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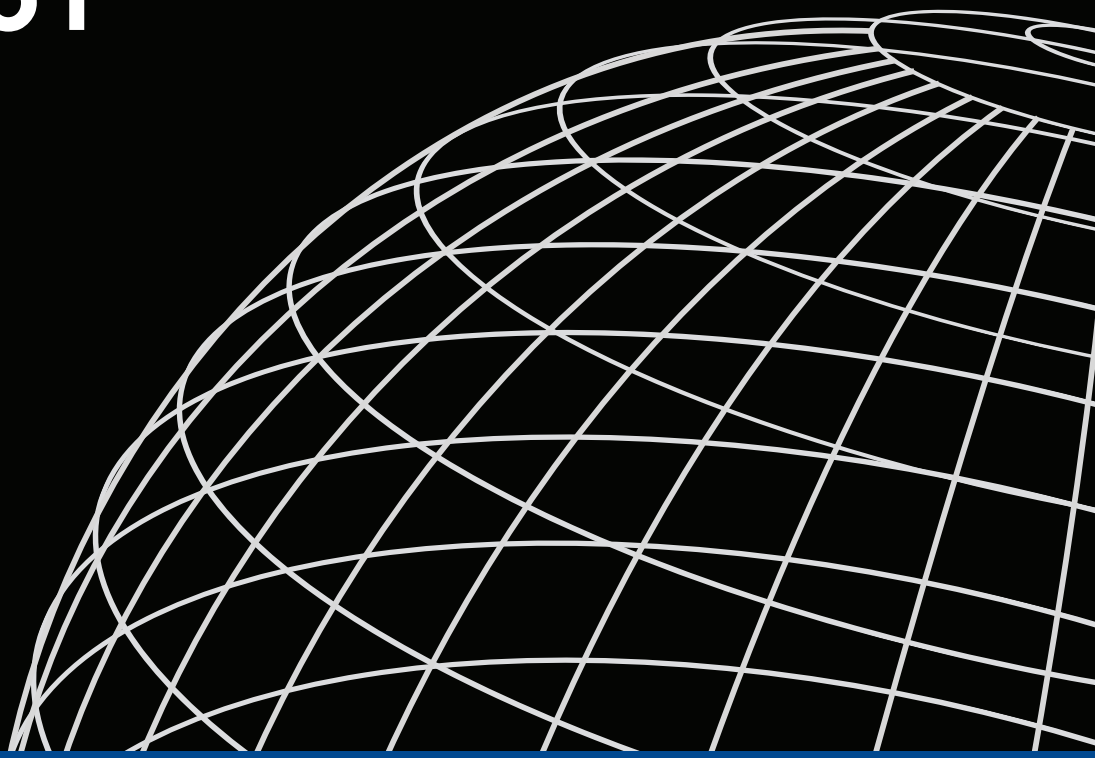
THE RELATIONSHIP BETWEEN THE HEALTH SERVICE ENVIRONMENT AND SERVICE UTILIZATION: LINKING POPULATION DATA TO HEALTH FACILITIES DATA IN HAITI AND MALAWI

DHS ANALYTICAL STUDIES 51



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The Relationship between the Health Service Environment and Service Utilization: Linking Population Data to Health Facilities Data in Haiti and Malawi

Wenjuan Wang

Rebecca Winter

Lindsay Mallick

Lia Florey

Clara Burgert-Brucker

Emily Carter

ICF International

Rockville, Maryland, USA

September 2015

Corresponding author: Wenjuan Wang, International Health and Development, ICF International, 530 Gaither Road, Suite 500, Rockville, MD 20850, USA; phone: +1 301-407-6500; fax: +1 301-407-6501; email: wenjuan.wang@icfi.com

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Preface

The Demographic and Health Surveys (DHS) Program is one of the principal sources of international data on fertility, family planning, maternal and child health, nutrition, mortality, environmental health, HIV/AIDS, malaria, and provision of health services.

One of the objectives of The DHS Program is to analyze DHS data and provide findings that will be useful to policymakers and program managers in low- and middle-income countries. DHS Analytical Studies serve this objective by providing in-depth research on a wide range of topics, typically including several countries and applying multivariate statistical tools and models. These reports are also intended to illustrate research methods and applications of DHS data that may build the capacity of other researchers.

The topics in the DHS Analytical Studies series are selected by The DHS Program in consultation with the U.S. Agency for International Development.

It is hoped that the DHS Analytical Studies will be useful to researchers, policymakers, and survey specialists, particularly those engaged in work in low- and middle-income countries.

Sunita Kishor
The DHS Program

Abstract

Access to and quality of health services are key determinants in utilization of health services and consequently, health outcomes. By linking DHS household data and health facility survey data, this paper explores the relationship between the service environment (service availability and readiness to provide a service) and utilization and quality of health care obtained in several health areas in Haiti and Malawi. The health areas included are family planning, maternal health care, child care, and HIV testing services in Haiti, and malaria-related health care services in Malawi. Geographically appropriate buffer zones around each cluster were determined based on area of residence—metropolitan, other urban, and rural areas in Haiti and urban and rural areas in Malawi. For each health area, data from the facilities within the buffer were summarized to cluster level to measure the cluster's service environment relative to the health area included in the buffer zone. These cluster-level data were then linked to individual women in the household surveys. As expected, for all the health services examined in Haiti, clusters in the metropolitan area were linked to a much greater number of health facilities than clusters in other urban and rural areas. For most health areas, a significant association was found in rural areas (and other urban areas in Haiti) between access to or readiness of service provision and utilization of health services. The relationship does not hold however in the metropolitan area in Haiti; more precise measurements of the health service environment would be needed for areas with both high density of health facilities and population.

Executive Summary

Access to and quality of health services are thought to be key determinants in utilization of health services and health outcomes. However, analysis of the relationship between health services and health service utilization has its challenges. It requires data from both facilities and individuals in order to capture both service environment and service use outcomes. The DHS Program collects data at both levels through population surveys (DHS) and health facility surveys (SPA). A limited number of studies have linked the two, mostly by connecting clusters to the nearest health facility and analyzing how the physical access to health facilities, i.e. distance to the nearest facility, and/or the service provision in that health facility affects population use of health services. These studies have found an association between service environment and use of family planning (FP), maternal, curative, and HIV services. However, the geographic and temporal proximity of facility and household datasets, as well as the linking method employed, is limited and leaves room for improvement.

This study aims to fill a major gap in the knowledge base on the relationship between provision of health services and utilization of health services in developing countries. By using a broader, service-environment linkage approach, errors due to GIS displacement of clusters in DHS datasets can be minimized. The relationship between the service environment and utilization of specific services was explored for a number of health areas including family planning (FP), maternal health care, child care, and HIV testing services in Haiti, while malaria-related health care services were examined in Malawi.

Methods

The analysis was based on linked population data and health facility data from Haiti and Malawi, drawn from household surveys—the 2012 Haiti DHS and the 2012 Malawi Malaria Indicator Survey (MIS)—and service provision assessment surveys—the 2013 Haiti SPA and the 2013-14 Malawi SPA. Instead of relating health services utilization to service provision in a single facility (the nearest one), we measured the service environment comprised of all the facilities in the formal sector of each country, within a specified buffer distance. The distances were operationalized by creating a group of facilities within a 5-kilometer buffer distance from an urban cluster and a 10-kilometer buffer distance from a rural cluster. These buffer sizes were chosen to ensure that facilities within the same distance from the real location of the cluster were captured (given that urban clusters were displaced up to 2 km and most rural clusters were displaced up to 5 km by DHS). Facility-level variables for each health area, such as the facility's capacity to provide a service or the facility's readiness score to provide this service, were summarized at the cluster level to measure the cluster's service environment within the specific distance. This cluster-level facility variable for each health area was then linked to clusters from the corresponding household survey.

Results

In Haiti, the results suggest that service readiness is a significant predictor of health care utilization, particularly in rural areas. Overall, the findings were not as strong in urban areas for most of the health areas covered. The results on family planning in Haiti indicate an association between the availability of contraceptive method choice and women's use of modern contraceptive methods in rural and other urban areas. The presence of at least one facility offering a range of methods within the buffer distance from the community significantly increased adoption of modern contraceptive methods.

Antenatal care (ANC) services are widely available at health facilities in Haiti. As a result, all clusters irrespective of location have at least one ANC facility within 5 km or 10 km. However, there is limited capacity to conduct urine and blood tests, little use of ANC guidelines, and poor availability of tetanus

vaccine. In addition, our analyses showed that service readiness is an important determinant of women's receipt of four or more ANC visits and high quality ANC, although these associations are strongly significant only in rural areas.

A significant association was found between facilities' capacity to provide HIV testing and use of HIV testing services in rural areas of Haiti. In the metropolitan area, there was no association between the HIV service environment and use of HIV testing services. On the other hand, we found a significant positive association between the level of service readiness and care seeking for children's diarrhea at health facilities in the metropolitan area but not in rural and urban areas.

In Haiti, one-third of other urban clusters and half of rural clusters do not have any facility with basic emergency obstetric care services (BEmOC) within the 5 km or 10 km buffer and availability of comprehensive emergency obstetric care services (CEmOC) is even more limited. Our findings indicate a strong effect of having a BEmOC facility on facility delivery in the metropolitan area; however, the results in rural and urban areas suggest that being able to access a facility providing normal delivery services, with or without BEmOC, seems more important in rural and other urban areas.

In Malawi, mixed results were found regarding availability of facilities providing malaria services and use of these services. Despite the high prevalence of malaria in rural areas of Malawi, over half of rural clusters do not have any facility within 10 km that is ready to provide intermittent preventive treatment of malaria in pregnancy (IPTp). High access to IPTp service-ready facilities is significantly associated with the IPTp2 coverage (two doses) among pregnant women in rural areas. By contrast, the association between insecticide-treated net (ITN) availability and malaria parasitemia is significant in urban areas but not in rural areas. We did not find an association between either ITN use by households and ITN provision at the health facility or an association between children's receipt of malaria diagnostic testing and diagnostic capacity at health facilities in either urban or rural areas.

Conclusions

The buffer linkage method can be applied in several health areas to examine how the service environment affects health services utilization when there are a household survey and a health facility census conducted around the same time period. This method has also been found to be useful in settings with low density of health facilities. For most health services, a significant association is found in rural (and other urban areas in Haiti) between access to or readiness of service provision and utilization of health services. The relationship does not hold in the metropolitan area in Haiti; more precise measurements of the health service environment would be needed for areas with both high density of health facilities and population.

1. Introduction and Literature Review

Access to health services and quality of health services are a high priority for investments designed to increase health services utilization and eventually to improve health outcomes. However, understanding the role of health service environment on use and related outcomes has been constrained by limited data and methodological challenges in such an analysis. Analysis requires both data from facilities on service provision and data from households or the community on service use outcomes. Facility assessments can provide useful information on the availability and quality of services offered by providers, while household surveys provide information on population level need and demand for services. When available, combining data from representative household surveys and health facility assessments can be used to explore the relationship between service environment and use, including the role of service availability and quality in population-level use of health services. However, linking these two types of data is not straightforward primarily because of two reasons: 1) two types of surveys are independently conducted and are not necessarily designed for linking purposes; 2) the true location of clusters in household surveys is unknown due to geographic displacement of clusters for the purpose of protecting confidentiality.

This study aims to fill the gap in the literature on the relationship between provision and utilization of health services by using a service environment linkage approach. Using data from independent household and health facility surveys in Haiti and Malawi, we linked households to health facilities within a specified distance (i.e. buffer) and used data from linked health facilities to measure the service environment. The relationship between the service environment and utilization of specific services was explored for a number of health areas including family planning (FP), maternal health care, child care, and HIV testing services in Haiti and malaria-related health care services in Malawi.

1.1. Linking Household and Health Facility Data from the Same Survey

Some studies have linked household and health facility data using information from the same survey. Early household surveys, including the World Fertility Surveys and the Demographic and Health Surveys (DHS) (Phase I to III) included a Service Availability Module (SAM). However, the SAM approach used key informants to generate data on service availability among a range of public and private providers and few visited actual facilities, raising questions about the validity of these data (Casterline 1987). Such data measured perceived access to services within a community rather than true access (Rose et al. 1999).

A number of secondary analyses have linked facility characteristics and population data from these early DHS surveys that included SAM (Do and Koenig 2007; Magnani et al. 1999; Mroz et al. 1999; Pullum 1991; Steele, Curtis, and Choe 1999). These analyses linked facility and individual data collected during the same survey in the same cluster. Pullum and colleagues developed a hierarchal model to assess the impact of service environment on contraceptive use. Their analysis of Guatemala 1987 DHS data found that increasing distance and travel time acted as a barriers to contraceptive use (Pullum 1991). Two similar analyses linked FP service availability data from the 1992 Morocco DHS with individual data for the 1992 and 1995 DHS. These analyses found a significant association between the availability of FP methods at the closest public clinic and contraceptive use (Magnani et al. 1999) and proximity to a public health facility with increased adoption of modern FP methods after birth (Steele, Curtis, and Choe 1999). An analysis of the Vietnam 1997 DHS found that longer travel time to a commune health center was associated with significantly greater odds of discontinuing first and all methods of contraception. Individuals residing in communities with high quality health centers were also less likely to discontinue a method (Do and Koenig 2007). However, Mroz and colleagues' analysis of the 1992 Tanzania DHS and its 1993 facility supplement with additional service accessibility component found perceived facility quality, as reported by key

informants, was a better predictor of contraceptive use than time, distance, or perceived accessibility of a FP facility (Mroz et al. 1999).

Rose and colleagues assessed the association between service environment and both use of FP and maternal health services in ten countries using data from the women's questionnaire and SAM from DHS III surveys. This analysis found that across the ten countries representing the Latin American and Caribbean, Asia, and Africa regions, rural women living nearer to health services were not only more likely to use a modern contraceptive method, but also seek antenatal care (ANC) earlier and more frequently, deliver at a facility, and deliver with a skilled provider (Rose et al. 1999).

1.2. Linking Data from Independent Household Surveys and Health Facility Surveys

1.2.1. Household and health facility surveys used in linking analyses

Multiple nationally representative stand-alone health facility surveys are now routinely conducted, including the Service Provision Assessment (SPA) by the DHS Program and the Service Availability and Readiness Assessment (SARA) by the World Health Organization (WHO 2014). Both the SPA and SARA collect nationally representative information on formal health facility readiness using an inventory scoring system. The SPA additionally collects data of adherence to standards of care through direct observation and client exit interview. These surveys typically collect information on a sample of formal sector health facilities. They do not collect data from community-based or informal points of care that may constitute the source of care for a significant proportion of health events. The SPA collects data from a census of health facilities in a limited number of countries (Hozumi et al. 2006).

Beyond the SPA and SARA, there are additional mechanisms for collecting data on service provision. The World Bank has been conducting Service Delivery Indicator (SDI) surveys in several African countries to collect data on service delivery in education and health (The World Bank 2015). Zambia and Malawi have collected data on all public facilities and a sample of private facilities using the Japanese International Cooperation Agency's (JICA) Health Facility Census tool (Hozumi et al. 2006). Population Council's situation analysis has also been used in the past to capture health facility data on availability of reproductive services (Fisher et al. 1992). Other studies have been implemented to collect both population and facility data for specific programs or evaluation.

1.2.2. Linking analyses in various health areas

A number of analyses have linked population data from DHS and health facility data from SPA to look at the association between FP service availability, quality, and contraceptive use. Hong and colleagues looked at the association between service quality and IUD use, using data on household clusters from the Egypt 2003 Interim DHS within 10 km of a public facility providing FP services sampled in the 2002 SPA. Their analysis found use of an IUD from a public facility was positively associated with living within the catchment area of a public facility with higher quality counseling and examinations. However, the authors note women may not have used the nearest facility (Hong, Montana, and Mishra 2006). Wang and colleagues analyzed FP data from four East African countries using regional administrative boundaries to link individual data and facility data on service environment, calculated as an index of quality of FP counseling, infection control, pelvic examination, and management practice. Their analysis found both an increase in the regional average number of available contraceptive methods and more favorable service environment were associated with greater odds of a woman in the region using a modern contraceptive method (Wang et al. 2012).

Other analyses have used targeted household and facility surveys to assess the influence of service environment on FP. Gage and Zomahoun used linked data from the 2009 Community Participation for Action in the Social Sectors project health facility and household surveys to look at the association between FP service environment and contraceptive outcomes in five Nigerian states. Their analysis found both better reproductive health staff training and stronger quality of provider-client interactions were associated with increased odds of modern contraceptive use within an local government area (Gage and Zomahoun 2011). Using data on individual reproductive health status and facility reproductive services from the 1999 Delivery of Improved Services for Health (DISH) Evaluation Surveys in Uganda, Charles et al. found that proximity to a private health facility was associated with increased contraceptive use in urban areas; but none of the family planning service environment factors was independently associated with current use of modern contraception in rural areas (Katende, Gupta, and Bessinger 2003). Mensch and colleagues' analysis of the 1992 Peru situation analysis and 1991-1992 DHS found increased contraceptive prevalence was associated with increased quality of facility care within the cluster. Quality of care was defined using an index of method availability, cleanliness, privacy, counseling, and provider method bias and restrictiveness (Mensch, Arends-Kuenning, and Jain 1996).

A number of analyses have also looked at the relationship between service provision and maternal health services coverage. Wang and colleagues analysis of 2012 Haiti DHS and 2013 SPA data found higher average service readiness within 10 km of a cluster was associated with increased use of delivery services (Wang et al. 2014). In this study service readiness was assessed as a set of WHO-defined indicators of facility readiness to provide good-quality delivery services. A study by Gabrysch and colleagues using the Zambia DHS 2007 and national data from the Zambia Health Facility Census 2005 found increasing geographic distance was associated with decreasing odds of a woman delivering in a health facility. Access to higher-level health facilities was associated with increased odds of facility delivery. The authors noted the potential misclassification of level of obstetric care due to the difference in timing of the two surveys and imprecision in distance measures as a result of DHS cluster displacement and missing geo-coordinates (Gabrysch et al. 2011). Linking National Facility Censuses and DHS in Zambia and Malawi, Lohela et al. found that distance to the closest facility with delivery care was significantly associated with use of facility for delivery in both countries. Higher level of care in closet facility also increased use of facility delivery in Zambia but not in Malawi (Lohela, Campbell, and Gabrysch 2012). Kyei and colleagues' analysis of the same datasets found no association between distance to a facility or level of service provided at a facility and timing of ANC or number of visits (Kyei, Campbell, and Gabrysch 2012). An analysis using the 1991 Nepal FP and Health Survey with supplemental facility data from district records found use of ANC was associated with having a health post within the community and residing in the catchment area of a facility with higher structural quality, assessed as availability of trained staff, equipment, supplies and facilities (Acharya and Cleland 2000).

Fewer analyses have looked at the association between service environment and use of HIV volunteer counseling and testing (VCT) services or curative health services. Hutchinson and Mahlalela used household data on adult health from the 2002-2003 Eastern Cape Primary Health Care Evaluation Survey and facility data from the 2002 Eastern Cape Facility Survey to measure the association between service provision and VCT use in Eastern Cape, South Africa (Hutchinson and Mahlalela 2006). The study found that among the rural population, increasing distance from a clinic offering VCT was associated with decreasing odds of an individual being tested. Among rural men, proximity to a clinic offering rapid testing and home visits for palliative care were associated with increased odds of being tested. Another study using a sample of married women and known information on primary health clinics in southern Mozambique found increasing distance to the closest clinic was associated with decreasing odds of HIV testing (Yao et al. 2012). One study using the Household and Health Facility Survey in four health districts Sri Lanka found distance to care was the most significant determinant in choice of facility for curative services, with increasing distance associated with decreasing likelihood of facility utilization (Akin et al. 1998).

1.2.3. Linking methods and limitations

In the absence of surveys designed explicitly for linking, various methods may be used to associate data from population-based surveys, primarily the DHS, to stand-alone health facility survey data. Most analyses linked household or individual data to facilities using a measure of geographic proximity. Geographic linking methods include 1) linking households to the nearest one or more facilities either with (Hong, Montana, and Mishra 2006; Kyei, Campbell, and Gabrysch 2012) or without a limit on maximum distance to nearest facility (Akin et al. 1998; Gabrysch, Simushi, and Campbell 2011; Hutchinson and Mahlalela 2006); 2) linking households to all facilities within a defined radius (Mensch, Arends-Kuenning, and Jain 1996; Wang et al. 2014); 3) linking households to facilities within the same cluster (Acharya and Cleland 2000; Katende, Gupta, and Bessinger 2003); and 4) linking households to facilities within the same administrative unit (Gage and Zomahoun 2011; Wang et al. 2012).

There are a number of limitations associated with these analytical methods. Different linking methods may introduce errors. For example, assigning individuals or households to the nearest health facility does not account for potential provider bypassing (Rose et al. 1999; Skiles et al. 2013). Additionally, straight-line distance may not accurately reflect true provider accessibility, due to varied road distance, quality, terrain, and seasonal variation (Gage and Zomahoun 2011; Hong, Montana, and Mishra 2006; Rose et al. 1999; Wang et al. 2014). The DHS displaces household cluster locations and use of these displaced cluster locations may result in misclassification and imprecision using straight-line distance linking methods (Perez-Heydrich et al. 2013). Cluster or administrative boundary linkages do not account for potential use of providers outside of the catchment boundaries (Gage and Zomahoun 2011). Skiles and colleagues explored the issues of linking DHS household and SPA facility data using data from the 2007-2008 Rwanda Interim DHS and 2007 Rwanda SPA to simulate the effect of cluster sampling and displacement. Both sampling and displacement resulted in misclassification of cluster links and estimated relative service environment. Additionally, assigning individuals to the closest facility resulted in greater misclassification than linking an individual to all facilities within an administrative boundary. Facility sampling in particular was shown to have the potential to underestimate service availability. These findings highlight the need for careful consideration when designing or selecting studies and linking methods for these types of analyses (Skiles et al. 2013).

Stand-alone facility surveys may not be conducted at the same time as a population-based survey and sampled facilities may not correspond with the cluster locations collected through population surveys. This limits the potential viability of using these data to assess the impact of service provision on use, as facility data may not accurately reflect the service environment for a household at the time of the population survey. Additionally, any analysis that uses health facility data drawn exclusively from public health facilities excludes the contribution of private sector or community-based providers to the service environment. The potential level of contribution of non-public health facilities varies by setting and service being assessed.

In summary, multiple studies have found an association between service environment and use of FP, maternal, curative, and HIV services. However, analyses that combine facility and household data require special consideration. The geographic and temporal proximity of facility and household datasets, as well as the linking method employed, must be considered during analysis and interpretation of study findings. In this study, we link nationally representative household surveys and health facility censuses in Haiti and Malawi with the buffer linkage method, which is shown to be less prone to misclassification errors due to cluster displacement (Skiles et al. 2013). The reason for choosing Haiti and Malawi is that both have a national facility census and a household survey (DHS in Haiti and MIS in Malawi) conducted within a year apart. Given the data available in DHS and MIS, we analyzed the use of multiple health services in Haiti including FP, maternal health care, child care, and HIV testing services, and the use of malaria related

health services in Malawi. The section followed overviews country background and health care systems in both countries.

1.3. Country Background and Health Systems in Haiti and Malawi

1.3.1. Haiti

Haiti is a small Caribbean country occupying the western third of the island of Hispaniola. The country is organized into 10 departments. Haiti is the poorest nation in the Western Hemisphere, with a per capita GDP of $1800 (Dowell, Tappero, and Frieden 2011) and over 80 percent of the population living below the poverty line (World Bank 2015a). Haiti has experienced political instability over much of its history and is vulnerable to natural disasters. In January 2011, Haiti experienced a devastating earthquake that killed or displaced millions and destroyed already weak infrastructure (Dowell, Tappero, and Frieden 2011).

Haiti has a population of 10.32 million (WHO 2015a). Despite improvements in maternal and child survival, Haiti's under-five mortality rate (73 deaths per 1000 live births) and maternal mortality ratio (380 deaths per 100,000 births) are the highest in the region (Cayemittes et al. 2013). High fertility (TFR 3.5) and mortality rates have contributed to a young age distribution with a median population age of 22 years (Cayemittes et al. 2013). Haiti's life expectancy at birth is the lowest in the region at 63 years (WHO 2015a).

Haiti experiences high food insecurity because of stagnant agricultural production and high food prices (Pan American Health Organization 2012). Literacy rates are low, particularly in rural areas. Less than two-thirds of the population has access to improved water and only a quarter has access to improved sanitation facilities. Infectious disease continues to contribute to a significant proportion of morbidity and mortality in the country. Acute respiratory infection, low birth weight, and diarrhea are the leading causes of under-five mortality. Haiti is the only Caribbean country still affected by malaria. Moderate HIV prevalence (2 percent of the population age 15-49 years) has contributed to increased rates of tuberculosis (Chatterjee 2008; Ivers 2011; UNDESA 2012).

Haiti has a chronically underfunded and understaffed health system (World Bank 2015a). The government health system is organized into 3 levels, including approximately 700 primary health facilities (community health centers, dispensaries, and communal hospitals), supported by 10 departmental hospitals and 4 university hospitals (Ivers 2011). The government has limited capacity to administer health services; the public sector accounts for only 38 percent of health infrastructure (Chatterjee 2008). While government expenditure on health has increased, Haiti has the lowest health care spending in the region ($83.7 purchasing power parity) accounting for 5.5 percent of total government expenditure (WHO 2015a). Much of the health system is dependent on donor funding or NGO support. Health infrastructure is limited with only 1.3 hospital beds per 1,000 population (Dowell, Tappero, and Frieden 2011). Additionally, emigration of health workers to other countries has left the country under-resourced (Cayemittes et al. 2013). The majority of health facilities and workers are concentrated in urban centers, with nearly half of health facilities concentrated in the Port-Au-Prince area. Traditional medicine plays a significant role in health care, constituting the first source of care for almost 80 percent of the population. A number of private providers and retail pharmacies also operate in the country. The majority of drug retailers are not registered and are not operated by licensed prescribers (Ivers 2011).

Cost and geographic distance to care are key barriers in access to quality health services in the country (Ivers 2011). Low access has resulted in low utilization of maternal, child, and infectious disease health services. Contraceptive prevalence remains low at 35 percent. Only 67 percent of pregnant women receive four or more ANC visits and 36 percent of births take place in health facilities. Immunization coverage is

low and fewer than half of children with fever and one-third with diarrhea are taken for care (Cayemittes et al. 2013).

1.3.2. Malawi

Malawi is a small land-locked nation in southern Africa, divided into 28 districts. Malawi is comprised of multiple ethnic groups, each with its own language. English and Chichewa are the most commonly spoken languages. Malawi's economy is primarily agricultural and periodic droughts and flooding have often resulted in famine. Political inconsistency, corruption, and mismanagement have limited economic development, making Malawi one of the least developed nations in the world with a per capita GDP of $800 (Ministry of Development Planning and Cooperation 2010).

Malawi is a densely populated country, with a population of over 17.3 million in country of less than 100,000 km^2. Malawi achieved Millennium Development Goal 4 by decreasing under-five mortality from 245 deaths per 1000 live births in 1990 to 68 deaths by 2015 (National Statistical Office and ICF Macro. 2011; WHO 2015b). The maternal mortality ratio remains high, having halved to 550 deaths per 100,000 births over the same period. Malawi's total fertility rate is high at 5.4 births per woman, which coupled with high mortality, has resulted in a young population (National Statistical Office and ICF Macro. 2011). Almost half of the population is younger than 15 years (Ministry of Development Planning and Cooperation 2010).

Half of Malawi's population is below the poverty line. Less than a fifth of the population resides in an urban area. The majority of the population works in the agricultural industry. Population growth, environmental degradation, periodic droughts and flooding, and barriers to importation make a large proportion of Malawians food insecure (Ministry of Development Planning and Cooperation). Almost half of children are stunted (National Statistical Office and ICF Macro. 2011). While two-thirds of the population has access to improved water, only 28 percent have access to improved sanitation facilities (Ministry of Development Planning and Cooperation 2010). Three-fifths of adults over the age of 15 are literate. Infectious diseases are the leading cause of morbidity and mortality in the country. Malaria, acute respiratory infection, and HIV/AIDS are the leading causes of under-five mortality (UNICEF 2015). Malaria is endemic in 95% of the country and accounts for 30 percent of all outpatient hospital visits according to the Malawi Ministry of Health (Ministry of Health 2005).

The government health sector accounts for approximately 60 percent of health services, 37 percent are provided by Christian Health Association of Malawi (CHAM) facilities, and private or NGO facilities account for 3 percent of the formal health sector, as reported by the Malawi Ministry of Health (Ministry of Health 2011). The government health sector includes a professional cadre of community health workers, a range of primary community health posts and centers, district hospitals, and central hospitals located in large urban centers. The government of Malawi and other stakeholders have used a sector-wide approach to direct public health efforts over the past decade. Malawi provides an Essential Health Package free of charge through the public sector and service level agreements with CHAM and non-profit facilities (WHO 2015b). Malawi is heavily dependent on aid funding, which accounts for over half of total health expenditure (World Bank 2015b). Government spending on health has increased to 18 percent of total government expenditure (WHO 2009). Malawi experienced one of the most severe health human resource crises in sub-Saharan Africa due to high mortality from HIV/AIDS, lack of training programs, and emigration (Ministry of Health [Malawi]and ICF International 2014). The number of health facilities increased from 600 in 2011 to over 1,000 in 2013 (Mueller et al. 2011), however the average number of hospital beds remains low at 1.3 beds per 1,000 population (Ministry of Development Planning and Cooperation 2010). Inadequate infrastructure, lack of essential medicines, and the distance and cost of reaching care remain barriers to health care utilization (Burgert and Prosnitz 2014).

2. Data and Methods

2.1. Data

The analysis was based on linked population data and health facility data from Haiti and Malawi, drawn from household surveys—the 2012 Haiti DHS and the 2012 Malawi Malaria Indicator Survey (MIS)—and service provision assessment surveys—the 2013 Haiti SPA and the 2013-14 Malawi SPA. The DHS and MIS surveys provide data on the utilization of health services as well as respondents' socio-demographic characteristics. The SPA surveys provide information on the availability of health services at health facilities and facilities' readiness to provide good-quality services. Geographic coordinates data collected in both surveys were used to link DHS/MIS clusters and SPA facilities.

2.1.1. Population data

Population data came from the 2012 Haiti DHS and the 2012 Malawi MIS. The 2012 Haiti DHS is a population-based household survey that provides representative estimates for the country as a whole, for urban and rural areas, and for the 10 administrative departments of Haiti. The survey used a two-stage cluster sampling design. At the first stage, 445 clusters, including 45 from the temporary camps that house the population displaced by the 2010 earthquake, were selected with probability proportional to their population size from a master national sample frame. At the second stage, a systematic sample of 13,181 households was drawn in the selected clusters. All women age 15-49 in the sampled households were eligible for individual interview, in which their socio-demographic characteristics and health services utilization information were collected. The 2012 Malawi MIS is designed to provide representative data for key malaria indicators at the national level and at the regional level. A similar two-stage sample design was used to select a sample of 140 clusters and 3,500 households. All women age 15-49 in the selected households were eligible for individual interview. All children age 6-59 months listed in the household were eligible for anemia and malaria testing.

Both the DHS and MIS surveys georeferenced the locations of the sampled clusters using Global Positioning System (GPS) receivers to collect the coordinates of the center of the populated areas of the clusters. Prior to release of the geographic dataset, the cluster coordinates were verified and geographically displaced. Coordinates of urban clusters were displaced up to a maximum distance of 2 km. In rural areas, the displacement distance was up to 5 km with a further, randomly selected, 1 percent of rural clusters displaced up to 10 km (Burgert et al. 2013).

For Haiti, eight clusters with missing GPS data were excluded from the analysis. We also excluded 45 camps clusters from the analysis because respondents in these clusters were likely to reside in a different location at the time when they needed health care; therefore, the health care environment was not the same as where they were surveyed. In the end, 392 clusters (66 in the metropolitan area, 85 in other urban, and 241 in rural areas) were included in the analysis for Haiti. All 140 clusters sampled (44 in urban and 96 in rural areas) in the Malawi MIS were included in the analysis. In both countries, the analysis for each specific health service was limited to the respondents who had potential need for the service. For example, the analysis sample for ANC and delivery care was women who had a live birth in the five years preceding the survey. For family planning (FP), we restricted the analysis to all married women interviewed. Analyses of malaria outcomes were restricted to children less than five years of age (case management outcomes) and to women with recent births (prevention of malaria in pregnancy outcome). The analysis sample size and characteristics are described in the results section for each service area studied.

2.1.2. Health facilities data

Data on health facilities came from two SPA surveys—the 2013 Haiti SPA and the 2013-14 Malawi SPA—which provide a census of all the formal-sector health facilities in each country. The SPA surveys collect data on availability and readiness to provide key health services in public and private health facilities, from hospitals at the highest level to dispensaries or health posts at the lowest level. In total, 905 health facilities in Haiti and 977 facilities in Malawi were interviewed. Both SPA surveys collected GPS data of the locations of the health facilities. Unlike the DHS data, facilities' coordinates are not displaced.

For each specific health area, only facilities providing the service were included in the analysis. For example, for delivery care, only data on 195 hospitals and health centers with beds were used in this study. Health centers without beds and dispensaries were excluded because they are not mandated to provide delivery care and are rarely used for delivery care. In analyzing FP services, only the 756 facilities that provide FP services were included in the analysis.

Facility data for this study came primarily from the facility inventory interview, which was administered to the most knowledgeable person for each specific health service within each facility. The SPA facility inventory collects data on infrastructure, equipment, commodities, and medicines that are necessary for providing specific health services.

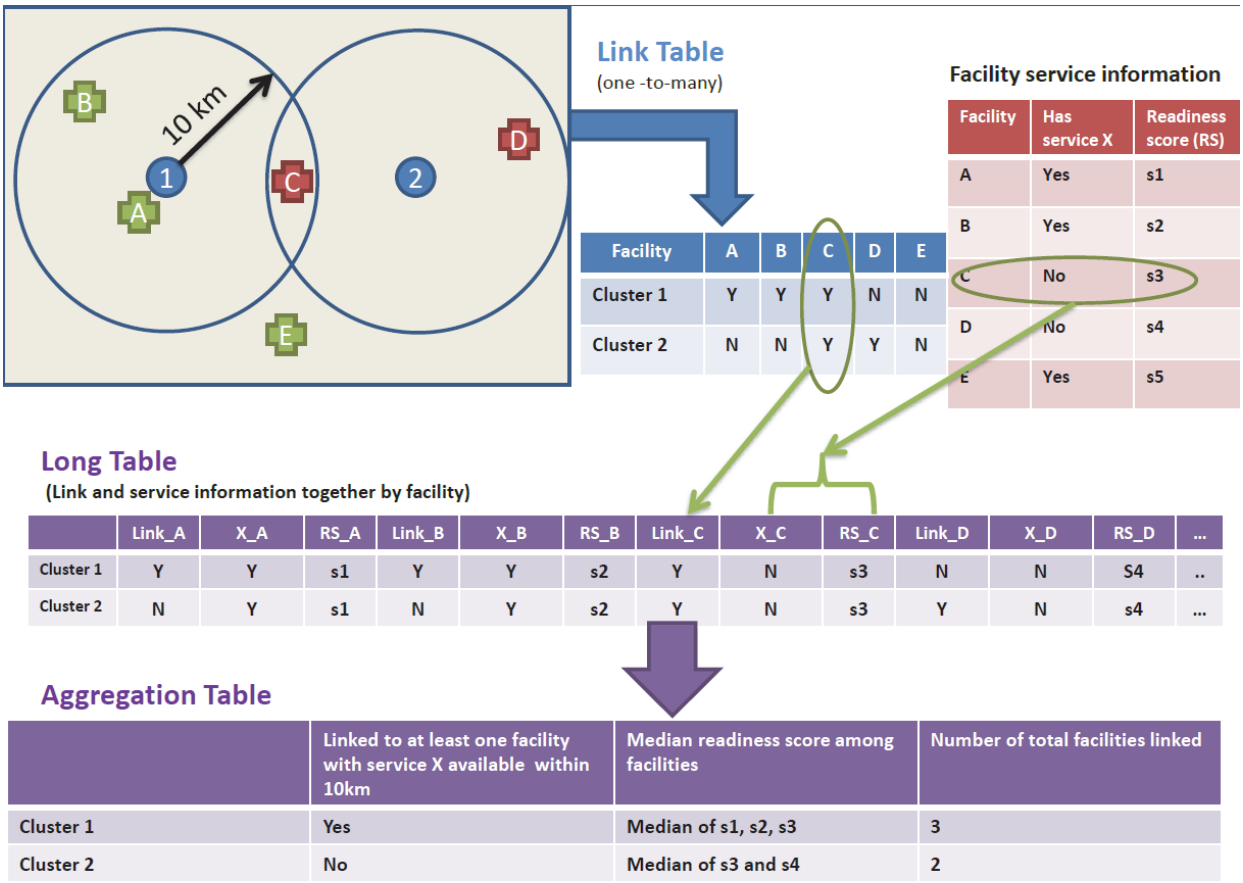
2.2. Linking Clusters and Health Facilities

The GPS locations of all health facilities were collected in the SPA surveys in both Haiti and Malawi and released without displacement. The DHS and MIS surveys, however, are sample household surveys and the GPS location data of sampled clusters are displaced to protect respondents' confidential data. The displacement of clusters limits our ability to link a cluster to its closest facility because the closest facility identified based on the released geographic data may not actually be the nearest facility in reality; therefore, such linkage is subject to substantial misclassification and errors (Skiles et al. 2013). In this analysis, we linked each cluster to all of the health facilities within a specific distance from the cluster and used data of the linked facilities to create measures of the service environment surrounding the cluster.

The steps to link DHS clusters and SPA facilities are illustrated in Figure 1. First, within a GIS[1], a matrix was created with the direct distance measurement from every DHS cluster location to every health facility. Second, the facility-level variable on service provision, for example, availability of service X and facility's readiness score to provide this service, were linked to each cluster in the "long" table. The distances were operationalized, creating a group of facilities within a 5-kilometer "buffer" distance from an urban cluster and a 10-kilometer "buffer" distance from a rural cluster. These buffer sizes were chosen to ensure that facilities within the same distance from the real location of the cluster were captured (given that urban clusters were displaced up to 2 km and most rural clusters were displaced up to 5 km). Finally, data from the facilities within the buffer were summarized to the cluster level to measure the cluster's service environment within the specific distance. Depending on the health service area, various summary indicators of facility-level data were used to obtain service measurements at the cluster-level. In the example shown in the aggregation table (Figure 1), whether there was at least one facility offering service X within a 10 km buffer from a rural cluster and the median readiness score of facilities within 10 km were used to measure the cluster's access to service X in rural areas.

[1] "Near Table" tool in ArcInfo (ESRI, Redlands, CA)

Figure 1. Illustration of linking DHS clusters and SPA facilities



Facility	A	B	C	D	E
Cluster 1	Y	Y	Y	N	N
Cluster 2	N	N	Y	Y	N

Facility	Has service X	Readiness score (RS)
A	Yes	s1
B	Yes	s2
C	No	s3
D	No	s4
E	Yes	s5

	Link_A	X_A	RS_A	Link_B	X_B	RS_B	Link_C	X_C	RS_C	Link_D	X_D	RS_D	...
Cluster 1	Y	Y	s1	Y	Y	s2	Y	N	s3	N	N	S4	..
Cluster 2	N	Y	s1	N	Y	s2	Y	N	s3	Y	N	s4	...

	Linked to at least one facility with service X available within 10km	Median readiness score among facilities	Number of total facilities linked
Cluster 1	Yes	Median of s1, s2, s3	3
Cluster 2	No	Median of s3 and s4	2

2.3. Definitions of Key Variables

In this section, we describe two groups of key variables for the analysis of each type of health services. The first group is the *outcome variables*, which comprise 1) utilization of a specific service, 2) quality of services received, and 3) specific health outcome (malaria positivity). The second group is the *explanatory variables*, which describe the service environment. These variables measure the availability of specific services and/or facilities' readiness to provide the service within a defined area around each survey cluster. In assessing the service readiness, the WHO Service Availability and Readiness Assessment (SARA) Reference Manual (WHO 2014) is used to guide the selection and definitions of readiness indicators. The service environment variables are measured at the cluster level and are derived from the facility-level data based on the linkage between clusters and facilities.

2.3.1. Family planning

The outcome variable in the FP analysis is women's use of any modern contraceptive method including female sterilization, male sterilization, pill, intrauterine device (IUD), injectables, implants, male condom, and lactational amenorrhea method, and other modern methods. Condom users are excluded from the analysis because the sources of condoms are often beyond the facilities that a SPA survey usually captures. More than 80 percent of male condom users in Haiti reported their most recent source of condoms was pharmacies, shops, or friends/relatives (Cayemittes et al. 2013).

Regarding service provision, we focused on the range of contraceptive method choice at facilities. This was assessed by the number of facilities offering three or more modern methods (excluding condom) within the specific area.

At the facility level, facilities offering FP services were identified by asking the facility manager if the facility provides, prescribes, or counsels on each of a series of modern methods and if the facility has valid products observed on-site (including pills, injectables, implants, and emergency contraception). Thus, for each FP facility the total number of modern methods provided was determined. Again, condoms were excluded.

After linking clusters and FP facilities within a buffer of 5 km around a cluster in metropolitan and other urban areas and a buffer of 10 km around a cluster in rural areas, we counted the number of facilities offering three or more methods and used this number to classify clusters into three groups: low, medium and high level of access to multiple method choices. These three levels of choice were defined by geographic areas because of the varying distribution and number of facilities. In rural and other urban areas, clusters linked to no facilities providing three or more methods within the buffer were classified in the *low-level group*; those linked to one such facility were classified in the *medium-level group*; and the rest, which were linked to more than one facility offering three or more methods, were classified in the *high-level group*. All clusters in the metropolitan area had one or more facilities offering three or more methods within the buffer; therefore, we divided the clusters into low-, medium-, and high-level groups based on the terciles of the numbers of facilities.

2.3.2. Antenatal care

The analysis of ANC focused on the care that women received for their most recent birth in the five years preceding the survey. Two outcomes were examined: having four or more ANC visits and the quality of ANC received during pregnancy. A woman was considered to have high quality ANC if she received 6 out of 8 types of services at least once during pregnancy: weight measured, blood pressure measured, urine sample collected, blood sample collected, iron tested, counseled on pregnancy complications, intestinal parasite treatment, and full tetanus coverage.

The key independent variable is the readiness to provide good quality ANC among the facilities linked to a cluster within the specific distance. Similar to the FP service measurement, the indicator of ANC at the cluster level is the aggregation of the facility-level data after clusters and facilities are linked. First, at the facility level, according to the WHO SARA Reference Manual (WHO 2014), eight readiness indicators were constructed to reflect ANC service readiness in four domains: staff and training, equipment, diagnostic, and medicines and commodities; their definitions are presented in Appendix Table A4. A service readiness score was then created for each facility by giving equal weights to the four domains and equal weights to the indicators within the same domain. If the target readiness score is 100 points for a facility, each domain weighs 25 points and each indicator weighs 25 divided by the number of indicators in the domain. Each facility was assigned the appropriate points based on the presence or availability of each indicator. A facility receives a total score by summing up all indicators. The readiness score is a relative summary indicator of how ready a health facility is to provide good-quality ANC services. A higher score indicates better readiness and a lower score indicates poorer readiness compared with other facilities.

After linking DHS clusters and SPA facilities as described above, the service readiness to provide ANC among facilities around a cluster was measured by the median readiness score of the facilities within the buffer. Given that the readiness score is a relative measurement, we divided the clusters into low-, medium-,

and high-level groups based on the score terciles at the cluster-level. The terciles were also generated separately for the three geographic areas.

2.3.3. Facility delivery

The outcome variable for the analysis on facility delivery is dichotomous, indicating whether or not a woman used a facility for delivery care for the most recent birth in the five years preceding the survey.

In analyzing the service environment, we focused on the availability of normal delivery services, basic emergency obstetric care (BEmOC), and comprehensive emergency obstetric care (CEmOC) at health facilities because of their importance in reducing maternal mortality. As mentioned earlier, only hospitals and health centers with beds that are mandated to provide delivery services were included in the analysis. We first identified facilities that provide normal delivery services based on a question asked of the facility inventory respondent: if the facility provides normal delivery service. Using the latest definitions of emergency obstetric care (WHO et al. 2009), BEmOC is considered available if the facility is able to implement the following six signal functions: administration of antibiotics, administration of uterotonic drugs/oxytoxics, administration of anticonvulsants, manual removal of placenta, assisted vaginal delivery, and removal of retained products. A full package of CEmOC includes all six BEmOC functions plus ability to perform a caesarean section and blood transfusion. Using these criteria, facilities with BEmOC or CEmOC were identified.

After linking clusters and health facilities, two service environment indicators at the cluster level were created—one on the availability of BEmOC and the other one on the availability of CEmOC. For the BEmOC indicator, clusters were categorized into three groups based upon the availability of normal delivery and BEmOC at health facilities within the specific distance from the cluster: 1) clusters linked to no facilities offering normal delivery, 2) clusters linked to a facility offering normal delivery but without BEmOC, and 3) clusters linked to a facility offering both normal delivery and BEmOC. The CEmOC indicator was constructed in a similar way with three categories: 1) clusters linked to no facilities offering normal delivery, 2) clusters linked to a facility offering normal delivery but without CEmOC, and 3) clusters linked to a facility offering both normal delivery and CEmOC.

2.3.4. Child care

Care seeking in health facilities for children's diarrhea is the primary focus of the child care analysis. The outcome is whether the child with diarrhea was taken to a health facility. The denominator for this outcome is children under five who had diarrhea in the two weeks preceding the survey.

In measuring the service environment for providing child health care, we examined the readiness to provide child curative care among the facilities linked to a cluster within the specific distance. The method used to create the readiness measurement for child curative care is similar to that used for ANC. First, among facilities that provide child curative care, a number of indicators representing a facility's readiness to provide child curative care in four domains (staff and training, equipment, diagnostic, and medicines and commodities) were generated according to the WHO SARA Reference Manual (WHO 2014). These indicators and their definitions are presented in Appendix Table A11. With a similar approach to that used to create the ANC readiness score, a score reflecting the relative readiness to provide child curative care services was constructed for each facility.

The facility readiness score was aggregated to the cluster level after the DHS clusters and SPA facilities were linked. The median readiness score of the facilities within the buffer from the cluster was calculated and used to divide clusters into three groups with access to low, medium, and high level of readiness for child curative care based on the score terciles at the cluster-level. The terciles were generated separately for metropolitan, other urban, and rural areas.

2.3.5. HIV testing

In the analysis of HIV testing, we focused on the utilization of HIV testing services, defined as women who were tested for HIV in the 12 months preceding the survey. The denominator of this outcome is all women interviewed.

Regarding the health facilities, among those that reported providing HIV testing and counseling services, each was examined regarding HIV testing capacity and the availability of items to support quality testing and counseling services. A facility is considered to have HIV testing capacity if the facility can conduct the test on-site with RDT kit or ELISA test, with functioning equipment and the reagents needed observed on-site (WHO 2014). Items that support quality HIV testing and counseling services include guidelines for HIV counseling and testing, availability of staff trained in HIV counseling and testing, visual and auditory privacy, and condoms. The selection of these indicators was guided by the WHO SARA Reference Manual (WHO 2014).

We measured clusters' access to HIV testing services with low, medium, and high levels relative to the geographic areas. In rural areas and other urban, a cluster is categorized as having low access to HIV testing services if it is linked to no facilities with HIV testing capacity, medium access if it is linked to a facility with HIV testing capacity but not having all the supportive items, and high access if it is linked to a facility with HIV testing capacity and all the supportive items. In the metropolitan area, all clusters were linked to at least one facility that demonstrated HIV testing capacity and 98 percent were linked to a facility with both HIV testing capacity and all items to support quality HIV testing and counseling services. Therefore, we classified clusters in the metropolitan area into three levels of access by using the terciles of the number of health facilities that provide HIV testing and counseling services.

2.3.6. Malaria-related health services

Three outcomes of malaria prevention and treatment were measured at the population level. The first was intermittent preventive treatment during pregnancy (IPTp2), defined as receipt of at least two doses of sulphadoxine-pyrimethamine (SP) for prevention of malaria, with at least one dose administered at an ANC visit, among interviewed women who had a live birth in the two years preceding the survey. The other two outcomes were measured in children: the coverage of malaria diagnostic testing in children with fever in the two weeks preceding interview; and malaria positivity as measured by microscopy among children age 6-59 months. Information on malaria diagnostic testing is not collected directly through the Malawi MIS questionnaires. Instead, a proxy measure was used—whether a child under five years of age with a fever in the past two weeks had blood taken from a finger- or heel-stick. This information is collected for children of interviewed women. The other child health outcome is malaria parasitemia prevalence as measured via microscopy among all children age 6-59 months from interviewed households in the Malawi MIS.

Health service capabilities related to each of the three outcomes were assessed in health facilities. These include facility's readiness in providing IPTp, malaria diagnostic capacity, and the availability of insecticide-treated mosquito nets (ITNs). A facility was considered to be IPTp-ready if it had SP in stock, guidelines on IPTp, and a staff member trained in IPTp administration in the last 24 months. Malaria

diagnostic capacity refers to a facility having unexpired malaria rapid diagnostics test (RDT) kits in stock, a staff member trained in RDT within the past 24 months, and a malaria RDT protocol available or a functioning microscope with relevant stains and glass slides and a staff member trained in microscopy within the past 24 months. The availability of ITN at health facilities was assessed by asking if ITNs or vouchers for ITNs were available in the facility for distribution to clients on the day of the survey.

The service environment at the cluster level was defined according to the number of health facilities within 10 km in rural areas and 5 km in urban areas that met the criteria of readiness or availability. For example, for the cluster-level service readiness indicator about ITN availability, we counted the number of health facilities within the buffer that had ITNs available and used this number to divide clusters into low (no facility providing ITNs), medium (1-2 facilities providing ITNs), and high (3 or more facilities providing ITNs) level access to facilities with ITNs. Similarly, clusters were also classified into three levels in terms of IPTp readiness and malaria diagnostic capacity. Cutoff values for different levels were determined based on the distribution of the number of health facilities with service ready or available and varied among the indicators and sometimes between urban and rural areas.

2.4. Statistical Analysis

Separate analyses were conducted for Haiti and Malawi. For Haiti, a number of health service areas were studied including family planning, ANC, delivery care, care seeking for children's diarrhea, and HIV testing. We focused on malaria-related services in Malawi because only malaria-related outcome data were collected in the Malawi MIS. The analysis was stratified by urban-rural residence because of substantial differences in the health service environment and in health care seeking behaviors between urban and rural areas. In Haiti, we further separated the Port-au-Prince metropolitan area (Port-au-Prince and urban zones of the Ouest region) from other urban areas because of the substantial differences in the density and types of health facilities[2].

The analysis starts with descriptive statistics in three dimensions. First, at the health facility level, we described the background characteristics of health facilities that provide the service, the availability of services, commodities, or supplies at these facilities. Second, at the cluster level, after linking clusters to health facilities, the service environment indicators were constructed and summarized. Lastly, individual socio-demographic characteristics and other covariates that may be associated with the utilization of health services were described. Bivariate relationships between the individual's utilization of health services and the service environment where they live were examined. We also visualized the relationships by showing selected outcomes of interest at the regional level and relevant facility-level variables on maps for Haiti. The effect of complex sample design was taken into account in the descriptive analysis.

In the multivariable analysis, logistic regressions were used because all the outcome variables are dichotomous. The DHS and MIS data follow a hierarchical structure—that is, individuals are nested within households and households are nested within clusters. Respondents who live in the same cluster may not be independent of one another. Individual-level analysis ignores the nesting of people within clusters, which can result in underestimation of standard errors. Moreover, the outcome variable is at the individual level but the key explanatory variables of most interest—the service environment indicators—are at the cluster level. A multilevel analysis approach is more appropriate to allow for simultaneous investigation of the effects of the group-level and individual-level predictors on individual-level outcomes (Raudenbush and

[2] Seven rural clusters were reallocated to the metropolitan group because they are located on the edge of Port-au-Prince and are linked to a large number of health facilities. Two clusters next to Cap Haitien were reassigned to the "other urban" group for a similar reason.

Bryk 2002). Therefore, we applied multilevel (individual- and cluster-level) random intercept logistic regression models to investigate how the service environment affects the utilization of health services.

In the regression models there were three possible outcomes: utilization of a specific service, receipt of a specific intervention, and a specific health outcome (for example, malaria status in children). The key predictors were level of *access to the service* and level of *readiness to provide the service*, both of which were measured at the cluster level. For each outcome, the regression adjusted for covariates that have been shown in the literature to be associated with the outcome. These typically include age, education, occupation, and household wealth. Other covariates, depending on the type of outcome, were also included. For example, in analyzing women's use of modern contraceptive methods, number of living children and women's exposure to FP messages were included in the regressions. Mother's age at birth and birth order were important covariates and thus controlled for in the analysis of ANC and facility delivery. Number of ANC visits was adjusted for in the regression of facility delivery. In the analysis of HIV testing, in addition to individual socio-demographic variables, we controlled for the variable: having a birth in the 12 months before the interview, because women may have been tested for HIV during ANC visits. In the analysis of malaria parasite prevalence in children, household ownership of an ITN was included because ITNs are protective against malaria. In the analysis of IPTp coverage in women, exposure to malaria messages in the media was included as a covariate in the multivariable models.

3. Results

Results are presented by health service area. In each section, we start with a description of health facilities including background characteristics of health facilities, availability of specific services, commodities, or supplies at health facilities. We then describe indicators of the service environment within the specific buffer around DHS clusters. Lastly, relationships between each outcome and the service environment are presented, controlling for relevant covariates.

3.1. Family Planning

3.1.1. Contraceptive methods choices in family planning facilities

Among the 905 health facilities interviewed in the Haiti SPA, 756 were identified to provide FP services, the majority of which were located in rural areas. Table 1 shows the distribution of the FP facilities in each geographic location by type of facility, managing authority and department. In the metropolitan area, over 60 percent of FP facilities are health centers without beds, while hospitals are 20 percent of the total. In contrast, in rural areas dispensary is the most common type of facility that provides FP services. The composition of FP facilities in other urban areas is more evenly distributed among different facility types. While the majority of FP facilities in rural and other urban are managed by the government or a mixed government and private non-profit managing author, private for-profit FP facilities are more commonly seen in the metropolitan area.

Table 1. Characteristics of health facilities in Haiti that provide family planning services, by residence, Haiti SPA 2013

Characteristics	Metropolitan	Other urban	Rural	Total
Type of facility				
Hospital	20.3	29.3	3.3	11.2
Health center with beds	14.6	22.6	12.0	14.5
Health center without beds	63.4	33.5	22.6	31.4
Dispensary	1.6	14.6	62.1	42.9
Managing authority				
Government	15.4	53.4	45.6	42.2
NGO/private not-for-profit	25.2	9.4	14.7	15.4
Private for-profit	46.3	13.3	17.0	21.0
Mixed	13.0	23.9	22.8	21.4
Department				
Aire metropolitaine/ Reste-Ouest	100.0	13.3	21.9	32.9
Sud-Est	na	6.6	9.5	7.4
Nord	na	15.3	8.9	8.7
Nord-Est	na	3.3	5.8	4.4
Artibonite	na	8.6	19.0	13.9
Centre	na	6.6	5.4	4.7
Sud	na	20.6	6.6	8.3
Grand-Anse	na	10.0	5.0	5.1
Nord-Ouest	na	8.9	14.2	10.8
Nippes	na	6.6	3.9	3.8
Total number of facilities	123	150	483	756

FP facilities in Haiti reported a wide range of modern contraceptive methods, with the most commonly-reported methods being pills, injectables, male condom and implant (Appendix Table A1). Overall, pill, injectables and male condom are provided by 77 percent or more of the facilities. Implant was reported by a considerable proportion of FP facilities (42 percent) in other urban areas, but by a much smaller group of facilities in metropolitan and rural areas. Figures 2a-c show the percentage of facilities that provide at three modern methods by residence, facility type and managing authority. The highest level of availability is in other urban areas: 51 percent of facilities in other urban areas provide at least three methods, followed by the metropolitan area at 28 percent and rural areas at 23 percent. By facility type, the percentage providing three or more methods is highest in hospitals and lowest in dispensaries. A limited proportion (25 percent) of health centers without beds reported to have at least three methods. About one–third of the government FP facilities reported having at least three methods, compared with 20 percent of the private for-profit facilities.

Figure 2a. Percentage of FP facilities providing at least three modern contraceptive methods, by residence, Haiti SPA 2013

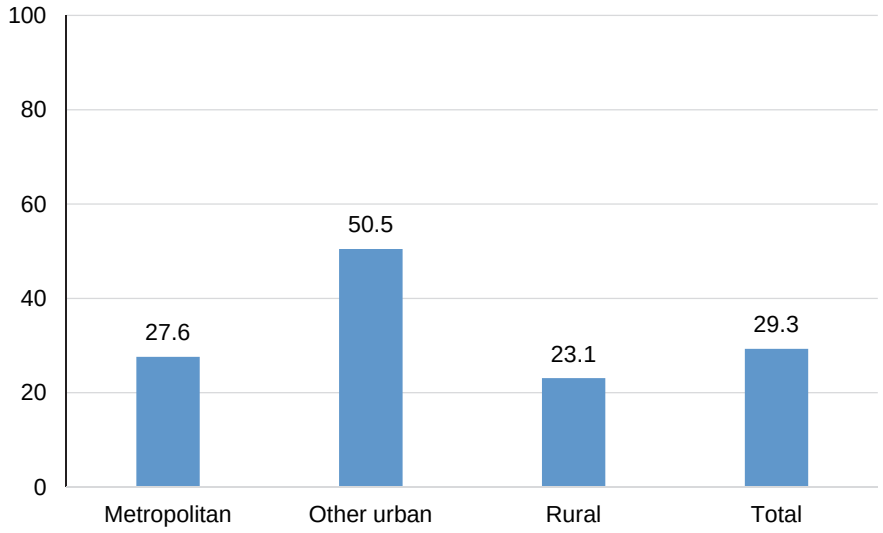


Figure 2b. Percentage of FP facilities providing at least three modern contraceptive methods, by facility type, Haiti SPA 2013

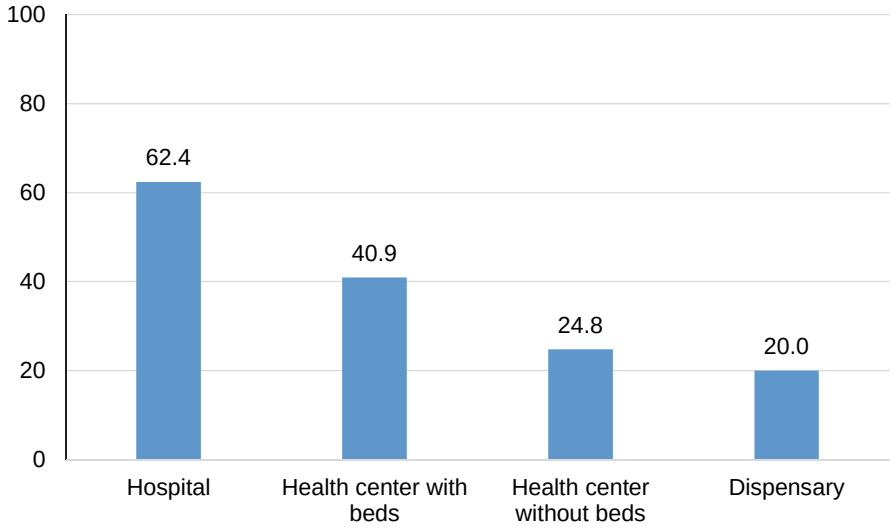
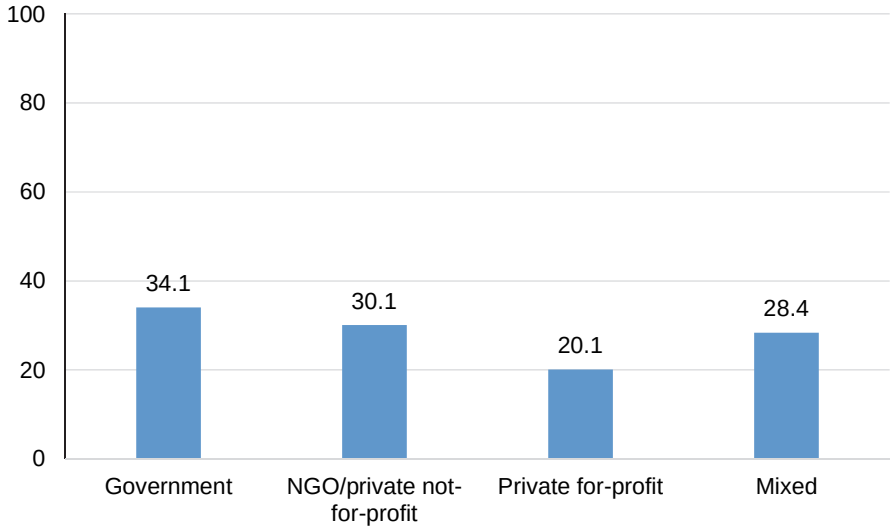


Figure 2c. Percentage of FP facilities providing at least three modern contraceptive methods, by managing authority, Haiti SPA 2013

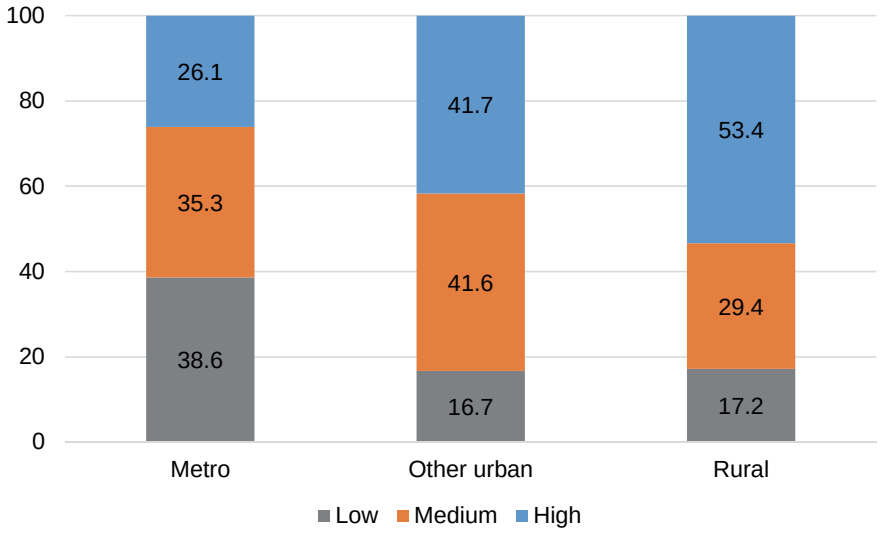


3.1.2. Access to contraceptive method choices in DHS clusters

In the Haiti DHS, after excluding 45 camp clusters and 8 clusters with missing GPS data, 392 clusters remained in the analysis including 66 in metropolitan areas, 85 in other urban, and 241 in rural areas. Among the linked facilities within the buffer, we counted the number of facilities that provide at least three methods and used this number to categorize clusters. Figure 3 shows the distribution of clusters by the level of access. In rural areas, 17 percent of the clusters have low level of method choices, meaning no facility with 10 km from the cluster offers at least three modern methods, 29 percent and 53 percent have medium and high level of choice, respectively. Out of the 85 clusters in other urban areas, 42 percent of the clusters have high level of choice, i.e. linked to two to five facilities that reported availability of at least three

methods. All clusters in metropolitan areas have at least one (up to 21) facilities offering three or more methods within 10 km; therefore, we divided the clusters into low, medium, and high levels of choice of access based on the terciles of the number of facilities.

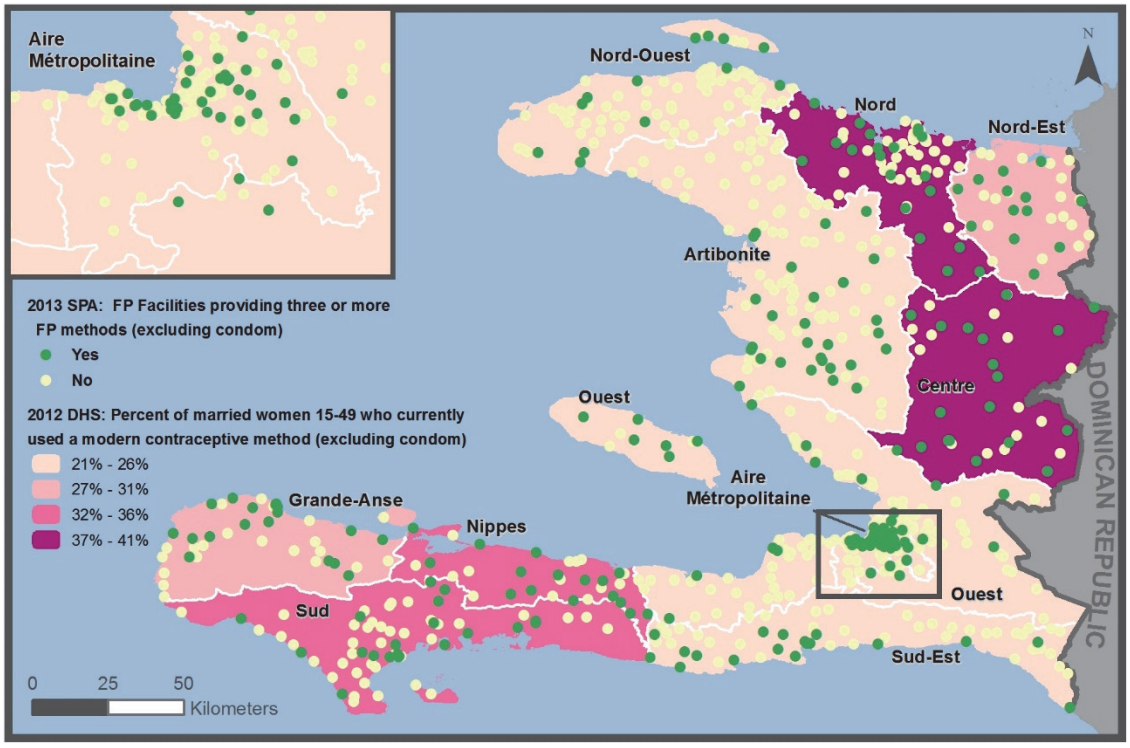
Figure 3. Percent distribution of DHS clusters in Haiti by level of access to facilities with three or more methods and residence



3.1.3. Modern contraceptive use and its association with the FP service environment

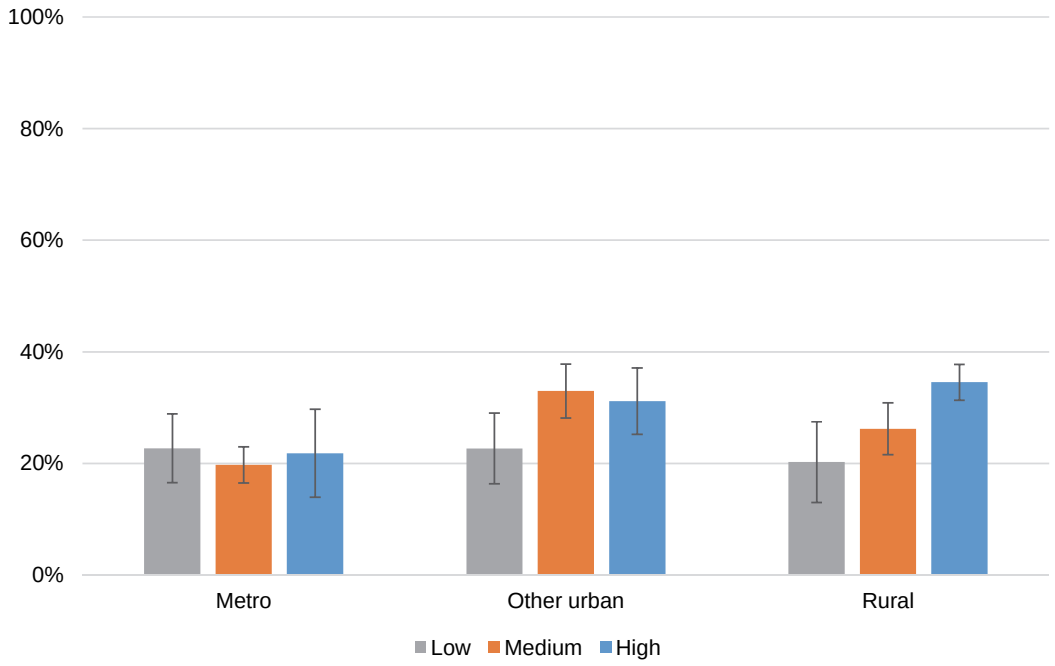
Overall, 7,339 married women were analyzed for their use of modern contraception. Background characteristics of these women in each geographic location are shown in Appendix Table A2. Modern contraceptive prevalence rate (except condom use) ranges from 22 percent in the metropolitan area to 30 percent in rural and other urban areas. Figure 4 visualizes the bivariate relationship between the location of FP facilities with at least three family planning methods (excluding condom) available (green dots) and percent of married women 15-49, by department, who are currently using a modern contraceptive method (excluding condom) ranging from low (light pink) to higher (dark pink). Overall, areas with more facilities providing three or more methods (higher density of dark green dots) coincide with areas where there are a higher percentage of women using modern contraception (dark pink departments).

Figure 4. Map of bivariate relationship between the location of FP facilities in Haiti with at least three modern family planning methods and percentage of married women age 15-49 who are currently using a modern contraceptive method by department, Haiti DHS 2012 and Haiti SPA 2013



Specifically, Figure 5 highlights the bivariate relationship between women's use of modern contraception and the level of access to multiple FP methods. In rural areas, modern contraceptive use increases with the level of access to modern methods. Among women who lived in areas with high level of access to multiple method choices, 35 percent reported current use of a modern contraception, while among those who were from clusters in which no facility within the service environment offered three or more methods, only 20 percent used a modern method. In other urban areas, the medium and high-level groups show high use of contraception than the low-level group. The bivariate relationship between modern contraceptive use and the level of access to methods is not obvious in the metropolitan area. The bivariate associations between contraceptive use and other covariates are presented in Appendix Table A3.

Figure 5. Women's use of modern contraceptive methods in Haiti by level of access to FP facilities with 3+ methods and residence



Using multilevel, multivariable logistic regression models, we assessed how women's contraceptive use is associated with the level of method choice within the service environment. We ran a multilevel model for each of the three geographic areas. Table 2 presents odds ratios and 95% confidence intervals for the level of access to contraceptive methods as well as for the covariates adjusted for in the models. In rural areas the level of method choice is positively and significantly associated with women's use of modern contraception after controlling for women's characteristics. Compared with the women who lived in a cluster with low level of access to multiple methods, the odds of using a modern contraceptive method is 73 percent higher for women from a cluster with medium level of access, and over two times higher for those from a community with high level of access. A similar positive relationship is also found in other urban areas. However, in the metropolitan area we found no significant association between women's use of modern contraception and their communities' access to facilities that provided three or more contraceptive methods. Among women's individual characteristics, woman's age, the number of living children she had, and her contact with FP provider are consistently associated with her use of contraception in all geographic areas. Household wealth and household wealth do not seem to be important predictors of contraceptive use.

Table 2. Results of multivariable logistic regressions of use of modern contraceptive methods among married women age 15-49 in Haiti, by residence

	Metropolitan		Other urban		Rural	
Variables	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Level of access to FP methods						
Low	1.00		1.00		1.00	
Medium	0.84	0.54 - 1.30	1.77**	1.19 - 2.63	1.73**	1.23 - 2.45
High	0.91	0.56 - 1.46	2.01**	1.33 - 3.05	2.23***	1.61 - 3.09
Age						
15-24	1.00		1.00		1.00	
25-34	0.84	0.55 - 1.30	0.78	0.54 - 1.13	1.04	0.83 - 1.31
35-44	0.33***	0.19 - 0.58	0.52**	0.33 - 0.81	0.81	0.61 - 1.06
45-49	0.22***	0.10 - 0.50	0.25***	0.13 - 0.47	0.29***	0.20 - 0.42
Number of living kids						
0-1	1.00		1.00		1.00	
2-3	2.99***	2.05 - 4.37	2.10***	1.54 - 2.86	2.70***	2.15 - 3.38
4-5	2.96***	1.66 - 5.26	1.78**	1.15 - 2.75	3.32***	2.52 - 4.37
6+	1.92	0.68 - 5.47	2.27**	1.23 - 4.20	3.19***	2.32 - 4.38
Education						
None	1.00		1.00		1.00	
Primary	1.54	0.86 - 2.74	1.08	0.71 - 1.64	1.09	0.91 - 1.31
Secondary or higher	1.71	0.93 - 3.12	1.02	0.65 - 1.61	1.13	0.87 - 1.46
Occupation						
Unemployed	1.00		1.00		1.00	
Agriculture	2.30*	1.14 - 4.65	1.07	0.57 - 2.02	1.27	0.98 - 1.63
Professional	1.17	0.83 - 1.66	1.23	0.93 - 1.63	1.28**	1.08 - 1.52
Other	0.56	0.26 - 1.21	1.76	0.97 - 3.18	1.17	0.67 - 2.04
Wealth Quintile						
Lowest	na		na		1.00	
Second	na		na		0.93	0.78 - 1.11
Middle	na		na		1.01	0.80 - 1.29
Lowest-Middle	1.00		1.00		na	
Fourth	1.05	0.63 - 1.74	0.86	0.63 - 1.18	1.22	0.83 - 1.79
Highest	0.71	0.41 - 1.22	0.64*	0.43 - 0.93	0.77	0.40 - 1.46
Religion						
Catholics	1.00		1.00		1.00	
Protestant	1.04	0.75 - 1.44	0.79	0.61 - 1.02	0.78**	0.67 - 0.92
Vaudousant/other	1.36	0.76 - 2.42	0.58	0.32 - 1.05	0.94	0.70 - 1.25
Exposure to FP messages						
No exposure	1.00		1.00		1.00	
Weekly or more	0.86	0.62 - 1.19	0.91	0.71 - 1.17	1.03	0.88 - 1.20
Contact with FP provider						
No	1.00		1.00		1.00	
Yes	2.29***	1.61 - 3.26	1.89***	1.45 - 2.46	1.82***	1.55 - 2.13
Number of women	1181		1402		4079	
Number of clusters	66		85		241	

***p<0.001 **p<0.01 *p<0.05

3.2. Antenatal Care

3.2.1. Antenatal care service readiness at health facilities

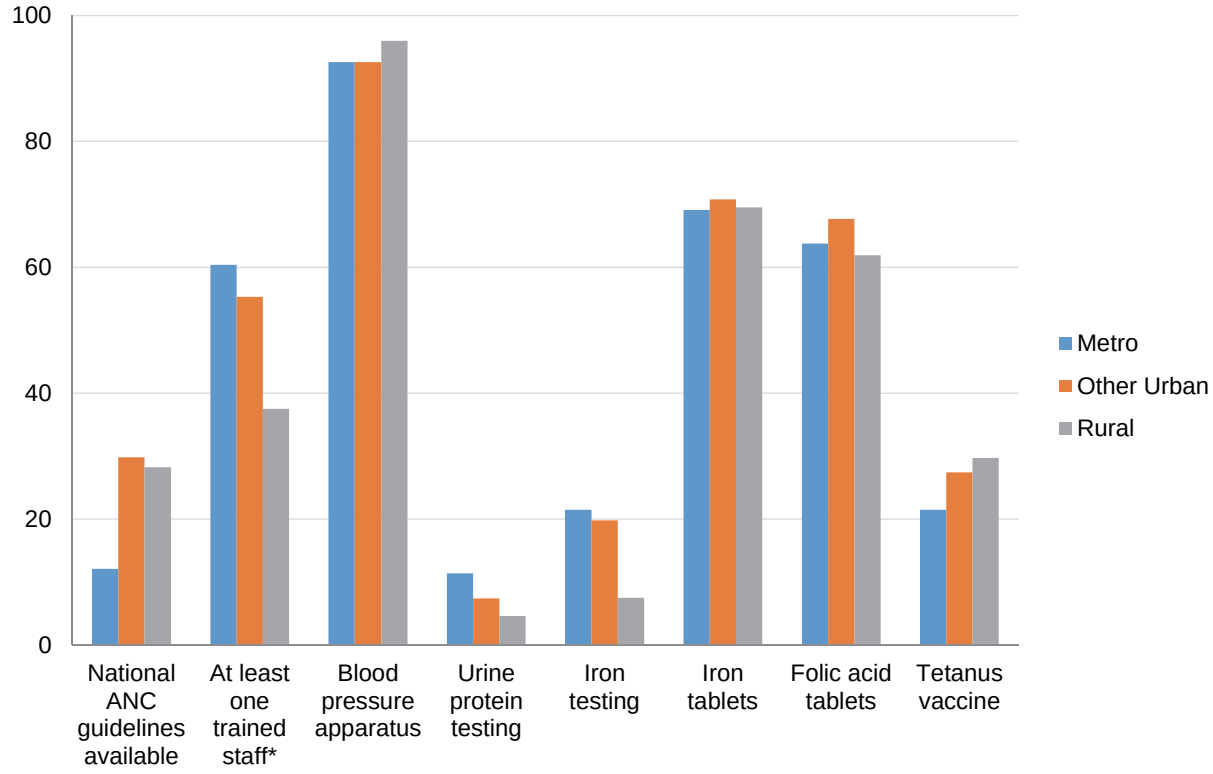
Table 3 shows the distribution of the ANC facilities in Haiti in each geographic location by type of facility, managing authority and department. There are 832 facilities that provide ANC services, the majority (63 percent) of which are located in rural areas (Table 3). Most often the government is the managing authority in other urban and rural areas, while close to half of the ANC facilities in the metropolitan area are private for-profit. Dispensaries account for almost 60 percent of facilities in rural areas, yet they represent only 4 percent of the facilities in the metropolitan area.

Figure 6 shows the indictors used to create the ANC service readiness score by metropolitan, other urban, and rural areas. The difference in indicators by residence is minimal. The largest disparity is in the availability of a staff member trained in ANC; 60 percent of facilities in the metropolitan area have at least one staff providing ANC services trained in some aspects of ANC in the last two years, while less than 40 percent in rural areas have at least one. The service readiness indicators are similar between facility types (Appendix Table A4), with the largest discrepancy again being in trained staff. Only 27 percent of all dispensaries have at least one trained staff available.

Table 3. Characteristics of health facilities in Haiti that provide antenatal care services, by residence, Haiti SPA 2013

Characteristics	Metropolitan	Other Urban	Rural	Total
Type of facility				
Hospital	21.5	29.8	4.2	12.2
Health center with beds	11.4	23.6	13.4	15.0
Health center without beds	63.1	31.8	23.8	32.4
Dispensary	4.0	14.9	58.6	40.4
Managing authority				
Government	14.1	50.4	43.7	39.7
NGO/private not-for-profit	26.8	10.5	15.9	16.8
Private for-profit	46.3	14.9	17.8	22.3
Mixed	12.8	24.2	22.6	21.1
Department				
Aire metropolitaine/				
Reste-Ouest	100.0	13.0	24.3	35.6
Sud-Est	na	8.1	9.6	7.6
Nord	na	18.0	8.8	9.0
Nord-Est	na	3.1	5.5	4.1
Artibonite	na	8.7	18.0	13.0
Centre	na	6.8	6.3	5.3
Sud	na	18.6	6.1	7.4
Grand-Anse	na	9.3	4.8	4.8
Nord-Ouest	na	7.6	13.3	9.8
Nippes	na	6.8	3.4	3.5
Total number of facilities	149	161	522	832

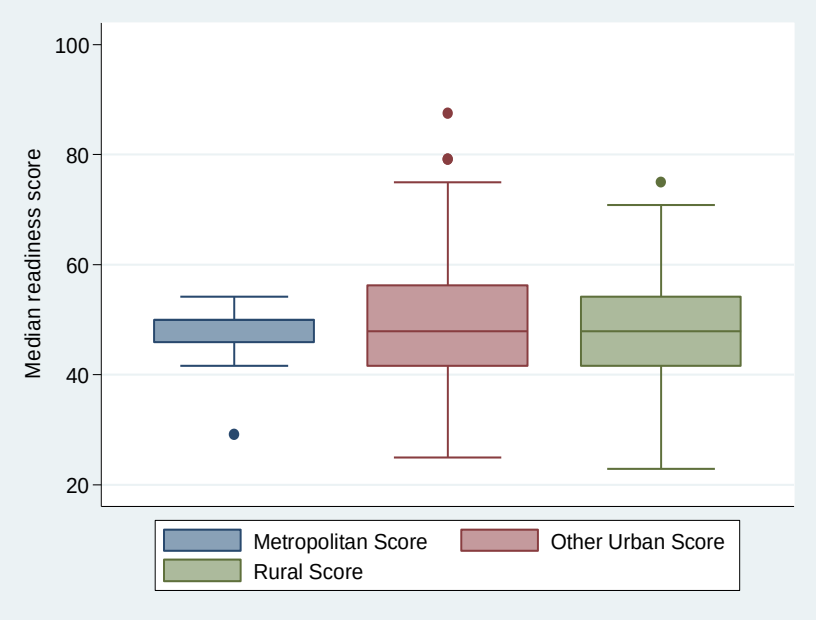
Figure 6. Percentage of ANC facilities with specific items for supporting ANC services by residence, Haiti SPA 2013



3.2.2. Access to ANC facilities and service readiness in DHS clusters

Based on geographic location, clusters were linked to between three to 89 health facilities in the metropolitan area, one to twenty in other urban, and one to 22 in rural areas. The ANC service environment measure was created from the median of all facility readiness scores within the specified cluster's service environment. Figure 7 shows the range, median, and outliers of readiness scores among DHS clusters by residence. The median score is very similar across all residence areas; however, the distribution of the score is much narrower in the metropolitan area compared to other urban and rural, which have a much broader range of scores. The distributions in rural and other urban areas are similar.

Figure 7. Boxplots of ANC readiness scores among clusters, by residence, Haiti SPA 2013

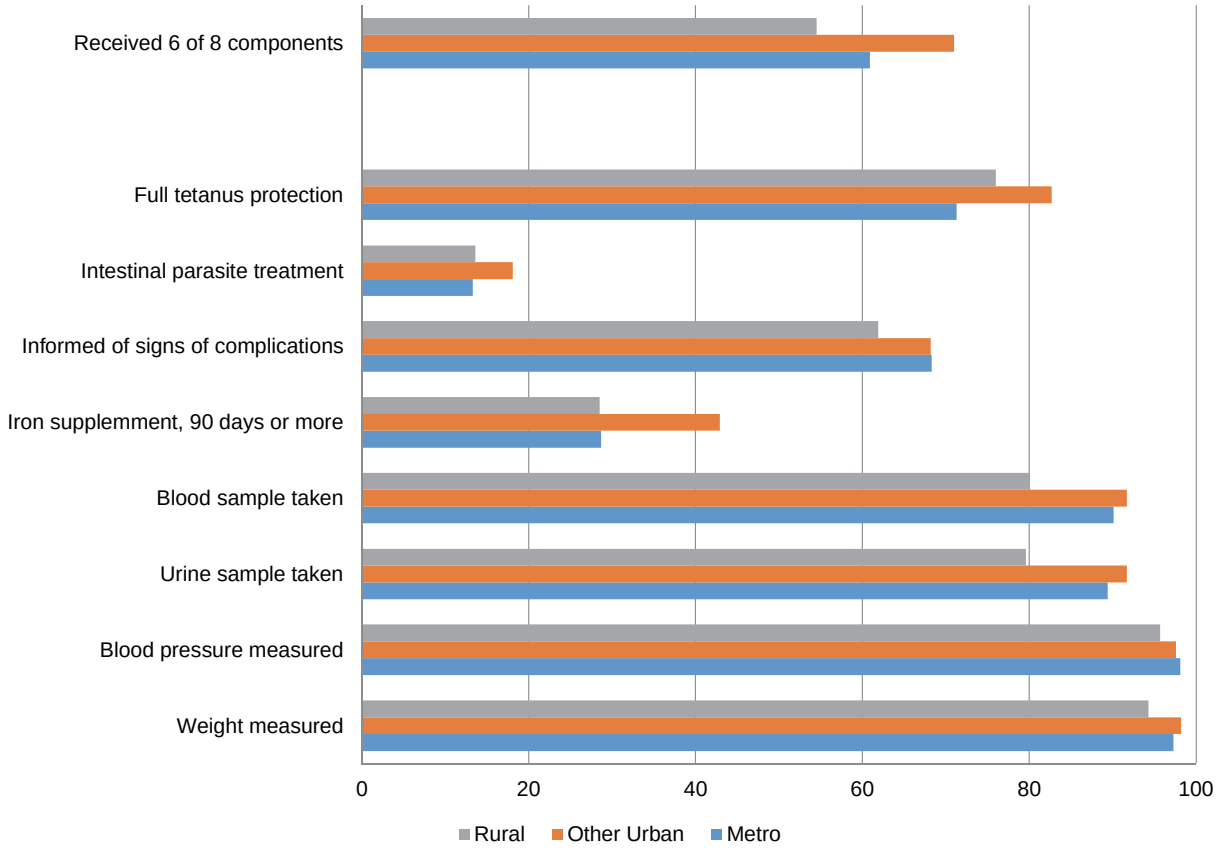


3.2.3. Recommended levels of ANC services that women received and determinants

Among all women surveyed in the 2012 Haiti DHS, 4,921 gave birth in the five years preceding the survey. Appendix Table A5 shows the background characteristics of these women. The majority of women reside in rural areas (59 percent), followed by the metropolitan area (25 percent), and then other urban areas (17 percent). Of the women in the metropolitan area, 70 percent reside in a service environment with medium or high-level access to facilities with ANC readiness. In other urban areas, 64 percent reside in the same service environment. In rural areas, 62 percent of women have a medium or high level ANC service environment. Both outcomes, having four or more ANC visits during their last pregnancy and having high quality ANC, are more prevalent among women from urban areas compared to those from rural areas.

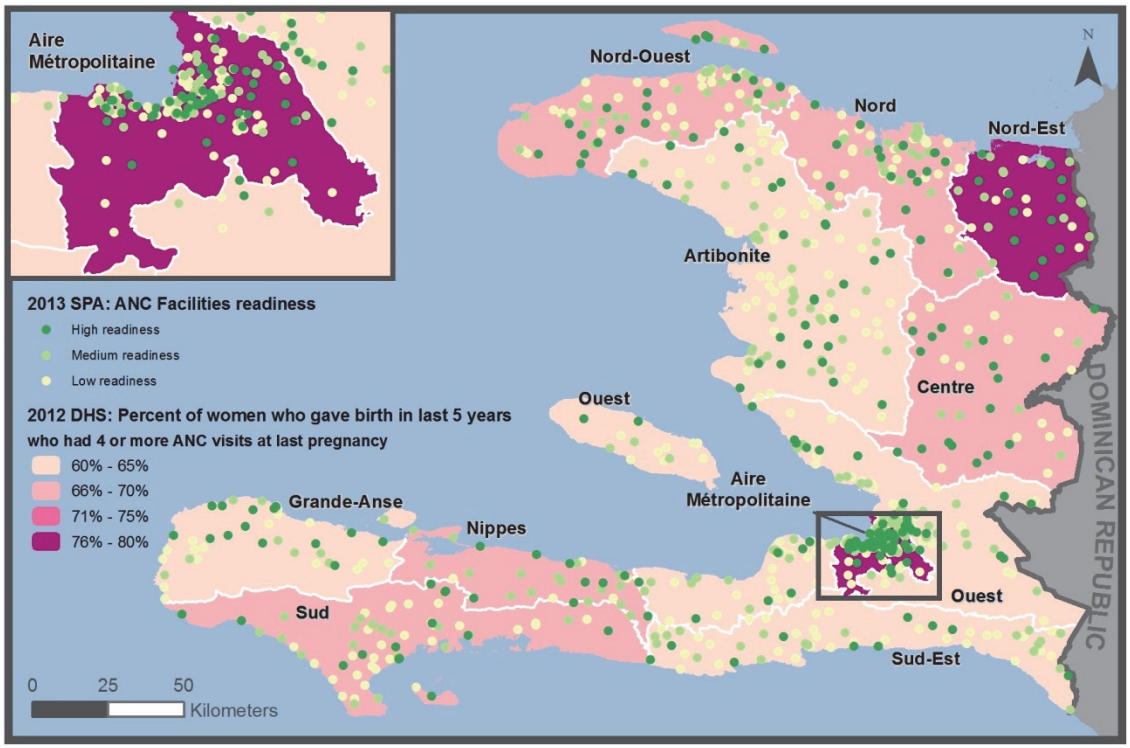
High quality ANC was defined as having any six out of eight of the following: weight measured, blood pressure measured, urine sample taken, blood sample taken, 90 days of iron supplementation, tetanus vaccine given, informed of signs of complications, intestinal parasites treatment given during pregnancy. Figure 8 shows there does not appear to be a large disparity in the receipt of individual components of ANC care across residence areas. While some components are widely received across all localities, for example weight and blood pressure measurements; others are less prevalent, like parasite treatment, in all three areas. The exception is receipt of the full 90-day iron supplementation: there is a noticeably higher prevalence of iron supplementation in other urban areas compared with both rural and metropolitan areas.

Figure 8. Percentage of women age 15-49 who received selected components of ANC, by residence, Haiti DHS 2012



The relationship between facility service readiness to provide ANC services and the use of ANC services by department is illustrated in Figure 9. Service readiness of facilities is represented by green dots, range from low readiness (light green) to high readiness (dark green). The percentage of women who gave birth in last five years who had 4 or more ANC visits at last pregnancy by department ranges from low (light pink) to high (dark pink). The Aire Metropolitaine and Nord-Est have the highest density of dark green dots (high readiness) as well as the departments with the highest percentage of women having 4 or more visits (dark pink), though many of the other departments have fairly high density of medium and high readiness among their facilities.

Figure 9. Map of bivariate relationship between facility service readiness to provide ANC services in Haiti and women's receipt of 4 ANC visits, by department, Haiti DHS 2012 and Haiti SPA 2013



Figures 10 and 11 show women's receipt of four or more ANC visits and high quality ANC, by level of ANC service readiness within the service environment. In rural areas for both outcomes, it appears a higher proportion of women in areas with better ANC service readiness received the recommended ANC services. The relationship, however, is not obvious in metropolitan and other urban areas. Appendix Tables A6 and A7 show the bivariate relationships between women's background characteristics and the two ANC outcomes.

Figure 10. Percentage of women in Haiti with 4 or more ANC visits by level of service readiness and residence

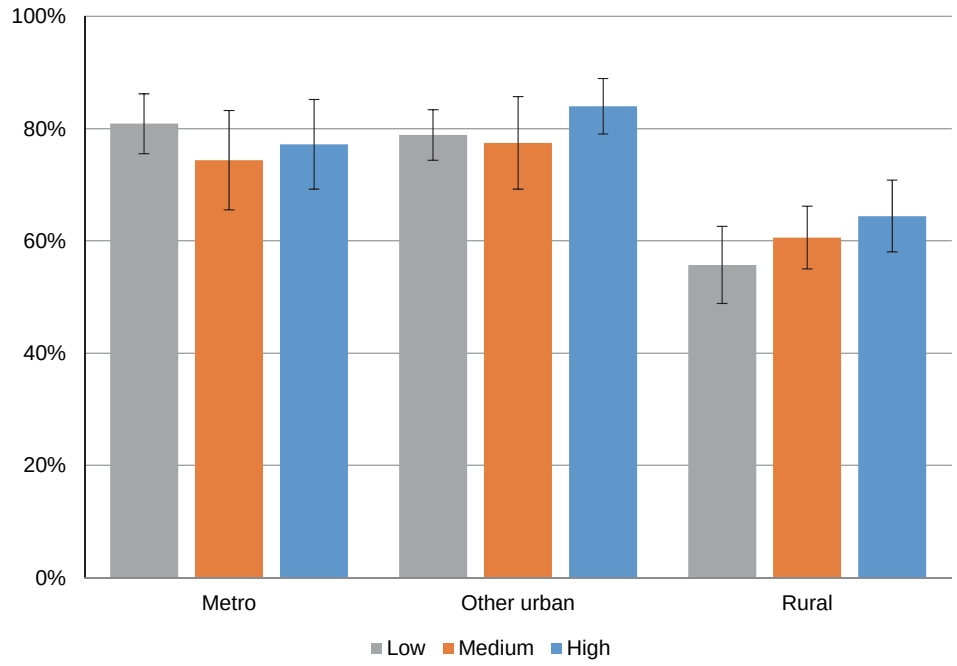
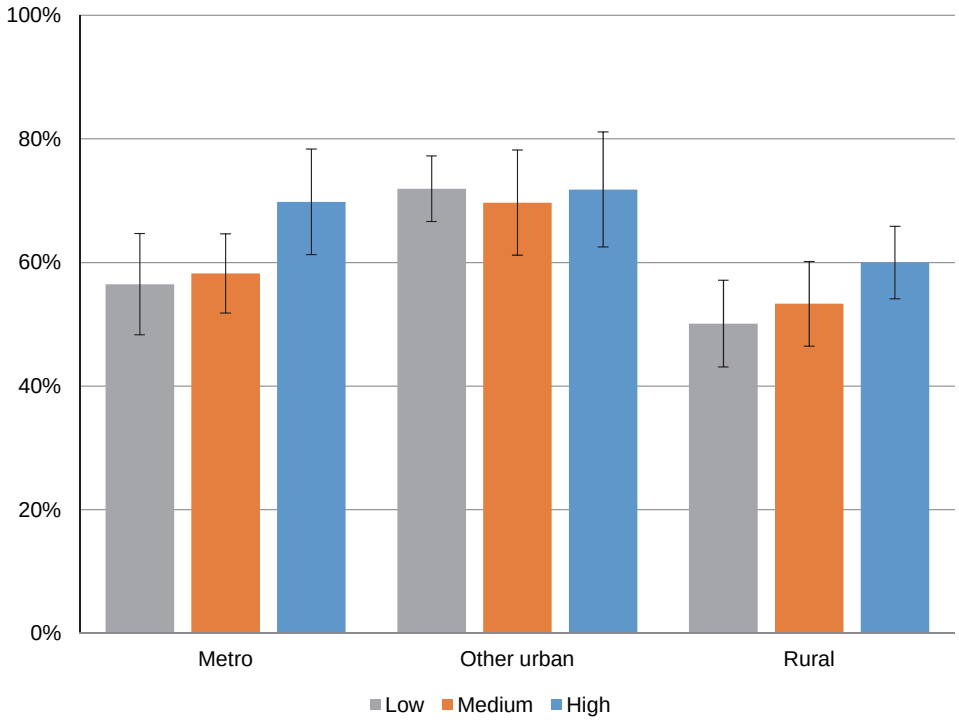


Figure 11. Percentage of women in Haiti who received high quality ANC by level of service readiness and residence



These two variables, four or more ANC visits and high quality of ANC care, were used as outcomes in logistic regression models to test the association between the respective outcome and service readiness environments while controlling for other covariates. Separate models were fitted for metropolitan, other urban, and rural areas for each outcome. As seen in Table 4, having a higher quality service environment was associated with having four or more ANC visits in rural and other urban areas. In rural areas, women in clusters with facilities with a high readiness score have almost two times the odds (OR=1.99, 95% CI=1.480–2.668) of having four or more ANC visits compared to women in clusters with facilities with a low readiness score. In other urban areas, women in clusters with high-level service environment had 68 percent higher odds (OR=1.68, 95% CI=1.041–2.710) of having had four or more ANC visits, compared to women in clusters with low-scoring facilities. Service readiness was not significantly associated with having four or more visits in the metropolitan area. Other covariates including woman's age at birth, birth order, household wealth, and mass media exposure were also found to be significant predictors of receiving 4 or more ANC visits and the associations are in the expected direction.

Table 4. Results of multivariable logistic regressions of having 4 or more ANC visits among women in Haiti who had a live birth in the five years preceding the survey, by residence

	Metro		Other Urban		Rural	
Variables	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Facility service readiness						
Low	1.00		1.00		1.00	
Medium	0.71	0.42 - 1.19	1.09	0.70 - 1.70	1.26	0.94 - 1.69
High	0.77	0.43 - 1.40	1.68*	1.04 - 2.71	1.987***	1.48 - 2.67
Maternal age at first birth						
<20	1.00		1.00		1.00	
20-34	2.92***	1.67 - 5.10	2.26**	1.26 - 4.04	1.84***	1.39 - 2.43
35-49	3.57**	1.60 - 7.95	1.93	0.87 - 4.27	1.88**	1.29 - 2.74
Birth Order						
1	1.00		1.00		1.00	
2-3	0.49**	0.30 - 0.82	0.62	0.37 - 1.03	0.67**	0.52 - 0.85
4-5	0.43*	0.22 - 0.85	0.47*	0.26 - 0.88	0.70*	0.52 - 0.94
6+	0.20***	0.08 - 0.46	0.78	0.34 - 1.76	0.60**	0.42 - 0.85
Education						
None	1.00		1.00		1.00	
Primary	1.08	0.58 - 2.03	1.62	0.93 - 2.81	1.34**	1.09 - 1.65
Secondary or higher	1.65	0.83 - 3.27	2.90***	1.57 - 5.36	2.24***	1.67 - 3.01
Occupation						
Not Employed	1.00		1.00		1.00	
Agriculture	0.96	0.34 - 2.68	0.65	0.26 - 1.61	0.94	0.71 - 1.24
Professional	1.25	0.82 - 1.90	1.17	0.80 - 1.71	1.44***	1.20 - 1.74
Other	0.79	0.38 - 1.67	0.68	0.32 - 1.46	0.78	0.44 - 1.36
Wealth quintile						
Lowest	na		na		1.00	
Second	na		na		1.10	0.91 - 1.33
Middle	na		na		1.87***	1.41 - 2.47
Lowest-Middle	1.00		1.00		na	
Fourth	1.27	0.73 - 2.21	1.44	0.98 - 2.13	2.83***	1.61 - 4.94
Highest	2.78**	1.44 - 5.36	3.48***	1.94 - 6.24	1.95	0.73 - 5.23

(Continued)

Table 4. – *Continued*

Variables	Metro		Other Urban		Rural	
	OR	95%CI	OR	95%CI	OR	95%CI
Religion						
Catholics	1.00				1.00	
Protestant	0.97	0.64 - 1.48	1.12	0.77 - 1.63	1.08	0.90 - 1.29
Vaudousant/other	0.41**	0.22 - 0.76	0.47*	0.26 - 0.85	0.89	0.64 - 1.22
Exposure to media						
Less than one time per week						
Weekly or more	1.22	0.70 - 2.12	1.51*	1.02 - 2.23	1.54***	1.29 - 1.83
Number of women	746		952		3087	
Number of clusters	66		85		241	

***p<0.001 **p<0.01 *p<0.05

Associations with quality of ANC are presented in Table 5. Here, only the rural model showed that women in clusters with a high level service environment were significantly associated with having high quality ANC care (OR=1.84, CI=1.344–2.508) compared to women in a low level service environment. Service environment was not significantly associated with high quality ANC in other urban or metro areas. Household wealth and women's education seem to be more important for women receiving high quality of ANC service in rural and other urban areas than in the metropolitan area.

Table 5. Results of multivariable logistic regressions of receiving high quality ANC[1] among women in Haiti who had a live birth in the five years preceding the survey, by residence

Variables	Metro		Other Urban		Rural	
	OR	95%CI	OR	95%CI	OR	95%CI
Facility service readiness						
Low	1.00		1.00		1.00	
Medium	1.17	0.78 - 1.79	1.10	0.66 - 1.82	1.21	0.88 - 1.67
High	1.57	0.95 - 2.58	1.22	0.73 - 2.05	1.84***	1.34 - 2.51
Maternal age at first birth						
<20	1.00		1.00		1.00	
20-34	2.06**	1.27 - 3.35	1.33	0.79 - 2.23	1.27	0.95 - 1.69
35-49	2.40*	1.20 - 4.78	1.96	0.94 - 4.12	1.40	0.94 - 2.07
Birth order						
1	1.00		1.00		1.00	
2-3	0.79	0.54 - 1.16	0.99	0.65 - 1.50	1.03	0.81- 1.32
4-5	1.26	0.70 - 2.29	0.50*	0.29 - 0.86	0.97	0.72 - 1.30
6+	0.96	0.40 - 2.31	0.86	0.40 - 1.85	0.93	0.65 - 1.32
Education						
None	1.00		1.00		1.00	
Primary	1.29	0.68 - 2.48	1.33	0.73- 2.43	1.40**	1.12 - 1.74
Secondary or higher	1.42	0.73 - 2.76	2.16*	1.14 - 4.07	2.33***	1.73 - 3.16
Occupation						
Catholics	1.00		1.00		1.00	
Agriculture	1.91	0.82- 4.46	0.89	0.37 - 2.10	1.04	0.77 - 1.41
Professional	1.26	0.89 - 1.79	1.78**	1.25 - 2.53	1.29**	1.07 - 1.56
Other	0.86	0.46 - 1.63	1.17	0.56 - 2.41	0.72	0.40 - 1.30

(Continued)

Table 5. – *Continued*

	Metro		Other Urban		Rural	
Variables	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Wealth quintile						
Lowest	na		na		1.00	
Second	na		na		0.96	0.78 - 1.17
Middle	na		na		1.30	0.98 - 1.72
Lowest-Middle	1.00		1.00		1.00	
Fourth	1.46	0.84 - 2.52	1.52*	1.03 - 2.27	2.52***	1.52 - 4.17
Highest	1.12	0.62 - 2.03	1.87*	1.14 - 3.08	2.02	0.83 - 4.95
Religion						
Catholics	1.00		1.00		1.00	
Protestant	0.92	0.65 - 1.30	1.07	0.76 - 1.50	0.92	0.77 - 1.11
Vaudousant/other	0.56	0.31 - 1.00	0.48*	0.26 - 0.89	0.92	0.65 - 1.29
Exposure to media						
No exposure	1.00		1.00		1.00	
Weekly or more	1.30	0.77 - 2.20	1.21	0.80 - 1.81	1.10	0.92 - 1.33
Number of women	703		916		2733	
Number of clusters	66		85		241	

[1] High quality ANC is defined as having any 6 out of 8 of the following: weight measured, blood pressure measured, urine sample taken, blood sample taken, iron supplementation, tetanus vaccine given, informed of signs of complications, intestinal parasites treatment given during pregnancy.

***p<0.001 **p<0.01 *p<0.05

3.3. Facility Delivery

3.3.1. Availability of basic and comprehensive emergency obstetric care at health facilities

We examined all hospitals and health centers with beds in Haiti that provide normal delivery services. Of the 195 facilities, 61 offer basic emergency obstetric care (BEmOC) and 36 of these offer comprehensive emergency obstetric care (CEmOC). Of the 36 CEmOC facilities, 8 are located in the metropolitan area, 23 are in other urban areas, and 5 are in rural areas. Table 6 provides information on the distribution of these facilities by background characteristics, and Appendix Table A8 provides additional information on the distribution of the key functions included in BEmOC and CEmOC.

Table 6. Characteristics of all health facilities in Haiti with normal delivery services, facilities with BEmOC services, and facilities with CEmOC services, by residence, Haiti SPA 2013

	Facilities with normal delivery services				BEmOC Facilities				CEmOC Facilities			
Characteristics	Metro	Other Urban	Rural	Total	Metro	Other Urban	Rural	Total	Metro	Other Urban	Rural	Total
Type of facility												
Hospital	74.4	57.3	24.3	48.2	83.3	73.7	36.4	68.9	87.5	87.0	60.0	83.3
Health center with bed	25.6	42.7	75.7	51.8	16.7	26.3	63.6	31.1	12.5	13.0	40.0	16.7
Managing authority												
Government/public	17.9	62.2	35.1	43.1	50.0	71.1	36.4	60.7	50.0	60.9	20.0	52.8
NGO/ Private not for profit	23.1	7.3	16.2	13.8	33.3	7.9	27.3	16.4	25.0	8.7	40.0	16.7
Private for profit	56.4	12.2	25.7	26.2	16.7	7.9	18.2	11.5	25.0	13.0	20.0	16.7
Mission/ faith-based	2.6	18.3	23	16.9	0.0	13.2	18.2	11.5	0.0	17.4	20.0	13.9
Department												
Aire metropolitaine/ Reste-Ouest	100.0	13.4	28.4	36.4	100.0	7.9	36.4	31.1	100.0	8.7	40.0	33.3
Sud-Est	na	6.1	2.7	3.6	na	5.3	0.0	3.3	na	8.7	0.0	5.6
Nord	na	15.9	10.8	10.8	na	13.2	18.2	11.5	na	8.7	0.0	5.6
Nord-Est	na	4.9	8.1	5.1	na	7.9	0.0	4.9	na	4.3	0.0	2.8
Artibonite	na	12.2	20.3	12.8	na	26.3	9.1	18.0	na	21.7	0.0	13.9
Centre	na	9.8	10.8	8.2	na	7.9	18.2	8.2	na	13.0	40.0	13.9
Sud	na	13.4	4.1	7.2	na	10.5	0.0	6.6	na	13.0	0.0	8.3
Grand-Anse	na	7.3	2.7	4.1	na	7.9	18.2	8.2	na	4.3	20.0	5.6
Nord-Ouest	na	9.8	8.1	7.2	na	10.5	0.0	6.6	na	13.0	0.0	8.3
Nippes	na	7.3	4.1	4.6	na	2.6	0.0	1.6	na	4.3	0.0	2.8
Total number of facilities	39	82	74	195	12	38	11	61	8	23	5	36

Among the 195 facilities, 43 percent are government/public-run, 26 percent are private for-profit, and the remainder are mission/faith based (17 percent) and NGO/private not for profit (14 percent). Overall hospitals and health centers each account for half the facilities; but most facilities offering normal delivery services in the metropolitan area are hospitals and most are health centers in rural areas. The majority of BEmOC and CEmOC facilities in Haiti are hospitals (69 percent and 83 percent, respectively) and most are public/government run (61 percent and 53 percent, respectively), although as Table 6 shows, these distributions vary across metropolitan, other urban and rural areas.

In the metropolitan area, 31 percent of facilities with normal delivery services offer BEmOC and 21 percent offer CEmOC services (see Figure 12a). In other urban areas, 46 percent offer BEmOC and 28 percent offer CEmOC services. Availability of emergency care is lowest in rural areas, where just 15 percent of facilities with normal delivery care offer BEmOC and 7 percent provide CEmOC services. Figures 12b and 12c highlight the availability of BEmOC and CEmOC services by the type of facility and the managing authority. BEmOC and CEmOC availability is most common in hospitals and in government/public and NGO/private not for profit facilities.

Figure 12a. Among facilities that offer normal delivery services, the percentage that provide BEmOC and CEmOC, by residence, Haiti SPA 2013

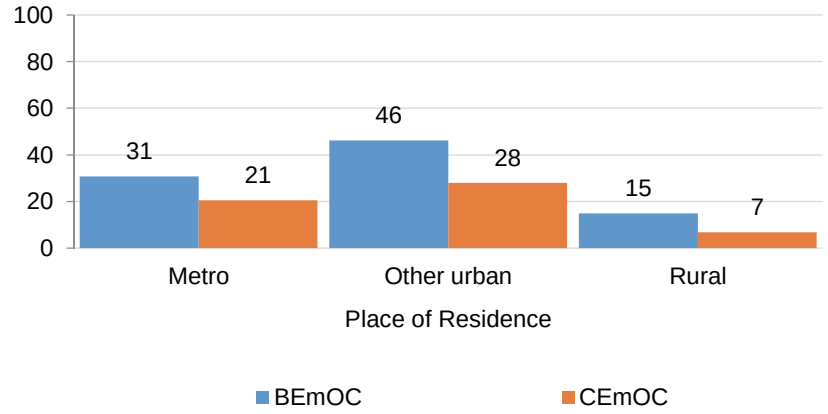


Figure 12b. Among facilities that offer normal delivery services, the percentage that provide BEmOC and CEmOC, by type of facility, Haiti SPA 2013

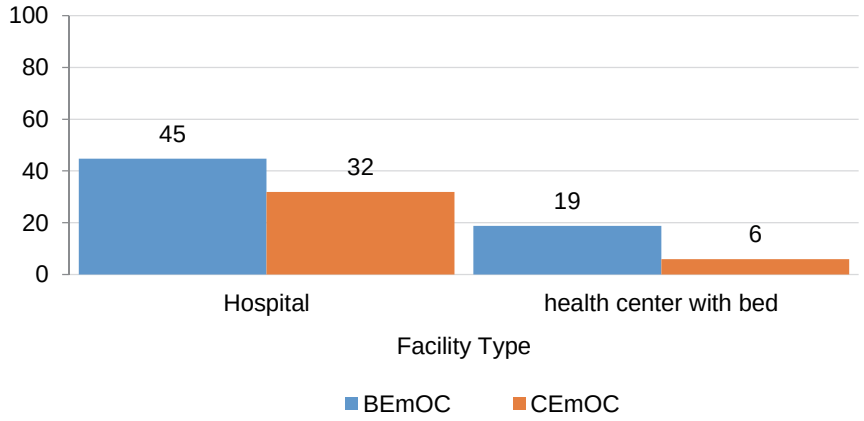
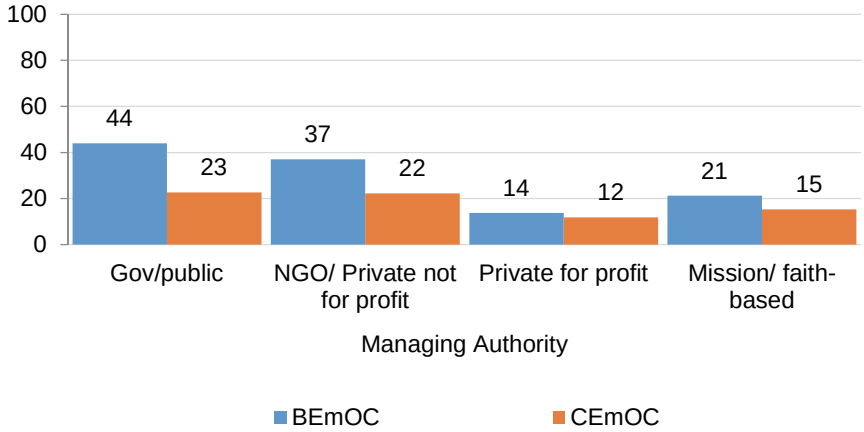


Figure 12c. Among facilities that offer normal delivery services, the percentage that provide BEmOC and CEmOC, by managing authority, Haiti SPA 2013



3.3.2. Access to normal delivery, basic and comprehensive obstetric care services in DHS clusters

Access to health facilities within a cluster is closely related to the population and facility density, with urban areas generally having greater access than rural areas. Nearly all metropolitan clusters are linked to at least one facility with normal delivery services, but 14 percent of other urban clusters and 18 percent of rural clusters do not have any facility with normal delivery services within the 5 or 10 kilometer buffer (Figures 13a-b). Proximity to a BEmOC facility is also nearly universal in metropolitan clusters, with 98 percent of clusters linking to a BEmOC facility within 5 km. However, only 67 percent of other urban clusters and 48 percent of rural clusters have a BEmOC facility within the buffer distance. Overall, the percentage of clusters near a CEmOC facility is lower than the percentage near a BEmOC facility, with 80 percent of metropolitan clusters, 56 percent of other urban clusters, and 33 percent of rural clusters linking to a CEmOC facility within the buffer distance.

Figure 13a. Percent distribution of DHS clusters in Haiti by access to normal delivery service and BEmOC, according residence

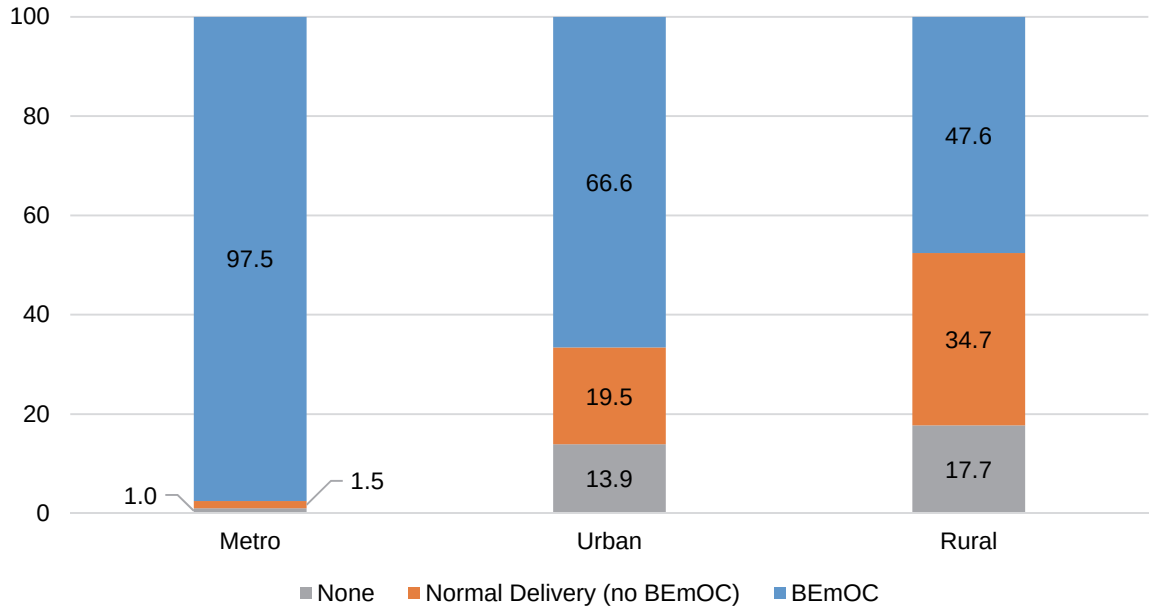
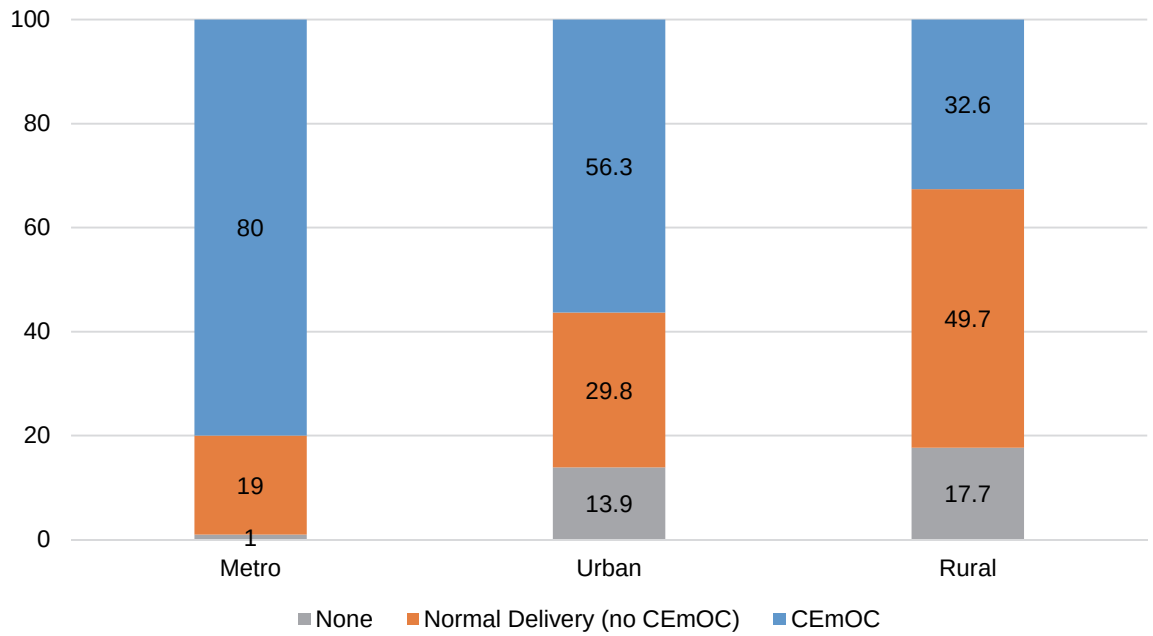


Figure 13b. Percentage distribution of DHS clusters in Haiti by access to normal delivery service and CEmOC, according to residence

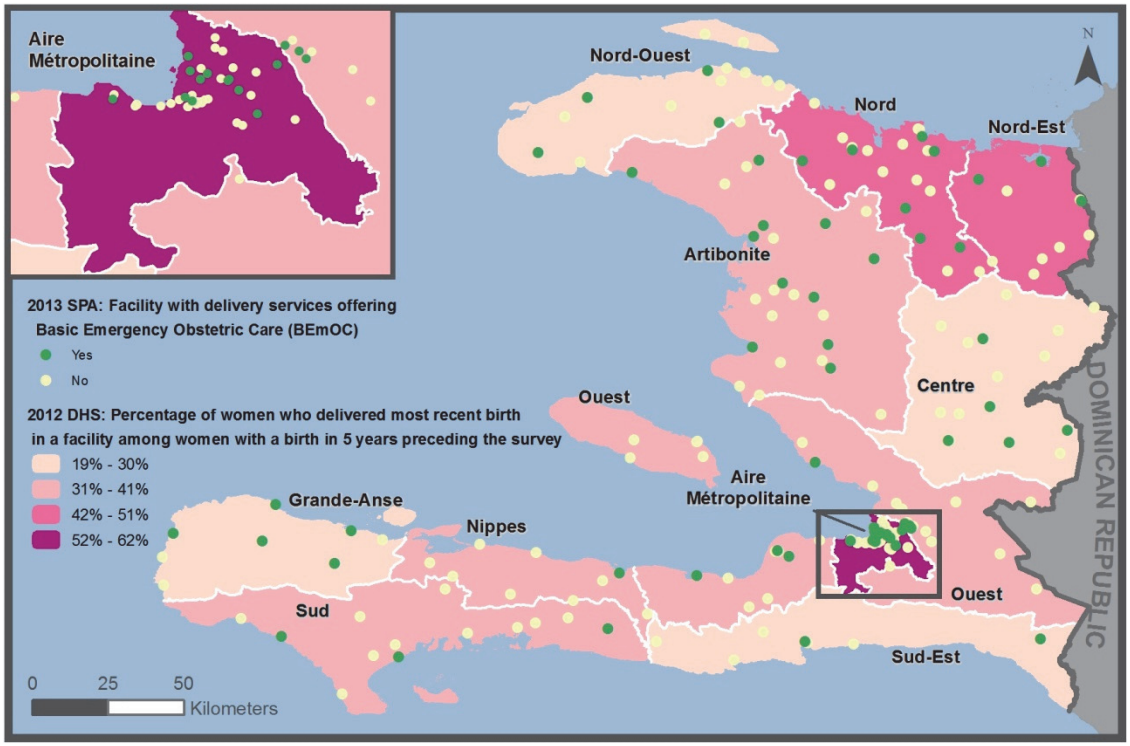


3.3.3. Utilization of facility-based delivery services and determinants

Of the 4,921 women with a live birth in the last five years for whom complete data are available, only 39 percent delivered the most recent birth at a health facility. Delivery in a health facility is far more common in the metropolitan and other urban areas (60 percent and 59 percent, respectively) compared with rural areas (24 percent). Appendix Table A9 shows the distribution of background characteristics of women who were analyzed.

Figure 14 shows the facilities that provide delivery services in Haiti and whether or not the facility offers BEmOC (dark green dots). Additionally, the percent of women who delivered their most recent birth in a health facility (among women with a birth in five years preceding the survey) is shown by department, ranging from low percentage of facility delivery (light pink) to high percentage of facility delivery (dark pink). Overall there are very few facilities in Haiti that provide BEmOC services (dark green dots), and a high number of these are concentrated in the Aire Metropolitaine, which corresponds to the department with the highest percentage of women delivering in a facility.

Figure 14. Map of relationship between facilities in Haiti that provide delivery services and whether the facility offers BEmOC and percentage of women who delivered their most recent birth in a health facility, by department, Haiti DHS 2012 and Haiti SPA 2013



Figures 15a-c highlight the bivariate association between the availability of delivery services and the percentage of women who delivered their most recent birth in a facility, separately for women in rural, other urban and metropolitan areas. In rural clusters without access to a facility with normal delivery services within 10 kilometers, only 8 percent of women delivered the most recent birth in a facility (Figure 15a). Coverage of facility delivery was significantly higher in clusters with at least one facility offering normal delivery services within the buffer distance, but there was no difference in coverage between clusters with only normal delivery services available, compared with clusters where emergency obstetric care was available within the buffer (either a BEmOC or CEmOC).

Figure 15a. Percentage of women in Haiti rural areas who delivered the most recent birth in a facility, according to the availability of delivery services within the buffer

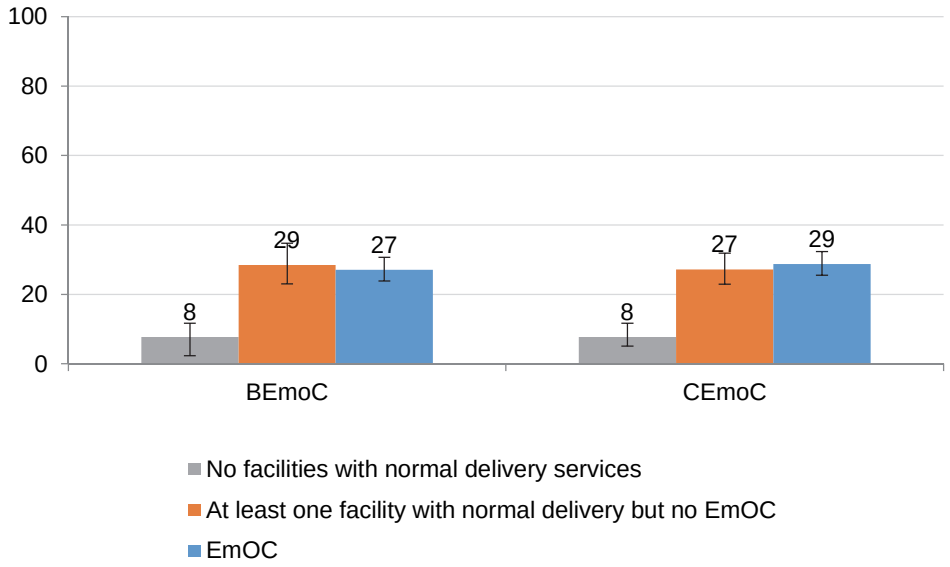


Figure 15b. Percentage of women in Haiti other urban areas who delivered the most recent birth in a facility, according to the availability of delivery services within the buffer

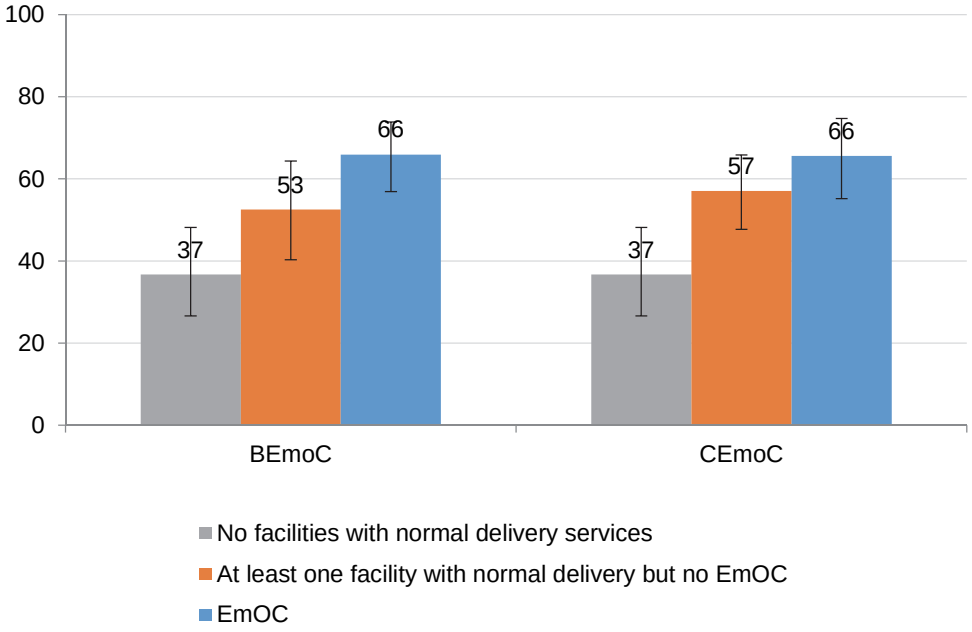
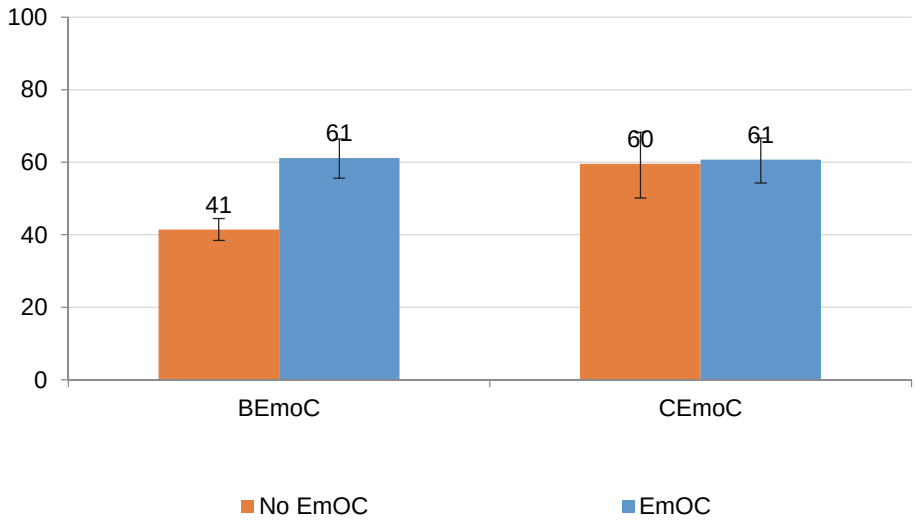


Figure 15c. Percentage of women in Haiti metropolitan areas who delivered the most recent birth in a facility, according to the availability of delivery services within the buffer



In other urban areas, facility delivery coverage increased incrementally with the availability of delivery and emergency obstetric services (see Figure 11b). In other urban clusters with no normal delivery services available, 37 percent of women delivered in a facility, while in clusters with normal delivery services available 53 percent delivered in a health facility, and in areas with a BEmOC or CEmOC within 5 kilometers, 66 percent delivered in a facility.

In the metropolitan area, nearly all clusters have at least one facility with normal delivery services available. In clusters with normal delivery services but no BEmOC services available within the buffer, 41 percent of women delivered the most recent birth in a health facility, while in clusters with at least one BEmOC within the buffer, 61 percent delivered in a facility. There was no difference in facility delivery coverage between clusters with and without access to a CEmOC within the 5 kilometer buffer. The unadjusted relationships between facility delivery and other covariates are shown in Appendix Table A10.

Using multilevel models, we assessed how women's utilization of facility delivery is associated with the availability of health facilities with normal delivery, BEmOC, and CEmOC services within the cluster service environment. We ran six multilevel models to examine BEmOC and CEmOC availability separately for metropolitan, other urban and rural areas.

Table 7 presents odds ratios and 95% confidence intervals for the indicators of availability of delivery services, as well as for the covariates adjusted for in the models. For rural and other urban clusters, we examined three levels of availability within their respective buffer: having no facility with normal delivery services, having a facility with normal services but no emergency care, and having at least one facility with emergency obstetric care available. Clusters with no facilities with normal delivery care were used as the reference category. Since 99 percent of metropolitan clusters were linked to at least one health facility with normal delivery care within 5 km of the cluster, in the models for metropolitan clusters, having normal delivery services but no emergency care are used as the reference category, and we examined the advantage of having at least one emergency obstetric care available within the buffer.

Table 7. Results of multivariable logistic regressions of facility delivery for the most recent birth among women in Haiti who had a live birth in the five years preceding the survey, by residence

	Metropolitan				Other Urban				Rural			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
Variables	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Availability of Basic Emergency Obstetric Care Services[1]												
None					1.00				1.00			
Any facility with normal delivery services but no BEmOC	1.00				2.15*	1.05 - 4.39			2.95***	1.80 - 4.83		
Any BEmOC	2.92*	1.28 - 6.68			3.38***	1.77 - 6.47			2.89***	1.77 - 4.72		
Availability of Comprehensive Emergency Obstetric Care Services[1]												
None							1.00				1.00	
Any facility with normal delivery services but no CEmOC			1.00				2.92**	1.48 - 5.76			2.90***	1.79 - 4.68
Any CEmOC			1.31	0.83 - 2.06			2.89**	1.48 - 5.65			2.97***	1.78 - 4.97
Maternal age at birth												
<20	1.00				1.00				1.00		1.00	
20-34	1.36	0.82 - 2.23	1.34	0.81 - 2.22	1.49	0.88 - 2.52	1.48	0.87 - 2.51	1.30	0.94 - 1.80	1.30	0.95 - 1.80
35-49	1.91	0.95 - 3.85	1.95	0.96 - 3.96	2.49*	1.18 - 5.23	2.45*	1.17 - 5.16	2.09**	1.29 - 3.39	2.09**	1.29 - 3.39
Birth order												
1	1.00				1.00				1.00		1.00	
2-3	0.57**	0.38 - 0.86	0.57**	0.38 - 0.86	0.39***	0.25 - 0.59	0.38***	0.25 - 0.58	0.33***	0.25 - 0.44	0.33***	0.25 - 0.44
4-5	0.40**	0.22 - 0.70	0.39**	0.22 - 0.69	0.41**	0.24 - 0.71	0.40**	0.23 - 0.70	0.20***	0.13 - 0.29	0.20***	0.13 - 0.29
6+	0.41*	0.18 - 0.93	0.39*	0.17 - 0.89	0.36**	0.17 - 0.77	0.35**	0.16 - 0.76	0.17***	0.10 - 0.27	0.17***	0.10 - 0.27
Education												
None	1.00				1.00				1.00		1.00	
Primary	2.60**	1.36 - 5.01	2.59**	1.34 - 5.00	0.93	0.51 - 1.68	0.92	0.51 - 1.67	1.33	0.97 - 1.81	1.33	0.97 - 1.81
Secondary or higher	4.54***	2.34 - 8.80	4.49***	2.30 - 8.79	1.76	0.95 - 3.27	1.73	0.93 - 3.22	2.17***	1.51 - 3.12	2.17***	1.51 - 3.12
Wealth quintile												
Lowest	na				na				1.00		1.00	
Second	na				na				1.68***	1.29 - 2.19	1.68***	1.29 - 2.18
Middle	na				na				2.61***	1.89 - 3.60	2.60***	1.89 - 3.60
Lowest-Middle	1.00				1.00				na		na	
Fourth	1.12	0.68 - 1.85	1.14	0.69 - 1.90	1.19	0.80 - 1.76	1.26	0.85 - 1.86	5.23***	3.18 - 8.59	5.21***	3.17 - 8.56
Highest	2.24**	1.30 - 3.88	2.24**	1.28 - 3.92	2.60***	1.56 - 4.33	2.88***	1.72 - 4.80	7.94***	3.28 - 19.20	7.90***	3.26 - 19.13
Number of ANC visits												
0	1.00				1.00		1.00		1.00		1.00	
1	3.37	0.97 - 11.74	3.12	0.89 - 10.88	1.38	0.39 - 4.91	1.40	0.39 - 4.98	2.47*	1.06 - 5.77	2.47*	1.06 - 5.76
2-3	2.22	0.95 - 5.18	2.21	0.94 - 5.20	1.71	0.70 - 4.17	1.70	0.70 - 4.12	3.49***	1.85 - 6.59	3.49***	1.85 - 6.58
4+	4.11***	1.94 - 8.73	4.09***	1.91 - 8.75	4.25***	1.88 - 9.57	4.19***	1.86 - 9.44	7.14***	3.90 - 13.08	7.13***	3.90 - 13.06
DK/Missing	2.91	0.52 - 16.24	3.24	0.58 - 18.18	1.19	0.21 - 6.66	1.25	0.22 - 6.94	7.53	0.18 - 316.28	7.61	0.18 - 319.67
Number of women	754		754		962		962		3,089		3,089	
Number of clusters	66		66		85		85		241		241	

***p<0.001 **p<0.01 *p<0.05

[1] Availability is assessed within 10 kilometers for rural clusters and 5 kilometers for metropolitan and other urban clusters. Since nearly all metropolitan clusters have at least one facility with normal delivery services, the reference category for the metropolitan models combine "None" with "Any facility with normal delivery services but no EmOC."

[2] For metropolitan and other urban areas, the first 3 quintiles were combined and used as the reference category.

In the metropolitan area, the availability of any BEmOC facility within the service environment was positively and significantly associated with women's use of facility delivery care after controlling for women's characteristics. Women in clusters with a BEmOC facility available within 5 kilometers had a 2.9 times higher odds of facility delivery, compared with women in clusters with normal delivery services but no BEmOC available within the buffer, after controlling for background characteristics of the woman. Having a CEmOC facility available within the buffer was not associated with significantly greater odds of facility delivery, compared with the odds among women in clusters with normal delivery services but no CEmOC facility available within the buffer.

In both other urban areas and rural areas, the availability of normal delivery services within the buffer was significantly associated with women's use of facility delivery care after controlling for women's

characteristics. In other urban areas, women in clusters with normal delivery services available within the 5 kilometer buffer were 2.2 times more likely to go to a facility for delivery, and women in clusters with a BEmOC facility available within the buffer were 3.4 times more likely to deliver in a facility compared with women in clusters with no delivery services available. Similarly, in the model examining availability of CEmOC facilities, in other urban areas women in clusters with normal delivery services available (but no CEmOC) within the buffer were 2.9 times more likely to go to a facility for delivery, and women in clusters with a CEmOC facility available within the buffer were also 2.9 times more likely to deliver in a facility compared with women in clusters with no delivery services available. The results were similar in rural areas.

As expected, household wealth, maternal education, and the number of ANC visits were positively and significantly associated with women's use of facility delivery care, while the child's birth order was negatively associated with the use of facility delivery care.

3.4. Care Seeking for Children's Diarrhea

3.4.1. Service readiness in providing child curative care services at health facilities

We examined the 848 facilities in Haiti that offer curative care services for children under five. Among these, over 40 percent are dispensaries, one third are health centers without beds (32 percent), and the remainder are health centers with beds (15 percent) and hospitals (13 percent) (Table 8). The type of facility varies widely between metropolitan, other urban, and rural areas. In rural areas, dispensaries are the most prevalent type of facility with curative care services for children (59 percent of all facilities with child care) while in the metropolitan area they represent only 3 percent of facilities. Child health services in Haiti are offered by a mix of government (29 percent), NGO/private not for profit (17 percent), private for-profit (23 percent), and mission/faith-based (21 percent) facilities. Government/public facilities are more common in rural and other urban areas, while private for-profit facilities are more common in the metropolitan area.

Table 8. Characteristics of health facilities in Haiti that offer curative care services for children under five years, by residence, Haiti SPA 2013

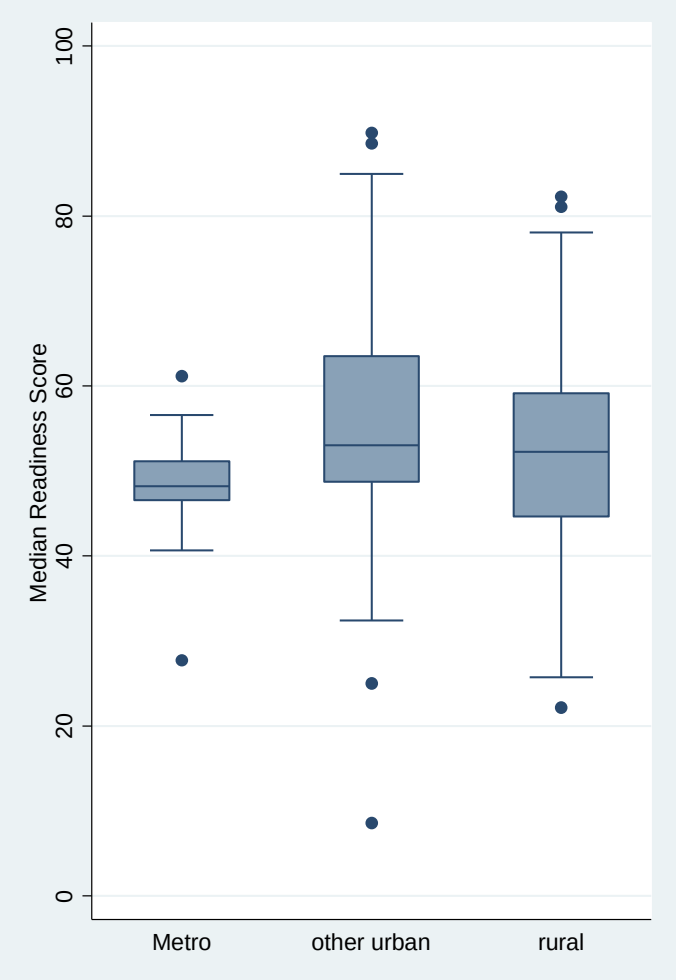
Characteristics	Metro	Other Urban	Rural	Total
Facility type				
Hospital	22.7	29.6	4.1	12.4
Health center with bed	12.7	21.8	13.3	14.8
Health center without bed	61.3	32.2	23.5	31.9
Dispensary	3.3	16.3	59.1	41.0
Managing authority				
Government/public	14.7	49.2	43.2	39.3
NGO/Private not for profit	27.3	11.5	15.6	16.8
Private for profit	44.7	15.7	19.0	22.9
Mission/ faith-based	13.3	23.6	22.3	21.0
Department				
Aire metropolitaine/ Reste-Ouest	100.0	12.7	23.9	35.2
Sud-Est	na	6.1	8.4	6.5
Nord	na	19.4	9.9	10.0
Nord-Est	na	3.6	5.4	4.1
Artibonite	na	8.5	18.7	13.4
Centre	na	6.7	6.2	5.2
Sud	na	19.4	5.8	7.4
Grand-Anse	na	9.7	4.9	4.9
Nord-Ouest	na	7.4	13.2	9.7
Nippes	na	6.7	3.6	3.5
Total number of facilities	150	165	533	848

3.4.2. Clusters' access to child care facilities and service readiness

To evaluate the service environment for curative child care, a readiness score was generated at the health facility level based on four domains of facility readiness: staff and training, equipment, diagnostic capacity, and the availability of medicines and commodities (see Appendix Table A11 for a detailed summary of the components of the readiness score). Each of the 392 clusters included in the 2012 Haiti DHS was linked to all facilities within a 5 or 10 kilometer buffer; and an overall readiness score was generated for each cluster based on the median score of all facilities linked to that cluster. Metropolitan clusters linked with an average of 54 health facilities offering curative child care, other urban clusters linked with an average of 6 facilities, and rural clusters linked with an average of 8 facilities.

Figure 16 shows the distribution of readiness scores among DHS clusters. While the median score was roughly similar across metropolitan, other urban, and rural areas (median values were 48.2, 53.0, and 52.3, respectively), the distribution of scores differed across the three groups of clusters. Scores in the metropolitan area were quite homogenous while the interquartile range was wider in other urban and rural clusters. The cluster-level service readiness score was divided into terciles, separately for metropolitan, other urban, and rural areas, to designate clusters as having either a low, medium, or high level of readiness for treating childhood illness.

Figure 16. Boxplots of child care readiness scores among clusters in Haiti, by residence

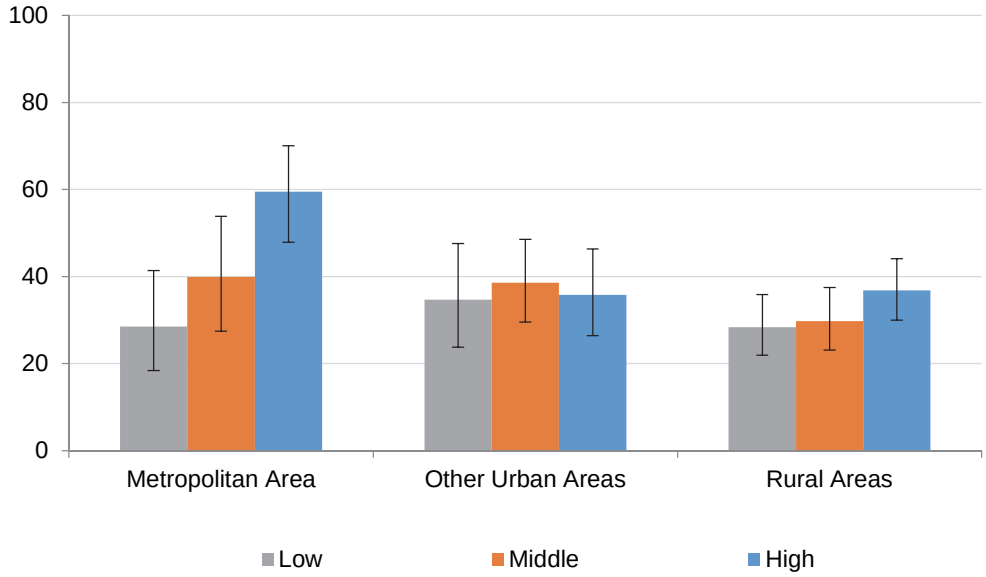


3.4.3 Care seeking at health facilities for children's diarrhea and determinants

The analysis of care seeking for children's diarrhea included 1,255 children under age five years who were reported to have had diarrhea in the two weeks preceding the mother's interview, according to the 2012 Haiti DHS. Appendix Table A12 shows the background characteristics of these children. Care seeking for children's diarrhea is low in Haiti. Care was sought from any public or private provider for roughly one third of these children (35 percent). The children are roughly equally spread across the three levels of the service readiness environment, as we would expect given that these were constructed as cluster-level terciles.

Figure 17 shows the bivariate association between the level of service readiness and the percentage of children for whom care was sought from a public or private source for recent diarrhea. In the metropolitan area, care seeking coverage increased with increasing service readiness among facilities. Care for diarrhea was sought from a public or private facility for 29 percent of children in clusters with low facility-level readiness, for 40 percent of children in clusters with medium readiness, and for 60 percent for children in clusters with high readiness. In other urban areas and rural areas, however, there was no difference in the level of care seeking across levels of service readiness (see Figure 16). The bivariate associations between seeking care for diarrhea at a health facility and other covariates can be found in Appendix Table A13.

Figure 17. Percentage of children in Haiti for whom care was sought from a public or private source for recent diarrhea, by level of facility service readiness to treat childhood illness and residence



Using multilevel models, we assessed how care seeking for children's diarrhea is associated with service readiness at health facilities within the specified buffer of the cluster. We ran separate multilevel models for metropolitan, other urban, and rural areas. Table 9 presents odds ratios and 95% confidence intervals for the level of service readiness, as well as for the covariates adjusted for in the models. In the metropolitan area, the level of service readiness of the facilities is positively and significantly associated with care seeking from a public or private facility for children's diarrhea, after controlling for background characteristics. The odds that children with recent diarrhea received care from a public or private facility were 3.3 times greater among children in clusters with a high level of service readiness among facilities, compared with the odds among children in clusters with a low level of service readiness. However, in other urban and rural areas there was no association between the level of service readiness among facilities and the odds of care seeking for children's diarrhea. Few background characteristics were associated with the odds of care seeking for children's diarrhea. Household wealth was positively associated with care seeking for diarrhea in other urban and rural areas, and the child's age was negatively associated with the odds of care seeking in the metropolitan area.

Table 9. Results of multivariable logistic regressions of care-seeking for children's diarrhea at any public or private facility in Haiti among children with diarrhea in the two weeks preceding the survey, by residence

	Metropolitan		Other Urban		Rural	
Variables	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Facility-level service readiness for treating childhood illness[1]						
Low	1.00		1.00		1.00	
Medium	1.92	0.67 - 5.45	1.35	0.65 - 2.80	1.16	0.74 - 1.80
High	3.29*	1.05 - 10.30	1.43	0.73 - 2.79	1.41	0.91 - 2.17
Age						
<1	1.00		1.00		1.00	
1-2	0.75	0.31 - 1.78	1.38	0.66 - 2.85	1.17	0.79 - 1.73
2-3	0.31*	0.11 - 0.89	1.17	0.51 - 2.64	1.12	0.71 - 1.78
3-4	0.08***	0.02 - 0.35	0.89	0.33 - 2.34	0.96	0.55 - 1.69
4-5	0.09*	0.01 - 0.58	1.57	0.50 - 4.96	1.15	0.62 - 2.13
Sex of child						
Female	1.00		1.00		1.00	
Male	0.90	0.44 - 1.81	0.86	0.48 - 1.52	0.76	0.56 - 1.04
Mother's age						
<20	1.00		1.00		1.00	
20-34	1.46	0.41 - 5.17	1.00	0.38 - 2.62	0.78	0.46 - 1.33
35-49	1.29	0.27 - 6.31	0.72	0.24 - 2.20	1.03	0.56 - 1.91
Mother's education						
None	1.00		1.00		1.00	
Primary	1.57	0.41 - 6.03	0.63	0.21 - 1.92	1.17	0.79 - 1.74
Secondary or higher	1.67	0.40 - 6.95	0.71	0.23 - 2.23	1.51	0.91 - 2.48
Wealth quintile						
Lowest	na		na		1.00	
Second	na		na		0.91	0.64 - 1.30
Middle	na		na		0.89	0.53 - 1.48
Lowest-Middle	1.00		1.00		na	
Fourth	0.83	0.30 - 2.31	1.21	0.63 - 2.31	2.46*	1.06 - 5.71
Highest	1.13	0.36 - 3.56	2.70*	1.15 - 6.35	1.58	0.33 - 7.57
Number of children	301		197		757	
Number of clusters	60		74		219	

***p<0.001 **p<0.01 *p<0.05

[1] To evaluate the service environment for curative child care, a readiness score was generated at the health facility level based on four domains of facility readiness: staff and training, equipment, diagnostic capacity, and the availability of medicines and commodities (see Appendix Table 1 for a detailed summary of the components of the readiness score). DHS clusters were then linked with the service readiness scores for facilities within a 5 or 10 kilometer buffer, and an overall readiness score was generated for each cluster based on the median score of all facilities linked to that cluster. These scores were divided into terciles, which we refer to as low, medium, and high readiness.

3.5. HIV Testing

3.5.1. HIV testing capacity at health facilities

In the 2013 Haiti SPA, 480 facilities reported to provide HIV counseling and testing services. The distribution of these facilities in each geographic area by facility type, managing authority, and regional location is presented in Table 10. In metropolitan and other urban areas, health centers without beds and hospitals are major providers of HIV testing and counseling services. In contrast, in rural areas, dispensaries account for 39 percent of the facilities that provided HIV counseling and testing services. Facilities'

managing authority varies among three locations. In the metropolitan area, private for-profit accounts for 45 percent of the health facilities providing HIV testing and counseling services, while other urban areas primarily rely on government facilities. Various management types are relatively evenly distributed in rural areas.

Table 10. Characteristics of health facilities in Haiti providing HIV counseling and testing services, by residence, Haiti SPA 2013

Characteristics	Metropolitan	Other urban	Rural	Total
Type of facility				
Hospital	32.6	35.9	8.9	23.1
Health center with beds	14.7	21.5	21.6	19.7
Health center without beds	51.2	34.0	30.7	37.2
Dispensary	1.6	8.6	38.7	20.0
Managing authority				
Government	14.7	51.8	32.6	33.4
NGO/private not-for-profit	28.7	15.2	21.3	21.5
Private for-profit	45.0	15.1	23.0	26.6
Mixed	11.6	17.9	23.1	18.5
Department				
Aire metropolitaine/ Reste-Ouest	100.0	10.0	33.9	44.7
Sud-Est	na	7.2	5.2	4.4
Nord	na	20.1	10.3	10.4
Nord-Est	na	4.3	8.9	5.2
Artibonite	na	9.3	11.3	7.7
Centre	na	9.3	7.1	5.8
Sud	na	17.2	3.8	6.7
Grand-Anse	na	8.6	3.3	3.9
Nord-Ouest	na	8.9	13.0	8.3
Nippes	na	5.0	3.3	2.9
Total number of facilities	129	139	212	480

The availability of HIV testing capacity and other items to support quality testing services is reported in Appendix Table A14. Overall, more than 64 percent of facilities that reported providing HIV counseling and testing services have full HIV testing capacity, which means they either have HIV diagnostic test kits or ELISA tests with essential equipment and materials for conducting the test. The availability of other items to support quality testing and counseling services is limited. In only 8 percent of facilities, all supportive items including HIV testing and counseling guideline, trained staff, visual and auditory privacy, and condoms are available. A facility is considered to be well-prepared for conducting HIV testing if it has all of these items. The HIV testing capacity and the availability of supportive items vary by geographic area. Only half of the facilities in rural areas have HIV testing capacity, compared to more than 70 percent in metropolitan and other urban areas. In all three areas, the majority of health facilities are equipped to provide visual and auditory privacy; but low percentages of facilities have guidelines on HIV counseling and testing and staff trained in HIV counseling and testing.

Figures 18a-c present the distribution of the facilities that reported providing HIV testing and counseling by availability of HIV testing capacity and preparedness to provide the HIV testing services. In rural areas, about half of the facilities do not have HIV testing capacity and only 7 percent have testing capacity and also are well prepared to provide the services. Although more than 70 percent of facilities in metropolitan and other urban areas have HIV testing capacity, but few are prepared to provide the services. In Over 70 percent of dispensaries in rural areas, the major provider of HIV testing services in rural areas, do not have

Aire metropolitaine/Reste-Ouest HIV testing capacity. Hospitals are more prepared to provide HIV testing services than health centers with or without beds. Government facilities have the highest percentage without HIV testing capacity (43 percent).

Figure 18a. Percent distribution of facilities providing HIV counseling and testing services by capacity and readiness to conduct HIV testing, according to residence, Haiti SPA 2013

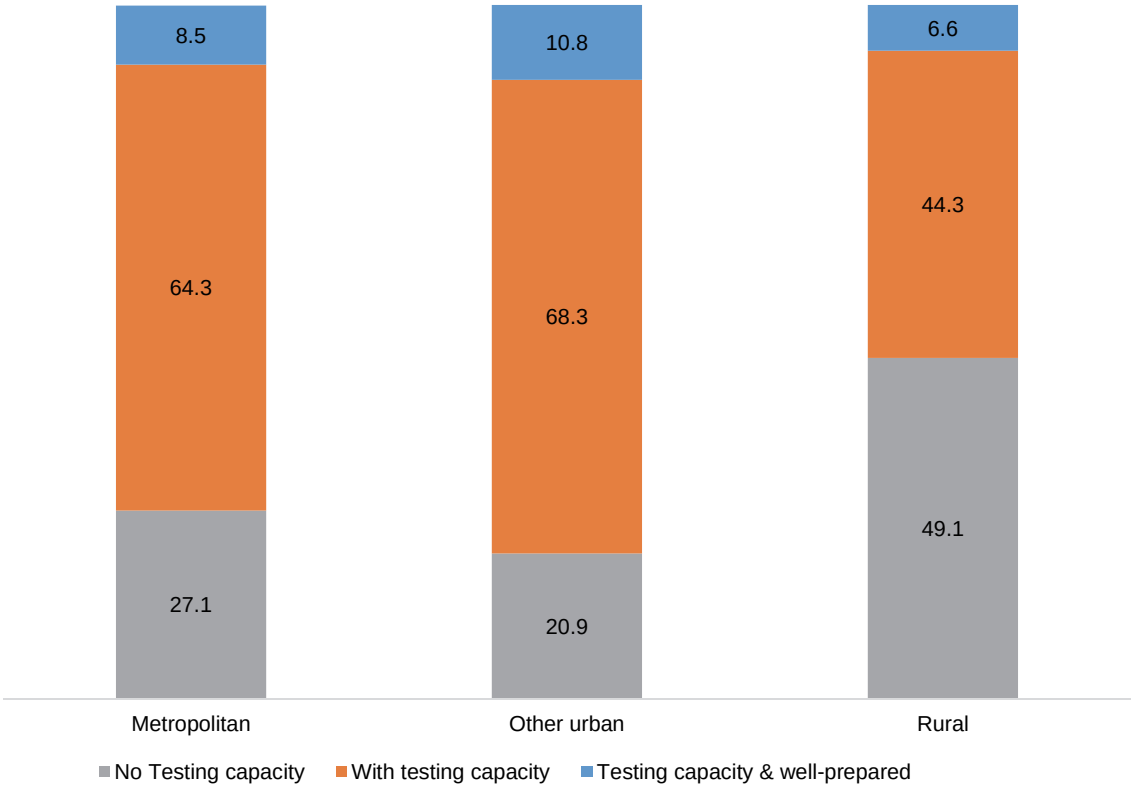


Figure 18b. Percent distribution of facilities providing HIV counseling and testing services by capacity and readiness to conduct HIV testing, according to facility type, Haiti SPA 2013

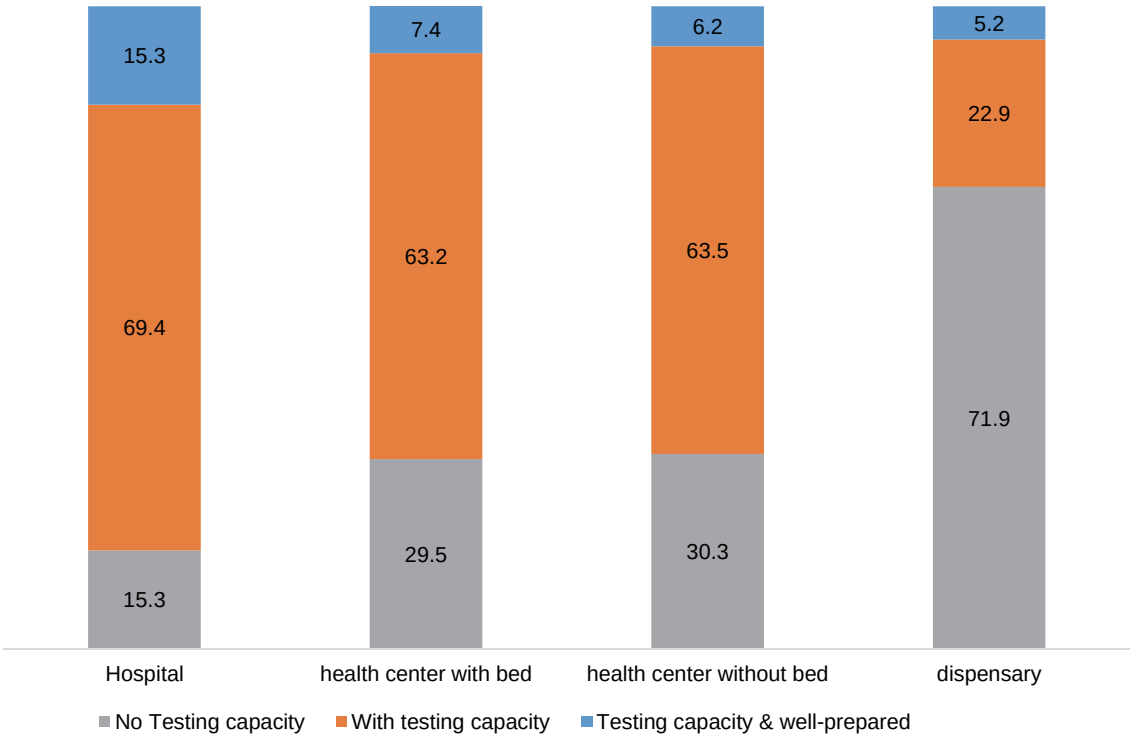
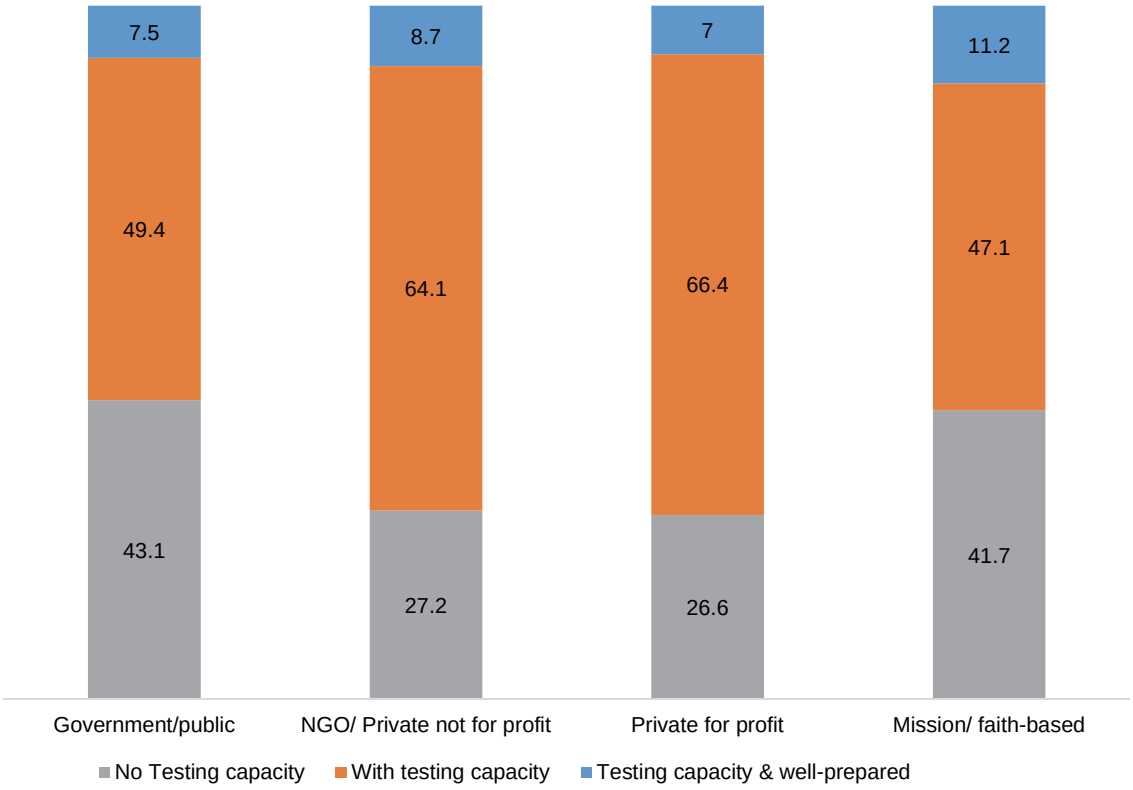


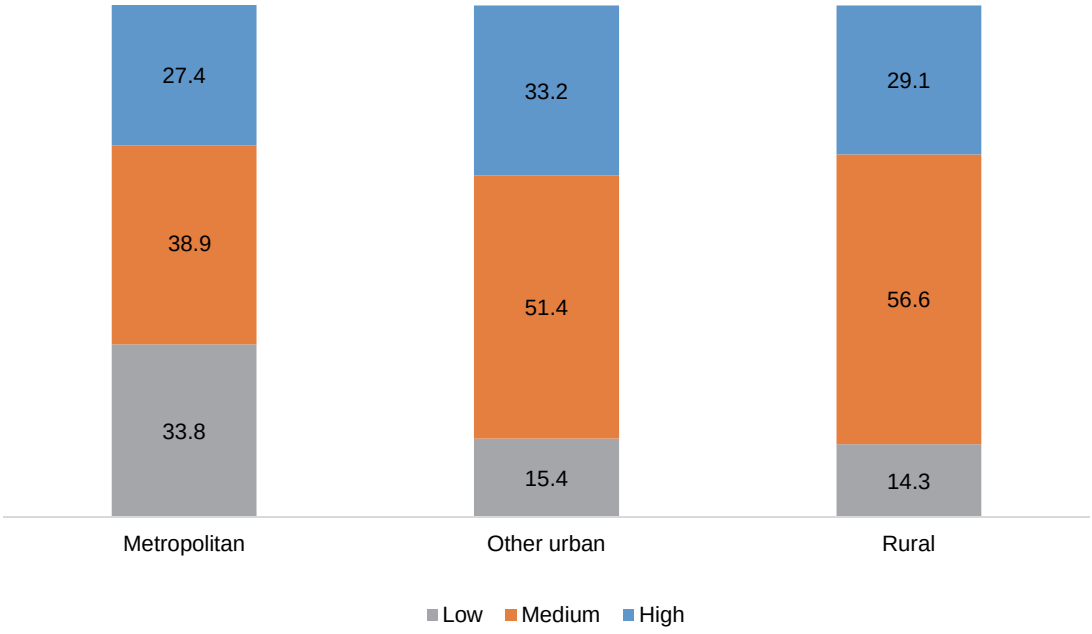
Figure 18c. Percent distribution of facilities providing HIV counseling and testing services by capacity and readiness to conduct HIV testing, according to managing authority, Haiti SPA 2013



3.5.2. Access to HIV testing services in DHS clusters

Clusters were classified into low, medium, and high access to HIV testing services based on if there is a health facility within the specific buffer with HIV testing capacity and level of readiness to provide the service. Figure 19 presents the distribution of clusters by the level of access. In rural areas, only 29 percent of the clusters have high access to HIV testing within 10 km, meaning there is a facility with both HIV testing capacity and also well prepared to provide HIV testing services. Moreover, 14 percent of the clusters have no facility with HIV testing capacity within 10 km from the cluster. In other urban clusters, a similar distribution is observed, with slightly higher percentage of clusters (33 percent) have high access to HIV testing services in other urban areas. Almost all clusters in the metropolitan area have one or more (up to nine) facilities that have full HIV testing capacity and also are well-prepared to provide the service. We divided the clusters into low-, medium-, and high-access groups based on the terciles of the number of facilities with full HIV testing capacity and readiness to provide HIV services.

Figure 19. Percent distribution of clusters in Haiti by access to HIV testing services, according to residence



3.5.3. Utilization of HIV testing services and its association with the service environment

We examined prior HIV testing experience among all women 15-49. Background characteristics of these women in each geographic location are shown in Appendix Table A15. In rural areas, only 19 percent of women reported to be tested for HIV in the 12 months prior to the survey. The coverage is about 30 percent in the metropolitan and other urban areas.

The relationship between facilities that provide HIV testing services and women who were tested for HIV is shown in Figure 20. Level of testing capacity and preparedness is displayed in light green (provide HIV testing and counselling services without testing capacity) to dark green (testing capacity and fully prepared). The percentage of women who were tested for HIV in the last 12 months preceding the survey by department is shown in lighter pink for lower values and darker pink for higher values. Departments with more facilities with testing capacity and higher preparedness (dark and medium green dots) also have higher percentage of women who have had an HIV test in the last 12 months (darker pink).

Figure 20. Map of relationship between facilities in Haiti that provide HIV testing services and percentage of women who were tested for HIV, by department, Haiti DHS 2012 and Haiti SPA 2013

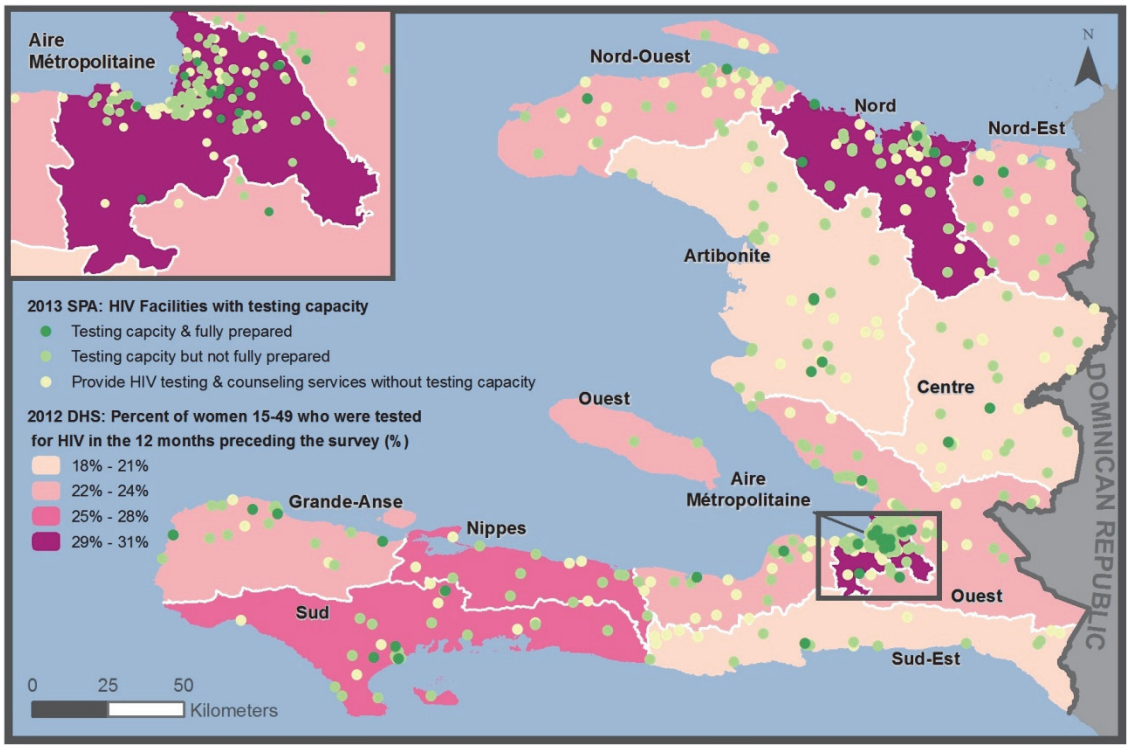
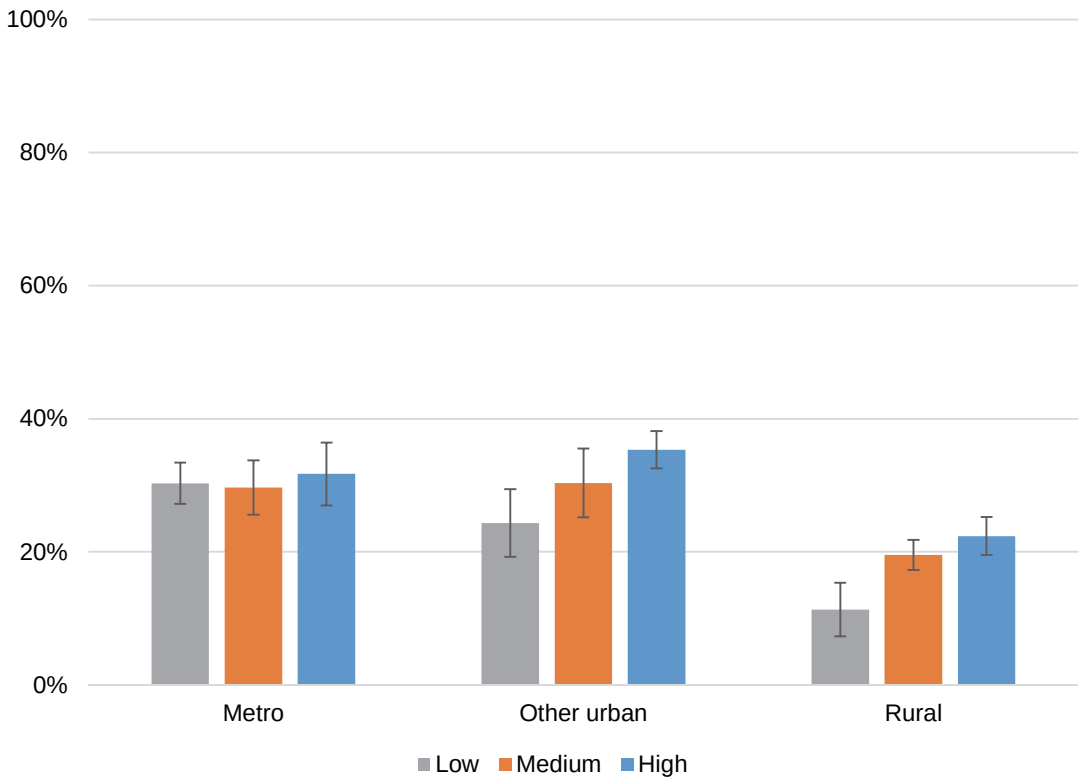


Figure 21 highlights the bivariate relationship between women's recent experience of HIV testing and the level of access to HIV testing services. In rural areas, HIV testing coverage increases with the level of access to HIV testing service. The coverage in clusters with high access to HIV testing service is 22 percent, which is twice the coverage in clusters with low access. The minimal difference in coverage between clusters with medium access and those with high access may suggest that HIV testing capacity is more important than the presence of the items to support the service. In other urban areas, HIV testing coverage incrementally increases with the level of access, from 24 percent in the low-access group to 35 percent in the high-access group. All three groups in the metropolitan area have similar percentages of women who were tested for HIV in the 12 months prior to the survey. The bivariate associations between prior HIV testing experience and other covariates are presented in Appendix Table A16.

Figure 21. Percentage of women age 15-49 in Haiti who were tested for HIV in the 12 months preceding the survey, by the level of access to HIV testing services and residence



In the multilevel logistic regressions models, we assessed how women's HIV testing in last 12 months is associated with the HIV testing service environment at health facilities within a specified buffer of the cluster. We ran separate multilevel models for each of the three geographic areas. Table 11 presents odds ratios and 95% confidence intervals for the level of access to HIV testing services as well as for the covariates adjusted for in the models.

In rural areas, the level of access is positively and significantly associated with women's likelihood of being tested for HIV after controlling for women's characteristics. Compared with the women who live in a cluster with low access (no facility with HIV testing capacity), the odds of having a HIV test is 58 percent higher for women from a community with medium access (there is a facility with HIV testing capacity), and more than twice as likely for those from a community with high access (there is a facility with HIV testing capacity and fully ready to provide the service). Similar results are shown in other urban areas. In the metropolitan area, we found no significant association between women's HIV testing experience and their communities' access to HIV testing services.

Table 11. Results of multivariable logistic regressions of HIV testing in past 12 months among women age 15-49 in Haiti, by residence

	Metropolitan		Urban		Rural	
Variables	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Service readiness level for HIV testing						
Low	1.00		1.00		1.00	
Medium	1.10	0.84 - 1.45	1.50*	1.02 - 2.21	1.58*	1.10 - 2.28
High	1.06	0.80 - 1.41	1.77**	1.18 - 2.66	2.09***	1.40 - 3.11
Age						
15-24	1.00		1.00		1.00	
25-34	1.17	0.91 - 1.49	1.45**	1.16 - 1.83	1.12	0.94 - 1.35
35-44	0.70*	0.52 - 0.95	1.00	0.75 - 1.33	0.69**	0.55 - 0.87
45-49	0.56*	0.36 - 0.88	0.64*	0.42 - 0.98	0.48***	0.34 - 0.67
Education level						
None	1.00		1.00		1.00	
Primary	1.05	0.69 - 1.59	1.91**	1.27 - 2.88	1.48***	1.20 - 1.82
Secondary or higher	2.03***	1.35 - 3.06	3.21***	2.12 - 4.86	3.08***	2.42 - 3.93
Occupation						
Unemployed	1.00		1.00		1.00	
Agriculture	1.59*	1.03 - 2.46	1.29	0.81 - 2.07	1.03	0.78 - 1.36
Professional	1.15	0.93 - 1.43	1.38**	1.13 - 1.69	1.32***	1.12 - 1.54
Other	1.17	0.80 - 1.72	0.99	0.64 - 1.53	1.88**	1.21 - 2.93
Wealth quintile						
Lowest	na		na		1.00	
Second	na		na		1.24*	1.03 - 1.48
Middle	na		na		1.86***	1.49 - 2.32
Lowest-Middle	1.00		1.00		na	
Fourth	1.11	0.77 - 1.60	1.08	0.84 - 1.39	2.56***	1.85 - 3.53
Highest	1.43	0.99 - 2.08	1.37*	1.04 - 1.81	3.16***	2.05 - 4.86
Marital status						
Never in union	1.00		1.00		1.00	
Currently married	2.99***	2.32 - 3.85	1.96***	1.55 - 2.48	2.61***	2.13 - 3.20
Former married	2.49***	1.73 - 3.59	1.37	0.96 - 1.96	1.92***	1.37 - 2.68
Religion						
Catholics	1.00		1.00		1.00	
Protestant	0.78*	0.64 - 0.95	0.86	0.72 - 1.02	0.85*	0.73 - 0.99
Vaudousant/other	0.82	0.56 - 1.20	1.19	0.79 - 1.78	0.81	0.60 - 1.09
Birth history						
No birth in past year	1.00		1.00		1.00	
Had a birth in past year	4.72***	3.38 - 6.60	6.03***	4.40 - 8.28	6.06***	5.07 - 7.25
Number of women	2592		3169		7066	
Number of clusters	66		85		241	

***p<0.001 **p<0.01 *p<0.05

As expected, having a recent live birth in last year is positively associated with being tested for HIV. These women possibly received HIV testing through ANC visits. More educated women are more likely to be tested for HIV. Household wealth seems to be important for getting HIV tested in rural areas but not in other two locations. Women coming from wealthier households are more likely to report a HIV test in last 12 months.

3.6. Malaria-related Health Services

Using data from the Malawi MIS and SPA, we examined the relationship between three malaria prevention and treatment outcomes and the relevant health service environment variables. This section describes the results for each outcome.

3.6.1. Association between children's receipt of malaria diagnostic testing and malaria diagnostic capacity at health facilities

3.6.1.1. Malaria diagnostic capacity at health facilities

In the 2014 Malawi SPA, 915 facilities provide child curative care services for children less than five years of age. Among these facilities, over 50 percent are health centers or maternity facilities, 32 percent are clinics, 12 percent are hospitals, five percent are dispensaries and only 1 percent are health posts (Table 12). The type of facility varies widely between urban, and rural areas. In rural areas, health centers/maternity facilities are the most prevalent type of facility with curative care services for children (66 percent of all facilities with child care), while in the urban areas they represent only 11 percent of facilities. Conversely, 67 percent of urban facilities offering curative care for children are clinics whereas only 18 percent of rural curative care facilities are clinics. Health posts are only found in rural areas. Child health services in Malawi are offered by a mix of government (49 percent), CHAM/faith-based (18 percent), private (22 percent), NGO (5 percent), and company facilities (6 percent). Government/public facilities are more common in rural areas, while private facilities are more common in urban areas.

Table 12. Characteristics of health facilities in Malawi that provide curative care services for children, by residence, Malawi SPA 2013-14

Characteristics	Urban	Rural	Total
Type of facility			
Hospital	20.5	8.1	11.7
Health centre/maternity	11.0	66.2	50.2
Dispensary	1.2	6.4	4.9
Clinic	67.2	17.7	32.1
Health post	0.0	1.6	1.1
Managing authority			
Public	23.7	59.5	49.1
CHAM/other faith-based	8.5	21.3	17.6
Private	50.7	10.1	21.9
NGO	12.0	2.5	5.3
Company	5.1	6.5	6.1
Region			
Northern	14.4	18.4	17.2
Central	39.9	35.8	37.0
South	45.7	45.8	45.8
Total number of facilities	265	649	915

Diagnostic capacity for malaria was examined for each health facility based on several indicators: availability of the valid Rapid Diagnostic Test (RDT) for malaria in conjunction with staff trained in administering RDT and presence of an RDT protocol; or equipment for testing blood slides for malaria parasites under a microscopy along with staff trained in malaria microscopy (see Appendix Table A17 for a detailed summary of the components of the diagnostic capacity definition). Results are shown in Figures

22a-c. In urban areas, 34 percent of child curative care facilities have malaria diagnostic capacity and 36 percent of facilities in rural clusters. Hospitals are much more likely to have malaria diagnostic capacity (73 percent) than are dispensaries (18 percent), clinics (18 percent) or health posts (11 percent).

Figure 22a. Percentage of facilities with sick child services that have the capacity to diagnose malaria, by facility type, Malaria SPA 2013-14

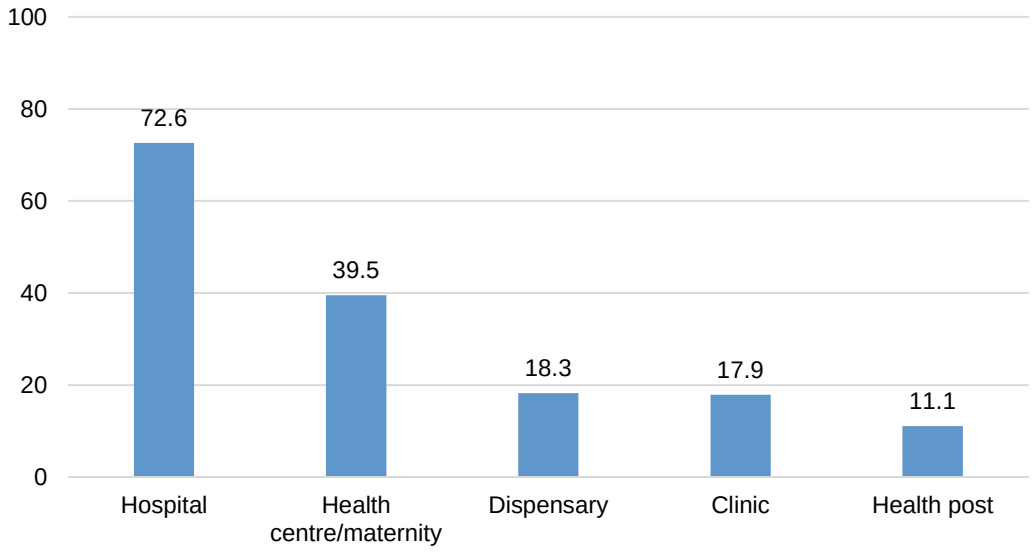


Figure 22b. Percentage of facilities with sick child services that have the capacity to diagnose malaria, by residence, Malawi SPA 2013-14

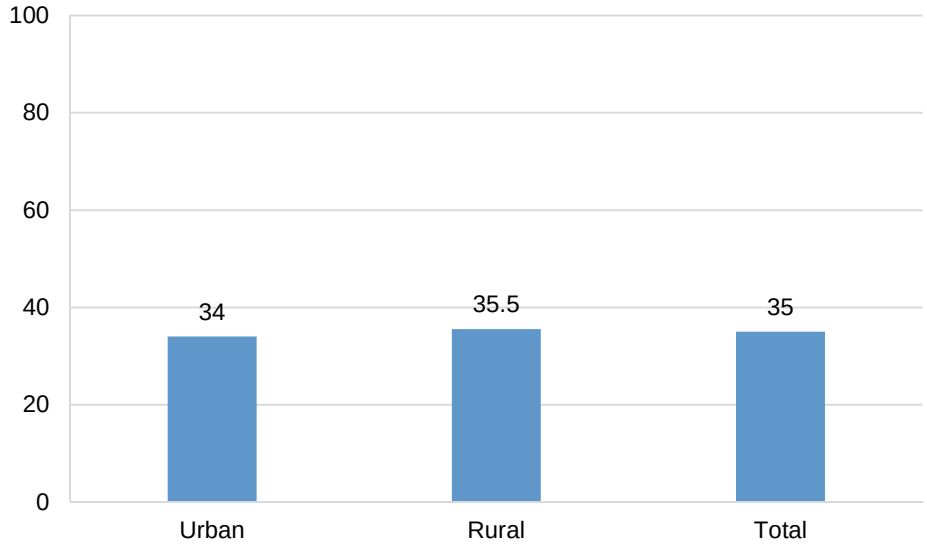
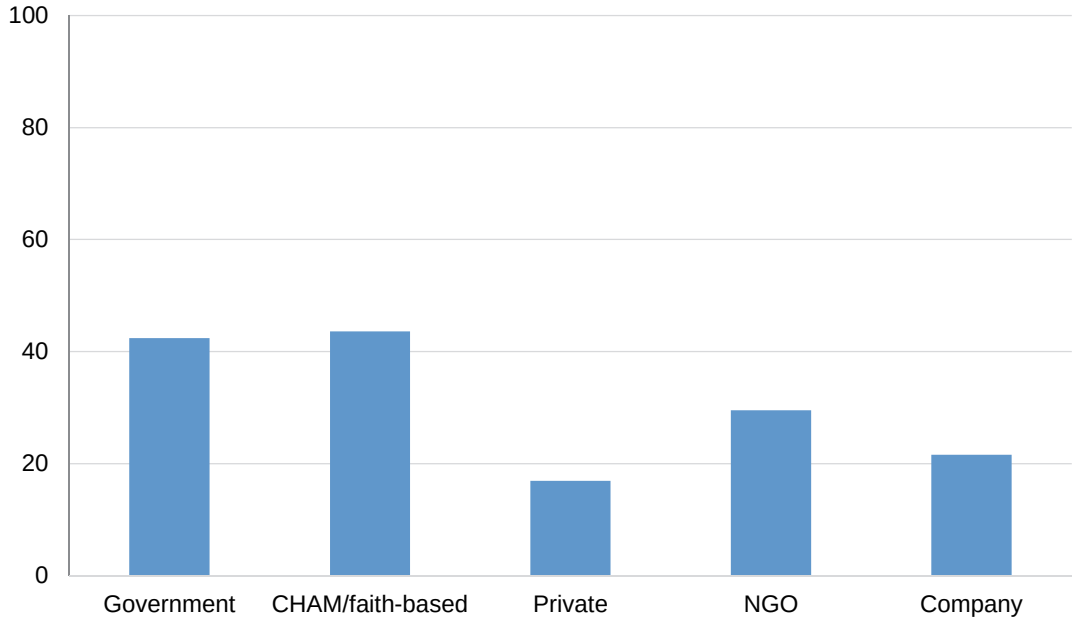


Figure 22c. Percentage of facilities with sick child services that have the capacity to diagnose malaria, by managing authority, Malawi SPA 2013-14

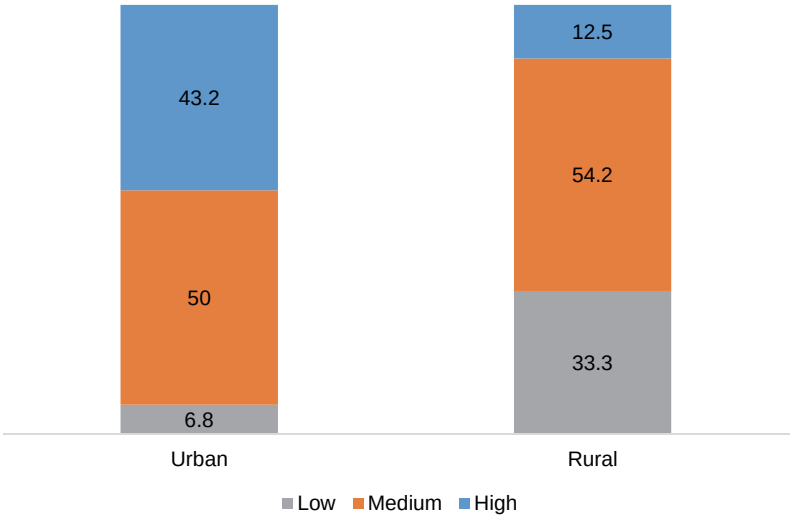


3.6.1.2 Access to malaria diagnostic capacity in MIS clusters

Each of the 140 clusters included in the 2012 Malawi MIS were then linked with the total number of facilities with diagnostic capacity for malaria within a 5 or 10 kilometer buffer. These counts were divided into three categories representing low, medium and high access to facilities with the capacity to diagnose malaria. This process was done separately for urban and rural clusters. Figure 23 shows the distribution of low (no facility within the buffer with malaria diagnostic capacity), medium (1-2 facilities for rural and 1-5 facilities for urban) and high access (3+ for rural and 6+ for urban) to child curative care facilities with malaria diagnostic capacity among MIS clusters, by urban and rural residence.

While approximately half of all clusters fell within the medium access category for both urban and rural clusters, only 7 percent of urban clusters had low access compared to 33 percent of rural clusters. In contrast, 43 percent of urban clusters had high access to malaria diagnosis compared to only 13 percent of rural clusters.

Figure 23. Diagnostic capacity of facilities with sick child services to diagnose malaria, by residence, Malawi SPA 2013-14

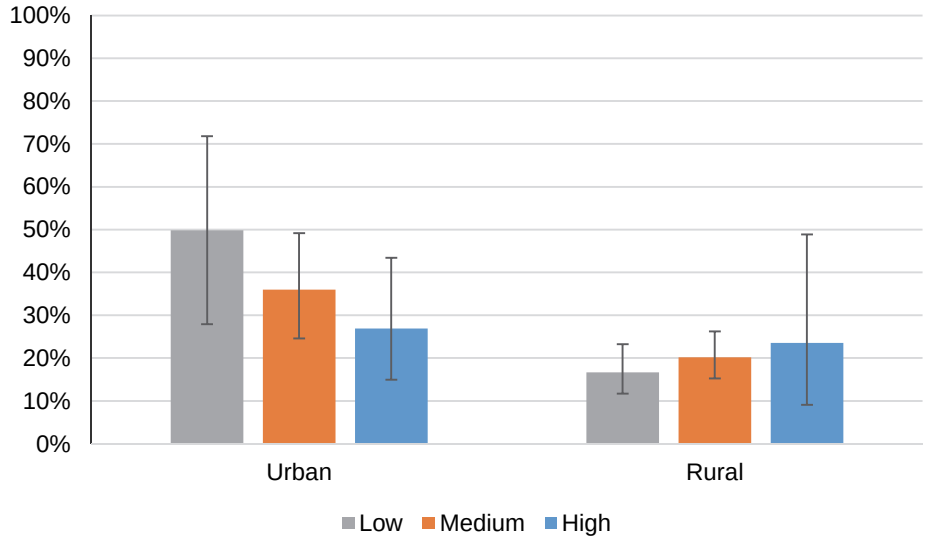


3.6.1.3. Malaria diagnostic testing among children with fever and determinants

The individual-level outcome of interest in this analysis is whether or not a child had a finger or heel stick as part of the case management response to a recent fever. This outcome is a proxy measure for a child receiving a malaria test (either an RDT or a blood slide for microscopy). Standards of care for children with fever in Malawi include testing for malaria before providing treatment. The analysis of finger/heel stick included 750 children under age five years who had fever in the two weeks preceding the mother's interview, according to the 2012 Malawi MIS. Appendix Table A18 shows the background characteristics of these children. Diagnostic testing for malaria in children with fever is relatively low in Malawi. Roughly a third of urban children (35 percent) and 19 percent of rural children less than five years old with recent fever reported having a finger/heel stick (Appendix Table A19).

Figure 24 shows the bivariate association between the level of malaria diagnostic capacity and the percentage of children for whom a finger or heel stick was performed for recent fever. In the urban clusters, testing coverage decreased with increasing numbers of facilities with diagnostic capacity. Finger/heel sticks were received by 50 percent of children in clusters with low facility-level diagnostic capacity, by 36 percent of children in clusters with medium readiness, and by 27 percent of children in clusters with high readiness. This association was not significant, however. In rural areas there was also no significant difference in the level of finger/heel stick across levels of diagnostic capacity (see Figure 24).

Figure 24. Proportion of children in Malawi under five with recent fever who had a finger/heel stick by access to facilities with malaria diagnostic capacity, according to residence



Using multilevel models, we assessed how diagnostic testing for malaria (as measured through the proxy finger/heel stick variable) in children with fever is associated with diagnostic capacity at health facilities within the specified buffer of the cluster. We ran separate multilevel models for urban and rural areas.

Table 13 presents odds ratios and 95% confidence intervals for the level of diagnostic capacity, as well as for the covariates adjusted for in the models. In both the urban and rural areas, no significant association was found between the level of malaria diagnostic capacity of the facilities and the likelihood that a child had a finger/heel stick in response to recent fever, after controlling for background characteristics.

Only one background characteristic was associated with the odds of finger/heel stick in children with recent fever. Children in rural areas whose mothers completed secondary or more education had 3.6 times the odds of having a finger/heel stick performed in response to recent fever, compared with children whose mothers had no formal education (OR=3.6; 95% CI=1.4–9.1). No significant associations were seen between finger/heel stick in children and background characteristics in urban areas.

Table 13. Results of multivariable logistic regressions of finger/heel stick in children under five years with recent fever in Malawi, by residence

	Urban		Rural	
Variables	**OR**	**95%CI**	**OR**	**95%CI**
Diagnostic capacity				
Low	1.00		1.00	
Medium	0.27	0.04 - 2.00	1.27	0.71 - 2.26
High	0.1300	0.01 - 1.39	1.08	0.458 - 2.55
Use of ITN				
No	1.00		1.00	
Yes	0.87	0.37 - 2.05	0.83	0.52 - 1.37
Age				
<1	1.00		1.00	
1-2	1.95	0.52 - 7.34	1.36	0.63 - 2.97
2-3	1.47	0.43 - 5.03	0.75	0.32 - 1.76
3-4	1.06	0.27 - 4.18	0.47	0.18 - 1.23
4-5	0.54	0.12 - 2.39	0.83	0.31 - 2.20
Birth order				
1	1.00		1.00	
2	0.57	0.27 - 1.46	1.39	0.79 - 2.30
3 or more	0.78	0.03 - 24.80	1.12	0.37 - 3.39
Sex				
Male	1.00		1.00	
Female	1.05	0.45 - 2.45	0.91	0.56 - 1.48
Mother's education				
None	1.00		1.00	
Primary	0.67	0.14 - 3.32	1.91	0.97 - 3.72
Secondary or higher	1.07	0.20 - 5.53	3.58**	1.40 - 9.12
Wealth quintile				
Lowest	1.00		1.00	
Second	1.44	0.14 - 15.41	1.05	0.53 - 2.08
Middle	0.97	0.13 - 7.45	0.60	0.29 - 1.27
Fourth	0.35	0.07 - 1.80	1.06	0.50 - 2.27
Highest	1.29	0.23 - 7.15	1.47	0.55 - 3.96
Number of children	145		502	
Number of clusters	36		95	

***p<0.001 **p<0.01 *p<0.05

3.6.2. Association between malaria parasitemia prevalence among children and availability of ITNs at health facilities providing malaria prevention and treatment services

3.6.2.1 Availability if of ITNs at health facilities providing malaria prevention and treatment services

We examined the 940 facilities in Malawi that offer malaria diagnosis and treatment services. Among these facilities, approximately 50 percent are health centers or maternity facilities, 34 percent are clinics, 12 percent are hospitals, five percent are dispensaries and only 1 percent are health posts (Table 14). The type of facility varies widely between urban and rural areas. In rural areas, health centers/maternity facilities are the most prevalent type of facility with malaria diagnostic and treatment services (67 percent), while in the urban areas they represent only 10 percent of facilities. Conversely, 70 percent of urban facilities offering malaria diagnosis and treatment are clinics whereas only 18 percent of these facilities in rural settings are clinics. Health posts are only found in rural areas. Malaria diagnosis and treatment services in Malawi are

offered by a mix of public (48 percent), CHAM/faith-based (17 percent), Private (22 percent), NGO (6 percent), and company facilities (7 percent). Government/public facilities are more common in rural areas, while private facilities are more common in urban areas.

Table 14. Characteristics of health facilities in Malawi that provide malaria diagnosis and/or treatment services, by residence, Malawi SPA 2013-14

Characteristics	Urban	Rural	Total
Type of facility			
Hospital	19.3	8.1	11.6
Health centre/maternity	10.3	66.5	49.0
Dispensary	0.8	6.2	4.5
Clinic	69.6	17.9	33.9
Health post	0.0	1.4	1.0
Managing authority			
Public	23.0	59.1	47.9
CHAM/other faith-based	7.7	21.5	17.2
Private	47.8	10.1	21.8
NGO	12.6	2.7	5.8
Company	8.9	6.5	7.2
Region			
North	13.8	18.3	16.9
Central	41.1	35.6	37.3
South	45.1	46.1	45.8
Total number of facilities	292	648	940

In order to evaluate the service environment for malaria prevention and treatment, availability of commodities relevant to malaria prevention, diagnosis and treatment were measured. For this analysis, ITNs at facilities offering malaria diagnosis and/or treatment was used as the facility-level variable of interest. Figure 25a-c show the percentage of facilities offering malaria diagnosis and/or treatment with ITNs available and observed, by residence, type of facility, and managing authority. In urban clusters, 19 percent of malaria diagnosis/treatment facilities had ITNs available and 50 percent of facilities in rural clusters. Health centers/maternity facilities and hospitals were much more likely to have ITN supplies (62 percent and 44 percent, respectively) than were dispensaries (20 percent), clinics (12 percent) or health posts (25 percent).

Figure 25a. Percentage of malaria diagnosis/treatment facilities with ITNs available and observed, by type of facility, Malawi SPA 2013-14

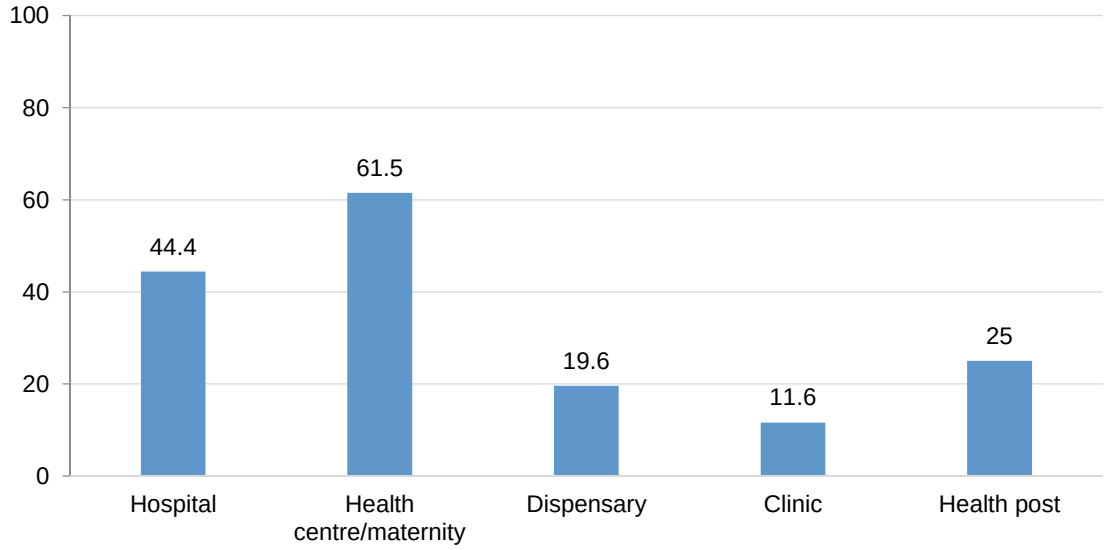


Figure 25b. Percentage of malaria diagnosis/treatment facilities with ITNs available and observed, by managing authority, Malawi SPA 2013-14

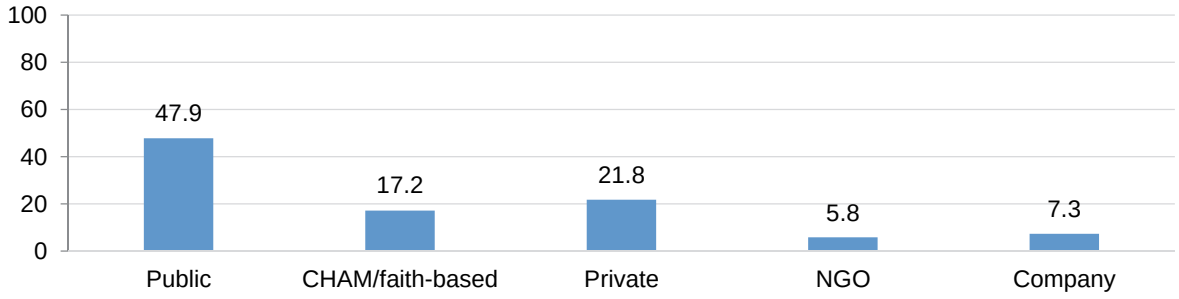
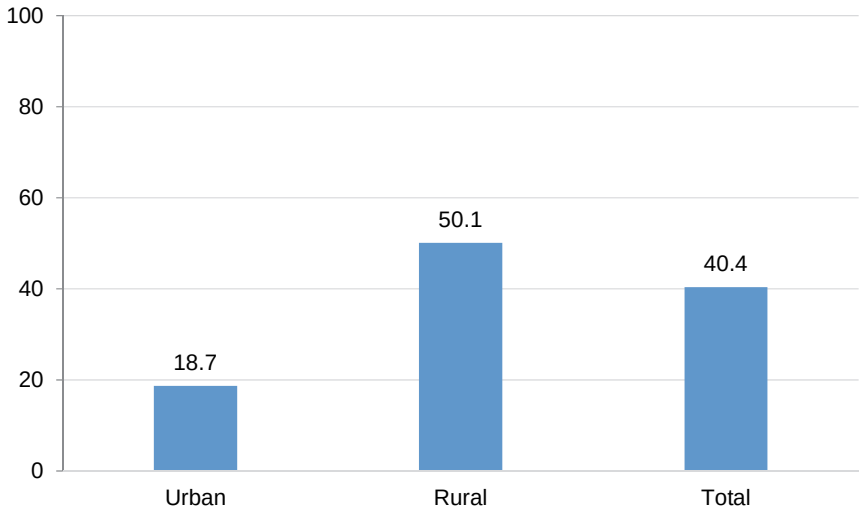


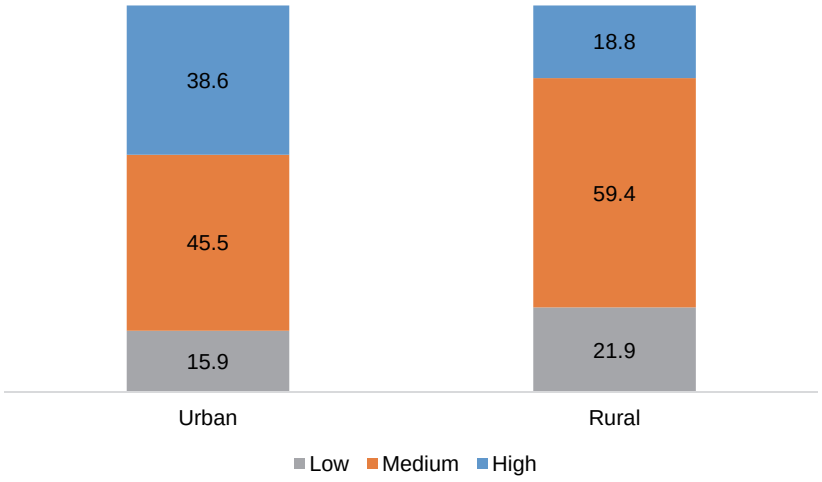
Figure 25c. Percentage of malaria diagnosis/treatment facilities with ITNs available and observed, by residence, Malawi SPA 2013-14



3.6.2.2. Clusters' access to facilities with ITNs

We linked each of the clusters included in the 2012 Malawi MIS to all facilities within a 5 or 10 kilometer buffer and obtained a count of total facilities with ITNs available for every cluster. These counts were then use to divide clusters into three categories representing into low (no facility), medium (1-2 facilities), and high (3 or more facilities) access to malaria diagnosis and treatment facilities with ITNs available. This process was done separately for urban and rural clusters. Figure 26 shows the distribution of three levels of access to facilities with ITNs available among DHS clusters. While approximately half of all clusters fell within the medium access category for both urban and rural clusters, only 7 percent of urban clusters had low access compared to 33 percent of rural clusters. In contrast, 43 percent of urban clusters had high access to malaria diagnosis compared to only 13 percent of rural clusters.

Figure 26. Distribution of access to facilities with ITNs available in Malawi clusters, by residence

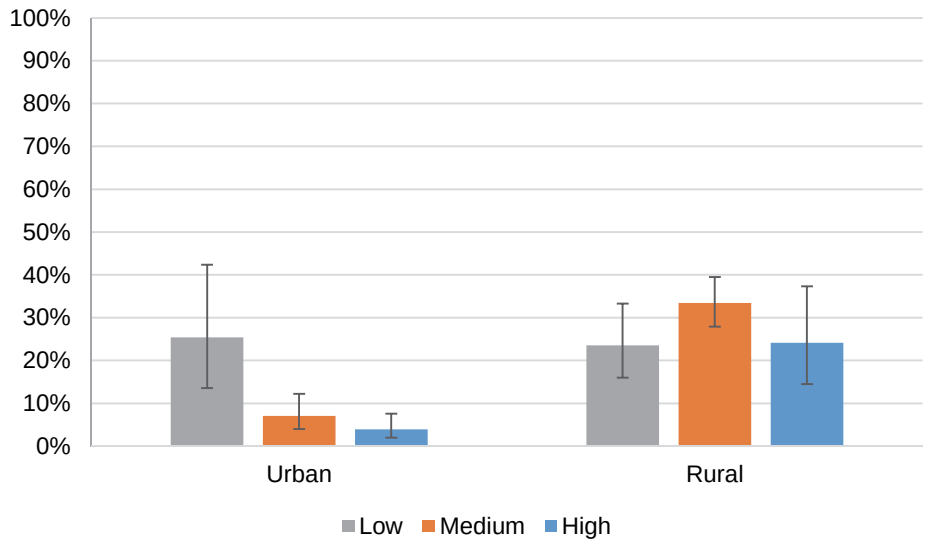


3.6.2.3. Malaria parasitemia prevalence among children and determinants

The individual-level outcome of interest in this analysis is whether or not a child had a positive microscopy test for malaria. This outcome indicates infection with the malaria parasite but not necessarily clinical disease as asymptomatic children were tested. Current recommendations in Malawi call for universal coverage and use of ITNs by the entire population. The analysis of malaria parasitemia included 2,254 children age 6-59 months who were tested for malaria parasites via microscopy as part of the 2012 Malawi MIS. Appendix Table A20 shows the background characteristics of these children. Malaria parasitemia prevalence varies in Malawi by urban-rural residence. Ten percent of urban children and 29 percent of rural children age 6-59 months tested positive for malaria parasites via microscopy (Appendix Table A21).

Figure 27 shows the bivariate association between the level of access to facilities with ITN supplies and the percentage of children with a positive malaria microscopy test. In the urban areas, parasitemia prevalence is lower in children with greater access to facilities with ITN supplies. A quarter of children in clusters with low facility-level ITN availability tested positive for malaria, compared with 7 percent of children in clusters with medium ITN availability, and for 4 percent of children in clusters with high ITN availability. The difference in parasitemia prevalence in low ITN access clusters and medium access clusters is significant as is the difference between low and high access clusters. In rural areas there was no difference in parasitemia prevalence across levels of ITN availability in facilities (see Figure 27).

Figure 27. Proportion of children age 6-59 months with a positive malaria microscopy test in Malawi, by level of access to facilities with ITNs available and residence



Using multilevel models, we assessed how parasitemia prevalence (as measured by microscopy) in children age 6-59 months is associated with ITN availability at health facilities within the specified buffer of the cluster. We ran separate multilevel models for urban and rural areas. Table 15 presents odds ratios and 95% confidence intervals for the level of ITN availability, as well as for the covariates adjusted for in the models. In urban areas children with medium and high access to facilities with ITN availability had lower odds of testing positive for malaria parasites (OR=0.24; 95% CI=0.08–0.77 and OR=0.16; 95% CI=0.04–0.64, respectively). In rural areas, no significant association was found between the level of access to facilities with ITNs and the odds that a child had a positive malaria test, after controlling for background characteristics.

Table 15. Results of multivariable logistic regressions of being malaria positive among children age 6-59 months in Malawi, by residence

	Urban		Rural	
Variables	**OR**	**95%CI**	**OR**	**95%CI**
ITN supply available				
Low	1.00		1.00	
Medium	0.24*	0.08 - 0.77	1.28	0.65 - 2.55
High	0.16**	0.04 - 0.64	0.78	0.32 - 1.93
Household owns at least one ITN				
No	1.00		1.00	
Yes	0.26***	0.12 - 0.54	0.78	0.59 - 1.03
Age				
<1	1.00		1.00	
1-2	2.45	0.58 - 10.34	1.22	0.74 - 2.01
2-3	6.24**	1.69 - 23.02	2.01**	1.22 - 3.30
3-4	2.70	0.67 - 10.87	2.46***	1.50 - 4.03
4-5	3.65	0.96 - 13.87	2.50***	1.52 - 4.11
Sex				
Male	1.00		1.00	
Female	0.56	0.28 - 1.10	1.03	0.80 - 1.32
Mother's education				
None	1.00		1.00	
Primary	3.12*	1.02 - 9.56	1.00	0.75 - 1.33
Wealth quintile				
Lowest	1.00		1.00	
Second	1.60	0.26 - 9.72	0.86	0.60 - 1.23
Middle	2.73	0.49 - 15.09	1.00	0.69 - 1.45
Fourth	1.96	0.48 - 8.03	0.67	0.45 - 1.00
Highest	0.74	0.17 - 3.15	0.41**	0.22 - 0.75
Region				
North	1.00		1.00	
Central	0.42	0.11 - 1.66	3.09**	1.32 - 7.22
South	0.52	0.12 - 2.25	1.56	0.67 - 3.65
Number of women	596		1,587	
Number of clusters	44		96	

***p<0.001 **p<0.01 *p<0.05

Several background characteristics were also associated with odds of a positive malaria test. In both urban and rural settings, older children are more likely to test positive for malaria than are younger children. In rural settings, children from the wealthiest households were less likely to test positive for malaria than were children from the poorest households (OR = 0.41; 95%CI = 0.22-0.75). Also, in rural settings, children from the Central region had 3.1 times greater odds of malaria parasitemia than children from the North (95% CI = 1.32-7.22). In urban areas, children whose mothers completed at least primary school had 3.1 times the odds of having a positive malaria test than children whose mothers did not complete primary school (OR = 1.0 – 9.6). Finally, urban children living in households owning at least one ITN were significantly had lower odds of testing positive for malaria than those living in households without ITNs (OR = 0.26; 95%CI = 0.12-0.54).

3.6.4. Association between IPTp2 coverage among pregnant women and service readiness for provision of IPTp services at health facilities

3.6.4.1. Service readiness for provision of IPTp services at health facilities

Among the 632 facilities in Malawi that offer ANC services, approximately 70 percent are health centers or maternity facilities, 16 percent are hospitals, 10 percent are clinics, three percent are dispensaries and less than 1 percent are health posts (Table 16). The type of facility varies widely between urban, and rural areas. In rural areas, health centers/maternity facilities are the most prevalent type of ANC facility (80 percent), while in the urban areas they represent only 24 percent of ANC facilities. Conversely, 44 percent of urban facilities offering malaria diagnosis and treatment are hospitals whereas only 10 percent of these facilities in rural settings are hospitals. Similarly, 29 percent of ANC facilities in urban settings are clinics whereas only 6 percent of ANC facilities in rural areas are clinics. Health posts are only found in rural areas. ANC services in Malawi are offered by a mix of public (63 percent), CHAM/faith-based (24 percent), Private (7 percent), NGO (2 percent), and company facilities (5 percent). Government/public facilities are most common in both rural and urban settings, however, private facilities comprise a greater proportion of ANC facilities in urban settings than in rural settings (24 percent versus 3.3 percent, respectively).

Table 16. Characteristics of health facilities in Malawi that provide ANC services, by residence, Malawi SPA 2013-14

Characteristics	Urban	Rural	Total
Type of facility			
Hospital	44.4	9.9	16.2
Health centre/maternity	24.4	80.8	70.5
Dispensary	1.9	3.0	2.8
Clinic	29.4	5.8	10.1
Health post	0.0	0.4	0.4
Managing authority			
Public	48.3	66.5	63.2
CHAM/other faith-based	17.7	24.9	23.6
Private	24.3	3.3	7.1
NGO	4.4	1.0	1.6
Company	5.3	4.3	4.5
Zone			
North	16.0	19.2	18.6
Central	40.8	36.3	37.1
South	43.2	44.5	44.3
Total number of facilities	116	516	632

Facility's service readiness for provision of IPTp was measured based on a number of components including the availability of IPTp guidelines, valid SP available and observed, self-report that IPTp services are offered as part of routine ANC, and ANC staff with recent IPTp training (see Appendix Table A22 for a detailed summary of indicators considered). Figures 28a-c indicate variations in readiness of health facilities for providing IPTp services. In urban clusters, 16 percent of ANC facilities were service ready for IPTp provision compared to 20 percent of facilities in rural clusters. Hospitals and health centers/maternity facilities were much more likely to be IPTp service ready (40 percent and 29 percent, respectively) than were dispensaries (12 percent), clinics (16 percent) or health posts (0 percent).

Figure 28a. Proportion of ANC facilities service ready for provision of IPTp, by type of facility, Malawi SPA 2013-14

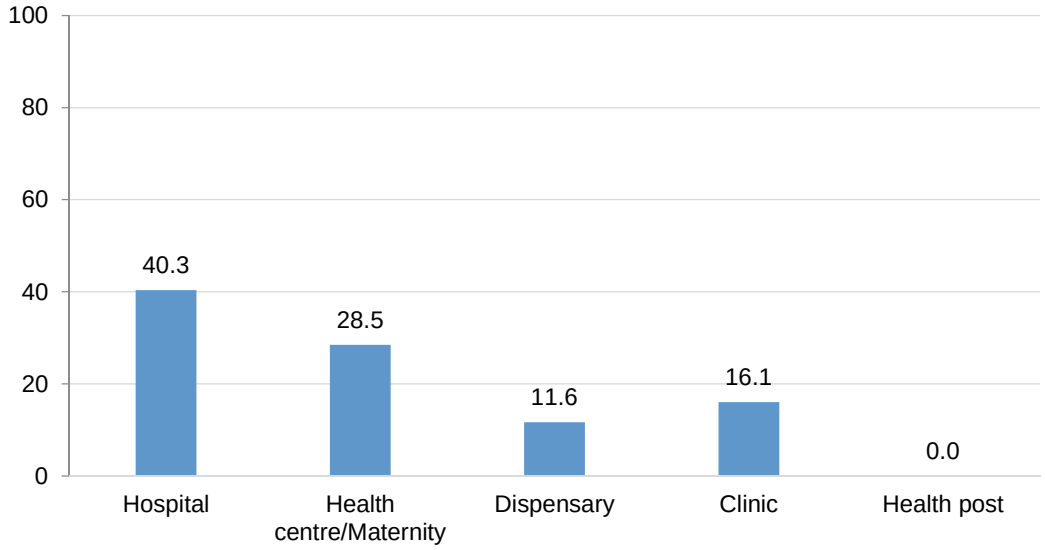


Figure 28b. Proportion of ANC facilities service ready for provision of IPTp, by managing authority, Malawi SPA 2013-14

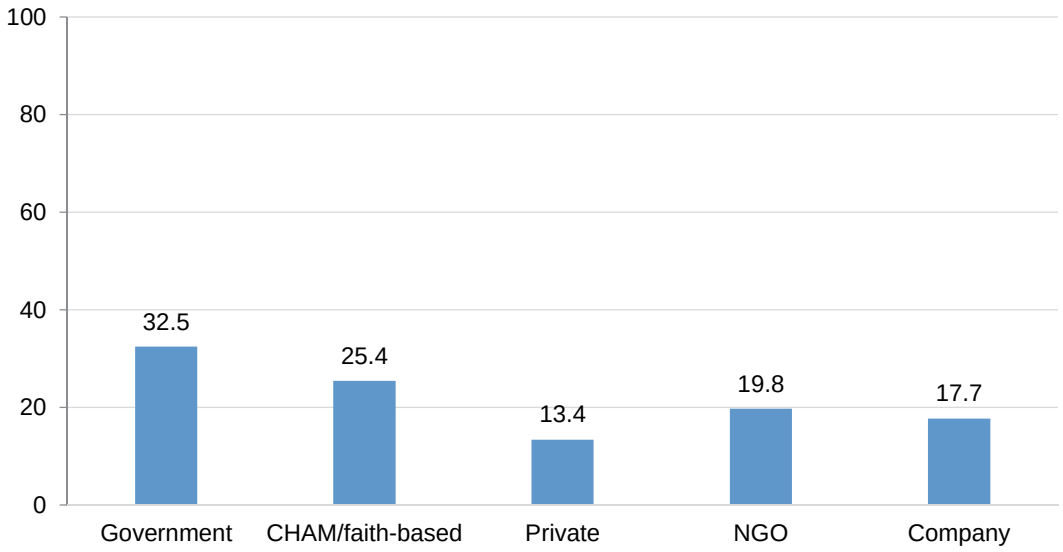
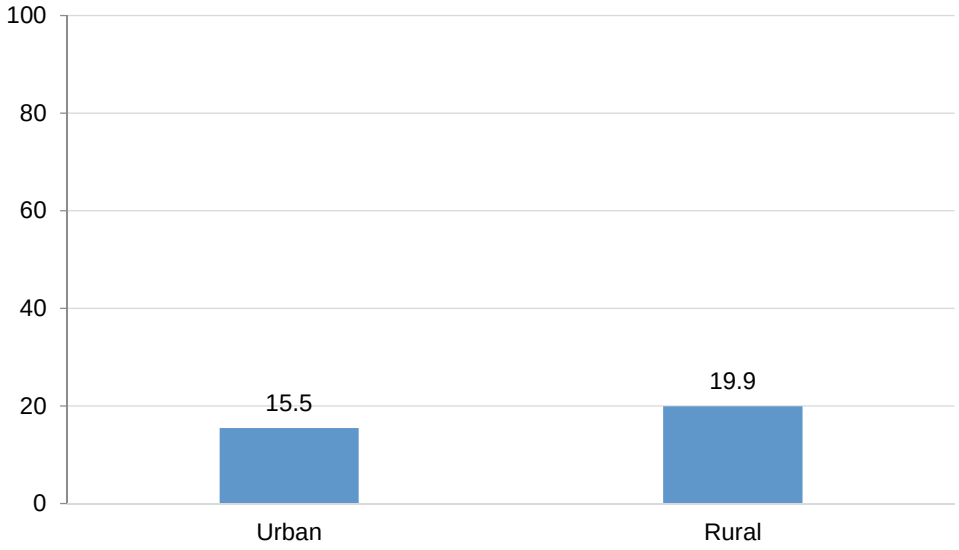


Figure 28c. Proportion of ANC facilities service ready for provision of IPTp, by residence, Malawi SPA 2013-14

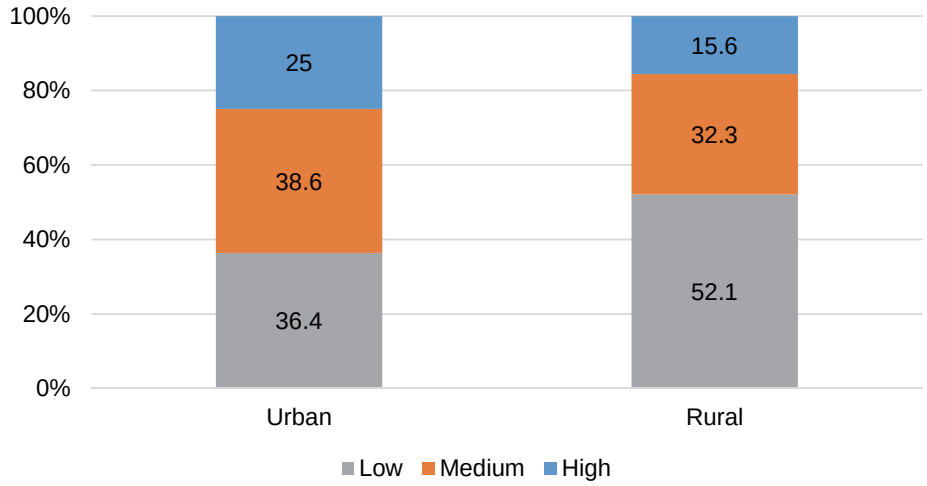


3.6.4.2. Access to facilities service -ready to provide IPTp in MIS clusters

After each of the 140 clusters included in the 2012 Malawi MIS were linked to all ANC facilities within the specific buffer, we counted the number of facilities linked to each cluster with IPTp service readiness. These counts were then use to divide clusters into three categories representing low, medium and high access to IPTp service ready facilities. This process was done separately for urban and rural clusters with different cutoff values because the distribution of the number of facilities is very different between urban and rural clusters. In rural clusters Low, medium and high access were defined as zero, one and 2-4 facilities service ready for IPTp, respectively. In urban clusters low, medium, and high access were defined as 0-1, 2-3, and 4-9 facilities, respectively.

Figure 29 shows the distribution of low, medium and high access to ANC facilities service ready for IPTp provision among DHS clusters, by urban and rural residence. Approximately one third of urban clusters fell within the low access category (36 percent); thirty-nine percent had medium-level access and one quarter had high-level access to IPTp ready facilities. Over one half of rural clusters had low access (52 percent), 32 percent had medium-level access and 16 percent had high level access to IPTp ready facilities.

Figure 29. Percent distribution of Malawi clusters by access to IPTp services, according to residence

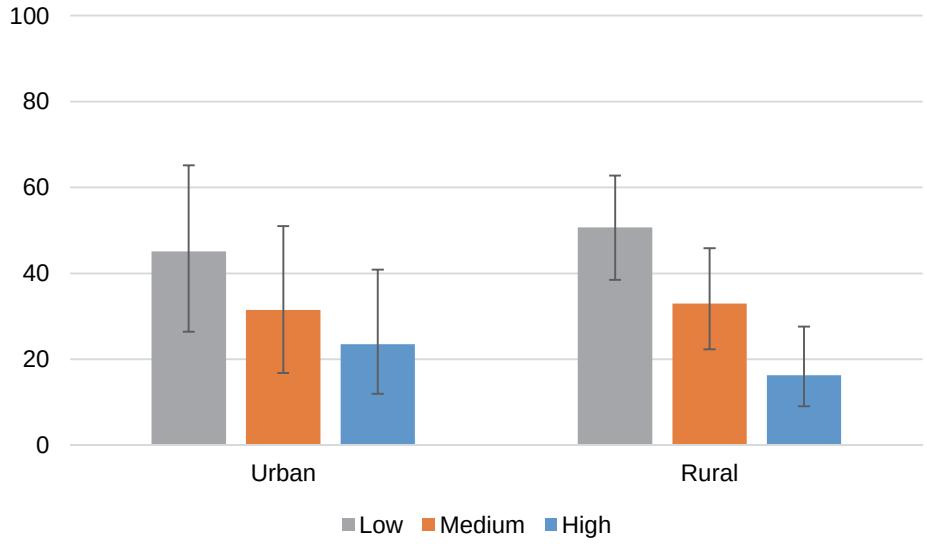


3.6.4.3. IPTp2 coverage among pregnant women and determinants

The individual-level outcome of interest in this analysis is whether or not an interviewed woman between the ages of 15 and 49 received two or more doses of SP for prevention of malaria during her last pregnancy that resulted in a live birth within two years of the survey. This intervention is recommended by Roll Back Malaria for all women in high malaria transmission settings. The analysis of IPTp2 included 990 women 15-49 years of age who were interviewed and had a live birth in the two years before the interview in the 2012 Malawi MIS. Appendix Table A23 shows the background characteristics of these women. IPTp2 coverage does not vary significantly in Malawi by urban/rural setting; 56 percent of urban women and 53 percent of rural women received the IPTp2 intervention (Appendix Table A24).

Figure 30 shows the bivariate association between the level of access to facilities with IPTp service ready readiness and the percentage of women who received at least two doses of IPTp. In the urban areas, no significant association was seen between level of access to facilities service ready for IPTp provision and IPTp2 coverage. In rural settings, women in clusters with high access to IPTp service ready facilities were significantly less likely to have received two doses of SP during her last pregnancy compared to women in clusters with low access to IPTp services (16 percent vs. 51 percent, respectively).

Figure 30. Women's use of IPTp2 in Malawi by level of access to ANC facilities service ready for IPTp provision, by residence



Using multilevel models, we assessed how IPTp2 coverage in interviewed women with a live birth in the past two years is associated with IPTp service readiness at health facilities within the specified buffer of the cluster. We ran separate multilevel models for urban and rural areas. Table 17 presents odds ratios and 95% confidence intervals for the level of IPTp service readiness, as well as for the covariates adjusted for in the models. In the multivariable model In rural areas the negative association between IPTp coverage and IPTp service readiness seen in the bivariate analysis becomes positive; women with high access to IPTp service ready facilities were more likely to have received the IPTp2 intervention than women in areas with low access (OR = 2.4; 95% CI=1.4-4.3). In urban areas, no significant association was found between the level of access to IPTp service ready facilities and the likelihood that a woman received IPTp2, after controlling for background characteristics.

Only two other covariates were associated with odds of IPTp2. In urban clusters, women who reported having seen or heard messages about malaria in the past six months were more likely to have received the IPTp2 intervention then were those who had not be exposed to these messages (OR = 2.0; 95%CI = 1.0-3.8). In rural settings, non-Catholic Christian women were more likely to have received the IPTp2 intervention than were Catholics (OR = 1.9; 95%CI = 1.1-3.2).

Table 17. Results of multivariable logistic regressions of IPTp2 among women who had a live birth in the two years preceding the survey in Malawi, by residence

	Urban		Rural	
Variables	**OR**	**95% CI**	**OR**	**95% CI**
Level of access to ANC facilities service ready for IPTp provision				
Low	1.00		1.00	
Medium	0.58	0.28 - 1.23	1.17	0.79 - 1.736
High	1.20	0.48 - 2.99	2.45**	1.39 - 4.301
Age				
15-19	1.00		1.00	
20-24	0.93	0.32 - 2.73	1.41	0.77 - 2.600
25-29	0.98	0.31 - 3.09	0.97	0.49 - 1.907
30-34	1.01	0.30 - 3.44	1.23	0.59 - 2.559
35-39	1.58	0.35 - 7.14	0.96	0.43 - 2.110
40-49	0.19	0.01 - 2.82	1.17	0.49 - 3.046
Parity				
1st birth	1.00		1.00	
2nd birth	1.41	0.69 - 2.86	1.06	0.70 - 1.607
3rd or higher	0.89	0.21 - 3.74	0.82	0.44 - 1.526
Number of household members				
1-3	1.00		1.00	
4-5	0.90	0.41 - 2.00	1.21	0.72 - 2.034
6-7	0.85	0.33 - 2.18	1.62	0.90 - 2.933
8-9	0.78	0.23 - 2.65	1.90	0.88 - 4.094
10 or more	0.35	0.05 - 2.49	1.04	0.35 - 3.038
Woman is literate				
No	1.00		1.00	
Yes	1.33	0.48 - 3.72	1.30	0.87 - 1.93
Completed primary school				
No	1.00		1.00	
Yes	1.32	0.67 - 2.60	1.03	0.64 - 1.65
Wealth quintile				
Lowest	1.00		1.00	
Second	1.95	0.25 - 15.12	1.34	0.82 - 2.17
Middle	0.92	0.16 - 5.38	1.36	0.83 - 2.25
Fourth	0.89	0.20 - 3.90	0.73	0.42 - 1.26
Highest	1.51	0.37 - 6.18	2.04	0.93 - 4.46
Region				
Northern	1.00		1.00	
Central	0.39	0.15 - 1.04	0.70	0.41 - 1.21
Southern	1.29	0.50 - 3.38	0.78	0.46 - 1.33
Woman's religion				
Catholic	1.00		1.00	
CCAP	2.57	0.98 - 6.74	1.30	0.69 - 2.45
Anglican	0.81	0.19 - 3.42	1.04	0.24 - 4.48
Seventh Day Advent./ Baptist	1.59	0.52 - 4.86	1.07	0.46 - 2.49
Other Christian	0.97	0.40 - 2.40	1.90*	1.14 - 3.19
Muslim	1.47	0.52 - 4.21	1.49	0.83 - 2.69
No religion	na		1.09	0.21 - 5.51
Other	0.56	0.07 - 4.31	0.89	0.42 - 1.84
Woman has seen or heard messages about malaria in past six months				
No	1.00		1.00	
Yes	1.99*	1.04 - 3.84	1.32	0.89 - 1.96
Number of women	234		629	
Number of clusters	44		96	

***p<0.001 **p<0.01 *p<0.05

4. Discussion and Conclusions

Using data from nationally representative household surveys and health facility censuses in Haiti and Malawi, this study developed a method of linking population data and health facilities data to examine the relationship between service environment and utilization for a number of key health services in Haiti and Malawi. In this section we discuss the key results for each health area, highlight benefits and constraints of the methodology, discuss the study limitations, and provide overall conclusions.

4.1 Key Findings on the Association between Service Environment and Use of Health Services

4.1.1. Family planning

The results on family planning in Haiti indicate a strong association between the availability of methods choice and women's use of modern contraceptive methods in rural and other urban areas. The presence of at least one facility offering a range of methods within a reasonable distance from the community was significantly associated with increased adoption of modern contraceptive methods. This finding is consistent with the findings of other studies, discussed earlier in this report (see section 1.2), even though different linking approaches were used in those studies. Providing a range of method choice is important to meet the needs of couples at different life stages and also to allow woman to switch methods if necessary, thereby increasing long-term use of contraception (Bruce 1990). However, choice of modern methods of contraception at health facilities is limited in Haiti—less than one-third of family planning facilities in the country provide three or more methods. The community's access to facilities with multiple method choice is poor. In both urban and rural areas, about 17 percent of clusters do not have a facility within 10 km offering three or more contraceptive methods. These findings suggest family planning programs in Haiti need to focus on increasing method choice in both urban and rural areas. In rural areas, health centers without beds and dispensaries will need to be better resourced in contraceptive supplies because they are the two major types of facilities that provide FP services.

4.1.2. Antenatal care

Antenatal care services are widely available at health facilities (832 out of 905) in Haiti. As a result, all clusters irrespective of location have at least one ANC facility within 5 km or 10 km. However, the readiness in providing high-quality ANC is of concern; the study identified limited capacity to conduct urine and blood tests, little use of the ANC guidelines, and poor availability of tetanus vaccine. Our analysis showed that facilities' service readiness is associated with women's receipt of 4 or more ANC visits in rural and other urban areas, and with increased quality of care in rural areas. A study in Nepal also showed that the quality of health services in the health post within the community is significantly associated with women's use of any antenatal care service (Acharya and Cleland 2000). As expected, our analyses showed that service readiness is an important determinant of women's receipt of high quality ANC care. However, this association is only significant in urban areas; coverage of high quality care in other urban areas already reaches 70 percent. It is possible that other factors, for example, cost of services affect the quality of care received. A study in rural Zambia based on linked data from DHS and the National Health Facility Census also found that level of antenatal care services in the closest facility was associated with the increased quality of antenatal care that women received (Kyei, Campbell, and Gabrysch 2012). However, the authors acknowledged the potential misclassification of level of services, due to the difference in timing of the two surveys and imprecision in distance measures as a result of DHS cluster displacement. In rural areas, for both outcomes (service readiness and quality of care), the difference in the relationship between the service environment and the respective outcome was only significant when comparing high and low service

readiness. This could imply that a certain level or threshold of readiness is needed to see an impact on ANC outcomes.

4.1.3. Facility delivery

Access to normal delivery care and basic (BEmOC) and comprehensive (CEmOC) emergency care is important for reducing maternal mortality. In Haiti, less than one-third of health facilities mandated to provide delivery services provide BEmOC, which is far from the government's goal of having 108 BEmOC facilities by 2015. We found that one-third of other urban clusters and half the rural clusters do not have any facility with BEmOC within the 5 km or 10 km buffer. Availability of CEmOC is even more limited. Nationwide, 36 facilities provide CEmOC and only 5 were located in rural areas where more than 150,000 births occur every year. Our findings indicate a strong effect of having a BEmOC facility on facility delivery in the metropolitan area. However, the results in rural and urban areas seem to suggest that being able to access a facility providing normal delivery services (with or without BEmOC) is more important in rural and other urban areas. These results suggest that efforts and resources should focus on increasing access to normal delivery services in rural and other urban areas. In Haiti, only hospitals and health centers with beds are mandated to provide delivery services. Health centers and dispensaries are more available in rural areas but are not equipped to provide service delivery services. The government may change the mandate of lower-level facilities and provide essential resources including training health providers for delivery care to meet local needs.

4.1.4. Care seeking for children's diarrhea

Diarrhea is one of the leading causes of under-five mortality in Haiti. Limited use of facility care for children's diarrhea could be related to the quality of care at health facilities. Using a wide range of components identified by WHO that are essential for providing child curative care services, we assessed facilities' readiness to provide the services. We found a significant positive association between the level of service readiness and care seeking for children's diarrhea in the metropolitan area but not in rural and urban areas. Possibly because of limited health knowledge and/or cultural factors, caregivers of children in rural and urban areas may not consider diarrhea to be an illness of sufficient severity to need facility care, even when it is accessible. In the metropolitan area, however, people generally have more education and are more likely to have the economic means to afford facility care for children. Another possible reason for the differential use of facility care for children's diarrhea may be that informal health services are more widely used for treatment of children's diarrhea in less developed areas. This issue will be discussed in the limitation section.

4.1.5. HIV testing

In rural areas, living in a community with a facility within 10 km having HIV testing capacity was found to significantly increase the use of HIV testing services. However, in urban areas the availability of the items that support the quality of care are significantly associated with HIV testing. In the metropolitan area, no association is found between the HIV service environment and HIV testing. It should be noted that all clusters in the metropolitan area are linked to at least one facility with HIV testing capacity. In areas where HIV-related services are widely available, people are likely to travel further for these services because of the fear of social stigma. In rural areas, where half of the facilities lack HIV testing capacity, care seeking may be constrained to nearby facilities.

4.1.6. Malaria-related health services

Service delivery at health facilities is considered important for malaria prevention and treatment. This study is the first we are aware of that links population data with health facility data to quantify the relationship between malaria-related population outcomes and the service environment. Despite the high malaria prevalence in rural areas of Malawi, over half of rural clusters do not have any facility within 10 km that is ready for provision of IPTp. As expected, high access to IPTp service-ready facilities is significantly associated with the IPTp2 coverage among pregnant women in rural areas. However, the association is not significant in urban areas. It is important to note that levels of service readiness are defined differently in urban and rural clusters because of the distribution of service-ready facilities. Future investigations of service readiness could use different methods of analysis such as population-adjusted measures of access.

The association between ITN availability and malaria parasitemia is significant in urban areas but not in rural areas. Although this association was seen in multivariable models that controlled for household wealth and other socio-demographic variables, it is possible that other unmeasured factors are playing an important role. For example, well-provisioned facilities may be more common in clusters with good housing quality (screens, eaves, air-conditioning, etc.) in which children would be at low risk of malaria. We did not find an association between malaria diagnostic testing in children with fever and diagnostic capacity at health facilities in either rural or urban areas. This could be due to the relatively high access to facilities offering malaria diagnostic tests in both urban and rural areas. Almost 90% of all facilities had available RDTs, although fewer reported the other components of diagnostic capacity (trained personnel and possession of the proper guidelines). In practice, having RDTs available is likely sufficient for a child to be tested, regardless of training or protocols. Thus, the near universal availability of the RDTs could explain our results.

4.2. Benefits of the Buffer Linkage Methodology

The availability of GPS data of clusters and health facilities provides opportunities for linking households and health facilities to examine the relationship between service provision and use. Among the limited studies based on DHS and SPA surveys or other health facility surveys, most linked DHS clusters to the nearest health facility and analyzed how physical access to health facilities—i.e. distance to the nearest facility and/or the services provided at the health facility—affects population use of health services. This approach of using distance as a measurement of access to health care is prone to errors resulting from the geographical displacement of DHS clusters. The coordinates of DHS clusters are displaced up to 2 km in urban areas and 5 km in rural areas; therefore, the distance to the identified "nearest" facility may not be the distance wanted. Skiles et al. (2013) indicated that the distance to closest facility can be misclassified for 34 to 43 percent of clusters due to clusters displacement.

When the identified "nearest" facility is not the closest in reality, associating its service provision with population use of services is problematic. In Haiti, we found that within the specific buffer, about 30 percent of clusters in rural and other urban areas were linked to more than one facility offering three or more family planning methods, and the majority of DHS clusters had more than one facility offering antenatal care services. In such circumstances, the displacement could cause one of these facilities to be identified as the closest facility, even though in reality it is not. Service provision in the identified facility therefore does not represent the service environment nearest to the community. Furthermore, even when the nearest facility is correctly identified, linking clusters to the nearest facility does not account for potential *provider bypassing* because of other considerations such as cost and quality of care. Women may be willing to travel further for services if the perceived quality of care in the nearest facility is poor.

Instead of relating health services utilization to the service provision in a single facility (the nearest one), we consider it more important and reasonable to look at the *average service provision* of all health facilities within an accessible distance from the community; therefore, we measured the service environment comprised of all the facilities within a specified buffer. We were able to include all formal-sector health facilities that provide specific services to gauge the service environment because both the Haiti and Malawi SPA surveys are censuses. The use of a 10-kilometer buffer distance in rural areas and a 5-kilometer buffer distance in urban areas reduced misclassification error due to cluster displacement and ensured that all facilities within the maximum displacement radius around the real location of the cluster were captured (given that urban clusters were displaced up to 2 km and most rural clusters were displaced up to 5 km) (Burgert 2013).

Depending on data available and indicators of interest, other methods can be applied to link household data and health facility data; these methods are discussed in Burgert (2014). It should be noted that the buffer linking method is not recommended in the absence of health facility censuses because such linkage based on facility sample data may result in substantial misclassification bias. Skiles et al. (2013) in their simulation analysis with Rwanda data showed that 50 to 60 percent of clusters were misclassified in terms of the number of linked family planning facilities, even using undisplaced GPS data on DHS clusters. When facility data come from a sample survey, linkage should only be made at the level for which the sample is representative, for example, at the regional level (Burgert 2014).

4.3. Methodological Lessons Learned

In the process of linking population data and health facility data for the purpose of analyzing multiple health services, some methodological lessons became evident. First, it is appropriate to stratify the analysis by urban and rural residence, and even further separate the metropolitan area from other urban areas. For example, in Haiti, as shown in the analysis for all health services examined, clusters in the metropolitan area were linked to a much greater number of health facilities than clusters in other urban and rural areas. Types of facilities and therefore service provision are different between them. In Malawi, similar findings were seen between urban and rural areas.

Second, it is necessary to use different cutoff points for different locations to distinguish service environment among clusters. In Haiti, because clusters in the metropolitan area were linked to a much greater number of health facilities than clusters in other urban and rural areas, to measure service availability it was necessary to use different cutoff points to distinguish clusters in the metropolitan area. For example, in measuring the family planning service environment in terms of the availability of a range of contraceptive methods at health facilities, clusters in rural and other urban areas were categorized into three groups based on whether within the buffer, there was zero, one, or more than one facility providing three or more methods. However, in the metropolitan area all clusters were linked to one or more facilities, so a different cutoff—terciles of the number of facilities—was used to distinguish clusters. Similarly, different cutoffs were necessary in urban and rural clusters in Malawi. When using different cutoffs, the high-low difference is no long comparable between locations.

Third, a 5 kilometer buffer may not be appropriate for defining the service environment for clusters in the metropolitan area. Because of the high density of health facilities and DHS clusters in the metropolitan area, using a 5 km buffer may result in adjacent clusters linking to (more or less) the same group of facilities; therefore, there is limited variation across metropolitan clusters in terms of the service environment. For example, in the assessment of ANC services, we found much less variation in the ANC service readiness among clusters in the metropolitan area compared with clusters in rural and other urban areas. Similar results were found regarding the service environment in providing curative child care: readiness scores in

the metropolitan area were largely homogenous while the interquartile range was wider in other urban and rural clusters.

Moreover, the populations in metropolitan areas are likely to have more transportation options available and can more easily access health services that are geographically further from their home. Therefore, the service environment defined with a 5 km buffer may not represent a meaningful service environment for the communities in this area. This study included the metropolitan area for comparison purposes. The findings indicate that the buffer linkage between DHS clusters and SPA facilities may not be appropriate in areas with a high density of both health facilities and population. More precise measurements of the service environment are needed for such areas.

4.4. Study Limitations

One important limitation of this study is the temporal gap between the outcome variables and the service variables. Facility data reflect the "current" service environment at the time of the Haiti 2013 SPA and the Malawi 2013-14 SPA, while outcomes may be measured over a time period preceding the household surveys in the two countries. For example, in Malawi, IPTp2 is measured during a 2-year period preceding the 2012 Malawi MIS; and in Haiti, antenatal care and facility delivery variables cover use of services for the last birth in a 5-year period preceding the 2012 Haiti DHS. Associating service provision and use data could be problematic if the service environment changed substantially over the time period.

For malaria, there is also the potential for biases due to seasonality. Malaria parasitemia is seasonal, therefore is possible that commodity supplies vary with the malaria season. If malaria outcomes and service environment are measured in different seasons—for example, one in high-prevalence season and one in low-prevalence season—bias may be introduced in examining their association. In Malawi, however, malaria transmission is holoendemic so seasonal variation in commodity supplies at health facility should be limited, and seasonal biases in Malawi should be minimal. Moreover, IPTp data are collected over a two-year lag so seasonality should not affect the measurement.

Another important limitation is the potential confounding effect of the use of informal health services or other modes of service delivery. SPA data only reflect services provided at formal health care facilities. Informal sectors may also be used for health care. For example, the majority of condom users in Haiti obtained condoms from the informal sector (shops, friends or relatives); therefore it is necessary to exclude condom from the analysis. Diarrhea treatment in Haiti also relies heavily on the informal health sector. Among children who received treatment for a recent episode of diarrhea, 20 percent received treatment from mobile clinics, shops, and traditional healers, which are not captured in the SPA survey. Use of the informal health sector is usually more common in the least developed areas, which could partially explain the nonsignificant association between the level of service readiness at health facilities and care seeking for children's diarrhea in rural and other urban areas. Use of informal health services is less of concern for antenatal care, delivery care, and HIV testing. The reported sources for these services are mostly formal health facilities.

People may use other modes of service delivery in addition to health facilities. For example, the Malawi National Malaria Control Program's ITN policy promotes free distribution of ITNs for children attending their first Expanded Program on Immunization (EPI) visit, among other modes of distribution. Availability of ITNs at health facilities represents potential access to a very effective malaria prevention intervention. However, ITNs are also distributed via national campaigns every two or three years, which could mitigate the effects of facility-level ITN availability on malaria prevalence. National distribution campaigns are

designed to provide equitable ITN access to the population but the availability of ITNs is not equal across health facilities from different clusters, which could influence malaria prevalence.

4.5. Conclusions

This report linked population survey data and health facility census data using a buffer-linkage method. As demonstrated, this linkage method can be applied in several health areas to examine how the service environment affects health service utilization when the available data sources are a household survey and a health facility census that were conducted around the same time period. This method has been found to be useful in settings with low density of health facilities. For most health services, a significant association is found in rural areas (and other urban areas in Haiti) between access to or readiness of service provision and utilization of health services. The relationship does not hold however in the Haiti metropolitan area because more precise measurements of the health service environment are needed for areas with high density of health facilities and population.

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Appendix

Table A1. Percentage of family planning facilities in Haiti that provide specific family planning methods[1], by residence, Haiti SPA 2013

Methods	Metropolitan	Other urban	Rural	Total
Pill	68.3	82.0	77.6	77.0
Injectables	69.1	81.3	77.8	77.1
Male condom	74.8	88.7	80.3	81.1
Implants	11.4	41.9	15.3	19.9
Female condom	2.4	6.0	6.4	5.7
IUD	7.3	5.3	0.6	2.6
Emergency contraception	8.9	8.6	3.9	5.7
Standard days method	14.6	19.9	12.0	14.0
Male sterilization	4.1	12.0	2.5	4.6
Female sterilization	5.7	17.3	2.7	6.1
Provide three or more methods (excluding condom)	27.6	50.5	23.1	29.3
Total number of facilities	**123**	**150**	**483**	**756**

[1] Facility provides, prescribes, or counsels clients on family planning methods and facility has valid products observed on-site if method is pill, injectables, implants, male condom, female condom, and emergency contraception

Table A2. Percent distribution of married women age 15-49 in Haiti, by selected family planning (FP) characteristics and background characteristics, according to residence

	Metropolitan		Other urban		Rural	
Characteristics	**%**	**N**	**%**	**N**	**%**	**N**
Current use of modern contraception*						
No	78.5	1519	69.6	846	70.3	2689
Yes	21.5	416	30.4	370	29.7	1137
Access to facilities with 3+ modern methods						
Low	39.9	773	17.1	209	16.6	635
Medium	32.2	624	40.5	493	29.2	1119
High	27.8	539	42.3	515	54.2	2072
Exposure to FP messages						
No	39.6	766	47.3	575	59.6	2281
Yes	60.4	1169	52.7	641	40.4	1545
Contact with FP providers						
No	78.9	1527	70.3	855	68.4	2617
Yes	21.1	408	29.7	361	31.6	1209
Mother's age at birth						
15-24	21.1	409	16.9	205	21.3	814
25-34	41.6	804	43.9	534	36.2	1385
35-44	28.2	546	29.3	356	28.9	1105
45-49	9.1	176	9.9	121	13.6	522
Number of living children						
0-1	48.2	933	39.4	479	26.2	1004
2-3	35.6	689	38.1	463	35.4	1355
4-5	12.8	247	16.5	200	20.9	801
6+	(3.4)	66	6.1	74	17.4	666
Mother's education						
None	10.1	196	11.0	134	34.0	1301
Primary	31.7	613	36.0	437	44.4	1700
Secondary or higher	58.2	1126	53.1	645	21.6	825
Occupation						
Not employed	36.3	702	28.1	342	32.6	1249
Agriculture	4.4	85	4.8	59	13.0	497
Professional	52.6	1017	62.4	759	52.8	2021
Other	6.8	131	4.7	57	1.6	60
Wealth quintile						
Lowest	0.0	0	0.0	0	35.2	1345
Second	0.3	5	0.5	6	34.0	1299
Middle	11.3	218	22.8	278	20.5	786
Fourth	37.8	732	40.0	486	8.2	312
Highest	50.6	979	36.6	446	2.2	83
Department						
Aire metropolitaine/Reste-Ouest	100.0	1935	7.7	93	20.4	780
Sud-est	0.0	0	4.9	59	6.1	234
Nord	0.0	0	28.2	342	10.0	384
Nord-est	0.0	0	8.8	107	4.3	165
Artibonite	0.0	0	22.6	275	21.8	835
Centre	0.0	0	6.8	82	10.5	402
Sud	0.0	0	6.2	75	10.4	399
Grand'anse	0.0	0	5.0	61	5.1	194
Nord-Ouest	0.0	0	7.7	94	6.4	243
Nippes	0.0	0	2.2	27	5.0	190
Religion						
Catholics	42.0	814	43.7	532	41.8	1598
Protestant	50.3	974	50.6	615	47.3	1811
Vaudousant/other	7.6	148	5.7	70	10.9	417
Total	100.0	1935	100.0	1216	100.0	3826

* Condom is excluded

Table A3. Percentage of married women age 15-49 in Haiti who are currently using a modern contraceptive method*, by selected family planning (FP) characteristics, background characteristics, and residence, Haiti DHS 2012

Characteristics	Metropolitan	Other urban	Rural
Access to facilities with 3+ modern methods			
Low	22.7	22.7	20.2
Medium	19.7	33.0	26.2
High	21.8	31.1	34.5
Exposure to FP messages			
No	23.3	29.3	28.2
Yes	20.3	31.4	32.0
Contact with FP providers			
No	18.5	25.7	24.2
Yes	32.7	41.6	41.6
Mother's age at birth			
15-24	25.6	33.6	25.4
25-34	26.8	32.8	35.6
35-44	14.0	28.7	32.1
45-49	10.9	19.5	15.7
Number of living children			
0-1	17.2	24.3	18.9
2-3	28.0	36.7	35.4
4-5	21.3	30.7	34.8
6+	13.8	30.4	28.4
Mother's education			
None	17.1	32.8	28.2
Primary	22.1	33.1	31.4
Secondary or higher	21.9	28.1	28.6
Occupation			
Not employed	21.5	27.4	26.2
Agriculture	34.6	26.8	28.7
Professional	21.8	31.3	32.2
Other	10.8	41.1	26.7
Wealth quintile*			
Lowest	*	*	29.2
Second	*	*	28.2
Middle	25.4	37.6	33.6
Fourth	26.6	32.1	31.5
Highest	16.7	24.0	18.4
Department			
Aire metropolitaine/Reste-Ouest	21.5	15.9	25.2
Sud-est	na	34.3	21.7
Nord	na	35.7	39.4
Nord-est	na	33.3	28.6
Artibonite	na	24.5	26.0
Centre	na	47.9	37.7
Sud	na	28.1	32.8
Grand'anse	na	34.6	28.8
Nord-Ouest	na	20.5	28.1
Nippes	na	32.5	35.2
Religion			
Catholics	19.6	33.8	33.0
Protestant	22.3	28.1	26.4
Vaudousant/other	26.4	25.0	31.6
Total	21.5	30.4	29.7

Note: Figures in parentheses are based on 25-49 unweighted cases. An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.
* Condom users are excluded from the analysis

Table A4. Percentage of ANC facilities in Haiti that have specific items available, by type of facility, Haiti SPA 2013

	Hospital	Health center with beds	Health center without beds	Dispensary	Total
Domain 1: Staff and Training					
National ANC guidelines available	21.6	31.2	16.4	32.1	25.6
At least one trained staff*	77.5	59.2	49.0	26.8	45.0
Domain 2: Equipment					
Blood pressure apparatus	93.1	93.6	94.8	95.5	94.7
Domain 3: Diagnostics					
Urine protein testing	11.8	8.8	8.2	2.4	6.4
Iron testing	23.5	23.2	15.2	2.7	12.4
Domain 4: Medicines and commodities					
Iron tablets	68.6	72.8	68.8	69.6	69.7
Folic acid tablets	73.5	70.4	65.8	55.7	63.3
Tetanus vaccine	28.4	24.8	23.0	32.5	27.8
Total number of facilities	102	125	269	336	832

*At least one staff member providing ANC was trained in ANC in the past two years

Table A5. Percent distribution of women in Haiti who had a live birth in the five years preceding the survey by selected ANC characteristics and background characteristics, according to residence, Haiti DHS 2012 and Haiti SPA 2013

	Metropolitan		Other Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**	**%**	**N**
Service readiness for ANC[1]						
Low	29.9	364	35.6	295	37.6	1081
Medium	42.7	519	40.2	333	29.6	853
High	27.3	332	24.2	200	32.8	945
4 or more ANC visits						
No	22.9	273	20.5	167	40.0	1150
Yes	77.1	921	79.5	650	60.0	1726
Quality of ANC care[2]						
Low	39.1	442	29.0	229	45.5	1158
High	60.9	689	71.0	560	54.5	1384
Mother's age at birth						
<20 yrs	15.3	186	13.8	115	13.7	396
20-34	69.4	843	71.9	596	65.3	1879
35-49	15.2	185	14.3	118	21.0	604
Birth order						
1	42.3	514	39.6	328	26.8	773
2-3	37.7	458	37.9	314	35.1	1010
4-5	13.6	166	14.3	119	18.4	530
6+	6.4	78	8.1	67	19.7	566
Mother's education						
None	8.5	103	8.8	73	26.8	772
Primary	32.1	390	34.5	286	48.1	1384
Secondary or higher	59.4	721	56.7	470	25.1	722
Occupation						
Not employed	42.3	514	34.5	286	38.3	1102
Agriculture	5.3	65	3.3	28	11.0	315
Professional	45.8	556	57.0	473	48.9	1406
Other	6.5	79	5.1	43	1.9	55
Wealth quintile[3]						
Lowest	na	na	na	na	36.4	1046
Second	na	na	na	na	34.4	991
Middle	na	na	na	na	19.7	567
Low-Middle	14.2	173	26.4	219	na	na
Fourth	43.2	524	40.2	333	7.7	222
Highest	42.6	517	33.4	277	1.8	52
Department						
Aire metropolitaine/ Reste-Ouest	100.0	1214	8.2	68	20.9	601
Sud-est	0.0	0	4.5	37	6.2	179
Nord	0.0	0	28.7	238	9.2	265
Nord-est	0.0	0	9.2	77	4.3	124
Artibonite	0.0	0	20.6	171	20.9	602
Centre	0.0	0	8.0	66	11.6	333
Sud	0.0	0	6.4	53	11.2	324
Grand'anse	0.0	0	5.4	44	5.0	145
Nord-Ouest	0.0	0	6.8	57	6.3	182
Nippes	0.0	0	2.2	18	4.2	122

(Continued)

Table A5. – *Continued*

Characteristics	Metropolitan		Other Urban		Rural	
	%	N	%	N	%	N
Religion						
Catholics	40.2	488	41.0	340	41.1	1184
Protestant	50.0	607	50.5	418	47.6	1370
Vaudousant/other	9.8	119	8.5	71	11.3	324
Exposure to Media						
Less than once a week	13.5	164	20.5	170	43.3	1246
Weekly or more	86.5	1050	79.5	659	56.7	1632
Total	24.7	1214	16.8	829	58.5	2878

[1] Within appropriate buffer; [2] High quality ANC is defined as having any 6 of the following 8 items: weight measured, blood pressure measured, urine sample taken, blood sample taken, iron supplementation, tetanus vaccine given, informed of signs of complications, intestinal parasites treatment given during pregnancy; [3] First 3 quintiles combined for metropolitan and other urban

Table A6. Percentage of women in Haiti who had a live birth in the five years preceding the survey and had four or more ANC visits at the last birth, by ANC service provision environment, women's background characteristics, and residence, Haiti DHS 2012 and Haiti SPA 2013

Characteristics	Metropolitan	Other Urban	Rural
Service readiness for ANC[1]			
Low	80.9	78.9	55.7
Medium	74.4	77.5	60.6
High	77.2	84.0	64.4
Quality of ANC care[2]			
Low	68.3	65.8	53.8
High	92.3	91.0	79.8
Mother's age at birth			
<20	63.2	71.0	52.8
20-34	80.5	81.7	62.8
35-49	75.7	76.7	56.0
Birth Order			
1	82.7	84.2	66.4
2-3	75.9	79.5	62.7
4-5	75.3	70.7	56.7
6+	52.1	72.8	49.8
Mother's education			
None	61.6	57.5	47.8
Primary	68.4	68.7	58.2
Secondary or higher	84.1	89.8	76.6
Occupation			
Not employed	75.9	79.1	57.2
Agriculture	80.8	72.9	52.8
Professional	77.8	80.7	64.3
Other	77.5	73.6	49.2
Wealth quintile[3]			
Lowest	na	na	50.8
Second	na	na	56.1
Middle	na	na	72.1
Low-Middle	42.8	65.3	na
Fourth	27.6	78.1	85.8
Highest	11.5	92.5	79.9
Department			
Aire metropolitaine/Reste-Ouest	77.1	73.8	51.6
Sud-est	0.0	80.0	57.2
Nord	0.0	79.2	58.4
Nord-est	0.0	82.9	78.2
Artibonite	0.0	80.1	58.7
Centre	0.0	79.2	65.7
Sud	0.0	77.9	67.3
Grand'anse	0.0	74.4	55.4
Nord-Ouest	0.0	85.4	61.5
Nippes	0.0	84.3	65.5
Religion			
Catholics	77.6	80.8	58.7
Protestant	81.2	81.5	61.4
Vaudousant/other	52.9	61.9	58.8
Exposure to Media			
Less than once a week	62.9	66.9	49.8
Weekly or more	79.3	82.8	67.8
Total	77.1	79.5	60.0

[1] Within appropriate buffer; [2] High quality ANC is defined as having any 6 of the following 8 items: weight measured, blood pressure measured, urine sample taken, blood sample taken, iron supplementation, tetanus vaccine given, informed of signs of complications, intestinal parasites treatment given during pregnancy; [3] First 3 quintiles combined for metropolitan and other urban

Table A7. Percentage of women in Haiti who had a live birth in the five years preceding the survey and received high quality ANC, by ANC service provision environment, women's background characteristics, and residence, Haiti DHS 2012 and Haiti SPA 2013

Characteristics	Metropolitan	Other Urban	Rural
ANC facility service readiness[1]			
Low	56.5	71.9	50.1
Medium	58.2	69.7	53.3
High	69.8	71.8	60.0
4 or more ANC visits			
No	27.5	39.0	34.3
Yes	67.7	77.0	63.9
Mother's age at birth			
<20	45.5	63.4	52.9
20-34	63.2	72.0	55.7
35-49	66.3	73.6	51.4
Birth order			
1	59.7	73.3	58.3
2-3	57.4	73.6	56.4
4-5	73.9	59.7	53.5
6+	63.3	66.2	45.8
Mother's education			
None	58.6	60.1	45.6
Primary	62.8	60.6	52.4
Secondary or higher	60.2	78.3	66.1
Occupation			
Not employed	56.6	66.8	50.6
Agriculture	74.3	60.7	50.2
Professional	64.5	74.4	58.5
Other	52.6	68.2	45.3
Wealth quintile[3]			
Lowest	na	na	48.9
Second	na	na	50.1
Middle	na	na	60.4
Low-Middle	54.6	57.6	na
Fourth	63.0	71.2	75.9
Highest	60.7	80.5	72.5
Department			
Aire metropolitaine/Reste-Ouest	60.9	58.8	44.0
Sud-est	0.0	54.8	43.8
Nord	0.0	75.7	68.1
Nord-est	0.0	69.1	58.2
Artibonite	0.0	68.9	50.2
Centre	0.0	64.0	60.6
Sud	0.0	79.5	61.9
Grand'anse	0.0	72.8	56.0
Nord-Ouest	0.0	80.4	56.5
Nippes	0.0	84.1	65.4
Religion			
Catholics	62.8	72.2	55.6
Protestant	62.0	72.5	54.5
Vaudousant/other	45.9	55.1	50.2
Exposure to Media			
Less than once a week	58.5	60.9	48.5
Weekly or more	61.2	73.5	58.6
Total	60.9	71.0	54.5

[1] Within appropriate buffer; [2] High quality ANC is defined as having any 6 of the following 8 items: Weight measured, blood pressure measured, urine sample taken, blood sample taken, iron supplementation, tetanus vaccine given, informed of signs of complications, intestinal parasites treatment given during pregnancy; [3] First 3 quintiles combined for metropolitan and other urban

Table A8. Among facilities in Haiti that offer normal delivery care, percentage that offer specific basic (BEmOC) and comprehensive (CEmOC) emergency care services, by residence, managing authority, and type of facility, Haiti SPA 2013

	Residence			Managing Authority				Type of Facility		
Services	Metro-politan	Other urban	Rural	Govern-ment/ Public	NGO/ Private not-for-profit	Private for-profit	Mission/ Faith-based	Hospital	Health center with bed	Total
BEmOC										
Antibiotics	94.9	78.0	68.9	75.0	88.9	88.2	60.6	90.4	66.3	77.9
Uterotonic drugs/oxytoxics	94.9	95.1	86.5	96.4	96.3	90.2	78.8	98.9	85.1	91.8
Anticonvulsants	48.7	67.1	40.5	64.3	63.0	43.1	33.3	71.3	36.6	53.3
Manual removal of placenta	59.0	79.3	58.1	79.8	63.0	52.9	60.6	70.2	64.4	67.2
Assisted vaginal delivery	89.7	92.7	90.5	94.0	88.9	90.2	87.9	94.7	88.1	91.3
Removal of retained products	64.1	75.6	48.6	79.8	66.7	52.9	33.3	72.3	54.5	63.1
Total BEmOC	30.8	46.3	14.9	44.0	37.0	13.7	21.2	44.7	18.8	31.3
CEmOC										
Blood transfusions	61.5	50.0	23.0	38.1	51.9	54.9	24.2	73.4	12.9	42.1
Caesarean section	71.8	52.4	23.0	42.9	55.6	54.9	27.3	83.0	9.9	45.1
Total CEmOC	20.5	28.0	6.8	22.6	22.2	11.8	15.2	31.9	5.9	18.5
Total number of facilities offering normal delivery care	39	82	74	84	27	51	33	94	101	195

Table A9. Percent distribution of women in Haiti who had a live birth in the five years preceding the survey, by ANC and delivery care characteristics and women's background characteristics, according to residence, Haiti DHS 2012 and Haiti SPA 2013

	Metropolitan		Other Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**	**%**	**N**
Facility delivery						
No	39.6	480	40.8	338	75.9	2,183
Yes	60.4	734	59.2	491	24.1	695
Availability of Basic Emergency Obstetric Care Services[1]						
None	1.0	12	12.1	101	18.0	519
Any facility with normal delivery services but no BEmOC	2.7	32	23.2	193	34.3	988
Any BEmOC	96.4	1,170	64.6	535	47.6	1,371
Availability of Comprehensive Emergency Obstetric Care Services[1]						
None	1.0	12	12.1	101	18.0	519
Any facility with normal delivery services but no BEmOC	18.6	226	33.0	273	50.6	1,455
Any BEmOC	80.5	977	54.9	455	31.4	904
Number of ANC visits						
None	6.8	83	4.8	40	11.7	336
1	2.2	26	3.0	25	4.6	133
2-3	13.5	164	12.3	102	23.7	681
4+	75.9	921	78.4	650	60.0	1,726
Don't know/missing	1.6	19	1.4	12	0.1	3
Mother's age at birth						
<20	15.3	186	13.8	115	13.7	396
20-34	69.4	843	71.9	596	65.3	1,879
35-49	15.2	185	14.3	118	21.0	604
Child's birth order						
1	42.3	514	39.6	328	26.8	773
2-3	37.7	458	37.9	314	35.1	1,010
4-5	13.6	166	14.3	119	18.4	530
6+	6.4	78	8.1	67	19.7	566
Mother's education						
None	8.5	103	8.8	73	26.8	772
Primary	32.1	390	34.5	286	48.1	1,384
Secondary or higher	59.4	721	56.7	470	25.1	722
Wealth quintile						
Lowest	0.0	0	0.0	0	36.4	1,046
Second	0.3	4	0.7	6	34.4	991
Middle	13.9	168	25.7	213	19.7	567
Fourth	43.2	524	40.2	333	7.7	222
Highest	42.6	517	33.4	277	1.8	52
Total	100.0	1,214	100.0	829	100.0	2,878

[1] Availability of health facilities with delivery services is assessed within 10 kilometers for rural clusters and 5 kilometers for metropolitan and other urban clusters.

Table A10. Percentage of women in Haiti who had a live birth in the five years preceding the survey and delivered the most recent birth in a facility, by availability of obstetric care services (BEmOC and CEmOC), number of ANC visits, women's background characteristics, and residence, Haiti DHS 2012 and Haiti SPA 2013

Characteristics	Metropolitan	Other Urban	Rural
Availability of Basic Emergency Obstetric Care Services[1]			
No BEmOC	(41.4)		
No facilities with normal delivery services		36.7	7.8
At least one facility with normal delivery but no EmOC		52.5	28.5
BEmOC	61.2	65.9	27.1
Availability of Comprehensive Emergency Obstetric Care Services[1]			
No CEmOC	59.6		
None		36.7	7.8
Normal Delivery (no CEmOC)		57	27.2
CEmOC	60.7	65.6	28.7
Total	60.4	59.2	24.1
Number of ANC visits			
0	24.5	(24.3)	4
1	*	(28.3)	17.1
2-3	45.6	37.8	15.3
4+	66.5	65.8	32
Don't know/missing	*	*	*
Mother's age at birth			
<20	59	57.6	30.3
20-34	61.2	59.9	25.8
35-49	58.2	57.5	14.9
Birth order			
1	71.8	72.7	42.3
2-3	58.3	54.6	23.7
4-5	45	45.5	14.3
6+	(30.8)	39.2	9.4
Mother's education			
None	21	35.8	10.1
Primary	49.3	43.3	21.4
Secondary or higher	72.1	72.5	44.5
Wealth quintile			
Lowest	*	*	9.7
Second	*	*	21.3
Middle	41.2	40.8	38.7
Fourth	51.1	53.9	56.8
Highest	76.2	81.1	73.5
Total	60.4	59.2	24.1

Note: Figures in parentheses are based on 25-49 unweighted cases. An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.

[1] Availability is assessed within 10 kilometers for rural clusters and 5 kilometers for metropolitan and other urban clusters. Since nearly all metropolitan clusters have at least one facility with normal delivery services, a combined "No EmOC" category is used which combines "None" with "Any facility with normal delivery services but no EmOC."

Table A11. Percentage of facilities with selected items to support child curative care services among facilities in Haiti that offer curative care for children under five, by residence, type of facility, and managing authority, Haiti SPA 2013

Components of the SARA Readiness Score	Residence			Managing Authority				Type of Facility				
	Metro-politan	Other urban	Rural	Govern-ment/ Public	NGO/ Private not-for-profit	Private for-profit	Mission/ Faith-based	Hos-pital	Health center with bed	Health center without bed	Dispen-sary	Total
Domain 1: Staff and Training												
Guidelines for IMCI	18.0	35.1	36.5	42.0	24.5	20.6	36.5	28.6	32.5	22.5	42.6	33.0
Guidelines for growth monitoring	16.7	38.2	27.8	27.6	32.9	20.1	32.6	27.6	33.3	21.9	30.5	27.8
Staff trained in IMCI	36.0	41.8	31.1	38.3	37.1	26.3	32.1	51.4	40.5	33.7	26.8	34.0
Staff trained in growth monitoring	48.0	53.2	37.9	47.0	47.5	26.3	48.3	57.1	46.0	45.2	35.1	42.7
Domain 2: Equipment												
Child and infant scale	52.0	63.6	46.5	52.2	51.7	43.2	55.6	59.0	57.1	51.8	45.2	50.8
Length/height measuring equipment	45.3	76.8	63.8	70.5	51.7	46.9	75.8	75.2	63.5	53.3	66.8	63.1
Thermometer	95.3	96.4	95.9	95.2	96.5	94.9	97.8	94.3	98.4	96.7	94.8	95.9
Stethoscope	100.0	98.8	98.1	97.0	99.3	99.5	100.0	99.0	100.0	100.0	96.8	98.6
Growth chart	32.0	50.9	45.6	49.5	42.0	31.4	50.0	41.0	51.6	38.1	47.2	44.2
Domain 3: Diagnostics												
Hemoglobin testing	45.3	53.9	22.7	25.2	39.1	41.2	32.5	64.8	55.6	38.5	10.4	32.8
General stool microscopy	42.0	51.5	21.6	23.4	33.5	39.6	33.7	59.0	50.0	39.3	9.2	31.0
Malaria diagnostic capacity	55.3	66.7	30.2	33.4	48.9	51.5	41.0	75.2	63.5	52.6	15.3	41.7
Domain 4: Medicines and commodities												
Oral rehydration solution	74.0	90.3	92.3	90.1	86.0	84.0	93.3	83.8	88.1	85.2	93.1	88.7
Amoxicillin syrup/suspension	82.0	86.7	73.4	74.8	74.8	81.5	80.3	86.7	81.7	80.7	70.6	77.5
Co-trimoxazole syrup/suspension	58.7	81.2	64.0	66.7	65.1	62.9	70.8	75.2	65.1	68.2	62.9	66.4
Paracetamol	87.3	95.2	85.4	84.4	90.2	88.7	90.4	91.4	91.3	90.4	83.0	87.6
Vitamin A capsules	41.3	58.9	58.2	63.7	51.8	41.8	57.4	46.7	44.4	46.8	68.6	55.4
Me-/albendazole capsules/tablets	88.0	91.5	88.2	88.9	86.7	86.6	92.7	87.6	90.5	89.3	88.2	88.8
Zinc sulphate tablets or syrup	44.0	61.9	64.8	70.6	54.6	44.3	64.1	50.5	65.1	49.4	70.7	60.5
Mean Total Readiness Score	44.9	59.3	49.0	52.6	46.5	45.2	55.3	55.6	59.2	48.8	46.5	50.3
Total number of facilities	150	165	533	333	143	194	178	105	126	270	347	848

Table A12. Percent distribution of children under age five years in Haiti with reported diarrhea in the two weeks preceding the interview, by service readiness of facilities for treating childhood illness, whether care was sought for a public or private source, background characteristics of child, and background characteristics of mother, according to residence, Haiti DHS 2012 and Haiti SPA 2013

	Metropolitan		Other Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**	**%**	**N**
Service readiness for treating childhood illness[1]						
Low	29.4	89	42.0	83	33.5	253
Medium	36.7	110	28.9	57	34.6	262
High	33.9	102	29.1	57	31.9	242
Care was sought from a public or private source for diarrhea						
No	56.8	171	63.8	126	68.5	518
Yes	43.2	130	36.2	71	31.5	239
Age of child						
<1	29.4	88	30.2	60	31.4	238
1-2	32.7	98	31.3	62	33.7	255
2-3	18.4	55	19.1	38	17.3	131
3-4	13.9	42	11.0	22	9.8	74
4-5	5.7	17	8.4	17	7.8	59
Sex of child						
Female	53.2	160	52.4	103	47.1	356
Male	46.8	141	47.6	94	52.9	400
Mother's age						
<20	8.0	24	9.5	19	10.1	76
20-34	79.6	240	69.9	138	66.9	507
35-49	12.4	37	20.5	41	23.0	174
Mother's education						
None	8.3	25	7.4	15	25.2	191
Primary	41.4	125	46.1	91	48.8	369
Secondary or higher	50.3	152	46.5	92	26.0	197
Wealth quintile						
Lowest	0.0	0	0.0	0	34.5	261
Second	0.7	2	1.3	2	40.3	305
Middle	21.1	64	37.8	75	16.6	126
Fourth	43.5	131	40.3	80	7.3	55
Highest	34.7	104	20.6	41	1.3	10
Total	100.0	301	100.0	197	100.0	757

[1] To evaluate the service environment for curative child care, a readiness score was generated at the health facility level based on four domains of facility readiness: staff and training, equipment, diagnostic capacity, and the availability of medicines and commodities (see Appendix Table 1 for a detailed summary of the components of the readiness score). DHS clusters were then linked with the service readiness scores for facilities within a 5 or 10 kilometer buffer, and an overall readiness score was generated for each cluster based on the median score of all facilities linked to that cluster. These scores were divided into terciles, which we refer to as low, medium, and high readiness.

Table A13. Percentage of children in Haiti with diarrhea in the two weeks preceding the survey for whom care was sought from a public or private source, by level of facility readiness (service environment) for treating childhood illness, child's background characteristics, mother's background characteristics, and residence, Haiti DHS 2012 and Haiti SPA 2013

Characteristics	Metropolitan	Other Urban	Rural
Service readiness for treating childhood illness[1]			
Low	28.5	34.7	28.4
Medium	39.9	38.6	29.8
High	59.5	35.8	36.8
Child's age			
<1	53.7	35.5	30.4
1-2	53.8	34.9	30.7
2-3	(37)	(39.7)	34.0
3-4	(11.6)	(26.5)	28.1
4-5	*	*	38.6
Sex of child			
Female	44.8	36.3	33.7
Male	41.3	36.0	29.7
Mother's age			
<20	*	*	37.5
20-34	44.2	38.0	29.4
35-49	*	(30.5)	35.2
Mother's education			
None	*	*	27.8
Primary	38.9	31.6	31.9
Secondary or higher	47.9	40.1	34.5
Wealth quintile			
Lowest	*	*	29.8
Second	*	*	27.9
Middle	40.8	31.8	34.9
Fourth	41.0	29.9	(50.7)
Highest	48.3	(53.8)	*
Total	**43.2**	**36.2**	**31.5**

Note: Figures in parentheses are based on 25-49 unweighted cases. An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.

[1] To evaluate the service environment for curative child care, a readiness score was generated at the health facility level based on four domains of facility readiness: staff and training, equipment, diagnostic capacity, and the availability of medicines and commodities (see Appendix Table 1 for a detailed summary of the components of the readiness score). DHS clusters were then linked with the service readiness scores for facilities within a 5 or 10 kilometer buffer, and an overall readiness score was generated for each cluster based on the median score of all facilities linked to that cluster. These scores were divided into terciles, which we refer to as low, medium, and high readiness.

Note: the N is total denominator - not the number for whom care was sought

Table A14. Percentage of facilities providing HIV counseling or testing services in Haiti that have HIV testing capacity and other items to support quality HIV testing and counseling services, by residence, Haiti SPA 2013

HIV services	Metropolitan	Other Urban	Rural	Total
HIV testing capacity[1]	71.3	78.4	50.5	64.1
Items to support quality HIV CT services				
HIV testing and counseling guideline	27.1	41.0	25.0	30.2
Staff trained in HIV counseling and testing[2]	45.0	45.3	28.2	37.7
Visual and auditory privacy	73.6	69.8	75.0	73.1
Condoms	48.1	65.5	64.2	60.2
All items to support quality HIV CT services	8.5	10.8	6.6	8.3
Total number of facilities	129	139	212	480

[1] Facility had HIV rapid diagnostic test kits or ELISA test with ELISA washer, ELISA reader, incubator, specific assay kit
[2] Facility had at least one interviewed staff member providing HIV testing services who reported receiving in-service training in some aspects of HIV testing and counseling during the 24 months preceding the survey

Table A15. Percent distribution of women age 15-49 in Haiti, by level of facility service readiness (service environment) for HIV testing, whether woman had an HIV test in the 12 months preceding the survey, and women's background characteristics, according to residence, Haiti DHS 2012 and Haiti SPA 2013

	Metropolitan		Other urban		Rural	
Characteristics	**%**	**N**	**%**	**N**	**%**	**N**
Service readiness for HIV testing						
Low	34.1	1417	11.9	325	12.9	852
Medium	37.4	1555	52.0	1427	57.7	3815
High	28.5	1183	36.1	991	29.4	1942
Had HIV test in last 12 months						
No	69.5	2889	68.6	1881	80.7	5332
Yes	30.5	1265	31.4	862	19.3	1276
Women's age						
15-24	43.1	1790	43.7	1200	43.6	2883
25-34	31.9	1325	31.1	853	27.1	1790
35-44	18.2	755	18.3	501	19.6	1298
45-49	6.9	285	6.9	189	9.6	637
Education						
None	6.4	267	6.9	189	23.5	1551
Primary	26.4	1097	29.7	815	45.3	2991
Secondary or higher	67.2	2790	63.4	1740	31.3	2066
Occupation						
Not employed	51.0	2119	49.1	1346	46.2	3051
Agriculture	4.4	184	3.5	95	9.8	651
Professional	38.1	1583	43.1	1182	42.3	2796
Other	6.4	268	4.4	120	1.7	110
Wealth quintile						
Lowest	0.0	0	0.0	0	32.4	2143
Second	0.2	6	0.4	10	33.4	2208
Middle	9.1	380	19.0	522	22.8	1504
Fourth	36.2	1503	38.4	1053	8.3	546
Highest	54.5	2266	42.2	1159	3.1	206
Marital status						
Never married	39.0	1621	43.6	1196	33.9	2239
Currently married	51.0	2120	47.3	1298	59.3	3921
formerly married	10.0	414	9.1	249	6.8	448
Department						
Aire metropolitaine/Reste-Ouest	100.0	4155	7.3	199	19.2	1265
Sud-est	0.0	0	4.5	125	6.8	448
Nord	0.0	0	27.9	765	9.9	657
Nord-est	0.0	0	8.4	230	4.3	285
Artibonite	0.0	0	23.2	637	21.2	1403
Centre	0.0	0	6.3	174	10.0	661
Sud	0.0	0	7.0	192	11.9	785
Grand'anse	0.0	0	4.9	133	5.0	329
Nord-Ouest	0.0	0	8.4	231	6.7	439
Nippes	0.0	0	2.1	57	5.1	336
Religion						
Catholics	36.1	1501	41.6	1141	39.6	2614
Protestant	56.6	2351	53.0	1455	51.2	3382
Vaudousant/other	7.3	303	5.4	147	9.3	612
Had a birth in past year						
No	91.4	3799	92.1	2525	85.6	5657
Yes	8.6	356	7.9	218	14.4	951
Total	100.0	4155	100.0	2743	100.0	6608

Table A16. Percentage of women age 15-49 in Haiti who were tested for HIV in the 12 months preceding the survey, by level of service readiness (service environment) for HIV testing and background characteristics, Haiti DHS 2012 and Haiti SPA 2013

Characteristics	Metropolitan	Other urban	Rural
Service readiness for HIV testing			
Low	30.3	24.3	11.3
Medium	29.7	30.3	19.5
High	31.7	35.3	22.4
Women's age			
15-24	23.8	25.1	17.6
25-34	41.2	42.7	28.4
35-44	31.3	31.7	15.8
45-49	20.2	19.5	8.5
Education			
None	24.0	16.4	11.8
Primary	24.6	25.2	17.1
Secondary or higher	33.4	36.0	28.1
Occupation			
Not employed	27.4	26.1	17.0
Agriculture	40.4	32.3	14.5
Professional	33.6	38.0	22.7
Other	29.7	26.6	24.4
Wealth quintile			
Lowest	na	na	13.5
Second	na	na	17.5
Middle	na	na	na
Low-Middle	29.1	25.8	22.6
Fourth	27.3	29.1	31.8
Highest	32.8	36.2	40.7
Marital status			
Never in union	17.5	23.1	11.9
Currently married	40.8	40.0	23.7
Formerly married	28.3	26.7	18.1
Department			
Aire metropolitaine/ Reste-Ouest	30.5	28.6	17.5
Sud-est	na	25.7	15.6
Nord	na	36.3	21.8
Nord-est	na	24.7	19.9
Artibonite	na	28.1	17.0
Centre	na	29.0	17.9
Sud	na	35.4	25.3
Grand'anse	na	34.6	17.8
Nord-Ouest	na	32.0	19.6
Nippes	na	37.1	25.0
Religion			
Catholics	34.9	32.5	20.0
Protestant	27.7	30.0	19.0
Vaudousant/other	29.5	37.2	17.6
Had a birth in the past year			
No	26.7	28.1	14.8
Yes	71.0	69.8	45.9
Total	30.5	31.4	19.3

Table A17. Percentage of facilities in Malawi with specific indicators of malaria diagnostic capacity, by type of facility and residence, Malawi SPA 2013-14

	Type of Facility					Residence		
Indicators	**Hospital**	**Health centre/ maternity**	**Dispen-sary**	**Clinic**	**Health post**	**Urban**	**Rural**	**Total**
Facility offers malaria rdt	98.2	95.3	77.1	77.4	42.4	89.1	88.1	88.4
Facility offers malaria lab test	61.7	5.9	0.0	10.9	0.0	28.0	7.8	13.7
Facility offers any malaria test (lab or rdt)	99.1	95.3	77.1	78.5	42.4	90.6	88.1	88.9
Staff trained in RDT	77.1	57.3	36.6	35.5	11.1	51.1	51.1	51.1
Staff trained in malaria diagnosis (RDT or microscopy)	78.9	61.8	41.5	40.0	22.6	55.6	55.2	55.3
Facility has RDT protocol	82.6	66.9	54.3	45.8	42.4	56.8	62.8	61.0
Diagnostic Capacity[1]	72.6	39.5	18.3	17.9	11.1	34.0	35.5	35.0
Total	107	459	45	293	10	265	649	915

[1] Composite of RDT or microscopy equipment, staff trained in malaria diagnosis, and RDT protocol available in the facility.
[2] Diagnostic capacity, malaria treatment guidelines, first-line medicines, and personnel recently trained in malaria diagnosis and/or treatment available.

Table A18. Percentage of children under five in Malawi who had fever in the two weeks preceding the mother's interview, by whether the child used an ITN the previous night, background characteristics of the child, background characteristics of the mother, and residence, Malawi MIS 2012

	Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**
Slept under an ITN the previous night				
No	50.0	40	44.6	299
Yes	50.0	40	55.4	372
Age of child				
<1	19.3	15	15.4	104
1-2	22.0	17	26.4	177
2-3	24.8	20	23.3	156
3-4	18.4	15	19.1	128
4-5	15.5	12	15.8	106
Sex of child				
Male	51.8	41	48.1	323
Female	48.2	38	51.9	348
Birth order				
1	64.5	51	58.6	393
2	32.6	26	36.0	241
3 or more	3.0	2	5.4	36
Mother's education				
None	9.4	7	24.4	163
Primary	57.8	46	66.5	446
Secondary or greater	32.8	26	9.2	61
At least a primary school education				
No	9.4	7	24.4	163
Yes	90.6	72	75.6	507
Wealth quintile				
Lowest	7.9	6	26.7	179
Second	4.3	3	25.6	172
Middle	7.3	6	23.2	155
Fourth	25.7	20	17.5	117
Highest	54.7	43	7.0	47
Region				
Northern	11.1	9	10.7	72
Central	64.0	51	42.1	282
Southern	24.9	20	47.2	317
Total		79		671

Table A19. Percentage of children under five in Malawi with recent fever who had a finger/heel stick, by whether the child slept under an ITN the night before the interview, background characteristics of the child, background characteristics of the mother, and residence, Malawi MIS 2012

Characteristics	Urban	Rural
Child slept under an ITN last night		
No	34.8	20.4
Yes	34.3	18.6
Age of child		
<1	23.8	22.7
1-2	45.4	27.4
2-3	42.5	15.9
3-4	29.3	10.4
4-5	26.2	18.9
Sex of child		
Male	30.9	21.5
Female	38.4	17.5
Birth order		
1st child	38.1	17.1
2nd child	26.3	22.0
3 or more	47.2	27.5
Mother's education		
None	28.0	14.1
Primary	29.5	19.6
Secondary or higher	45.4	32.3
Mother has at least a primary school education		
No	28.0	14.1
Yes	35.2	21.1
Wealth quintile		
Lowest	45.8	20.0
Second	35.0	19.5
Middle	41.1	11.6
Fourth	24.6	21.6
Highest	36.7	37.2
Region		
Northern	32.4	20.5
Central	29.1	16.1
Southern	49.5	22.1
Total	34.5	19.4
Total number of children	79	671

Table A20. Percent distribution of children age 6-59 months in Malawi, by whether household owns at least one ITN, background characteristics of child, and background characteristics of mother, according to residence, Malawi MIS 2012

	Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**
Household owns at least one ITN				
No	38.3	111	33.4	656
Yes	61.7	179	66.6	1,307
Age of child				
6-11 months	11.9	34	10.2	200
1-2 years	20.8	60	23.9	469
2-3 years	22.2	64	22.1	434
3-4 years	22.4	65	22.1	434
4-5 years	22.8	66	21.7	425
Sex of child				
Male	47.1	137	46.1	905
Female	52.9	154	53.9	1,058
Mother has at least primary education				
No	17.0	49	31.8	624
Yes	83.0	241	68.2	1,339
Wealth quintile				
Lowest	4.5	13	24.4	478
Second	4.8	14	25.7	505
Middle	5.5	16	22.2	435
Fourth	17.6	51	19.2	376
Highest	67.8	197	8.6	169
Region				
Northern	10.9	32	14.3	312
Central	45.0	131	42.9	953
Southern	44.1	128	43.8	988
Total	12.9	291	87.1	1963

Table A21. Percentage of children age 6-59 months in Malawi who tested positive for malaria via microscopy, by whether household owns at least one ITN, background characteristics of child, background characteristics of mother, and residence, Malawi MIS 2012

Variables	Urban	Rural
Household owns at least one ITN		
No	14.3	32.3
Yes	6.7	27.6
Age of child		
6-11 months	5.9	19.4
1-2 years	7.1	22.1
2-3 years	16.1	31.8
3-4 years	6.6	32.6
4-5 years	10.3	35.4
Sex of child		
Male	10.7	28.5
Female	8.6	29.7
Mother has at least primary education		
No	6.6	32.2
Yes	10.2	27.7
Wealth quintile		
Lowest	13.9	37.0
Second	14.7	29.8
Middle	22.9	30.1
Fourth	20.9	23.5
Highest	4.8	15.2
Region		
Northern	12.1	20.1
Central	11.2	36.4
Southern	7.4	25.2
Total	9.6	29.2

Table A22. Percentage of ANC facilities in Malawi that had specific items related to malaria diagnosis, prevention, and treatment available, by type of facility and residence, Malawi SPA 2013-14

	Type of Facility					Residence		
Items	**Hospital**	**Health centre/ maternity**	**Dispen-sary**	**Clinic**	**Health post**	**Urban**	**Rural**	**Total**
IPTp guidelines observed at facility	56.5	49.0	52.7	35.7	100.0	43.1	50.6	49.2
Valid SP for IPTp available and observed at facility	94.2	97.2	81.4	95.2	50.0	91.3	96.9	95.9
IPTp services offered as part of routine ANC	99.1	98.7	100.0	98.4	100.0	99.2	98.7	98.8
ANC staff trained in IPTp	60.2	40.1	29.5	27.3	0.0	60.1	37.5	41.6
Service ready for provision of IPTp services[1]	40.3	28.5	11.6	16.1	0.0	15.5	19.9	18.5
Total number of facilities	103	445	18	64	2	116	516	632

[1] An ANC facility is considered service ready for provision of IPTp services if it has valid SP available and observed, IPTp guidelines available, at least one staff member with in-service training or training updates on IPTp within the past 24 months

Table A23. Percent distribution of women age 15-49 in Malawi who had a live birth in the two years preceding the survey, by background characteristics, according to residence, Malawi MIS 2012

	Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**
Age				
15-19	10.2	13	10.6	92
20-24	34.7	43	28.9	250
25-29	25.4	31	25.1	218
30-34	19.6	24	19.2	167
35-39	8.4	10	11.2	97
40-44	0.8	1	4.2	36
45-49	0.9	1	0.9	8
Parity				
1st birth	50.8	62	39.4	341
2nd birth	41.4	51	49.4	428
3rd or higher	7.8	10	11.2	97
Number of household members				
1-3	26.4	32	21.4	186
4-5	40.5	50	39.5	342
6-7	23.4	29	27.2	236
8-9	7.1	9	9.1	79
10 or more	2.6	3	2.8	24
Completed primary school				
No	45.3	56	80.8	700
Yes	54.7	67	19.2	167
Woman is literate				
No	15.0	18	39.8	345
Yes	85.0	104	60.2	522
Wealth quintile				
Lowest	5.1		26.5	229
Second	3.7	6	25.7	223
Middle	6.8	5	22.2	192
Fourth	17.3	8	18.2	157
Highest	67.1	21	7.5	65
Region				
Northern	11.9	15	13.6	118
Central	46.8	57	41.6	361
Southern	41.3	51	44.8	388
Woman's religion				
Catholic	18.3	22	17.5	152
CCAP	21.6	26	10.8	94
Anglican	4.1	5	1.3	11
Seventh Day Advent./ Baptist	10.7	13	5.8	50
Other Christian	26.9	33	33.4	289
Muslim	14.8	18	20.9	181
No religion			1.7	14
Other	3.7	5	8.7	75

(Continued)

Table A23. – *Continued*

Characteristics	Urban		Rural	
	%	N	%	N
Woman's ethnicity				
Chewa	28.2	35	40.2	348
Tumbuka	7.2	9	11.7	101
Lomwe	16.4	20	13.7	119
Tonga	1.8	2	1.6	14
Yao	21.6	26	19.8	171
Sena	1.0	1	4.0	34
Nkhonde	2.0	2	1.0	9
Ngoni	16.9	21	4.9	42
Other	5.0	6	3.2	28
Woman has seen or heard messages about malaria in past six months				
No	67.6	81	72.5	581
Yes	32.4	39	27.5	221
Total		123		867

Table A24. Percentage of women age 15-49 in Malawi who had a live birth in the two years preceding the survey and who took at least two doses of SP for prevention of malaria at least once during ANC, by background characteristics and residence, Malawi MIS 2012

	Urban		Rural	
Characteristics	**%**	**N**	**%**	**N**
Age				
15-19	50.8	13	43.5	92
20-24	53.8	43	57.3	250
25-29	55.5	31	49.9	218
30-34	60.4	24	56.3	167
35-39	58.9	10	50.7	97
40-44	0.0	1	50.0	36
45-49	100.0	1	66.3	8
Parity				
1st birth	58.5	62	52.1	341
2nd birth	55.5	51	55.6	428
3rd or higher	37.9	10	43.3	97
Number of household members				
1-3	58.0	32	47.4	186
4-5	54.1	50	53.8	342
6-7	53.0	29	56.9	236
8-9	61.2	9	50.3	79
10 or more	65.0	3	49.5	24
Completed primary school				
No	48.8	56	51.7	700
Yes	61.3	67	57.7	167
Woman is literate				
No	38.6	18	47.6	345
Yes	58.6	104	56.3	522
Wealth quintile				
Lowest	44.5		46.8	229
Second	55.2	6	56.0	223
Middle	35.6	5	58.2	192
Fourth	52.9	8	43.3	157
Highest	59.3	21	70.9	65
Region				
Northern	67.1	15	60.9	118
Central	44.2	57	50.8	361
Southern	65.3	51	52.3	388
Woman's religion				
Catholic	51.8	22	46.3	152
CCAP	67.2	26	48.3	94
Anglican	57.5	5	47.5	11
Seventh Day Advent./ Baptist	59.0	13	51.8	50
Other Christian	47.2	33	63.1	289
Muslim	61.7	18	50.2	181
No religion			44.7	14
Other	32.4	5	41.6	75

(Continued)

Table A24. – *Continued*

Characteristics	Urban		Rural	
	%	N	%	N
Woman's ethnicity				
Chewa	46.1	35	48.8	348
Tumbuka	65.7	9	63.2	101
Lomwe	63.2	20	56.4	119
Tonga	71.3	2	70.4	14
Yao	58.7	26	50.0	171
Sena	25.5	1	69.7	34
Nkhonde	53.4	2	29.9	9
Ngoni	50.8	21	54.1	42
Other	74.8	6	44.0	28
Woman has seen or heard messages about malaria in past six months				
No	51.3	81	51.3	581
Yes	66.0	39	57.6	221
Total	55.6	123	52.8	867