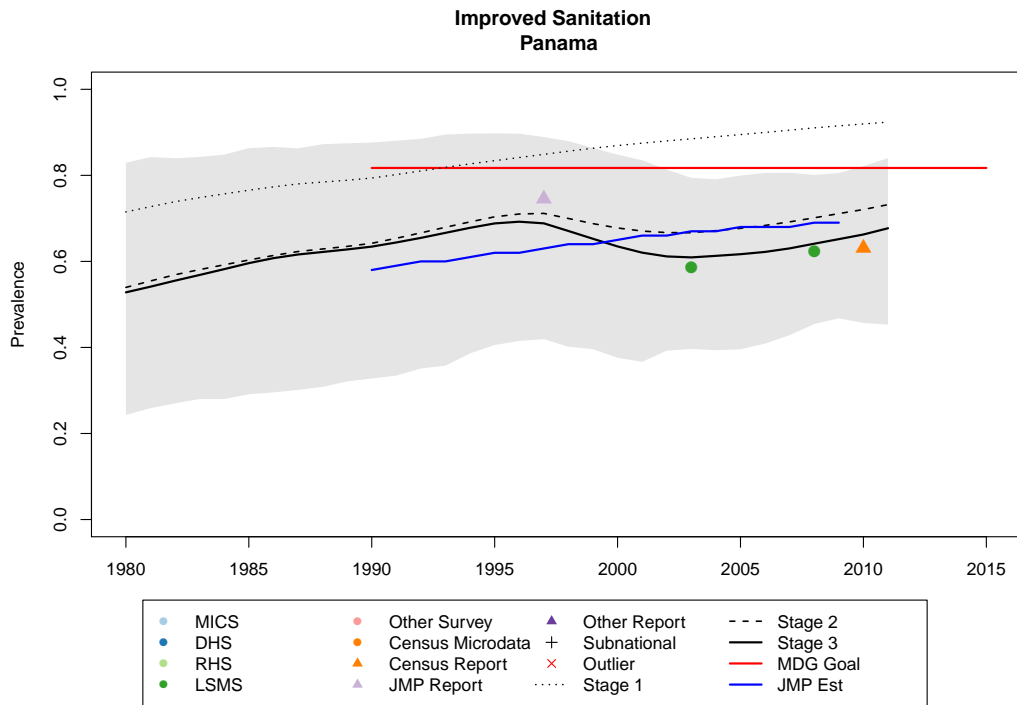


Figure A.231: Prevalence of access to improved sanitation, Panama

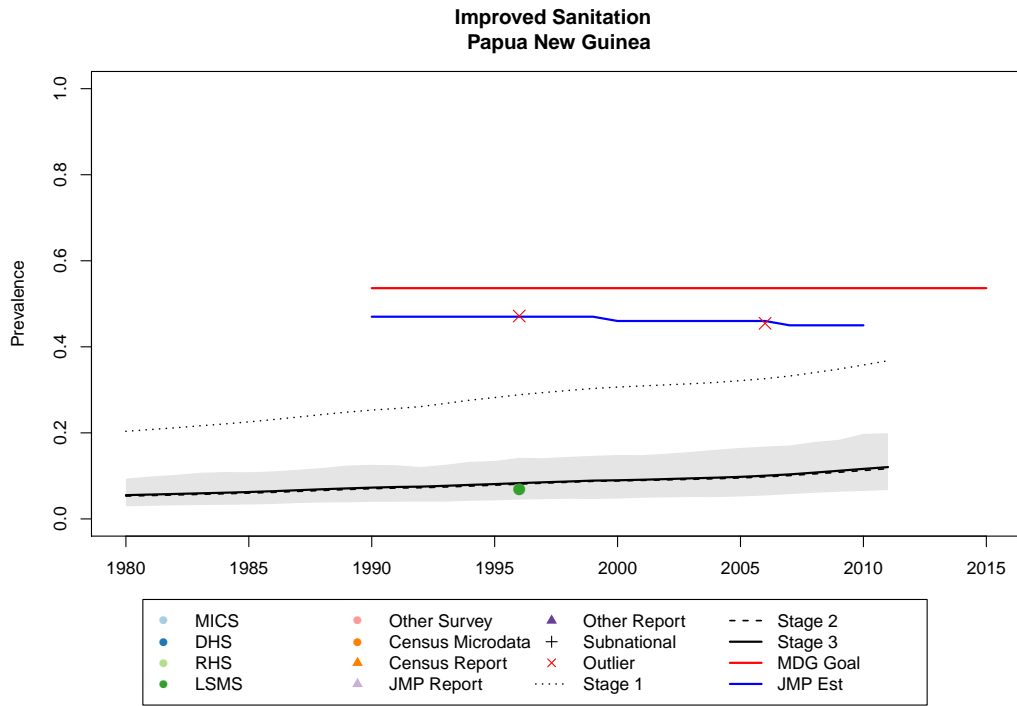


Figure A.232: Prevalence of access to improved sanitation, Papua New Guinea

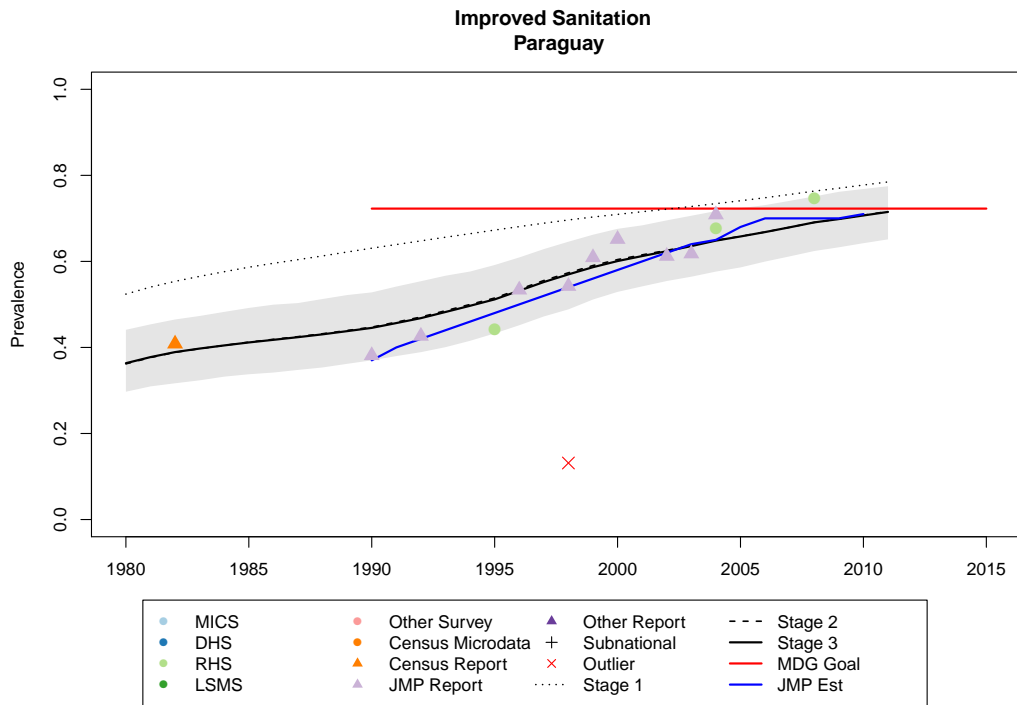


Figure A.233: Prevalence of access to improved sanitation, Paraguay

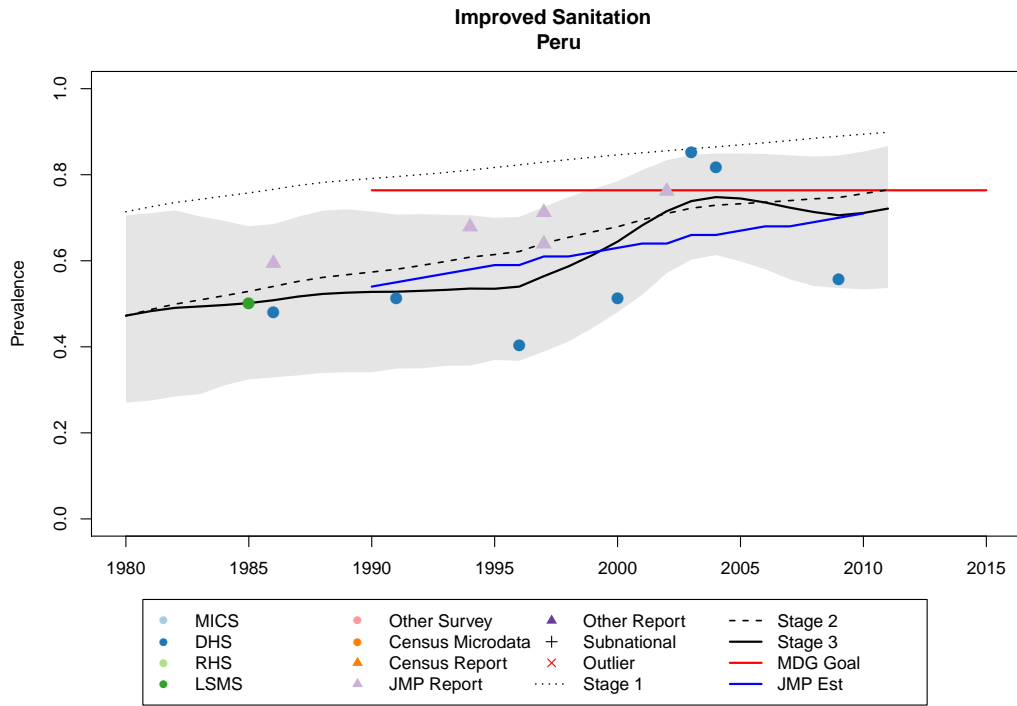


Figure A.234: Prevalence of access to improved sanitation, Peru

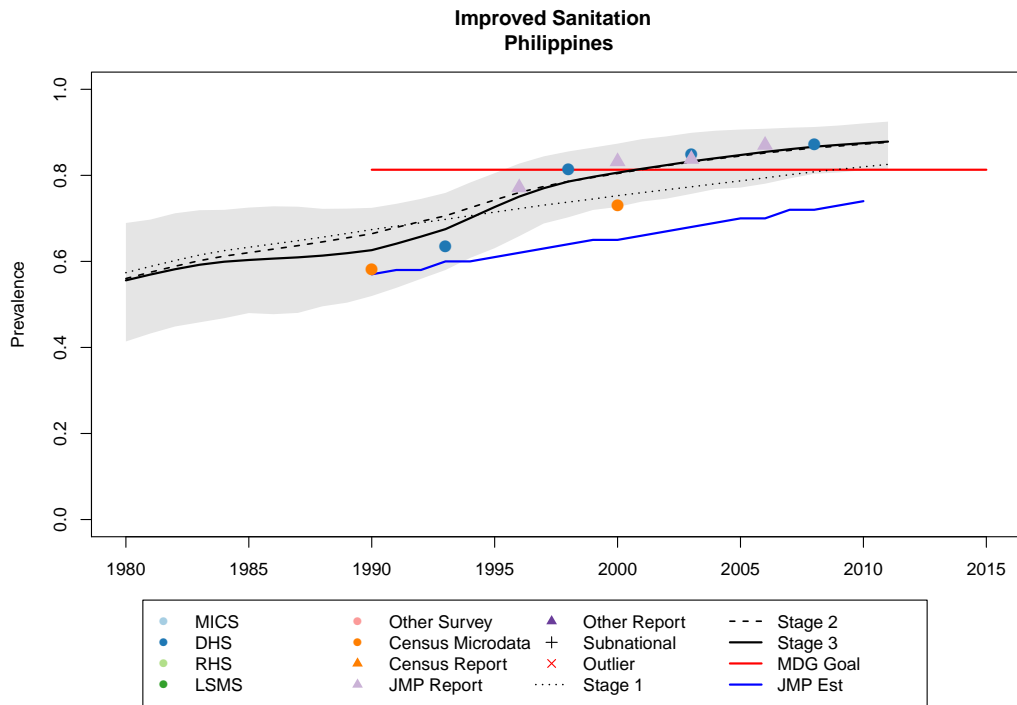


Figure A.235: Prevalence of access to improved sanitation, Philippines

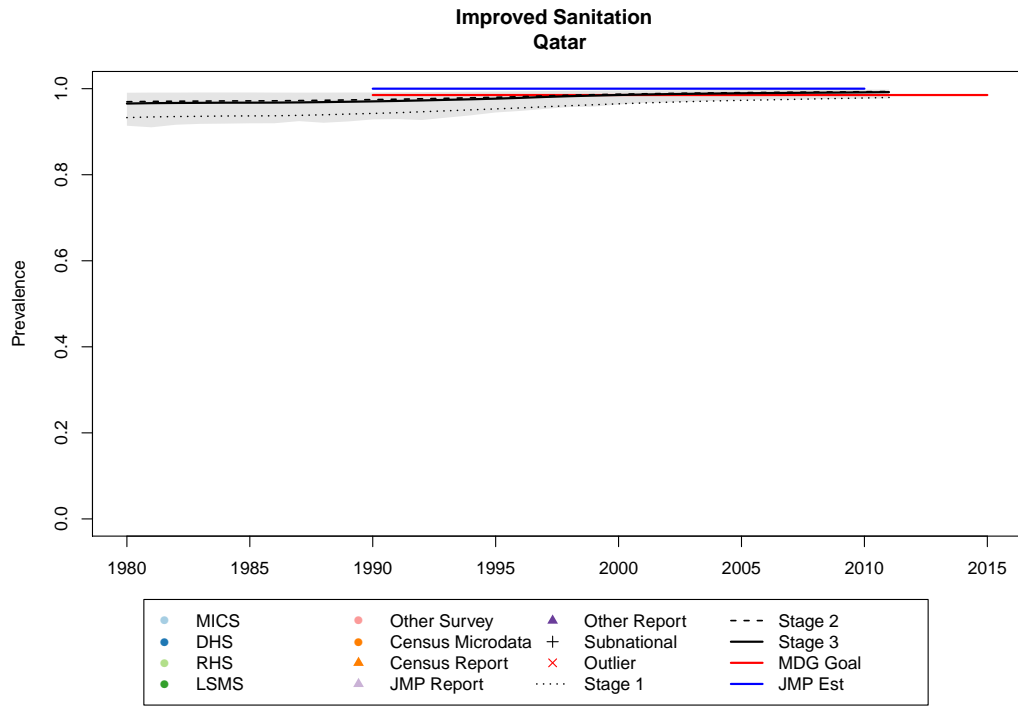


Figure A.236: Prevalence of access to improved sanitation, Qatar

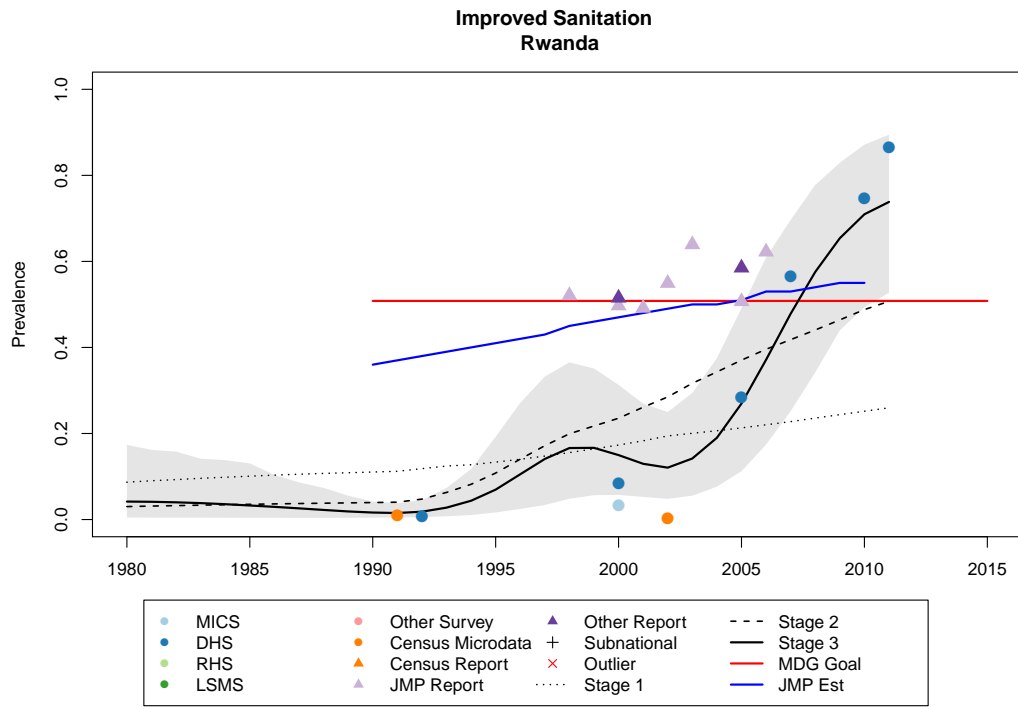


Figure A.237: Prevalence of access to improved sanitation, Rwanda

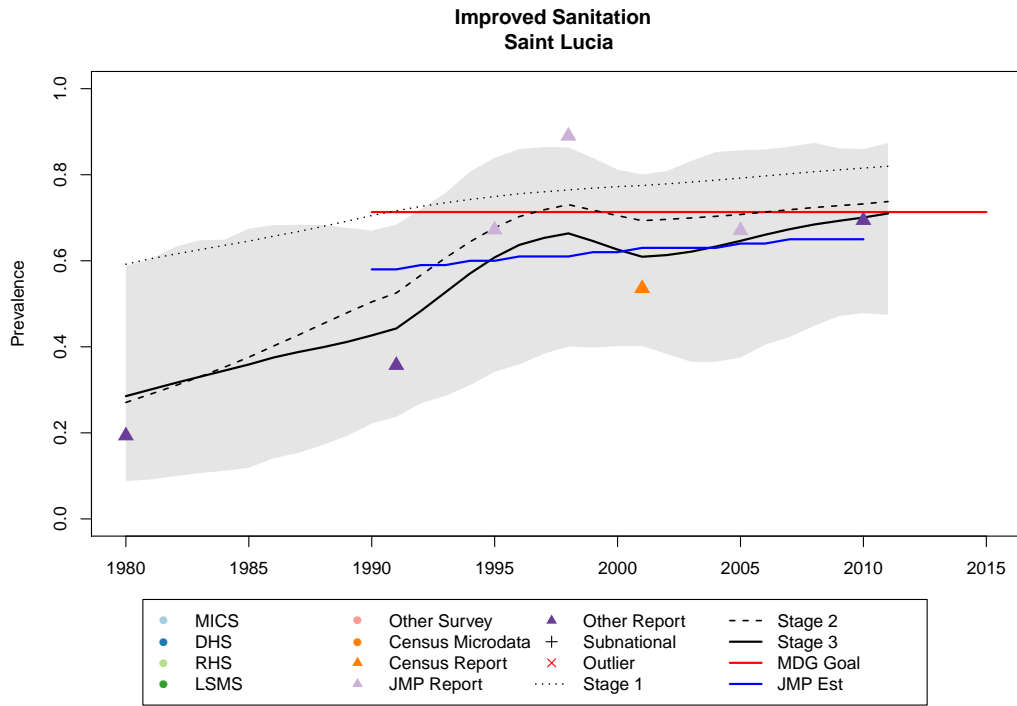


Figure A.238: Prevalence of access to improved sanitation, Saint Lucia

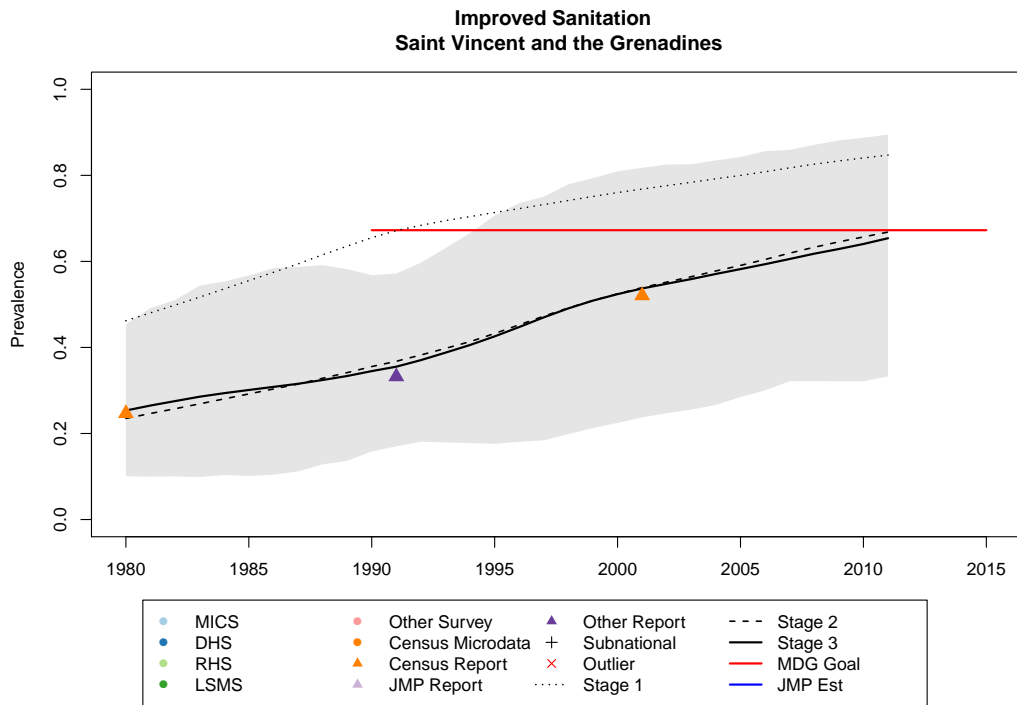


Figure A.239: Prevalence of access to improved sanitation, Saint Vincent and the Grenadines

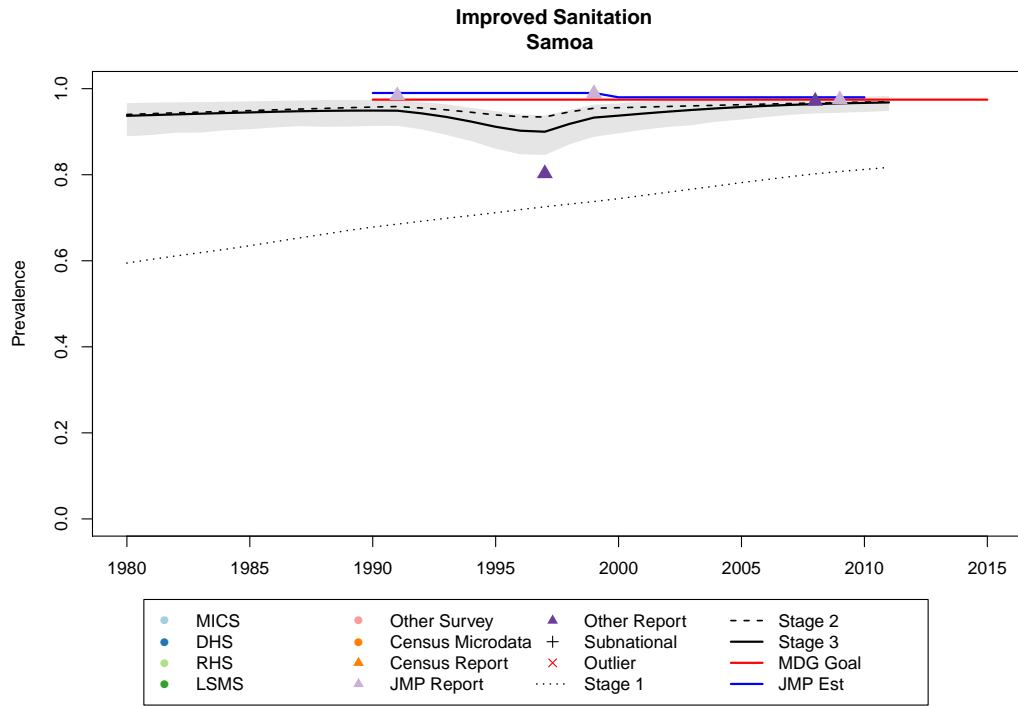


Figure A.240: Prevalence of access to improved sanitation, Samoa

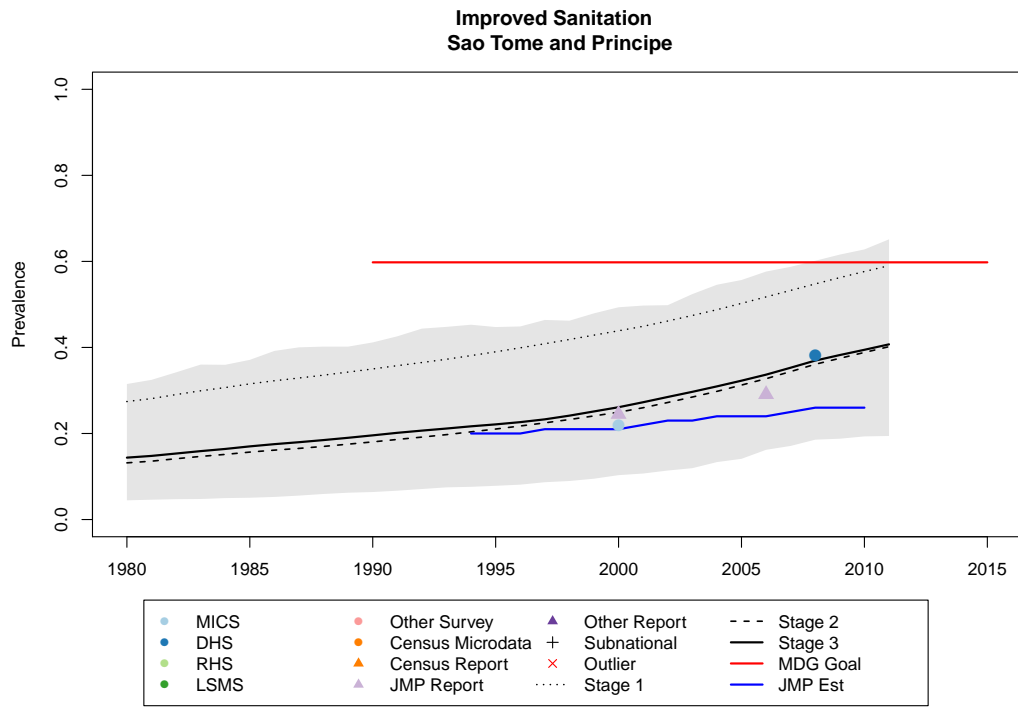


Figure A.241: Prevalence of access to improved sanitation, Sao Tome and Principe

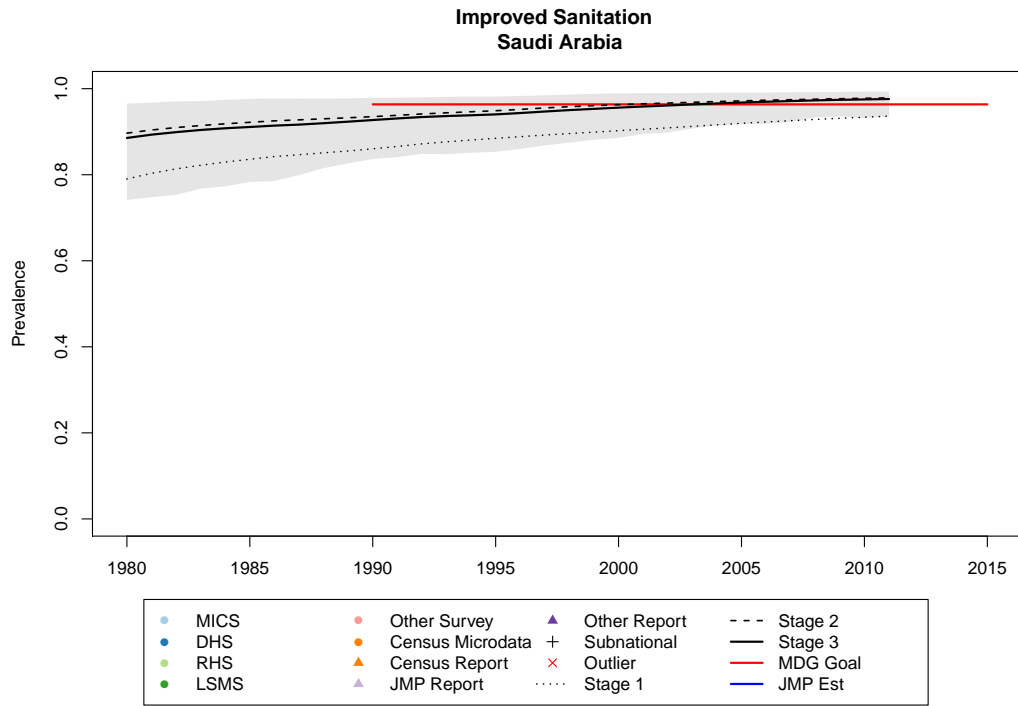


Figure A.242: Prevalence of access to improved sanitation, Saudi Arabia

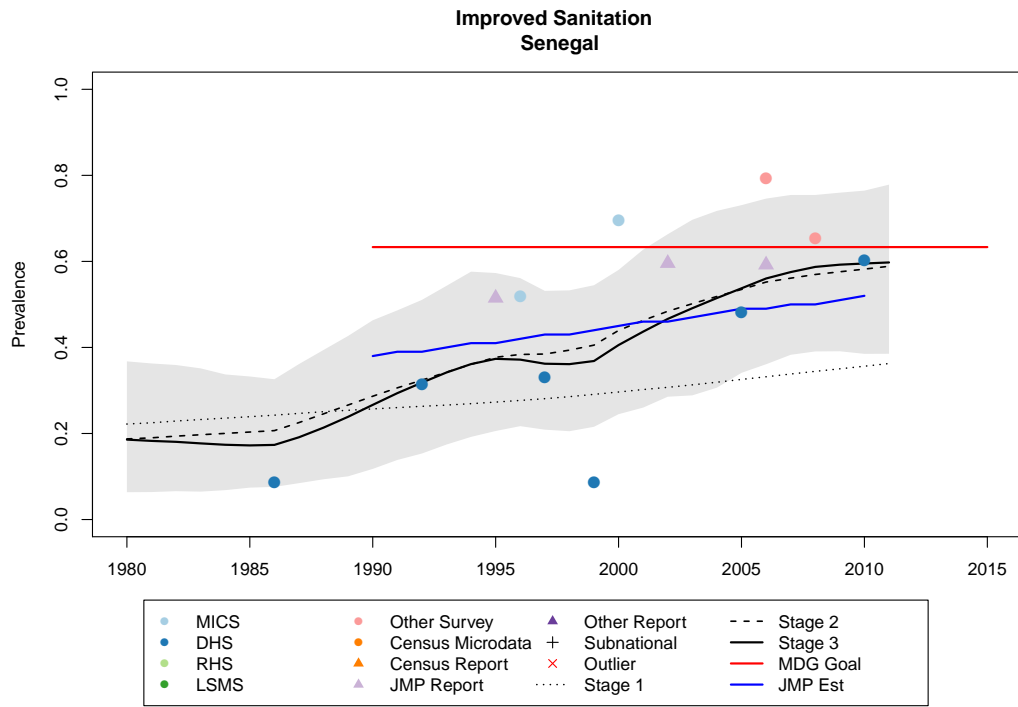


Figure A.243: Prevalence of access to improved sanitation, Senegal

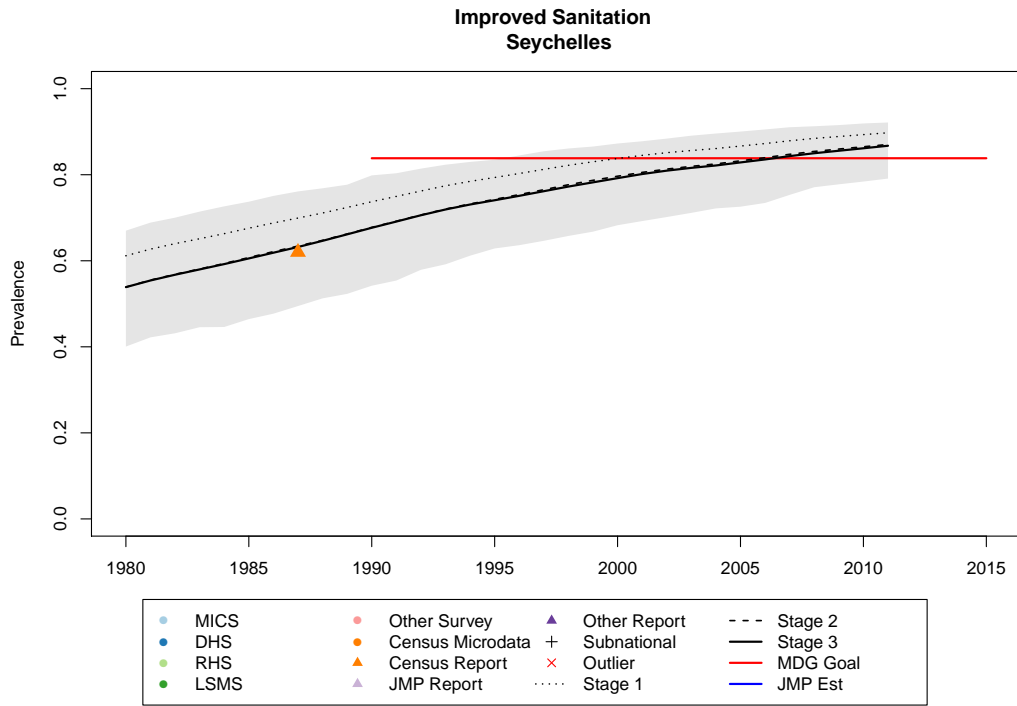


Figure A.244: Prevalence of access to improved sanitation, Seychelles

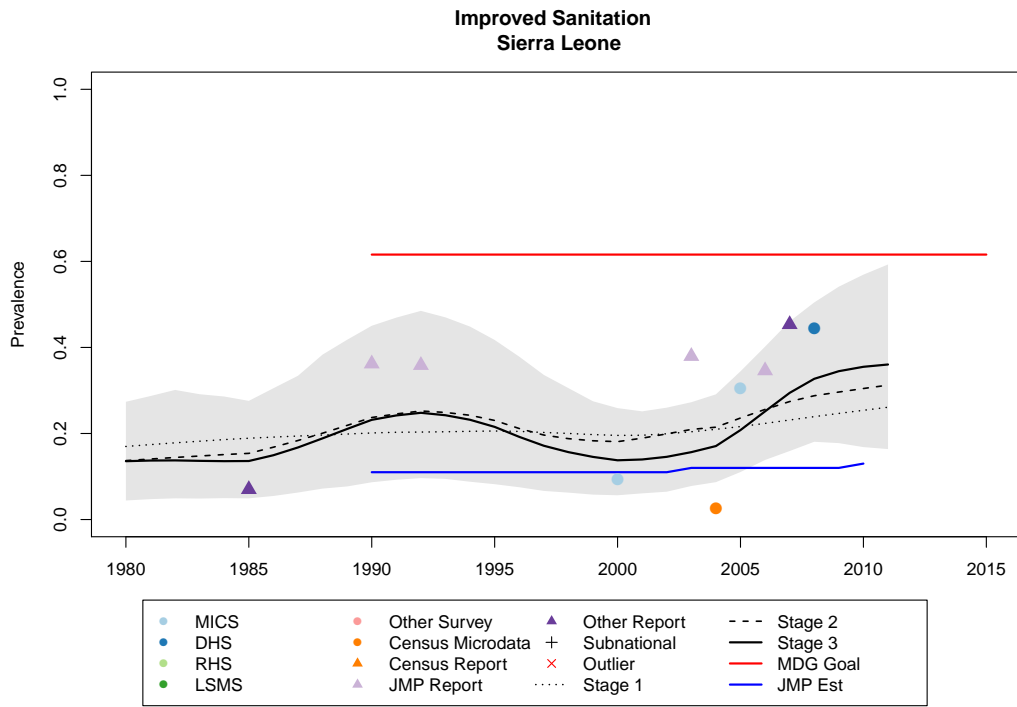


Figure A.245: Prevalence of access to improved sanitation, Sierra Leone

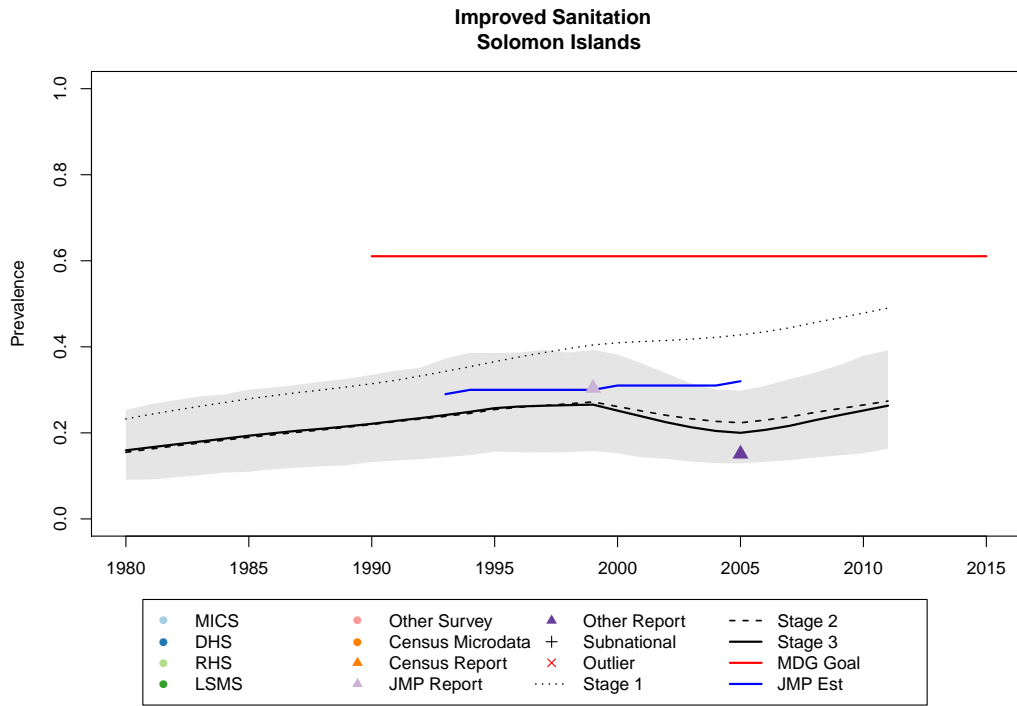


Figure A.246: Prevalence of access to improved sanitation, Solomon Islands

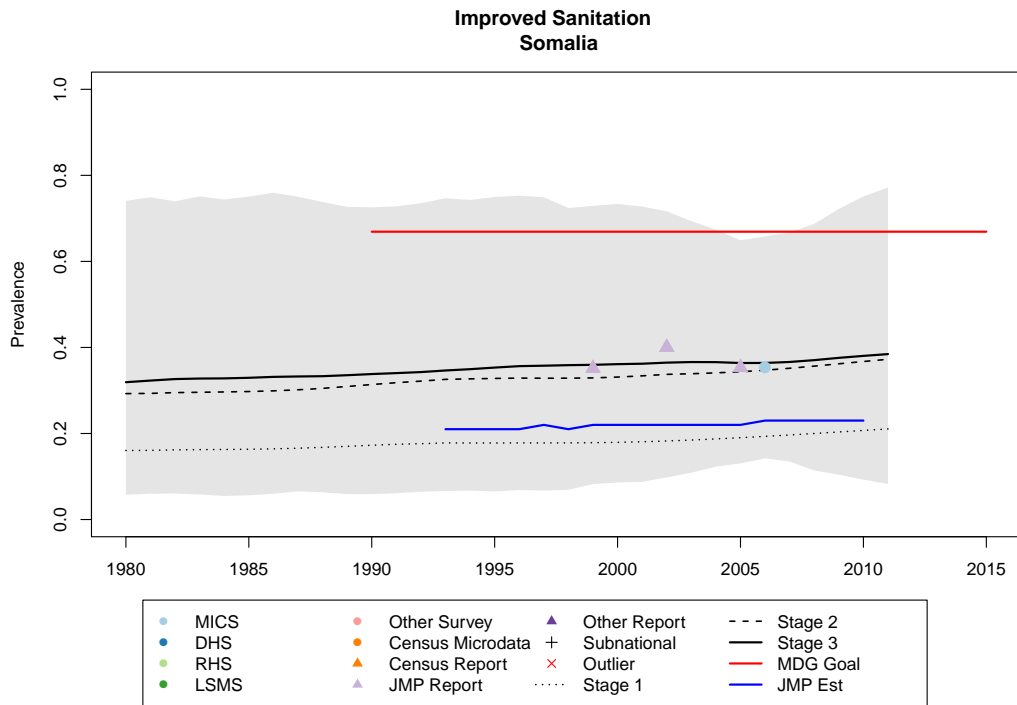


Figure A.247: Prevalence of access to improved sanitation, Somalia

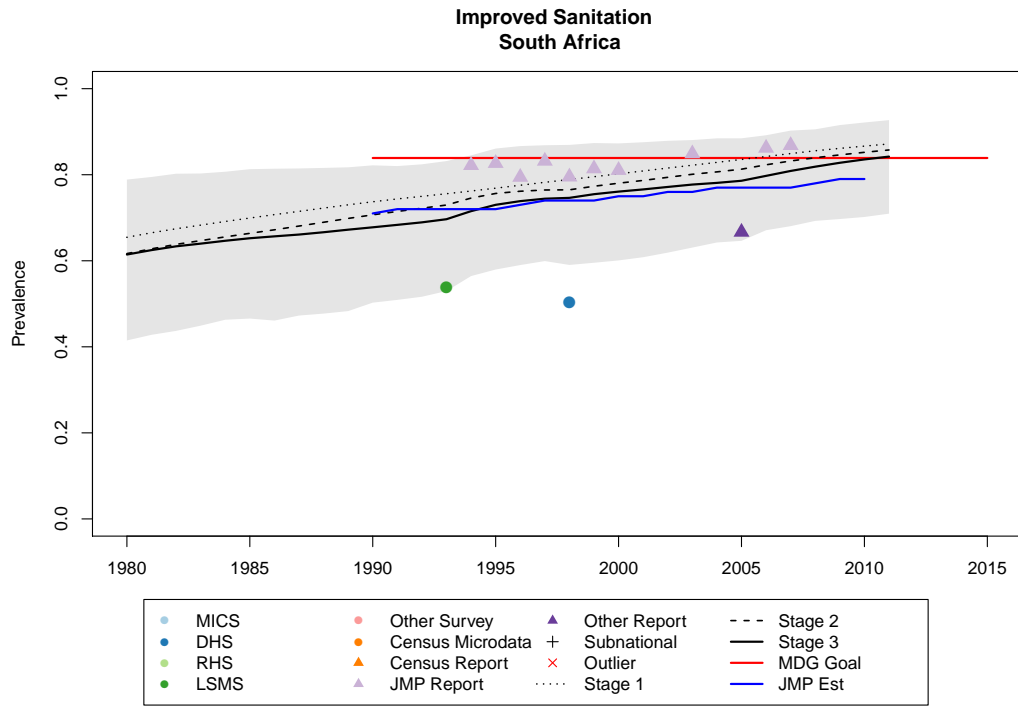


Figure A.248: Prevalence of access to improved sanitation, South Africa

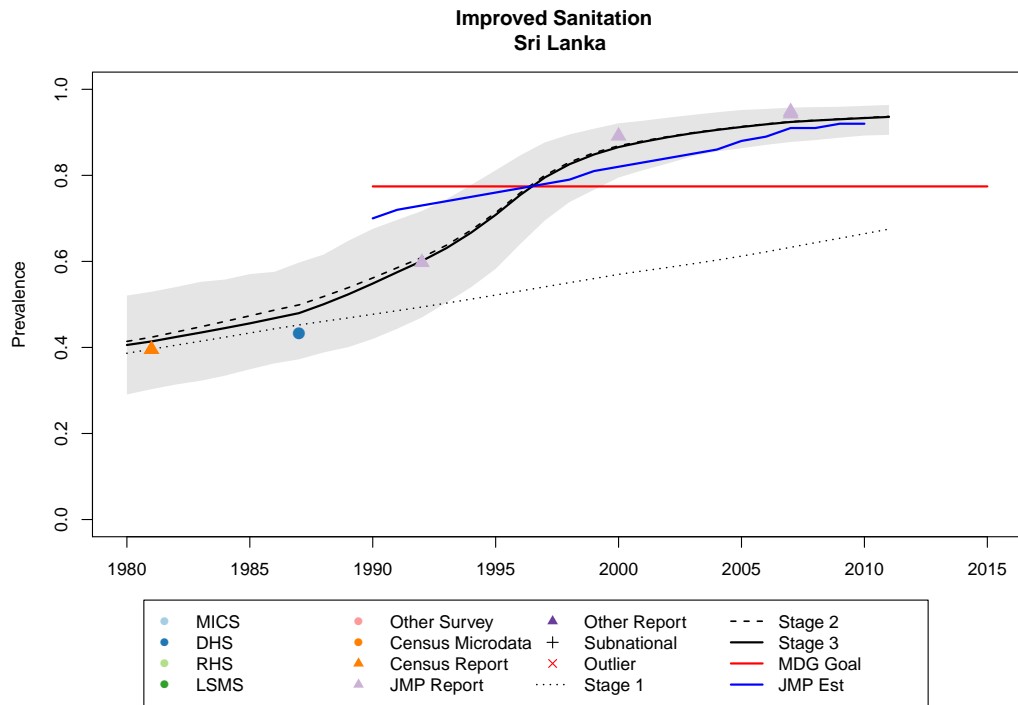


Figure A.249: Prevalence of access to improved sanitation, Sri Lanka

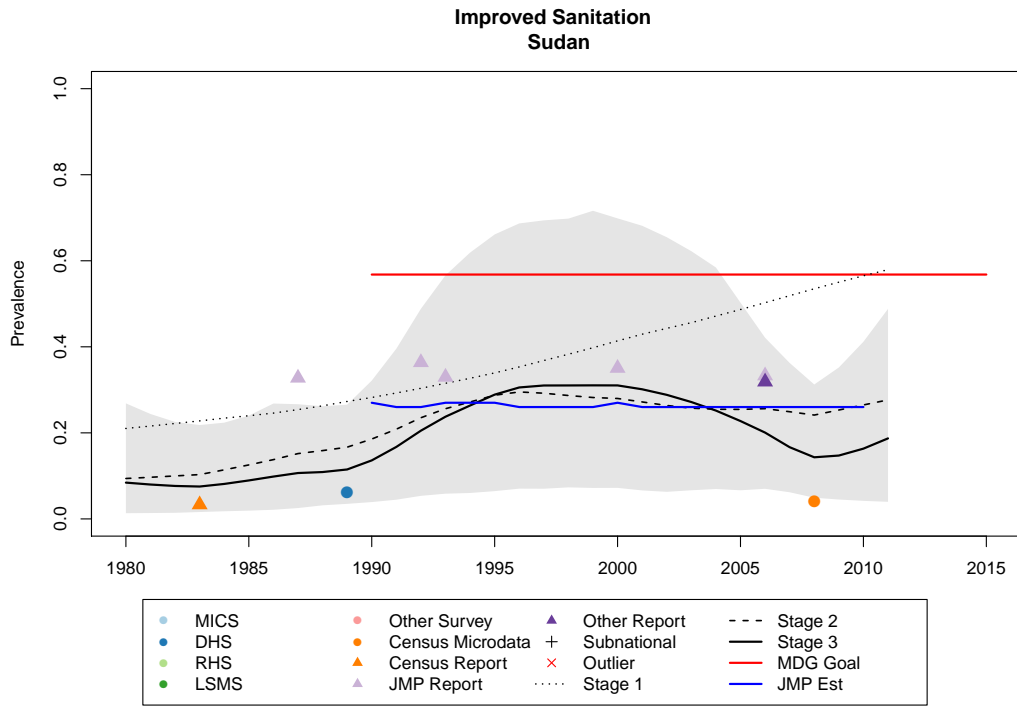


Figure A.250: Prevalence of access to improved sanitation, Sudan

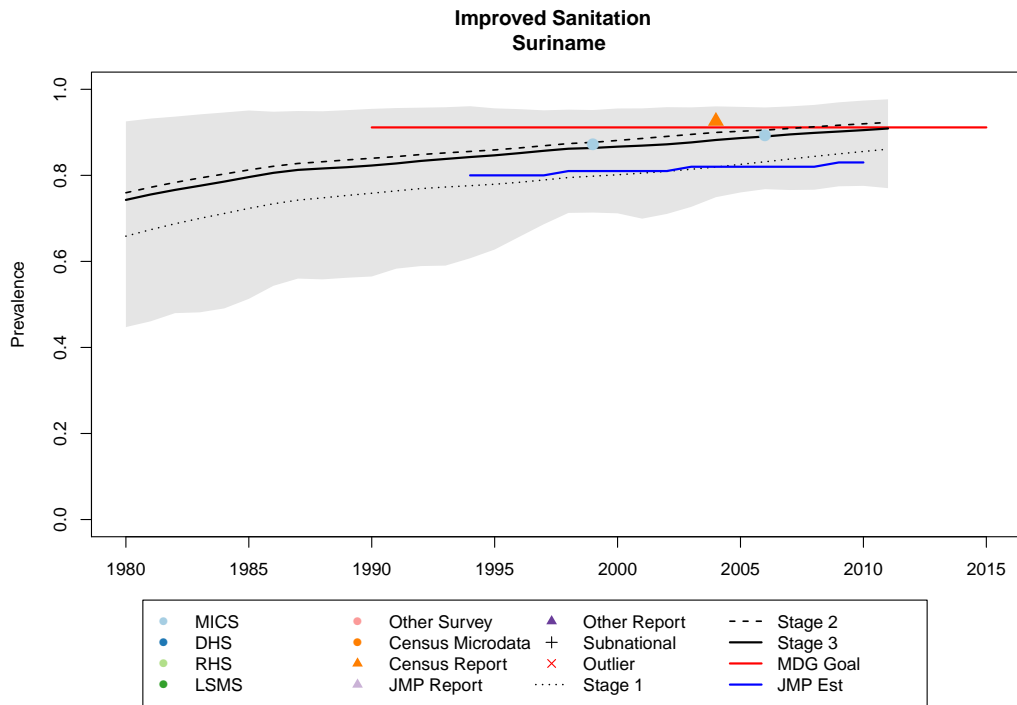


Figure A.251: Prevalence of access to improved sanitation, Suriname

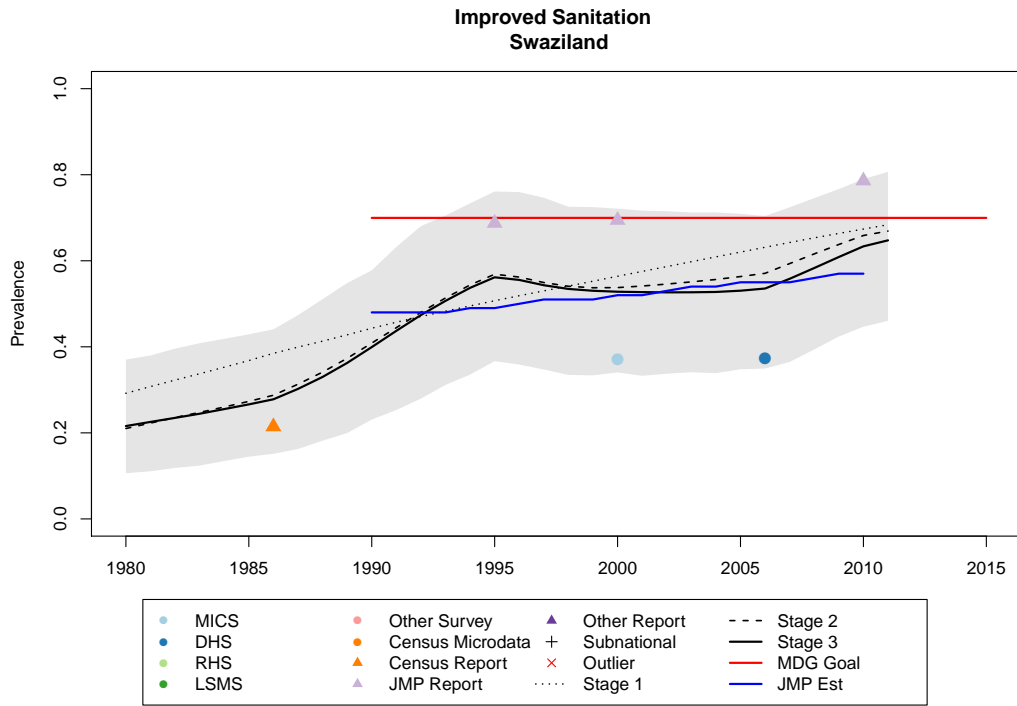


Figure A.252: Prevalence of access to improved sanitation, Swaziland

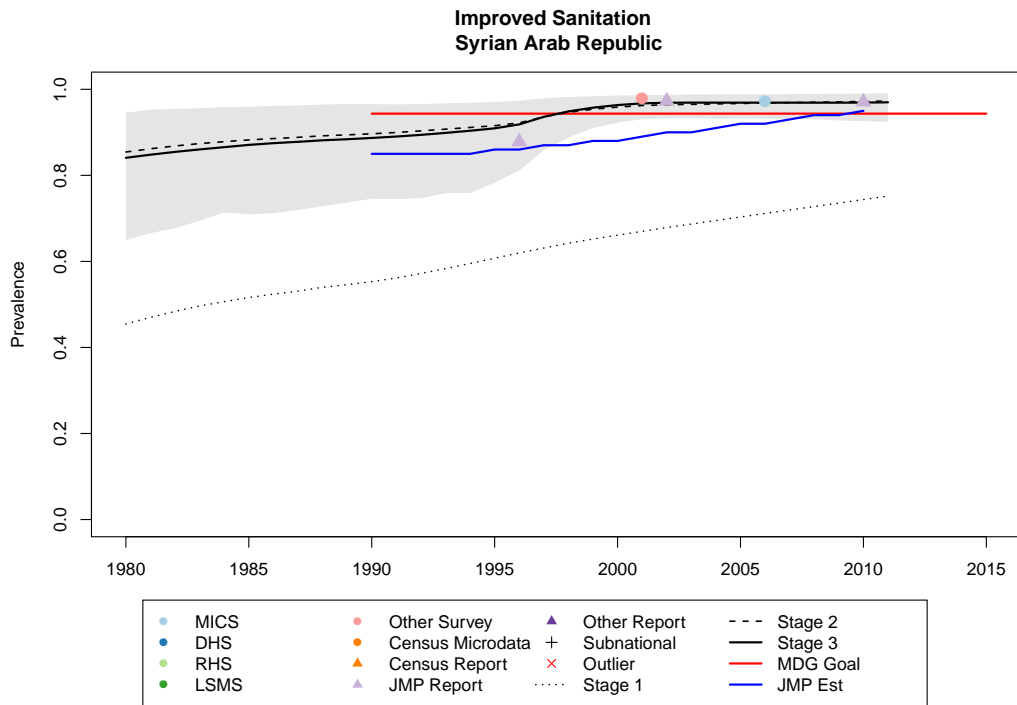


Figure A.253: Prevalence of access to improved sanitation, Syrian Arab Republic

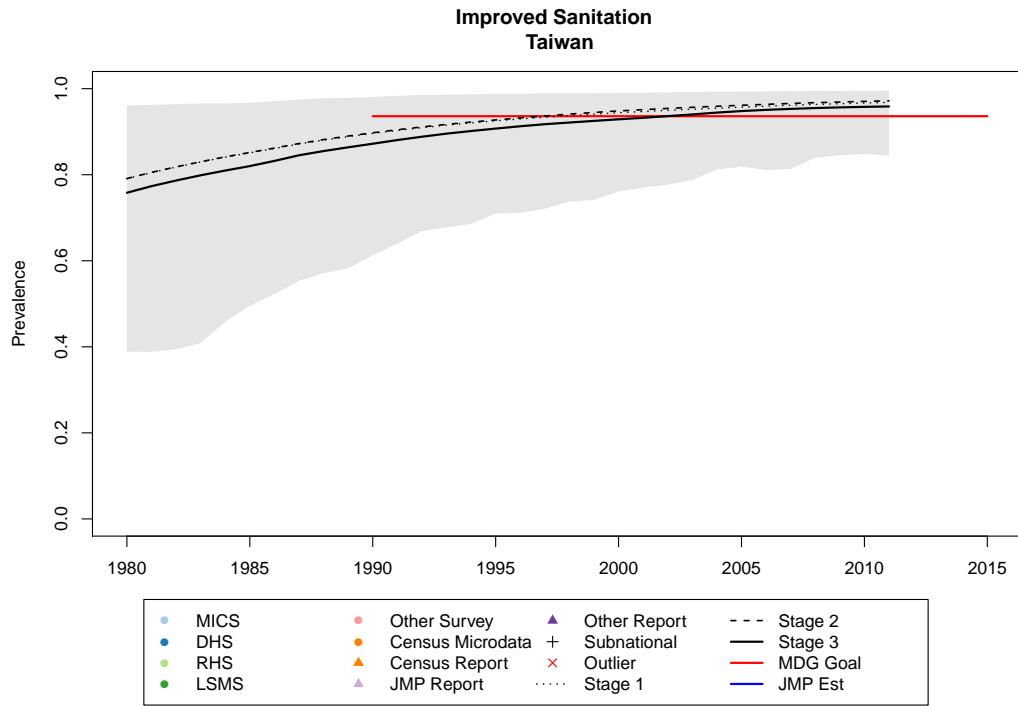


Figure A.254: Prevalence of access to improved sanitation, Taiwan

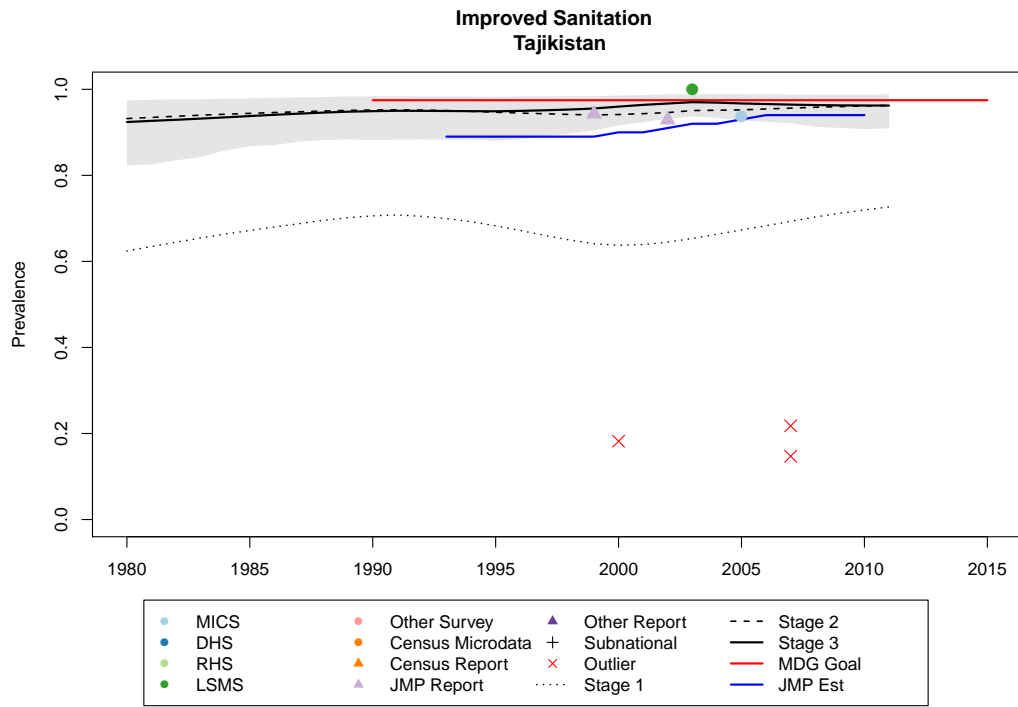


Figure A.255: Prevalence of access to improved sanitation, Tajikistan

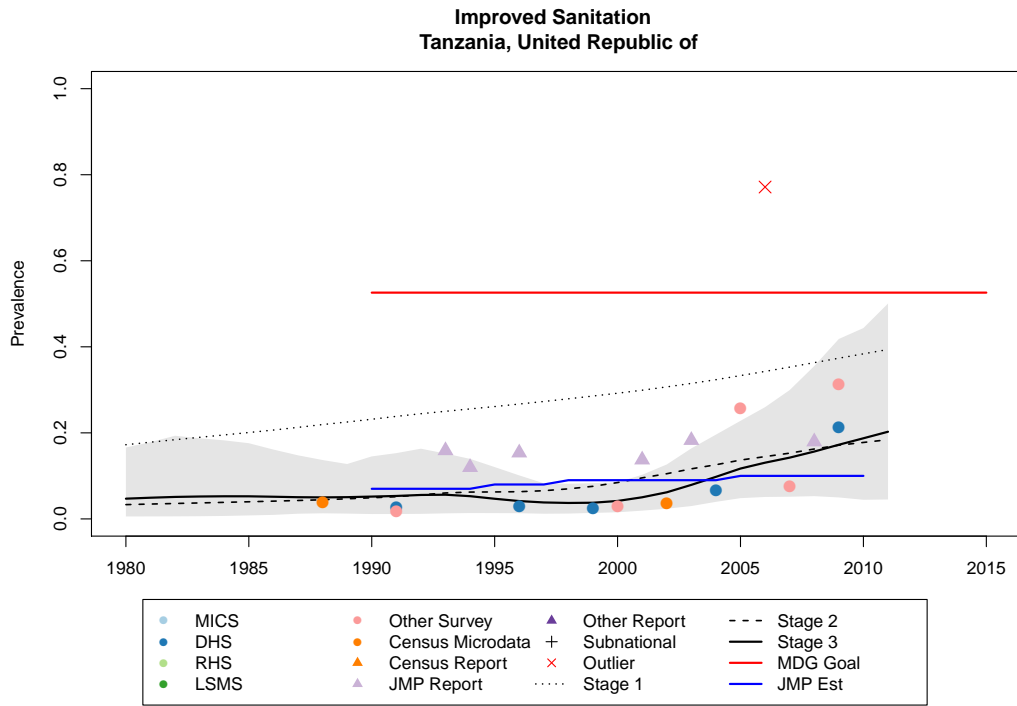


Figure A.256: Prevalence of access to improved sanitation, Tanzania, United Republic of

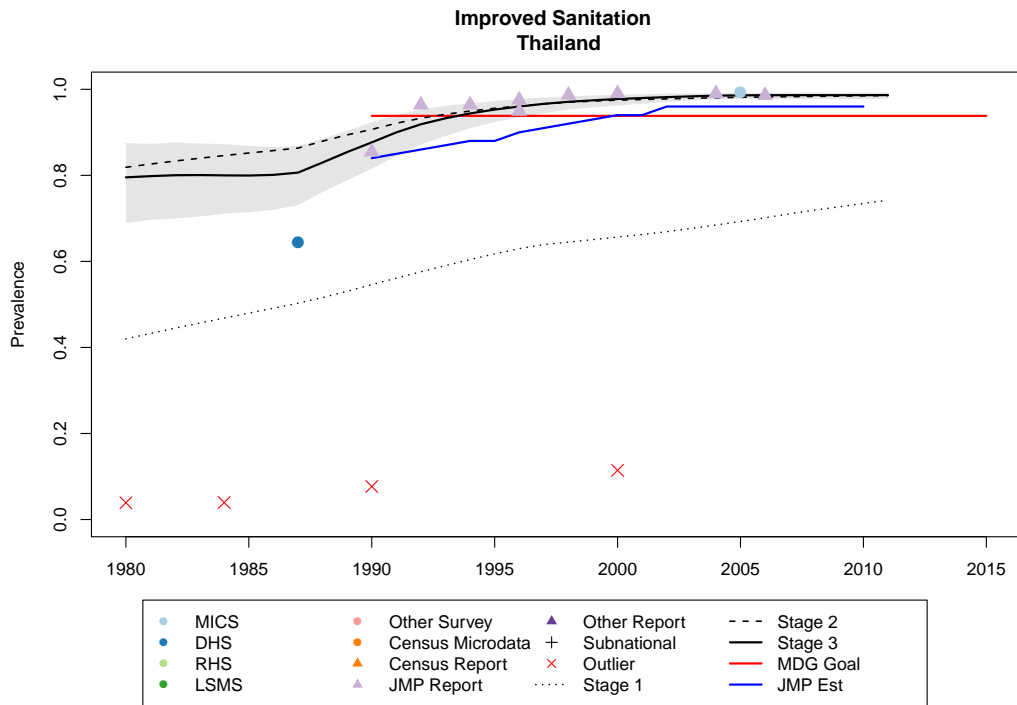


Figure A.257: Prevalence of access to improved sanitation, Thailand

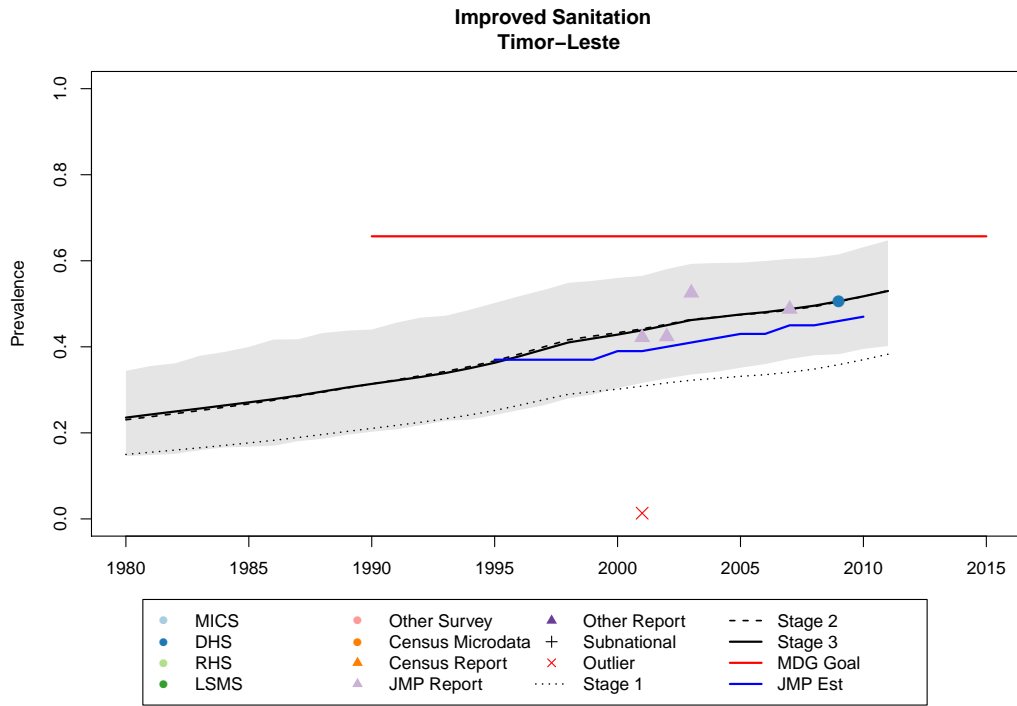


Figure A.258: Prevalence of access to improved sanitation, Timor-Leste

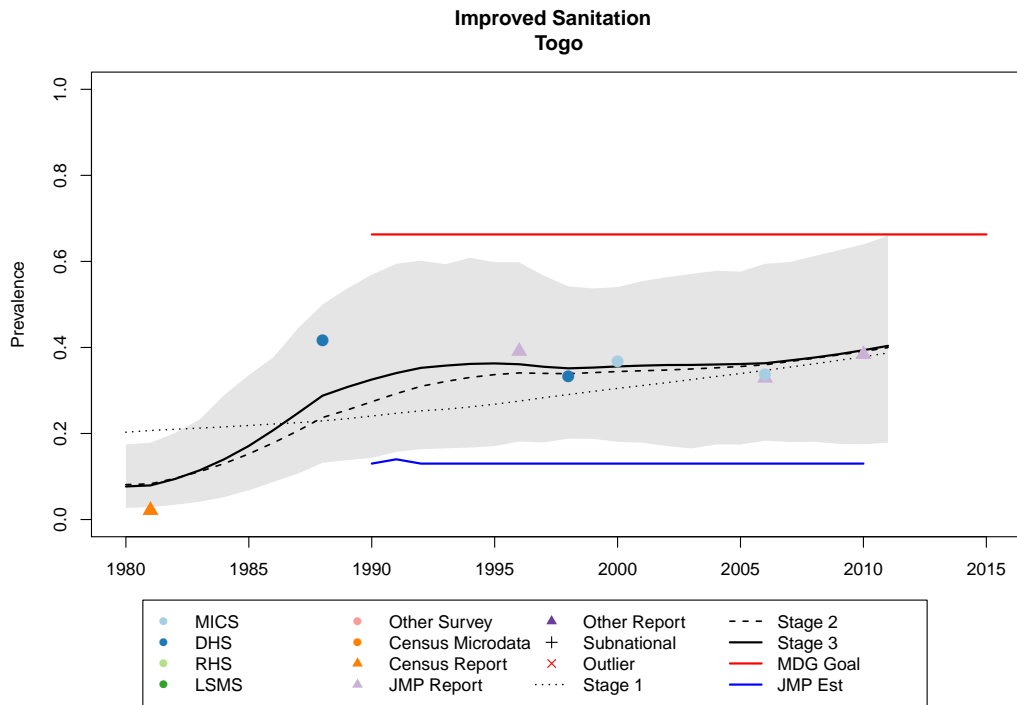


Figure A.259: Prevalence of access to improved sanitation, Togo

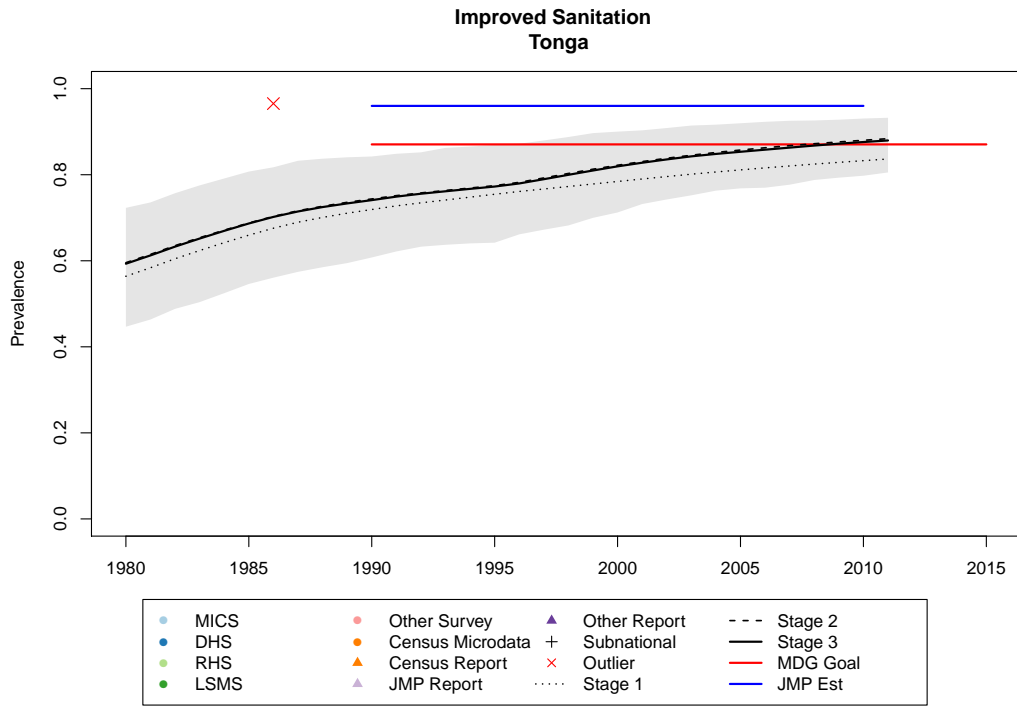


Figure A.260: Prevalence of access to improved sanitation, Tonga

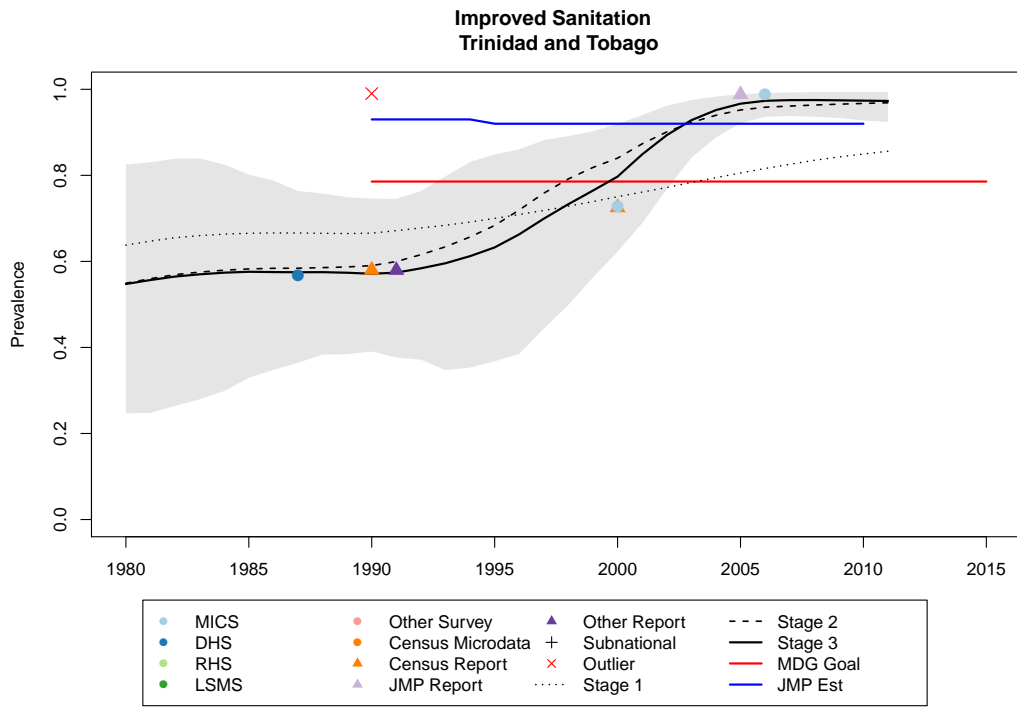


Figure A.261: Prevalence of access to improved sanitation, Trinidad and Tobago

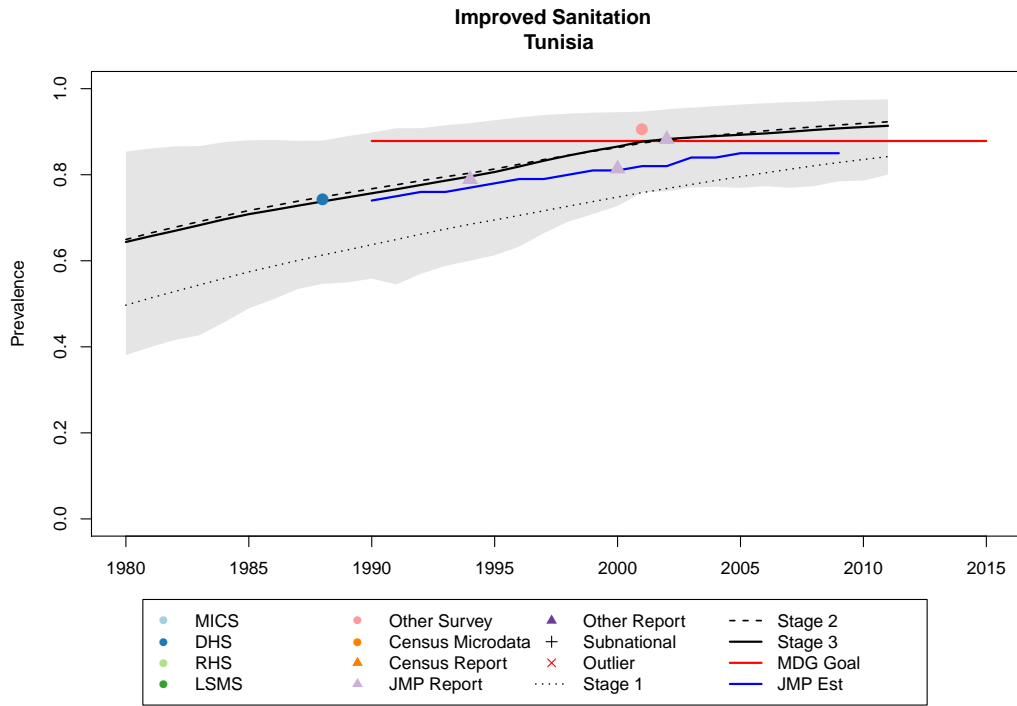


Figure A.262: Prevalence of access to improved sanitation, Tunisia

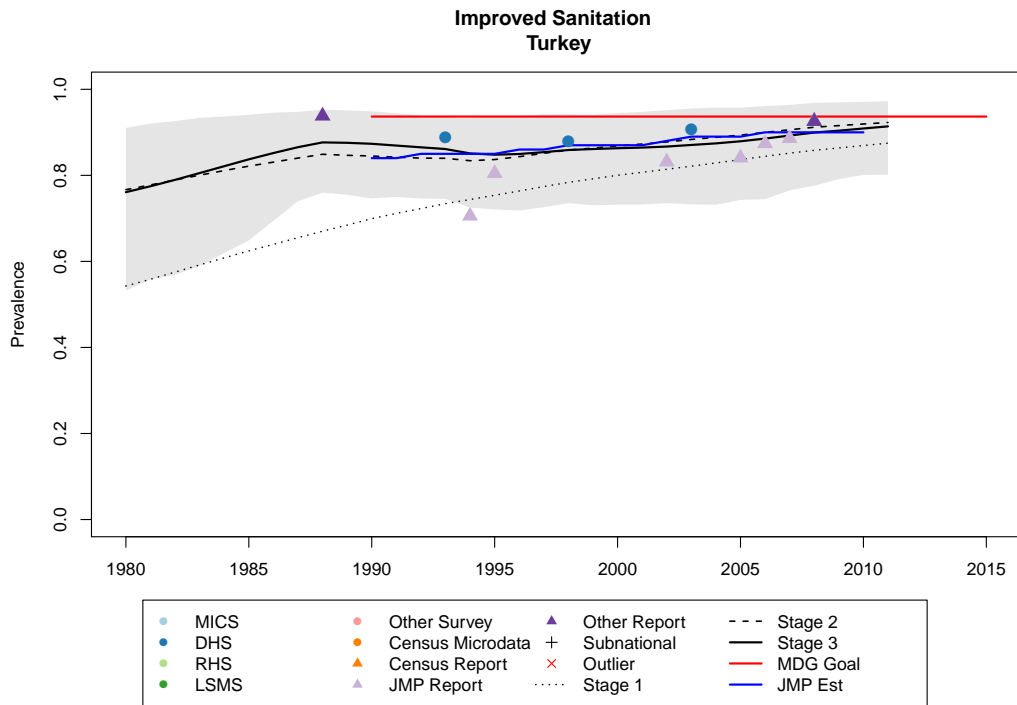


Figure A.263: Prevalence of access to improved sanitation, Turkey

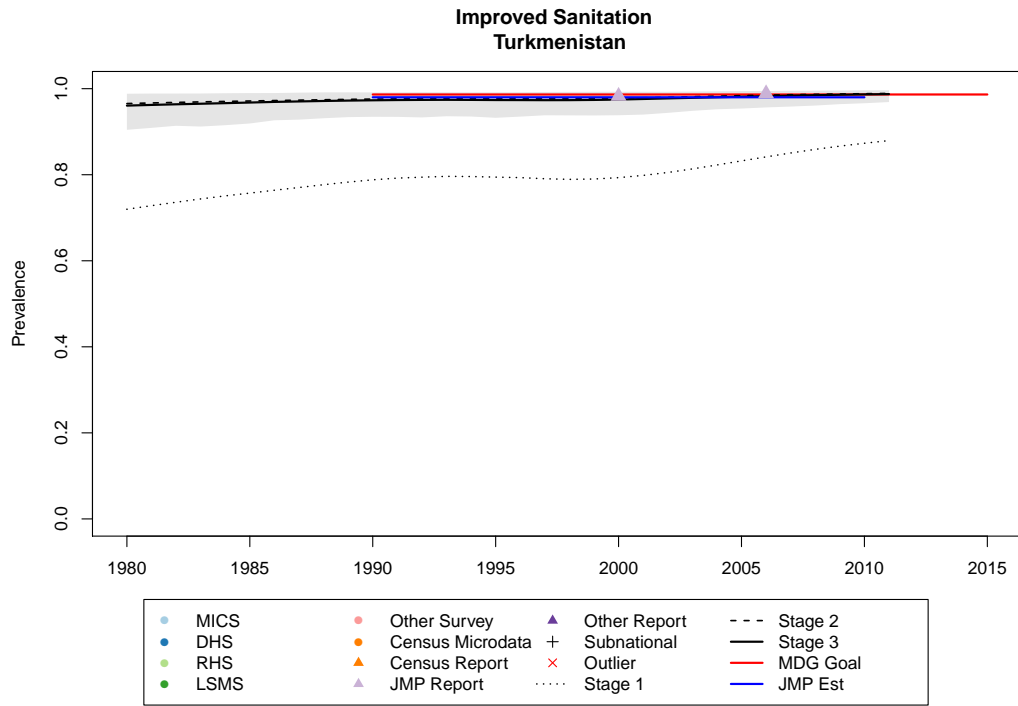


Figure A.264: Prevalence of access to improved sanitation, Turkmenistan

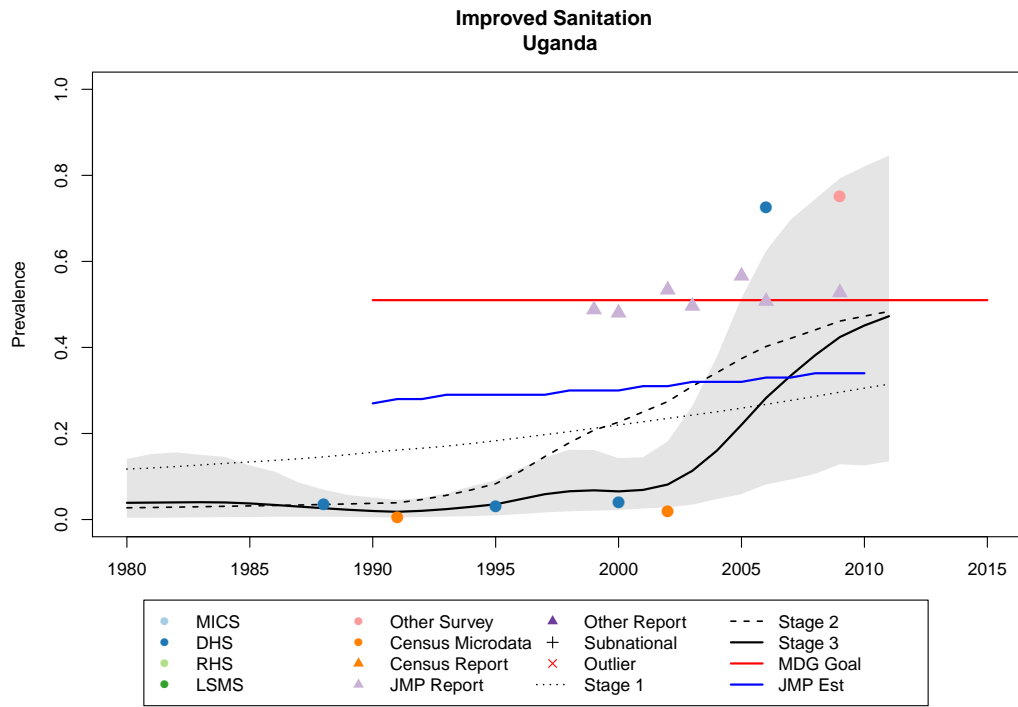


Figure A.265: Prevalence of access to improved sanitation, Uganda

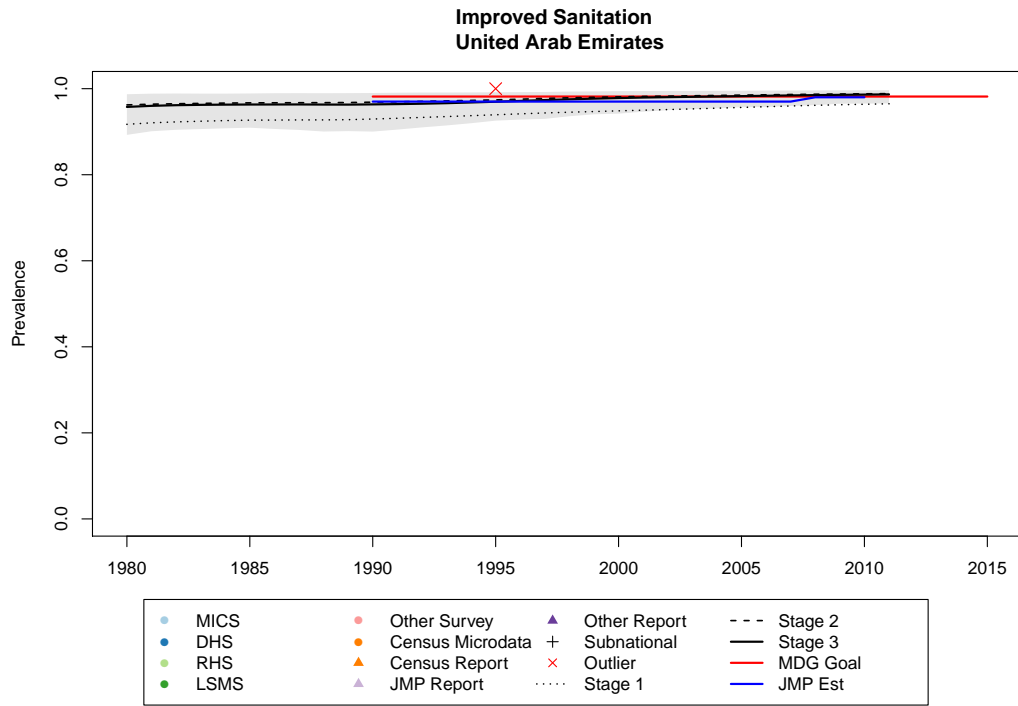


Figure A.266: Prevalence of access to improved sanitation, United Arab Emirates

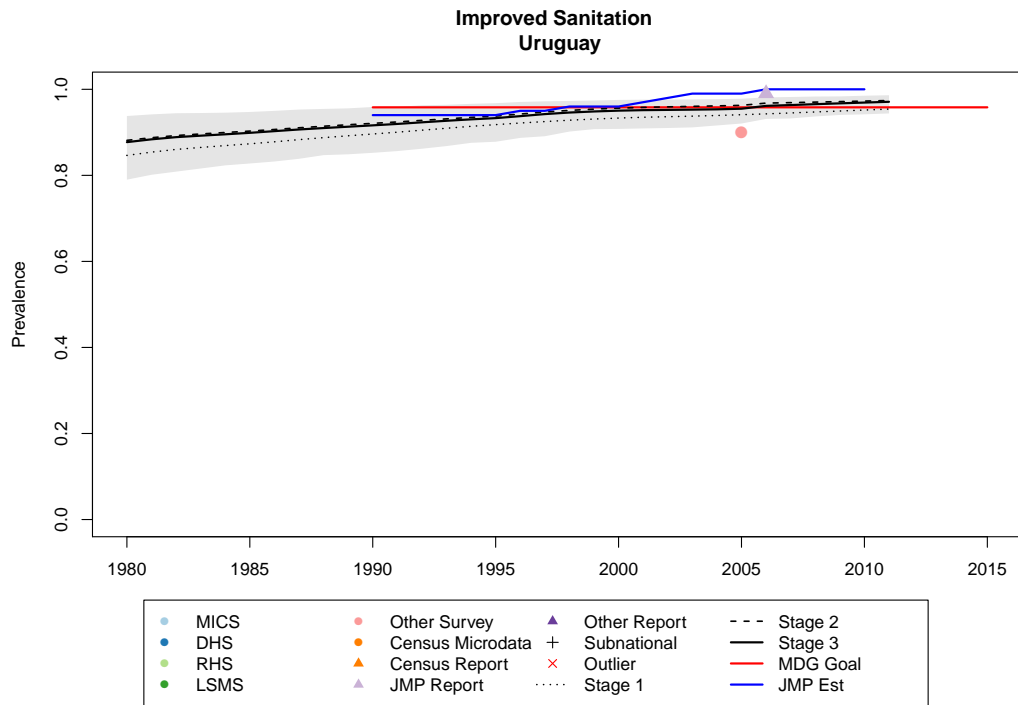


Figure A.267: Prevalence of access to improved sanitation, Uruguay

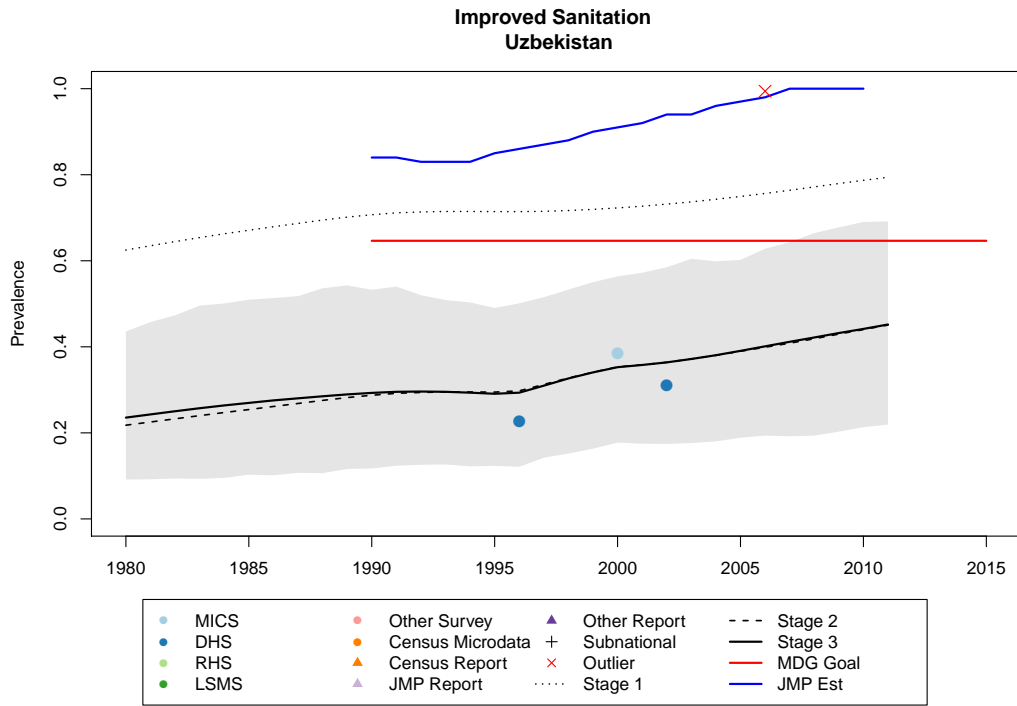


Figure A.268: Prevalence of access to improved sanitation, Uzbekistan

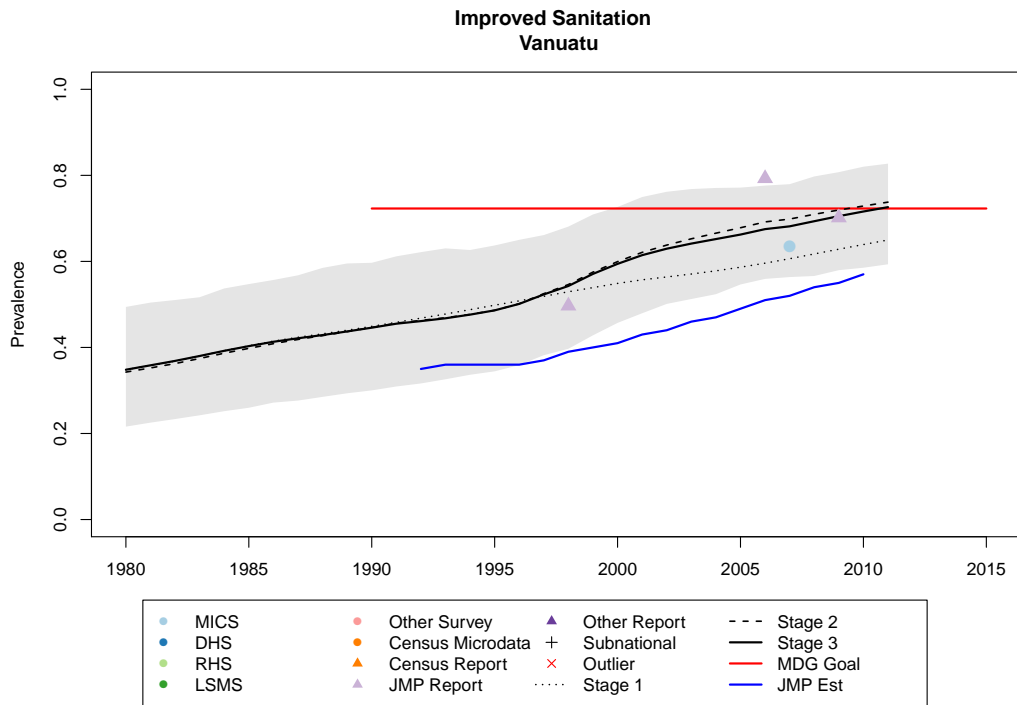


Figure A.269: Prevalence of access to improved sanitation, Vanuatu

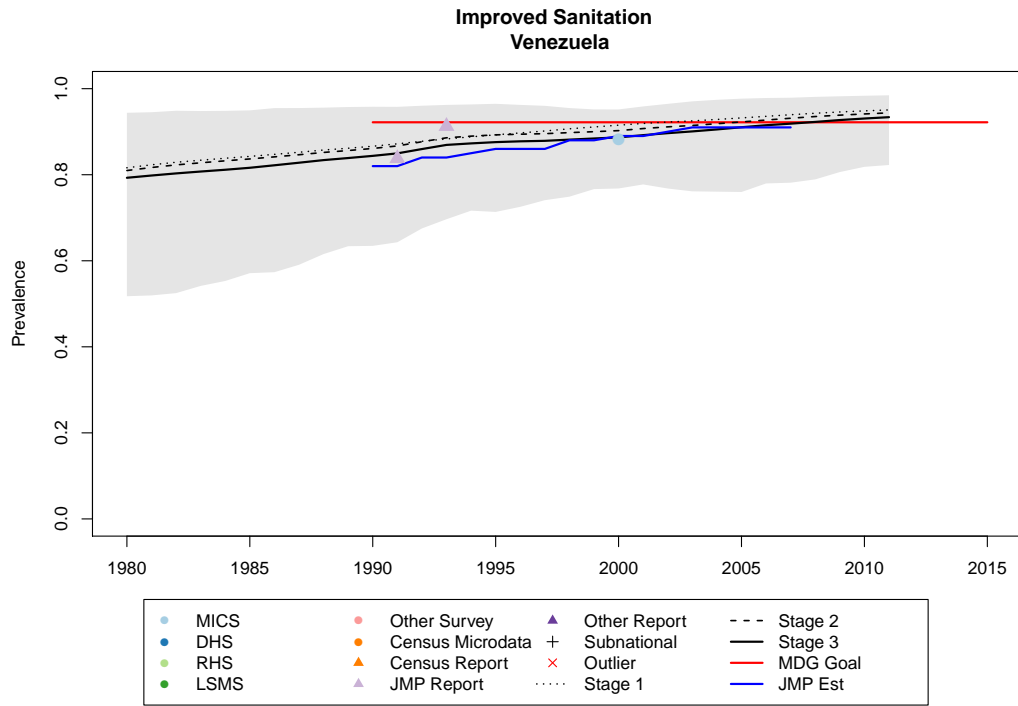


Figure A.270: Prevalence of access to improved sanitation, Venezuela

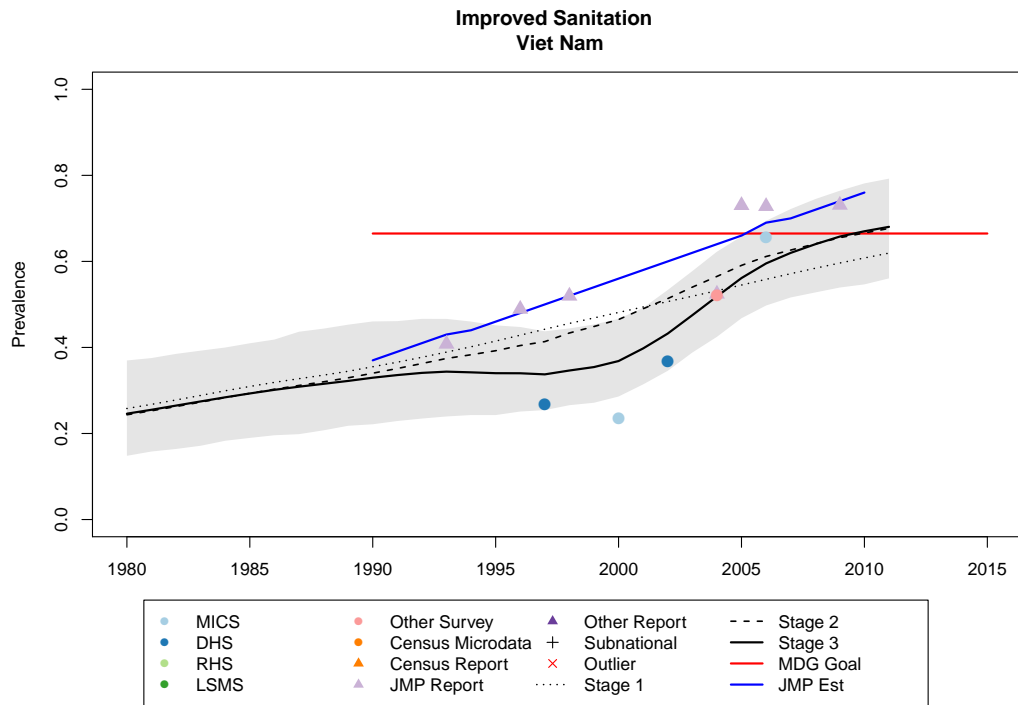


Figure A.271: Prevalence of access to improved sanitation, Viet Nam

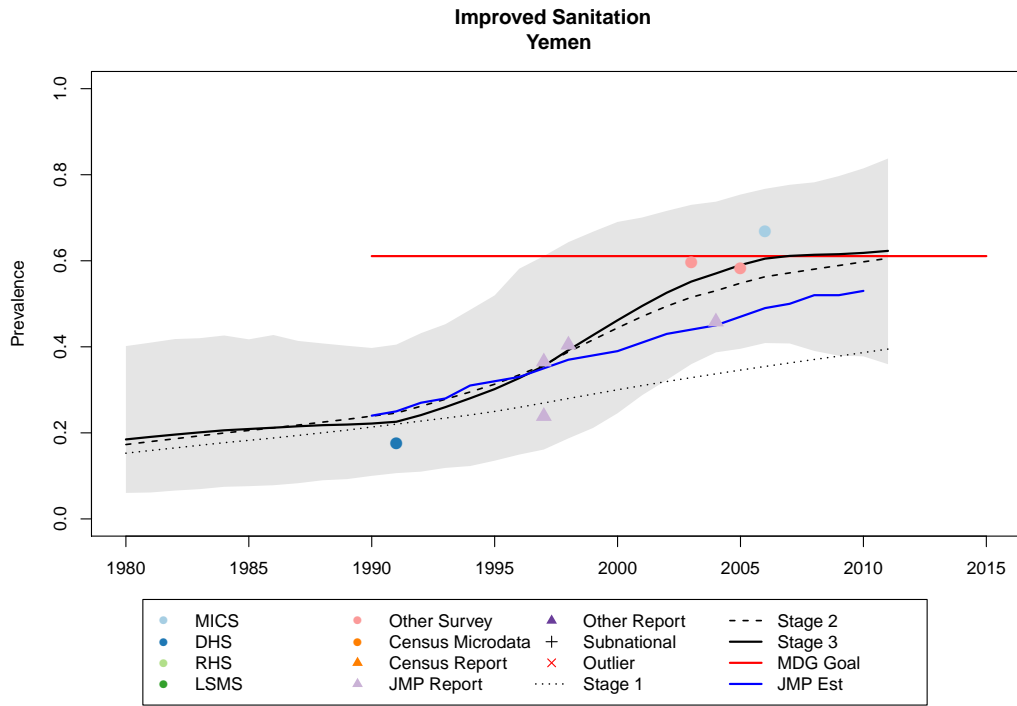


Figure A.272: Prevalence of access to improved sanitation, Yemen

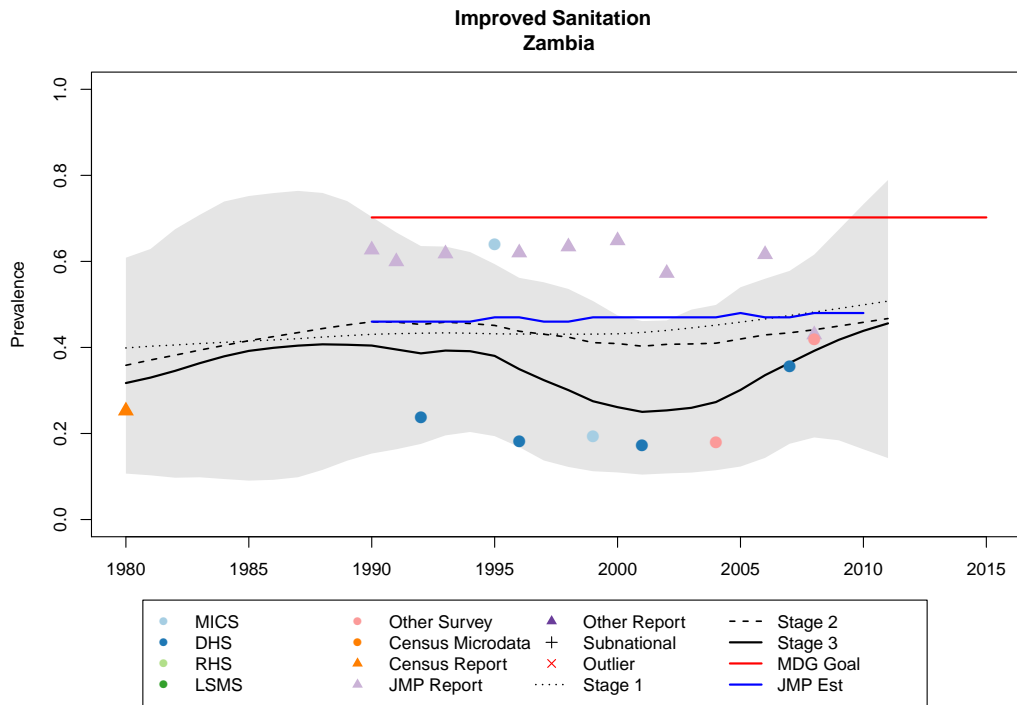


Figure A.273: Prevalence of access to improved sanitation, Zambia

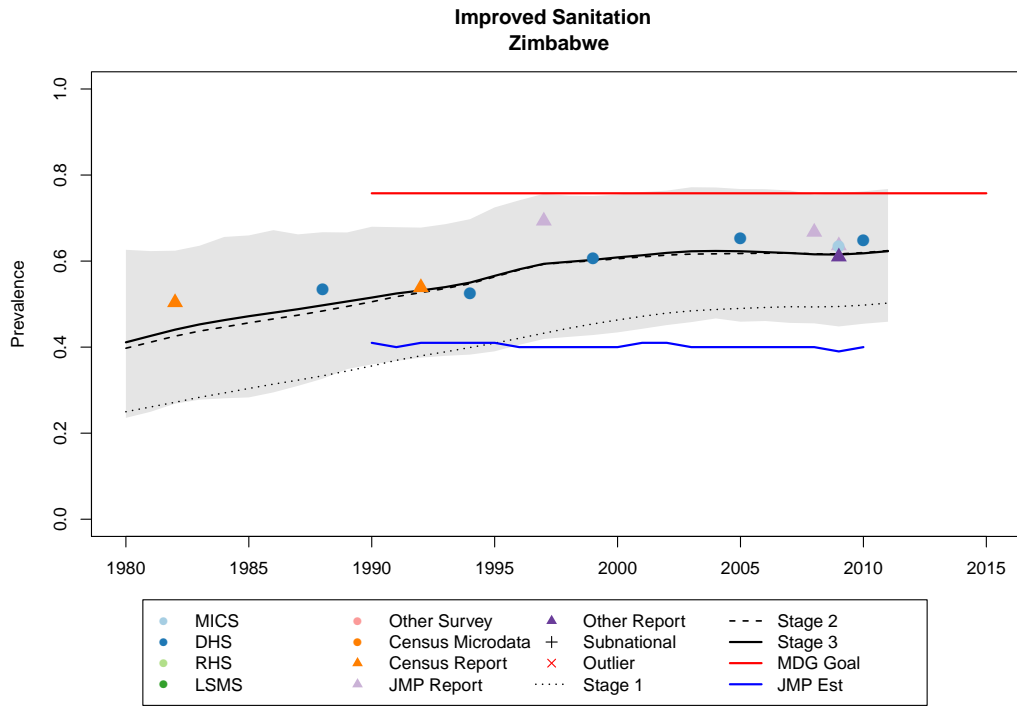


Figure A.274: Prevalence of access to improved sanitation, Zimbabwe