USAID
FROM THE AMERICAN PEOPLE

# A COMPARISON OF SUMMARY MEASURES OF QUALITY OF SERVICE AND QUALITY OF CARE FOR FAMILY PLANNING IN HAITI, MALAWI, AND TANZANIA

## DHS METHODOLOGICAL REPORTS 20

**AUGUST 2017**

This publication was produced for review by the United States Agency for International Development. It was prepared by Lindsay Mallick, Wenjuan Wang, and Gheda Temsah.

DHS Methodological Report No. 20

# A Comparison of Summary Measures of Quality of Service and Quality of Care for Family Planning in Haiti, Malawi, and Tanzania

Lindsay Mallick[1]

Wenjuan Wang[2]

Gheda Temsah[3]

ICF

Rockville, Maryland, USA

August 2017

[1] The Demographic and Health Surveys (DHS) Program, Avenir Health
[2] The DHS Program, ICF
[3] Program Assistance, Design, Monitoring and Evaluation for Sustainable Development (PADMES), ICF

*Corresponding author:* Lindsay Mallick, International Health and Development, ICF, 530 Gaither Road, Suite 500, Rockville, MD 20850, USA; phone: +1 301-572-0211; fax: +1 301–572-0950; email: Lindsay.Mallick@icf.com

**Acknowledgment:** The authors would like to thank Courtney Allen for her contribution to the literature review on country context, Clara Burgert-Brucker and Trinadh Dontamasetti for their assistance preparing GIS data and reviewing GIS-related linkage methodology, and Bill Winfrey for his thoughtful review.

Editor: Diane Stoy
Document Production: Joan Wardell

This study was conducted with support provided by the United States Agency for International Development (USAID) through The DHS Program (#AID-OAA-C-13-00095). The views expressed are those of the authors and do not necessarily reflect the views of USAID or the United States Government.



Recommended citation:

Mallick, Lindsay, Wenjuan Wang, and Gheda Temsah. 2017. *A Comparison of Summary Measures of Quality of Service and Quality of Care for Family Planning in Haiti, Malawi, and Tanzania*. DHS Methodological Report No. 20. Rockville, Maryland, USA: ICF.

# Contents

# Tables



# Figures

# 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 continually assess and improve the methodology and procedures used to carry out national-level surveys as well as to offer additional tools for analysis. Improvements in methods used will enhance the accuracy and depth of information collected by The DHS Program and relied on by policymakers and program managers in low- and middle-income countries.

While data quality is a main topic of the DHS Methodological Reports series, the reports also examine issues of sampling, questionnaire comparability, survey procedures, and methodological approaches. The topics explored in this series are selected by The DHS Program in consultation with the U.S. Agency for International Development.

It is hoped that the DHS Methodological Reports will be useful to researchers, policymakers, and survey specialists, particularly those engaged in work in low-and middle-income countries, and will be used to enhance the quality and analysis of survey data.

Sunita Kishor
Director, The DHS Program

# Abstract

Researchers generally agree on a framework of domains and indicators of quality of care in family planning, although there is less consensus on methodological approaches for creating summary measures. This study used Service Provision Assessment (SPA) and Demographic and Health Survey (DHS) data from Haiti, Malawi, and Tanzania to compare traditionally used additive methods with a data reduction method—principal component analysis (PCA).

We scored the quality of health facilities with three approaches (simple additive, weighted additive, and PCA) for two constructs: quality of services, with only facilities-level data, and quality of care, which incorporates observation and client data. We ranked facilities as high, medium, or low quality based on their scores. Our results indicated that the rankings change with the scoring methodology. There was more consistency in the rankings of facilities by the simple additive and PCA methods than the weighted additive and PCA-based rankings. This may be due to the low factor loadings and little variance explained by the first component in the PCA. We aggregated facility scores to their respective DHS clusters (Haiti, Malawi) or regions (Tanzania) and geographically linked them to women interviewed in DHS surveys to test associations between the use of family planning services and the quality environment, as measured with each index.

Results of multilevel logistic regressions indicated that the scoring mechanism influences how well the quality environment predicts women's use of family planning services. The quality environment measured with the weighted additive approach significantly predicted the use of family planning services more often than the simple additive or PCA-based measures.

We recommend weighted additive scoring methods for their ease of construction and interpretation, and their ability to predict associations with use of family planning services. However, results from the PCA suggest the use of subscales rather than one summary scale of quality.

KEY WORDS: family planning, quality of care, quality of service, service readiness, Haiti, Malawi, Tanzania, SPA, DHS, linking household and facility data

# 1. Introduction

The World Health Organization (WHO) embraces the position that health is a fundamental human right, a right that includes access to quality health services (WHO 2015a). Use of family planning is key to reducing maternal and child morbidity and mortality because it can prevent complications from unintended, inadequately spaced, or early adolescent pregnancy (Ahmed et al. 2012; Cleland et al. 2012; Rutstein 2005; Tsui, McDonald-Mosley, and Burke 2010). Experts hypothesize that high quality family planning services can influence fertility intentions (RamaRao et al. 2003), while research has found that some aspects of quality affect contraceptive use (Arends-Kuenning and Kessy 2007; Mensch, Arends-Kuenning, and Jain 1996; RamaRao et al. 2003; Tumlinson et al. 2015). Efforts in the last several decades have focused on identifying the key elements of quality of family planning services, as well as approaches for defining and assessing those elements (Bessinger and Bertrand 2001; Bruce 1990; Cuéllar, Quijada, and Callahan 2016).

A small but growing body of literature has focused on refining approaches to measuring quality of care in order to better assess its association with family planning outcomes (Do et al. 2016; Gage and Zomahoun 2017; Leisher et al. 2016). In these studies, authors use summary measures for an overall assessment of quality of care in family planning. However, there is a dearth of research that compares the methodologies that researchers use to create these summary measures. This study uses data from the Haiti Service Provision Assessment (SPA) 2013, Malawi SPA 2013-2014, and Tanzania SPA 2014-2015 to compare three common mechanisms for summarizing quality of care indices for family planning—a simple additive approach, a weighted additive approach, and the principal component analysis (PCA). We compare these different scoring mechanisms in terms of the simplicity of their construction, the interpretability of the results, and comparability in terms of their assignment of facilities to a low, medium, or high quality of care category. We use the three different scoring mechanisms to create indices of quality of service (service readiness) that rely on facilities data only, and another set of indices for quality of care that integrates facilities data with observation and client data. We examine the impact of the inclusion of observation and client data on the assignment of facilities to different levels of quality of care. We also geographically link the health facility data to women interviewed in the Demographic and Health Surveys (DHS) in each country to assess the differences in how these measures predict the use of family planning services at health facilities.

## 1.1. Quality of Care

### 1.1.1. *Defining quality of care*

Research on the quality of health care generally agrees on the necessity of setting standards of resources and practices, which optimally aid patients who are seeking care. These core beliefs about the key functions of quality of care stem from Donabedian's framework (Donabedian 1966, 1988), which identifies three core domains of quality of care: *structure, process*, and *outcomes*. *Structure* refers to the physical components of the health facility, including resources and infrastructure; *process* denotes the interactions between the providers and clients; and *outcomes* are the effect of the visit on the client's health (Donabedian 1966, 1988). In line with this framework, the WHO suggests that quality in healthcare is achieved when standards of interventions—interventions that are safe, affordable, and known to improve health of a society—have been properly met (Roemer and Montoya-Aguilar 1988). In 2006, the WHO revised their definition to include a more comprehensive, systems perspective in which quality included effectiveness, accessibility, acceptability, patient centered care, equity, and safety (WHO 2006).

There is consensus that quality includes a facility's capacity to provide not only services but also training for providers and respectful treatment for clients while receiving care (RamaRao and Jain 2016). Experts note the importance in distinguishing between two different aspects of quality—*quality of service* and *quality of care*—although, these terms are often used interchangeably (RamaRao and Jain 2001; RamaRao

and Jain 2016). Quality of service, also called service availability and readiness, refers to Donabedian's components of structure, such as availability of trained personnel and key resources such as infrastructure, equipment, amenities, commodities, and the readiness to provide care (RamaRao and Jain 2016; WHO 2015b). Quality of care includes process components that reflect the provider's performance and treatment of clients during visits (RamaRao and Jain 2016). Researchers must be cautious not to erroneously label facility-based measures of service quality as quality of care. RamaRao and Jain (2001) note that although better quality of service may lead to better quality of care (well-equipped health structures facilitate better care among providers), it is possible to have one without the other. One provider may offer thorough, respectful care at a facility with limited resources, while other providers at more well-equipped facilities may underperform. However, it is important for stakeholders to consider both as important components of quality until a more concrete link is determined (Sprockett 2016). Without assessing process indicators along with structure indicators, confounding associations with outcomes in question may go unseen (Cuéllar, Quijada, and Callahan 2016; Mant 2001).

#### 1.1.2. *Quality of care in family planning*

In 1990, Bruce developed the most notable, widely referenced work that outlined quality of care specific to family planning. Bruce sought to expand the general foundation of quality of care proposed by Donabedian and to tailor the framework to family planning (Bruce 1990). She delineated six elements of family planning services that are critical to quality of care from the client's perspective: choice of methods, information given to users, technical competence, interpersonal relations, follow-up or continuity mechanisms, and an appropriate constellation of services. She theorizes that these domains, each related to Donabedian's *structure* or *process* domains, will affect outcomes such as knowledge, satisfaction, health, and contraceptive use. This framework has helped to guide the growing research in this field since its publication in 1990. The domains have been further refined and expanded in other research over time (Hutchinson, Do, and Agha 2011; Tumlinson et al. 2015).

### 1.2. Assessing Quality of Care in Family Planning

#### 1.2.1. *Indicators*

Researchers note the importance of defining evidence-based standards to measure quality over time within individual service centers, and to benchmark health facilities against national standards (Campbell et al. 2002; Chapman and Montagu 2016; Cuéllar, Quijada, and Callahan 2016). Indicators must be acceptable to interviewers and interviewees, validated to ensure that they measure what they are intended to measure, and able to reliably capture the same information over repeated measurements (Cuéllar, Quijada, and Callahan 2016; Sprockett 2016). However, there is a lack of consensus on constructing the indicators that most accurately capture quality, and relating these indicators to one another (Cuéllar, Quijada, and Callahan 2016). Initially, after Bruce (1990) published her framework for quality of family planning, family planning evaluators created hundreds of indicators to be included in measurement tools (Helzner, Bruce, and Cuervo 1990). After several years of research on these indicators, MEASURE Evaluation (then The Evaluation Project) identified a core list of 25 indicators related to family planning (Bertrand, Magnani, and Knowles 1994). Researchers continue to evolve these indicators for quality assessment tools (Cuéllar, Quijada, and Callahan 2016), although as of 2016, there have been no formal, published validation studies (Sprockett 2016).

#### 1.2.2. *Data collection tools*

A number of agencies have developed cross-sectional tools to capture indicators of quality and conduct quality assessments. There are at least 20 tools that have been used to measure quality of services and care, including but not limited to, family planning (Sprockett 2016). These tools include the Population Council's Situation Analysis (SA) (Miller et al. 1997), which guided the development of ICF Macro's SPA surveys in the 1990s (Hozumi et al. 2006). The Quick Investigation of Quality (QIQ), an abbreviated version of the

SA created by Population Council, focused on family planning (MEASURE Evaluation 2000). The WHO first created the Service Availability Mapping (SAM) tool, which along with the SPA, guided the development of the widely-used Service Availability and Readiness Assessment (SARA) (WHO 2015b). None of these tools perfectly captures all potential elements of quality (Chakraborty, Mehrain, and Poyer 2016; Sprockett 2016). For example, the SPA and the QIQ include assessments of clinic visits, while other tools such as the SARA collect information only on the quality of service.

### 1.2.3. *Indices of quality of care*

Methodologically, there is debate about whether to condense indicators into summary indices of quality of care or to examine individual indicators or subscales separately, since research has shown an array of determinants of quality of care (Tessema et al. 2016). The few studies that have compiled indicators into a single index of quality of care vary in their methodological approaches or scoring mechanisms (Bellows et al. 2016; Do and Koenig 2007; Hong, Montana, and Mishra 2006; Jayachandran, Chapotera, and Stones 2016; Mensch, Arends-Kuenning, and Jain 1996; RamaRao et al. 2003; Wang et al. 2015). The following sections review the use of three different approaches for constructing overall measures of quality of care: simple additive indices, weighted additive indices, and PCA-based indices.

#### *Simple additive*

Researchers commonly use simple additive indices to produce overall scores by adding a number of binary variables. One study used data from the Malawi 2013-14 SPA to construct two simple additive indices of quality of care (Jayachandran, Chapotera, and Stones 2016). The first, an index of provision of care, added the number of "yes" items based on a checklist of procedures completed, as observed during the visit. The second index for experience of care, based on the client's responses in an exit interview, assigned numerical values to categorical responses and then added the responses[1] (Jayachandran, Chapotera, and Stones 2016). Gage and Zomahoun (2017) also constructed several additive indices for separate domains of quality of care, which they defined as the mean number of quality assurance methods, mean number of methods to solicit client feedback, and mean number of counseling items. The authors then used these indices (as well as additional indices created with other mechanisms and independent variables) to predict several outcomes of family planning. They found that positive associations of different dimensions of quality of care were associated with knowledge of family planning methods and contraceptive use. One longitudinal study used panel data from new family planning users at health facilities in the Philippines to create a simple additive index comprised of 24 indicators, which they divided into three levels of quality of care (high, medium, and low). They found that high quality of care positively predicted contraceptive continuation (RamaRao et al. 2003). A limitation of using the simple additive approach to create a single summary measure is the assumption that each indicator contributes equally to the concept of quality.

#### *Weighted additive*

Researchers often apply weights to account for potentially unequally weighted indicators. Like simple additive indices, weighted additive indices are easy to calculate. Typically, this procedure assigns equal weights to the domains and adjusts for the variation in the number of indicators within each domain so that the weight of the indicator is inversely proportional to the number of indicators in the domain. An early study that used indicators based on the Bruce framework (Bruce 1990) created two weighted additive indices of quality of care with SA data from Peru (Mensch, Arends-Kuenning, and Jain 1996). The first index was based on the structural domains, with almost 150 variables, and the second used indicators from both structure and process domains. Each of the domains included several variables that were summarized within the domain. Each domain score was then added to produce a total score (Mensch, Arends-Kuenning, and Jain 1996). Since that time, many others have adopted or recommended weighted additive indices of

[1] The authors compared quality of care with these measures among adolescent women versus women in older age groups and found slightly higher levels of quality of care among adolescents.

quality of service or quality of care for family planning (Arends-Kuenning and Kessy 2007; Hong, Montana, and Mishra 2006; Shahidzadeh-Mahani et al. 2008; Wang et al. 2015; WHO 2015b).

***Principal component analysis***

Analysts use PCA[2] as a data reduction method to obtain a smaller set of uncorrelated variables from a large list of correlated variables while maintaining most information in the original set – namely, the variance in the original set of variables (Dunteman 1989). Researchers also use PCA to determine the dimensionality of the data. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy can determine if the data are adequate for PCA (Dunteman 1989) by using a minimum cut-off of 0.4. Components that have an eigenvalue—a measure of the variance explained by the factor—equal to or greater than one are used (Kaiser 1960). The standard practice eliminates factors with an eigenvalue less than one because they contain less information than one variable alone (Kaiser 1960). The more components required to reach an eigenvalue of one, the more dimensional a construct, while the more variance explained by the first component, the better that component relates to the latent construct. The factor loadings represent the correlation of the indicator to the latent construct inferred from observed variables, and the loadings for each variable serve as the weight when using PCA to construct a summary score. That is, a score is assigned by multiplying each indicator by its factor loading on the component, typically the first component because it explains the most variance, and adding the weighted indicators. If using a correlation matrix, the variables are standardized with the resulting score having a mean of zero and a standard deviation of one. If a covariance matrix is used, the scores retain their original metrics. However, a limitation of using PCA to create a unidimensional index is when the first component does not explain much variance. This would indicate that the weights created from the factor loadings from the first component alone would not wholly represent the overall construct. Further, the variables that load highest on the first component may not align with most important theoretical aspects of the latent construct. Under these circumstances, using factor loadings from only the first component of PCA may also be an arbitrary method for assigning weights.

Researchers have used PCA in a number of areas in the life, behavioral, and social sciences (Dunteman 1989). The most notable index in the social sciences that draws on PCA is the Wealth Index, initiated by Filmer and Pritchett (2001) and later refined for the use of Demographic and Health Surveys (DHS) data by Rutstein and Johnson (2004). In family planning, a study by Bellows et al. (2016) used 35 indicators of structure and readiness with SPA data from Kenya. They constructed an index of quality of service by using the factor loadings from the first component of a PCA to create a score for each facility. The authors used the PCA results from this national survey to construct weights for the same indicators assessed in a country survey, which enabled them to benchmark the country survey against the national standards (Bellows et al. 2016). However, the authors did not report the proportion of variance explained by the component used to construct a score, or the factor loadings for each variable.

## 1.3. Linking Quality of Care to Individual Outcomes

A relatively uncommon but increasingly applied approach for assessing the impact of family planning quality of service or care is linking facility data to household or individual data geographically. Although it is theoretically possible to link individuals to their nearest facility, there are limitations to this

[2] PCA is similar to factor analysis in that they are both data reduction techniques that explain variance based on a few dimensions, but they differ in important ways (Dunteman 1989; Kim and Mueller 1978). One of the most important ways in which the two techniques differ is that PCA explains the percent of total variance in the variables while factor analysis explains the common variance of each variable with the remaining variables (Dunteman 1989). Where measurement error is expected to be high, factor analysis may be preferable since the measurement error is accounted for in the unique variance and not correlated with the common variance (Dunteman 1989). In theory, the two techniques should produce similar results when variables have high communalities (proportion of each variable's variance explained by the principal components) and there is a large number of variables (Dunteman 1989).

methodology: (1) displacement of GPS coordinates of households to maintain their anonymity and (2) women who do not necessarily seek care from their nearest facility (Montana 2001). Thus, the recommendation for linking individuals to health facility data is to use a measure of quality or service environment within a more broad geographical area by defining a radius for the environment relative to urban and rural localities (Skiles et al. 2013). A recent systematic review published by Do et al. (2016) identified 51 studies that linked individuals or households to at least one indicator of service environment or health care coverage. Of these, 18 published studies since 1991 have examined family planning related outcomes such as contraceptive use, contraceptive discontinuation or switching, and knowledge of family planning methods. The majority of these use DHS or SPA data (Do et al. 2016). Although these studies are important contributors to the development of methodologies for linking, only ten studies used this methodology to link to measures of quality of care, with only a handful that constructed composite indices for overall quality or domains of quality.

Among the most recent studies that linked the quality environment and family planning outcomes, researchers have tested elements of quality of care for associations with contraceptive use. Hong, Montana, and Mishra (2006) created a weighted additive quality index based on structural domains using SPA data from Egypt and linked women in the DHS to the most central facility within their cluster. After testing the association between IUD use and the facility's quality index score, they found that high quality facilities were associated with women's use of IUDs obtained from public facilities (Hong, Montana, and Mishra 2006). Do and Koenig (2007) also created an overall index of structural quality in the service environment for family planning by linking data from closely timed SPA and DHS surveys in Vietnam. Using hazard models to predict the effect of individual and service environment characteristics on contraceptive discontinuation, the authors found that women living in areas with higher service environment scores had a lower risk of discontinuation. In 2012, Wang et al linked contraceptive method availability as well as service environment structural quality within regions in Kenya, Rwanda, Uganda, and Tanzania to assess contraceptive use by analyzing linked DHS and SPA data. By combining data from these four countries and controlling for regional effects with multilevel modeling, the authors found that both method availability and the regional service environment were positively associated with contraceptive use (Wang et al. 2012). The Gage and Zomahoun (2017) study, which did not use data from the DHS or SPA surveys, geographically linked health facility data to women interviewed by household surveys in Nigeria.

Existing studies that link health facility data to data from women in household surveys generally do not measure the outcome of interest among the appropriate population (Do et al. 2016). For example, studies that attempt to examine the effect of quality of care on family planning outcomes must limit their population base to women who are in need or desire to space or limit future pregnancies. Infertile or post-menopausal women should be excluded from the analysis, because they are not expected to use family planning services. Although the existing literature illustrates a link between components of quality environment and contraceptive use, these studies either examine components separately or focus only on structural quality, and they rarely combine structure and process into a single index. This was an issue first noted by Mensch in 1996. In addition, the process for creating indices varies across studies. Few studies assessed the sensitivity of a quality of service (or service readiness) index that used PCA by comparing it with a simple additive score (Bellows et al. 2016). Using Cronbach's alpha, the authors found that the two indices were highly correlated, although there were some differences after they were categorized into quintiles.

### 1.4. Aims of Paper

This paper addresses gaps in the literature on the methodological considerations for constructing summary measures of quality of care of family planning. Traditionally, analysts use additive methods to create measures of quality of service or care, while the use of PCA as an alternative method to weight variables remains under-explored. No studies, to the authors' knowledge, have conducted a thorough comparison of all three scoring mechanisms (simple additive, weighted additive, and PCA-based scoring methods) that

detail the advantages and disadvantages of each. This study aims to compare the three methods of calculating indices of quality of service and quality of care. Specifically, we address three questions:

> (1) Does the ranking of the quality of family planning service and care change depending on the choice of scoring methodology?
>
> (2) Does the ranking of the quality of family planning service and care change if observation and client data are used?
>
> (3) Does the scoring mechanism influence how the quality of service and care environment predicts women's use of family planning services?

We use data from the Haiti SPA 2013, Malawi SPA 2013-2014, and Tanzania SPA 2014-2015 to compare the three commonly used methodologies for summarizing quality of service and care for family planning. We compare these different scoring mechanisms in terms of the simplicity of their construction, the interpretability of the results, and comparability in terms of their assignment of facilities to a low, medium, or high quality of care category. We examine the impact of the inclusion of observation and client data on the assignment of facilities to the different levels of quality of care. We use the three different scoring mechanisms to create indices of quality of service (service readiness) which rely on facilities data only, and we create another set of indices for quality of care that integrates facilities data with observation and client data. Finally, we assess and compare how these measures predict the use of family planning services at health facilities by linking SPA data to DHS data collected in Haiti in 2012, Malawi in 2015-16, and Tanzania in 2015-16.

## 1.5. Country Context

This study analyzes alternative approaches for constructing measures of quality of services and quality of care with SPA data from Haiti, Malawi, and Tanzania. The readiness of the health services sector and the use of family planning in the public sector vary among the study countries.

### 1.5.1. *Haiti*

Over half of the Haiti's health facilities are located in the capital city of Port-au-Prince (Ward, Santiso-Galvez, and Bertrand 2015). Many socioeconomic and health inequalities in Haiti were exacerbated by the 2010 earthquake, which resulted in more than 200,000 deaths, the displacement of 600,000 people (World Bank 2010), and the destruction of half of all public-sector facilities (Behrman and Weitzman 2016). Much of the rural population in Haiti lives in mountainous regions, and only 5% of the rural population have access to primary care that is of good quality (Gage et al. 2017). Only 52% of health facilities offer a basic package of services, which includes care for sick children, growth monitoring, vaccination services, availability of at least one contraceptive method, antenatal care (ANC), and services for sexually transmitted infections (STIs). In addition, the basic equipment available to health facilities is not ubiquitous (IHE and ICF International 2014). Seventy-six percent of health facilities offer at least one type of modern family planning method.

Haiti has the lowest contraceptive use in Latin America and the Caribbean (22% among all women), with injectables being the most common contraceptive (12% of all women and 19% of married women). The most common method among sexually active, unmarried women, however, is the male condom (24%) (Cayemittes et al. 2013; Howse 2014). After the earthquake, the use of injectables decreased along with the loss of health services (Behrman and Weitzman 2016). Only 23% of contraceptive users obtained their most recent contraceptive method from the public sector and an additional 14% obtained their contraception from a mixed public and private entity (Cayemittes et al. 2013).

### 1.5.2. *Malawi*

Malawi is one of the poorest countries in the world, with over 80% of the population living in rural areas. Only half of the health facilities offer a basic package of health services, and 62% of facilities have both running water and soap for infection prevention (MoH Malawi and ICF International 2014). Public health centers provide condoms, pills, and injectables free of charge (Skiles et al. 2006), and 8 in 10 health facilities in Malawi offer a type of family planning (MoH Malawi and ICF International 2014). About 45% of all women of reproductive age use a form of modern contraception. A total of 58% of currently married women use a modern method, with 30% using injectables. Among sexually active, unmarried women, 43% use a modern method, with injectables and the male condom among the most commonly used methods (NSO/Malawi and ICF 2017). Eighty-seven percent of women who use injectables obtain them from the public sector. Among young unmarried women, the major contraceptive method is the male condom (Howse 2014). Poorer, less-educated, rural women have lower contraceptive use and higher unmet need than their urban counterparts (USAID 2012).

### 1.5.3. *Tanzania*

The United Republic of Tanzania, a very large country compared with Haiti and Malawi, is not densely populated, with 32% of the population living in urban areas. Overall, a basic package of health services is available in 74% of Tanzanian health facilities (MoHSW/Tanzania et al. 2016). Eight in ten health facilities in Tanzania provide a family planning method, while in rural areas they can be found in 9 in 10 health facilities. Among currently married women, 32% are using a modern contraceptive, with 13% using injectables, the most common method. Among unmarried, sexually active women, 46% use a modern contraceptive method, with the male condom and injectables equally used by 15% each (MoHCDGEC et al. 2016). Sixty-one percent of all modern method users receive their contraceptives from a government or parastatal facility (MoHCDGEC et al. 2016).

# 2. Data and Methods

## 2.1. Data

This study draws from data collected in Haiti, Malawi, and Tanzania where the DHS recently conducted both SPA and DHS surveys within 1 to 3 years of each other. We linked data from the SPA and DHS surveys to explore the relationship between quality of family planning services and use of family planning services among women with a need for limiting or spacing children. We examine two population bases: health facilities surveyed with SPA surveys and women interviewed in the DHS surveys.

We used data from SPA surveys conducted in Haiti in 2013, Malawi in 2013-14, and Tanzania in 2014-15. The SPA surveys include several questionnaires that collect data on various aspects of the quality of care. These include (1) an inventory questionnaire, which examines the availability of services and features of the facility; (2) the health worker interview, which collects information from 8-15 selected health workers on their duties, training, and demographic characteristics; (3) the observation checklist, which records the proceedings of selected health visits; and (4) an exit interview, in which a client whose visit was observed provides their perceptions of the visit and demographic information. The interviewer can observe up to 5 consultations per provider and up to 15 consultations per service. This report included data from facilities with family planning services, health workers who provided family planning services, and clients who attended the health facility for family planning and who left the facility with a contraceptive method. In Haiti, there were 756 facilities with family planning services, 1,661 health workers, and 1,212 female family planning clients. For Malawi, the analysis included 809 family planning facilities, 1,585 health workers, and 1,482 women. For Tanzania, we analyzed a total of 947 facilities, 3,734 health workers, and 1,686 women.

The second population for analysis in this report included women age 15-49 who participated in household-based DHS surveys conducted in Haiti in 2012, Malawi in 2015-16, and Tanzania in 2015-16. These surveys are population based household surveys that provide nationally representative data for each country, and which use a multi-stage cluster sampling design to select households for participation. All women age 15-49 in the sampled households were eligible to participate in the interview.

## 2.2. Methods

The following section details our methodology for this report. In summary, we first selected our indicators of family planning quality of care and quality of service based on consensus in the literature (Bertrand, Magnani, and Knowles 1994; Hutchinson, Do, and Agha 2011; RamaRao et al. 2003; Sullivan and Bertrand 1999; Tumlinson et al. 2015; WHO 2015b). We constructed several composite indices of quality of care by using three scoring mechanisms, or methods of calculation: simple additive, weighted additive, and PCA. For each scoring mechanism, each facility was assigned a score on a scale of 0 – 100 and categorized as low, medium, or high based on the tercile distribution of the score. We compared the scores with statistical methods to determine the extent to which the categorization of facilities as low, medium, or high quality differed by the scoring mechanisms. To explore the relationship between quality of care and health care utilization, we linked SPA and DHS data at the cluster level for Haiti and Malawi and at the regional level for Tanzania, since the health facilities data for Tanzania are sample based. We used multilevel logistic regressions to test for associations between quality of service and quality of care in family planning health facilities near place of residence and use of family planning services.

All analyses included weights to account for nonresponse of facilities, health workers, and clients. In Tanzania, sampling weights also account for the complex survey design that ensures the sample of facilities in the survey is nationally representative. Since SPA surveys in Haiti and Malawi are a census of all health

facilities in each country, we do not present confidence intervals in the descriptive analysis since there are no potential sampling errors. We use Stata 14.0 to perform all analyses.

### 2.2.1. *Indicator selection, coding, and denominators for indices*

#### *Selection of indicators*

Previous studies of family planning quality of service and care guided the selection of domains and indicators used to create indices for this report. As described in the introduction, the seminal research of Donabedian (1966, 1988) and Bruce (1990) provide the underlying framework for conceptualizing quality of care. The indices in this report included indicators from the Donabedian structure and process components of quality of care, and assimilated the domains used by Bruce (1990), Hutchinson, Do, and Agha (2011) and Tumlinson et al. (2015). We structured the indices into eight domains. Table 1 illustrates the domains defined in this report, indicates their alignment with the Donabedian framework, summarizes the indicators included in each domain, and specifies the instrument or source of data for each indicator.

**Table 1. Summary of domains and indicators used to create indices of quality of service and care for family planning**

| Donabedian component | Domain | Quality of service | Quality of care | Indicator summary | Number of indicators | SPA questionnaire (source of data) |
|---|---|---|---|---|---|---|
| Structure | Choice of methods | Yes | Yes | Availability of methods | 1 | Facility |
| Process | | No | Yes | Provider discusses methods/choice | 2 | Observation |
| Structure | Constellation of service | Yes | Yes | Availability of other services: ANC, PNC, HIV, PMTCT, STI | 5 | Facility |
| Structure | Management | Yes | Yes | Supervision and human resource management, contraceptive commodity management | 6 | Facility |
| Structure | Infrastructure | Yes | Yes | General infrastructure (water, electricity, toilet, etc.) and family planning infrastructure (exam room and supplies for family-planning related procedures, including sanitation) | 17 | Facility |
| Structure | Provider/ technical competence | Yes | Yes | Provider training | 1 | Health worker |
| Process | | No | Yes | Assessment of reproductive history, fertility intentions, and physical health; review of client card | 14 | Observation |
| Process | Follow-up | No | Yes | Provider gives information on when to return | 1 | Observation and exit interview |
| Process | Information given to client | No | Yes | Provider gives information on method use and side-effects | 2 | Observation and exit interview |
| Process | Client-provider relations | No | Yes | Treatment of the client during the visit | 4 | Observation and exit interview |

#### *Coding of indicators*

We defined the structure-related indicators based on the approach adopted by SARA, where facilities must both report having a certain structure or commodity and also have the interviewer confirm that the structure was available and functioning on the day of the survey. Indicators that assess the client visit, such as whether or not a provider explained potential side effects of a selected method, whether the provider explained how to use the selected method, and when to return for a resupply were recorded by the interviewer in the observation of the visit and also assessed via self-report in the client exit interview. Previous research found that clients may misreport information in the exit interview because they may not effectively retain or comprehend the information communicated by the provider during the visit, indicating that the providers did not adequately transmit information (Assaf, Wang, and Mallick 2016). Therefore, in this study, we constructed our observation-based indicators with cases in which there is agreement between the client responses in an exit interview and the interviewer's observation. For example, we only coded the indicator for reporting side effects positively if both the observer noted that the provider discussed this during the visit and the client reported receiving this information. Although retention of information may depend in some part on the capacity of the individual, we coded the variables this way to ensure that the provider not only provided the information but that they relayed information effectively so that the client retained this information after the visit and reported it in the exit interview. Bessinger and Bertrand (2001) also

recommend using a combination of both observation and exit interview responses for creating process indicators. Because we constructed the indices at the facility level, we collapsed each provider or client variable to the facility level with the mean for each facility, following the methodology of Tumlinson et al. (2015). The mean scores were then merged into the facility file and dichotomized as either being above 1 or below 0, the mean for the entire sample for that indicator[3].

All indicators used to construct the indices were binary, and were coded as either 1, if the indicator was present (structure) or had occurred (process), or 0, if not. Cases with missing information for an indicator were recoded as 0 and assumed not to exist or to have occurred.

***Quality of service versus quality of care***

Assessing quality of care necessitates data from observation of family planning visits for clients currently using or initiating use of a family planning method. However, on the day of the survey, some facilities did not report having a health worker to provide family planning services or there were no contraceptive- using clients present and consenting to observation. The lack of provider, service availability, or clients obtaining services on a given day of an interview could indicate poor quality. However, since we cannot confirm this, scoring facilities without observations as 0—when facilities may be high quality—could introduce bias. Thus, we created two types of indices—quality of service and quality of care—by using two denominators.

The quality of service indices were based on the full sample of facilities with family planning services, including 756 facilities in Haiti, 809 in Malawi, and 947 in Tanzania. These indices included only the 29 indicators available at the facility level. The quality of care indices were calculated only among the sub-sample facilities that provide family planning with client and provider data: 405 in Haiti, 371 in Malawi, and 398 in Tanzania. These indices incorporate 53 indicators of quality of care. Because of the different sample base, the quality of service and quality of care indices are not comparable at the facility level unless both samples are restricted to facilities with observation data available.

### 2.2.2. *Index creation*

We created six indices—three indices for each quality of service and quality of care: a simple additive index, a weighted additive index, and an index that used PCA. We then categorized each score into three categories of high, medium, and low, by using tercile cut points.

***Simple additive index***

The simple additive index is a sum of all the items. For quality of service, the simple additive index can range between 0 and 29 since this only uses facility-based variables. For quality of care, the simple additive index can range between 0 and 53 since the index includes facilities with provider and client data available. To facilitate comparison between scoring mechanisms, we standardized the summary scores to a scale of 0 to 100 by dividing the total number of indicators and multiplying by 100. We calculated the simple additive score as follows:

$$Y_{\text{additive standardized}} = \left( \left(\sum_{i=1}^{n} x_i\right) / n \right) \times 100$$

Where $x$ is the indicator and n represents the total number of indicators.

[3] We attempted to dichotomize the variables with the median. However, because the median was highly skewed, using the median as a cut point created too little variation for inclusion of the indicator in a PCA.

***Weighted additive index***

The weighted additive index is also a sum of the items, but unlike the simple additive index, which assumes equal weights for all indicators, the weighted additive index accounts for the number of indicators within each domain. To do this, we first added the indicators within each domain and divided the sum in each domain by the number of indicators in that domain. We then multiplied by 100 and divided by the total number of domains for the index to obtain a domain score. Finally, we added together the domain scores—four domains for quality of service (only facility variables) and eight domains for quality of care (facility, provider and client variables)—in order to create the total weighted additive score.

$$Y_{\text{weighted additive}} = \sum_{d=1}^{m}(\sum_{i=1}^{n} x_{di} \,/\, n_d) \times 100 \,/\, m$$

Where d refers to domains and m represents the total number of domains.

***Principal Component Analysis***

PCA is a variation of factor analysis that can be used as a data reduction tool to determine a linear combination of the fewest number of variables that explain the largest proportion of variation of the latent factor in question. In this study, the latent factor is quality of service or quality of care. We applied the STATA command *pca* and conducted an unrotated, unweighted PCA by using a correlation matrix. We used the factor loadings from the first component to create an overall score for each facility. Although the convention is to retain only variables with a loading of 0.4 or greater, we did not impose a threshold or cut point for the inclusion of indicators. Where *i* is the number of indicators and where *a* represents the factor loadings or correlation of each indicator with the first component for each $j^{th}$ facility, the first component is a linear combination of the indicators:

$$Y_j = \sum_{i=1}^{n} a_i \, x_i$$

We then rescaled the score obtained from the first component of the PCA to a range of 0 to 100 to facilitate comparisons with the simple additive and weighted additive scores. Where *y* is equal to the predicted score from the first component for each $j^{th}$ facility, the normalized score becomes *z* for each $j^{th}$ facility:

$$z_j = (y_j - y_{min})/(y_{max} - y_{min}) \times 100$$

***Categorizing scores***

To facilitate a more intuitive understanding, we categorized the continuous scores from the three different approaches as low, medium, or high by using tercile cut points. A common practice in social science is to dichotomize continuous variables in order to simplify an analysis and the interpretation of results. However, statisticians often criticize this technique. A researcher who dichotomizes a continuous variable loses statistical power and may be unable to detect significant differences (Aiken, West, and Reno 1991; MacCallum et al. 2002). Further, when using a median split, every value below the median is treated as equal and distinctly different from all values above the median. An alternative approach is to categorize a continuous variable into terciles or quartiles. Discretization in this way allows researchers to compare the highest and lowest groups and results in less efficacy lost when compared with a normally distributed continuous variable that is dichotomized (Gelman and Park 2009). Although Gelman and Park's paper recommends excluding the middle category (or categories if using quartiles) to facilitate the comparison between high and low groups, we retained the middle tercile to avoid restricting our sample of facilities and, instead, focus the interpretation of our results on the differences between high and low groups.

### 2.2.3. *Comparison of scores*

We first calculated the percent agreement and Cohen's kappa coefficient, which is a statistic used to measure the overall agreement between two scores, by using the *kappa* command in Stata 14. Cohen's kappa, which adjusts for potential agreement due to chance, can range between -1.0 and 1.0. The larger the value, the greater the agreement. Analysts have defined discrete categories to describe levels of agreement. An estimate between 0.81–1.0 suggests near perfect agreement. Good agreement occurs with an estimate that falls within the range of 0.61–0.80. Moderate agreement is within the bounds of 0.41–.60. Fair agreement is an estimate between 0.21–0.40 and poor is 0.0–0.20. Agreement that is less than 0.0 signals the agreement is less than random chance (Landis and Koch 1977). We then cross tabulated the levels of quality for each quality of service care scoring mechanism by the background characteristics of facilities to explore variation by scoring mechanism.

### 2.2.4. *The relationship between use of family planning services and quality*

In addition to comparing the indices at the facility-level, we analyzed and compared the ability of each index to predict outcomes of family planning, and more specifically, women's use of family planning services. Although we are not able to identify the exact facility or facilities a woman used with the DHS and SPA data, we are able to link women to a summary measure of her nearby facilities. In this part of the analysis, we linked the facility level data from the SPA to the population-level data from the DHS household surveys to see if the association between women's use of family planning services and her nearby service environment differs by methodology for assessing quality of service and quality of care. In the following sections, we describe the methodology for linking the SPA and DHS data files, the outcome of interest, and the subsequent analysis.

#### *Linking SPA and DHS*

Since The DHS Program conducted recent SPA and DHS surveys in Haiti, Malawi, and Tanzania within 2 to 3 years of each other in each country, and collects the GPS locations for health facilities in the SPA surveys and for the centroid of each cluster in the DHS household surveys, it is possible to geographically link data from the two surveys. However, the DHS routinely displaces the GPS coordinates of clusters sampled in the DHS surveys in order to preserve the anonymity of the respondents (Burgert et al. 2013). Urban clusters are displaced up to 2 kilometers and rural clusters up to 5 kilometers, with another 1% of rural clusters displaced up to 10 kilometers. To minimize the effects of the displacement on the analysis, we created groups of facilities within a 5-kilometer buffer zone of urban clusters and 10-kilometer buffer zone of rural clusters. These "buffer" distances were large enough to accommodate the maximum displacement of the cluster, which ensured an accurate catchment area of facilities. The SPA surveys in Haiti and Malawi were both census surveys that included interviews with every formal-sector health facility in the country. Census SPA surveys allow for linking facility data to clusters sampled in the DHS. With sample-based SPA surveys, it is not possible to link every cluster to a facility because all facilities are not included (Burgert and Prosnitz 2014). Since the SPA surveys in Haiti and Malawi were a census of the health facilities, we were able to link women at the cluster level to facilities within these buffer distances. In Tanzania, however, the SPA survey was a sample of facilities. Burgert and Prosnitz (2014) recommend linking only at the regional level, for which SPA data are representative. Similar to the linkage in Malawi and Haiti, it is not possible to link women to the particular facility that they visited. Instead, we estimate the extent to which women's use of family planning services is associated with the quality of family planning service in the region. Detailed description of the methodology is available in Wang et al. (2015) and Burgert and Prosnitz (2014).

Because the availability and the quality environment can vary significantly by urban and rural location (Wang et al. 2015), we conducted bivariate and multivariable analyses separately for urban and rural areas. Previous research (Wang et al. 2015) suggests that the service environment produced by this method of

linking SPA and DHS data may not be precise enough in the most urbanized settings such as capital cities. In addition, because women may have ample choice of numerous facilities in these highly urbanized areas, as well as better access and transportation to travel to these facilities, we are unable to say that the 5-kilometer zone of service environment for women in the most urbanized areas captures the health facility of her choice. Thus, we excluded 4,155 urban residents of Port-au-Prince, Haiti, and 1,643 urban residents of Lilongwe, Malawi, from the analysis of urban women.

We summarized data from facilities within each respective urban and rural buffer by using the median of each continuous index score for each cluster, and created a variable of quality environment according to each index. We excluded clusters without any facilities with family planning services within the respective buffer from the regression analysis. Some clusters had a facility with family planning services within their relative buffer distance but no observation data for these facilities. These clusters were assigned a "0" value and were categorized as having low quality of care. We tested the assumption that facilities without observation data were of lower quality by examining the background characteristics of facilities without observation data. We found that these facilities tended to be lower level facilities (non-hospitals) with family planning services available fewer than 5 days per week. The Mensch, Arends-Kuenning, and Jain (1996) study also followed this assumption and used this methodology. In Haiti, this totaled seven clusters of 83 in urban areas and 13 of 241 clusters in rural areas. There were 4 of 159 clusters in urban areas and 166 of 650 rural clusters in Malawi that did not have a facility eligible for the quality of care index calculations within the respective buffer zone. Because we linked at the regional level in Tanzania, all regions had at least one facility that was eligible for the quality of care index calculations.

We then categorized the cluster-level scores for Haiti and Malawi and regional scores for Tanzania into high, medium, and low scores. Thus, each cluster or region can be described as having a high, medium, or low quality environment. The categorization was relative to urban and rural areas and the remainder of the analysis examined urban and rural areas separately.

***Outcome***

As described, the link between contraceptive use and quality is established. However, some researchers suggest that women who have resolved to use contraception (or not) will do so (or not) regardless of quality of service or care. Quality of care only has the potential to influence women who are undecided or hesitant about using a method (Bruce 1990; RamaRao et al. 2003). Determinants of a woman's use of contraception can vary in different contexts and can include individual, household, community, or quality of service or care factors (Stephenson et al. 2007). In our study countries—Haiti, Malawi, and Tanzania—fertility desires, the contraceptive prevalence rate (CPR), and unmet need for family planning are quite varied (Cayemittes et al. 2013; MoHCDGEC et al. 2016; NSO/Malawi and ICF 2017).

Thus, we explored an alternative outcome—the use of family planning services—which we theorize may more proximately relate to the quality of service or care across multiple countries, irrespective of the context of the determinants of contraceptive use. We created our outcome, use of family planning services, with responses to two questions. First, the survey asks if a woman visited a health facility in the previous 12 months. If the women responds yes, the next question asks, "Did any staff member at the health facility speak to you about family planning methods?" We coded women who both visited a facility and discussed family planning as "1" and women who did not visit a facility, or visited a facility and did not discuss family planning as "0". Although the question does not allow us to distinguish whether the health worker or woman seeking care had initiated the conversation, we hypothesize that the conversation would occur in the higher quality facilities more frequently than in lower quality facilities, regardless of who initiated it. This may occur through two pathways. First, providers may offer to discuss family planning services because of their skill, competence, or training in providing high quality care or if they work in well-equipped facilities with a high quality of service. Second, women may initiate the discussion because they are aware that they are

attending a high quality facility and are thus assured of better service. However, self-selection is still possible because some women could ask providers about family planning regardless of the quality of services.

While the survey asks this question of all women, we limited the denominator in our analysis to include only women with a need for family planning. In our study, we included only women with self-reported desire for family planning to limit or space births. We excluded women who reported infecundity, who were currently pregnant (and wanted current pregnancy at that time), or who were not using contraception but reported wanting a child within 2 years of the time of the interview (Bradley et al. 2012). We also excluded urban women from Port-au-Prince, Haiti, and urban women from Lilongwe, Malawi, as justified in the earlier section on *Linking SPA and DHS.* The total number of women in need of family planning used in this analysis was 4,473 in Haiti, 13,663 women in Malawi, and 6,531 in Tanzania.

***Statistical analysis***

First, we presented the background characteristics of women with a need for family planning. Then we provided the results of the bivariate relationship between women with a need for family planning who made a visit to a health facility for family planning and the service environment according to each scoring methodology.

Finally, we conducted multilevel, multivariable random-effects logistic regressions to assess how the quality of family planning environment from each scoring mechanism predicts service utilization. Women who live in the same cluster or region may not be independent of each other, although this is the assumption of individual level regressions. This can lead to underestimating the standard errors, increasing the odds of incorrectly rejecting the null hypotheses, and finding statistically significant effects of predictors (Raudenbush and Bryk 2002). Multilevel models account for the nesting of individuals within clusters to test the effects of group-level and individual-level predictors simultaneously on individual level outcomes. Multilevel models partition the variance in the outcome between and within groups and indicate the proportion of the total variance that the cluster-level predictors explain in the individual level outcome. The random effects model allows the intercept to vary randomly across clusters, although the covariates have fixed effects across clusters. In this study, variation in the likelihood that a woman with any need for family planning services discussed a method with a provider is a function of her individual level characteristics, including that of her household. However, cluster or regional-level factors, such as the quality of family planning care environment in the place of residence, can also influence the odds of service utilization. Factors other than quality environment can explain the between-group variance, such as the transportation infrastructure, but we model the impact of quality, which is the focus of this study.

At level 1, we model the use of family planning services of woman *i* in cluster/region j as a function of a woman's individual and household characteristics as follows:

$$Log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{0j} + \sum_{q=1}^{Q} \beta_{qj} X_{qij} + r_{ij}$$

Where:

$p_{ij}$ is the fitted probability of discussing family planning of woman i in cluster/region j;

$\beta_{0j}$ is the random intercept or the mean prevalence of discussing family planning with a provider in cluster/region j;

$X_{qij}$ is a series of woman-level q=1, …, q characteristics;

$\beta_{qj}$ are the level-1 coefficients measuring the effect of individual woman-level characteristics on their probability of discussing family planning in their last visit to a clinic;

$r_{ij}$ is the random error associated with woman *i* in cluster/region j on her probability of discussing family planning in their last visit to a clinic.

At level 2 (between-regions or between-clusters), we use the following model:

$$b_{qj} = g_{q0} + \sum_{s=1}^{S_q} g_{qs} W_{sj} + u_{qj}$$

Where:

$\beta_{qj}$ is a level-1 coefficient;

$\gamma_{qs}$ (q=0, 1, …, $S_q$) are level-2 coefficients;

$W_{sj}$ is the set of s region level variables for cluster or region j – namely, the quality of care score using differing scoring mechanisms;

$u_{qj}$ is the random effect of cluster/region j. It is assumed to be normally distributed with a mean of 0 and a standard deviation of 1.

The model partitions variance in the outcome within clusters or regions as a factor of women's individual and household level characteristics, and between clusters or regions as a factor of cluster or regional level variables, which in this study is the quality environment. The interclass correlation (ICC)[4] is a measure of the between-cluster (or between-region) component of the variance.

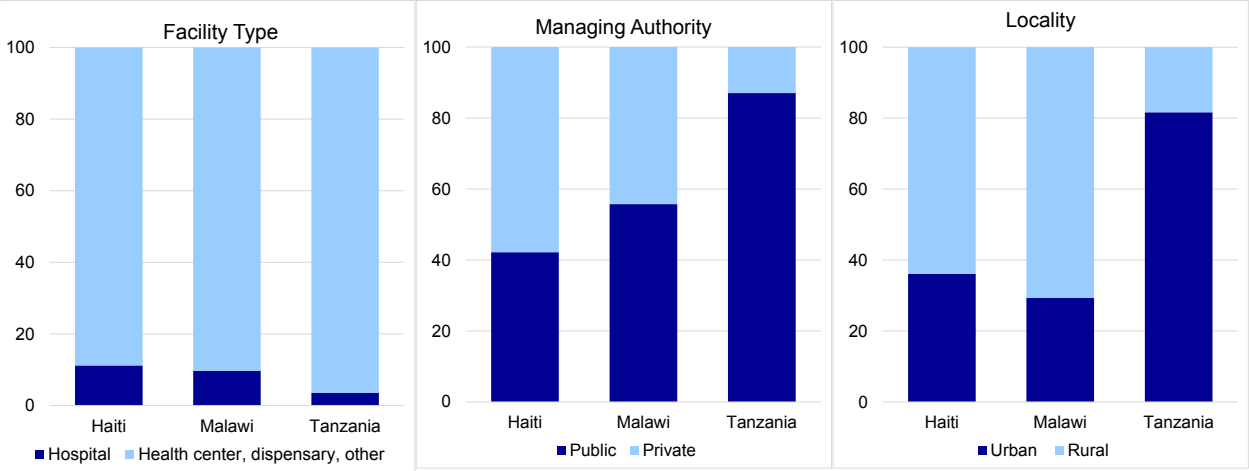
We used the STATA 14 command *melogit.* We ran separate models for each scoring mechanism and conducted the analyses separately for urban and rural areas, which resulted in twelve models per country. We reported the ICC for each model. Our models controlled for common covariates of health care utilization that include education (none, primary, secondary or higher), occupation (unemployed, agriculture, professional, other), wealth quintile, marital status (never married, currently married, formerly married), number of living children (0, 1-4, 5+), exposure to family planning messaging (yes or no), and current contraceptive use (none, traditional methods, short-acting modern methods, or long-acting and permanent modern methods). The wealth index is typically divided into quintiles, with categories labeled as lowest wealth, second lowest, middle, fourth highest, and highest wealth group. In urban areas in the three countries, however, there were very few (or no) women in the lower two wealth quintiles. Due to the infrequency of women in the lowest quintiles in urban areas, women in the three lowest groups (low, second, and middle) were then re-classified into one group, which served as the lowest to middle wealth group.

[4] The interclass correlation coefficient refers to the proportion of the total variance in the individual level outcome that is a result of the between-group variation or the cluster-level predictor – namely, quality of family planning care. We obtained this statistic with the *estat icc* command in Stata.

# 3. Results

A small proportion of facilities in the study countries were hospitals—less than 15% in Haiti, Malawi, and Tanzania. The majority of the facilities were health centers, dispensaries, and clinics. In Haiti and Malawi, a similar proportion of facilities are managed by the government or private entities. In Tanzania, however, the overwhelming majority of facilities are publically managed—close to 90%. In Tanzania, facilities are also disproportionately located in urban areas (around 80%), while in Haiti and Malawi about 30% to 40% of facilities are in urban areas. Figure 1 illustrates these distributions.

**Figure 1. Percent distribution of facilities with family planning services by facility characteristics, Haiti, Malawi, and Tanzania**




## 3.1. Availability of Quality of Service and Quality of Care Items

### 3.1.1. *Quality of service*

Table 2 presents the availability of services, commodities, infrastructure, and management related to quality of service in family planning. We included 95% confidence intervals, presented as lower and upper bounds (lb and ub), for the results in Tanzania because the survey in Tanzania was a sample-based survey.

*Choice of methods*: Only one-third of facilities in Haiti provide a mix of family planning methods (at least one long-term-acting method, one short-term-acting method, and one barrier method), while almost two-thirds of facilities in Malawi and just over half of facilities in Tanzania do.

*Constellation of services*: Almost 100% of facilities in all three countries provided STI services. In Haiti and Tanzania, over 90% provide ANC and postnatal care (PNC) services. In Tanzania, over 90% of facilities provide ANC, PNC, STI services, HIV counseling and testing (HCT), or prevention of mother-to-child transmission of HIV/AIDS (PMTCT) services. Fewer facilities Haiti provide HCT or PMTCT services, likely due to the country's HIV/AIDS prevalence, which is lower than in Malawi and in Tanzania.

*Management*: The availability of indicators of management varied, although they appear more consistent between the countries, with the exception of the inventory of contraceptive supplies (49% in Haiti, 80% in Malawi, and 66% in Tanzania). The most commonly reported item was recent supervision. Few facilities have a system for feedback from clients or have their stock of contraceptives organized by expiration date.

*Infrastructure*: Although the availability of infrastructure-related resources varied within the domain and across countries, there were some similarities across countries. For instance, around 90% or more of facilities in the three countries had a protected waiting area and a private waiting room. A telephone, quality assurance measures, a speculum, and a light were the least commonly available items. However, those varied by country.

**Table 2. Percentage of facilities providing items of quality of services for family planning, Haiti, Malawi, and Tanzania**

| | Haiti | Malawi | Tanzania | | |
|---|---|---|---|---|---|
| Indicator | % | % | % | lb | ub |
| Choice of methods | | | | | |
| Mix of methods provided (one long acting, one short acting, one barrier) and currently available | 33.9 | 63.0 | 54.9 | 50.4 | 59.4 |
| Family planning integration/Constellation of services | | | | | |
| With ANC services | 96.5 | 69.1 | 98.6 | 97.7 | 99.6 |
| With PNC services | 90.1 | 66.2 | 94.3 | 92.3 | 96.3 |
| With STI services | 98.0 | 96.8 | 98.0 | 96.7 | 99.3 |
| With HCT services | 52.9 | 84.2 | 96.5 | 94.6 | 98.5 |
| With PMTCT services | 37.1 | 63.1 | 93.5 | 91.2 | 95.8 |
| Management | | | | | |
| System for reviewing management/administrative issues | 56.6 | 56.2 | 72.1 | 68.1 | 76.1 |
| System to obtain client opinions | 2.4 | 7.0 | 11.0 | 8.3 | 13.8 |
| Supervision in the last 6 months | 89.4 | 81.6 | 98.3 | 97.0 | 99.6 |
| Inventory of contraceptive supplies | 49.3 | 80.1 | 66.5 | 62.6 | 70.5 |
| Stock organized by expiration date | 3.4 | 2.6 | 1.4 | 0.3 | 2.4 |
| Contraceptives protected from water, sun, pests | 62.2 | 74.3 | 56.7 | 52.3 | 61.0 |
| Facility infrastructure | | | | | |
| *General* | | | | | |
| Electricity | 63.2 | 58.6 | 63.0 | 58.6 | 67.4 |
| Water | 78.6 | 94.8 | 67.5 | 63.3 | 71.6 |
| Toilet | 43.3 | 33.6 | 35.3 | 31.3 | 39.2 |
| Telephone | 22.2 | 29.6 | 4.2 | 2.8 | 5.6 |
| Waiting area (protected) | 95.6 | 97.8 | 94.6 | 92.4 | 96.7 |
| Quality assurance measures in place | 7.3 | 12.7 | 15.4 | 12.3 | 18.5 |
| *Family planning area* | | | | | |
| Family planning services provided 5 days per week | 91.7 | 62.3 | 92.5 | 90.2 | 94.8 |
| Private exam room | 92.7 | 96.2 | 93.9 | 92.0 | 95.9 |
| Blood pressure cuff | 89.1 | 70.1 | 73.6 | 69.7 | 77.5 |
| Speculum | 2.6 | 14.5 | 23.4 | 19.8 | 26.9 |
| Family planning guidelines | 50.2 | 36.3 | 57.8 | 53.4 | 62.1 |
| Table and stool | 70.0 | 86.8 | 87.1 | 83.9 | 90.3 |
| Light | 19.0 | 27.8 | 12.8 | 9.8 | 15.8 |
| Soap | 72.1 | 56.5 | 65.4 | 61.2 | 69.5 |
| Gloves | 57.4 | 90.5 | 56.5 | 52.0 | 61.0 |
| Decontamination solution | 62.2 | 57.5 | 57.1 | 52.9 | 61.2 |
| Sharps box | 86.1 | 90.3 | 96.8 | 95.3 | 98.3 |
| **Number of facilities** | **756** | **809** | **947** | | |

**Note:** 95% Confidence Intervals (lb = lower bound, ub = upper bound) are presented for Tanzania only since data are from a sample of facilities.

### *3.1.2. Quality of care*

Table 3 also presents the availability of services, commodities, infrastructure, and management for the sub-sample of facilities that provide family planning services and have client data available, which were necessary for creating the quality of care scores. Here we observed a higher proportion of facilities that report availability of almost all these items among the subsample of facilities with observation data. Table 3 also includes the percentage of facilities with above average, observation-based items as follows:

*Choice of methods*: Over half of the facilities in Malawi and Tanzania had an above average number of visits where providers mentioned two or more methods. However, fewer than half of the facilities had an above average number of visits where the provider actually asked about the client's method of choice.

**Table 3. Percentage of facilities providing family planning with quality of service items and percentage of facilities with above average reports of observation-based quality of care items, Haiti, Malawi, and Tanzania**

| | Haiti | Malawi | Tanzania | | |
|---|---|---|---|---|---|
| Indicator | % | % | % | lb | ub |
| Choice of methods | | | | | |
| Mix of methods provided (one long acting, one short acting, one barrier) and currently available | 46.3 | 68.4 | 60.4 | 54.1 | 66.7 |
| Provider mentioned two or more family planning methods | 39.5 | 56.6 | 58.0 | 52.0 | 64.0 |
| Provider asked about client's method of choice | 41.7 | 45.3 | 37.6 | 32.2 | 42.9 |
| Family planning integration/ Constellation of services | | | | | |
| With ANC services | 98.0 | 75.3 | 99.7 | 99.5 | 100.0 |
| With PNC services | 90.8 | 71.1 | 95.0 | 92.4 | 97.6 |
| With STI services | 97.8 | 99.4 | 99.2 | 97.7 | 100.7 |
| With HCT services | 56.8 | 90.3 | 96.5 | 93.2 | 99.7 |
| With PMTCT services | 44.9 | 71.0 | 95.8 | 92.9 | 98.6 |
| Management | | | | | |
| System for reviewing management/administrative issues | 60.8 | 60.1 | 72.2 | 66.0 | 78.4 |
| System to obtain client opinions | 3.4 | 9.6 | 15.1 | 11.4 | 18.9 |
| Supervision in the last 6 months | 92.4 | 84.3 | 98.6 | 96.9 | 100.4 |
| Inventory of contraceptive supplies | 57.5 | 86.2 | 66.7 | 60.9 | 72.6 |
| Stock organized by expiration date | 4.2 | 1.6 | 2.5 | 0.2 | 4.7 |
| Contraceptives protected from water, sun, pests | 66.9 | 76.5 | 55.3 | 48.8 | 61.8 |
| Facility infrastructure | | | | | |
| *General* | | | | | |
| Electricity | 66.4 | 61.1 | 66.0 | 59.7 | 72.3 |
| Water | 81.7 | 95.7 | 69.7 | 63.2 | 76.2 |
| Toilet | 42.0 | 32.9 | 38.7 | 33.3 | 44.1 |
| Telephone | 23.2 | 33.9 | 4.9 | 3.4 | 6.4 |
| Waiting area (protected) | 96.3 | 98.2 | 93.2 | 89.5 | 96.8 |
| Quality assurance measures in place | 7.9 | 13.5 | 18.7 | 14.1 | 23.2 |
| *Family planning area* | | | | | |
| Family planning services provided 5 days per week | 94.3 | 71.7 | 93.0 | 89.5 | 96.4 |
| Private exam room | 94.6 | 97.3 | 93.2 | 90.0 | 96.4 |
| Blood pressure cuff | 90.1 | 69.6 | 79.4 | 74.1 | 84.6 |
| Speculum | 3.4 | 21.1 | 27.9 | 22.5 | 33.3 |
| Family planning guidelines | 61.7 | 38.4 | 64.8 | 59.0 | 70.6 |
| Table and stool | 69.1 | 88.0 | 91.2 | 86.8 | 95.5 |
| Light | 16.0 | 29.2 | 14.2 | 9.6 | 18.8 |
| Soap | 72.3 | 58.4 | 66.7 | 60.9 | 72.5 |
| Gloves | 58.2 | 92.0 | 63.0 | 56.2 | 69.8 |
| Decontamination solution | 65.7 | 58.2 | 59.9 | 53.7 | 66.2 |
| Sharps box | 91.9 | 92.0 | 96.4 | 93.7 | 99.0 |
| Technical/Provider competence | | | | | |
| Client card | 80.2 | 95.4 | 94.9 | 92.0 | 97.8 |
| Recent training in family planning provision | 42.4 | 45.9 | 19.9 | 17.2 | 22.5 |
| *Reproductive history* | | | | | |
| Last delivery date assessed | 41.4 | 43.3 | 49.2 | 43.6 | 54.9 |
| Pregnancy status assessed | 51.8 | 41.6 | 50.9 | 45.1 | 56.7 |
| Breastfeeding status assessed | 9.6 | 29.6 | 32.2 | 26.6 | 37.8 |
| Menstrual cycle regularity assessed | 27.6 | 35.0 | 37.7 | 32.3 | 43.1 |
| *Fertility intentions* | | | | | |
| Age of client assessed | 51.8 | 47.8 | 74.0 | 68.2 | 79.8 |
| Current number of children assessed | 45.6 | 51.7 | 78.2 | 73.6 | 82.9 |
| Desire for more kids assessed | 6.2 | 28.2 | 26.6 | 21.4 | 31.8 |
| Desired timing for next child assessed | 5.7 | 26.4 | 23.3 | 18.6 | 27.9 |
| *Physical health* | | | | | |
| Blood pressure measured | 70.5 | 41.0 | 35.4 | 29.5 | 41.2 |
| Weight measured | 50.5 | 54.8 | 38.7 | 32.4 | 45.0 |
| Smoking habits assessed | 4.2 | 3.7 | 2.4 | 0.7 | 4.1 |
| STI symptoms assessed | 17.3 | 18.8 | 11.8 | 8.3 | 15.2 |
| Chronic illnesses assessed | 12.1 | 19.2 | 24.1 | 19.4 | 28.9 |
| Follow-up | | | | | |
| Provider informed client when to return for resupply or follow-up | 64.0 | 66.3 | 79.3 | 74.8 | 83.7 |
| Information given to client | | | | | |
| Explains how to use the selected method | 49.6 | 51.6 | 66.8 | 61.2 | 72.3 |
| Explains side effects of selected method | 35.7 | 42.0 | 47.7 | 41.4 | 53.9 |
| Client-provider relations | | | | | |
| Staff treated client very well | 95.3 | 83.2 | 95.8 | 93.3 | 98.2 |
| Provider asked if client had any questions or concerns | 48.1 | 65.7 | 75.0 | 69.8 | 80.2 |
| Client felt comfortable asking questions during the visit | 89.9 | 74.7 | 95.4 | 93.1 | 97.6 |
| Provider assured client of confidentiality | 19.7 | 30.4 | 41.5 | 35.3 | 47.8 |
| **Number of facilities** | **405** | **371** | **398** | | |

**Note:** 1. The facilities included in this table are those facilities that have observation data available.
2. 95% Confidence Intervals (lb = lower bound, ub upper bound) are presented for Tanzania only since data are from a sample of facilities.

*Provider or technical competence*: Interviewers noted that the provider wrote in the client card, on average, in over 80% of facilities in Haiti and over 90% in Malawi and Tanzania. Less common was the observation of a provider assessment of smoking habits and symptoms of STIs.

*Follow-up information and client-provider relations*: The indicators of report of client treatment and whether the client felt they were able to ask questions are based on client report only and are quite commonly reported.

### 3.2. Results from the Principal Component Analysis

Tables 4 and 5 show the results from the PCA, including the factor loadings, the eigenvalue, the percent of total variance explained by the first component, and Cronbach's alpha (as a measure of reliability between factors). For both the quality of service and quality of care indices, no one single item had a loading of over 0.4 except for three facility-based indicators in Malawi for the full sample (all in the domain of family planning integration and constellation of services).

For the PCA conducted with variables theoretically related to quality of service, the items that loaded highest differed by country. In Haiti, availability of three types of methods, availability of HCT services, and electricity loaded the highest at between 0.30 and 0.35. In Malawi, the items that loaded the highest above 0.40 were related to integration: availability of ANC, PNC, and services for PMTCT. In Tanzania, the items that had the highest loadings, between 0.28 and 0.36, were related to infrastructure, such as telephone, speculum, light, soap, gloves, and decontamination solution.

Table 5 shows the results from the PCA conducted using the quality of care indicators among the sub-sample of facilities with observation data available. Here, the items with the highest loadings also varied. In Haiti and Tanzania, the highest-loading items were within the technical competence domain. In Malawi, we found a number of variables with negative loadings, which suggested an inverse relationship with the latent factor represented by the first component. In fact, the items with the highest absolute value also correlated negatively with the first component. These were within the integration domain, including ANC, PNC, and PMTCT. It is noteworthy that these items demonstrated the highest positive values in the PCA for quality of service.

For each set of indicators and in each country, the percent of variance explained by the first component was low, ranging from 8% for quality of care indicators in Haiti and Malawi to 14% for Malawi's quality of service indicators. The low variance, the diverging items with high loadings in each country, and the negative loadings elicit concerns for the use of PCA to create a summary score using the loadings from the first component. This is discussed in detail in the discussion section.

**Table 4. Factor loadings of the first component of a principal component analysis for quality of service indicators, eigenvalue, % of variance explained, and Cronbach's alpha, Haiti, Malawi, and Tanzania**

| | Haiti | Malawi | Tanzania |
|---|---|---|---|
| Choice of methods | | | |
| Mix of methods provided (one long acting, one short acting, one barrier) and currently available | 0.30 | 0.18 | 0.22 |
| Family planning integration/ Constellation of services | | | |
| With ANC services | 0.08 | 0.45 | 0.01 |
| With PNC services | 0.06 | 0.43 | 0.08 |
| With STI services | 0.17 | 0.10 | 0.04 |
| With HCT services | 0.35 | 0.31 | 0.07 |
| With PMTCT services | 0.28 | 0.45 | 0.07 |
| Management | | | |
| System for reviewing management/administrative issues | 0.03 | 0.24 | 0.00 |
| System to obtain client opinions | 0.12 | 0.06 | 0.25 |
| Supervision in the last 6 months | 0.15 | 0.18 | 0.04 |
| Inventory of contraceptive supplies | 0.16 | 0.19 | 0.07 |
| Stock organized by expiration date | 0.11 | -0.03 | 0.07 |
| Contraceptives protected from water, sun, pests | 0.14 | 0.00 | 0.06 |
| Facility infrastructure | | | |
| *General* | | | |
| Electricity | 0.30 | 0.13 | 0.14 |
| Water | 0.26 | 0.02 | 0.19 |
| Toilet | 0.21 | -0.14 | 0.22 |
| Telephone | 0.26 | -0.03 | 0.29 |
| Waiting area (protected) | 0.08 | 0.02 | 0.06 |
| Quality assurance measures in place | 0.18 | 0.02 | 0.32 |
| *Family planning area* | | | |
| Family planning services provided 5 days per week | 0.12 | -0.20 | 0.02 |
| Private exam room | 0.14 | 0.05 | 0.04 |
| Blood pressure cuff | 0.07 | -0.11 | 0.13 |
| Speculum | 0.17 | -0.09 | 0.36 |
| Family planning guidelines | 0.17 | 0.08 | 0.20 |
| Table and stool | 0.04 | 0.02 | 0.17 |
| Light | 0.09 | -0.10 | 0.29 |
| Soap | 0.20 | -0.11 | 0.28 |
| Gloves | 0.27 | 0.03 | 0.31 |
| Decontamination solution | 0.16 | -0.04 | 0.28 |
| Sharps box | 0.12 | 0.07 | 0.09 |
| **Eigenvalue** | 2.72 | 4.10 | 3.47 |
| **Percent of total variance** | 0.09 | 0.14 | 0.12 |
| **Cronbach's alpha** | 0.62 | 0.68 | 0.69 |

**Table 5. Factor loadings of the first component of a principal component analysis for quality of care indicators, eigenvalue, % of variance explained, and Cronbach's alpha, Haiti, Malawi, and Tanzania**

| | Haiti | Malawi | Tanzania |
|---|---|---|---|
| Choice of methods | | | |
| Mix of methods provided (one long acting, one short acting, one barrier) and currently available | 0.11 | 0.07 | 0.10 |
| Provider mentioned two or more family planning methods | 0.20 | 0.00 | 0.13 |
| Provider asked about client's method of choice | 0.19 | 0.07 | 0.13 |
| Family planning integration/ Constellation of services | | | |
| With ANC services | 0.06 | -0.30 | -0.05 |
| With PNC services | -0.01 | -0.29 | 0.00 |
| With STI services | 0.07 | 0.00 | -0.04 |
| With HCT services | 0.19 | -0.10 | 0.03 |
| With PMTCT services | 0.18 | -0.28 | -0.04 |
| Management | | | |
| System for reviewing management/administrative issues | -0.03 | -0.14 | 0.04 |
| System to obtain client opinions | 0.06 | 0.01 | 0.12 |
| Supervision in the last 6 months | 0.04 | -0.03 | 0.03 |
| Inventory of contraceptive supplies | 0.05 | -0.07 | 0.05 |
| Stock organized by expiration date | 0.02 | 0.04 | 0.01 |
| Contraceptives protected from water, sun, pests | 0.01 | 0.06 | 0.01 |
| Facility infrastructure | | | |
| *General* | | | |
| Electricity | 0.12 | -0.05 | 0.07 |
| Water | 0.05 | 0.05 | 0.06 |
| Toilet | 0.12 | 0.19 | 0.08 |
| Telephone | 0.20 | 0.23 | 0.14 |
| Waiting area (protected) | 0.03 | 0.00 | 0.05 |
| Quality assurance measures in place | 0.09 | 0.09 | 0.19 |
| *Family planning area* | | | |
| Family planning services provided 5 days per week | 0.00 | 0.17 | 0.05 |
| Private exam room | 0.00 | 0.04 | 0.07 |
| Blood pressure cuff | 0.02 | 0.15 | 0.03 |
| Speculum | 0.11 | 0.30 | 0.21 |
| Family planning guidelines | 0.05 | 0.07 | 0.10 |
| Table and stool | -0.03 | 0.06 | 0.04 |
| Light | 0.01 | 0.23 | 0.14 |
| Soap | -0.02 | 0.23 | 0.13 |
| Gloves | 0.06 | 0.10 | 0.16 |
| Decontamination solution | -0.03 | 0.17 | 0.11 |
| Sharps box | 0.01 | -0.02 | 0.05 |
| Technical/Provider competence | | | |
| Client card | 0.07 | -0.12 | 0.05 |
| Recent training in family planning provision | 0.07 | 0.08 | 0.04 |
| *Reproductive history* | | | |
| Last delivery date assessed | 0.27 | 0.13 | 0.27 |
| Pregnancy status assessed | 0.21 | 0.13 | 0.26 |
| Breastfeeding status assessed | 0.17 | 0.09 | 0.23 |
| Menstrual cycle regularity assessed | 0.21 | 0.19 | 0.24 |
| *Fertility intentions* | | | |
| Age of client assessed | 0.23 | 0.13 | 0.14 |
| Current number of children assessed | 0.25 | 0.16 | 0.13 |
| Desire for more kids assessed | 0.19 | 0.16 | 0.26 |
| Desired timing for next child assessed | 0.18 | 0.13 | 0.22 |
| *Physical health* | | | |
| Blood pressure measured | 0.12 | 0.17 | 0.20 |
| Weight measured | 0.14 | 0.03 | 0.19 |
| Smoking habits assessed | 0.20 | 0.08 | 0.14 |
| STI symptoms assessed | 0.22 | 0.12 | 0.17 |
| Chronic illnesses assessed | 0.25 | 0.13 | 0.21 |
| Follow-up | | | |
| Provider informed client when to return for resupply or follow-up | 0.07 | 0.02 | 0.09 |
| Information given to client | | | |
| Explains how to use the selected method | 0.10 | 0.02 | 0.16 |
| Explains side effects of selected method | 0.26 | 0.05 | 0.22 |
| Client-provider relations | | | |
| Staff treated client very well | -0.06 | 0.09 | -0.01 |
| Provider asked if client had any questions or concerns | 0.14 | 0.09 | 0.17 |
| Client felt comfortable asking questions during the visit | -0.13 | 0.13 | 0.02 |
| Provider assured client of confidentiality | 0.18 | 0.07 | 0.19 |
| **Eigenvalue** | 4.22 | 4.35 | 5.17 |
| **Percent of total variance** | 0.08 | 0.08 | 0.10 |
| **Cronbach's alpha** | 0.70 | 0.69 | 0.79 |

### 3.3. Agreement in the Categorization of Facilities' Quality by Scoring Mechanism

We classified facilities into low, medium, and high level of quality of service and quality of care groups based on terciles of the simple additive, weighted additive, and PCA scores. We analyzed the comparability of the facility classification across the three scoring mechanisms by calculating the percent agreement and Cohen's kappa statistic. Descriptive statistics of the continuous scores for each scoring methodology are presented in the Appendix only, as we are primarily interested in exploring the differences by the relative ranking of facilities—or how they differ after being categorized as high, medium, and low. Appendix Tables 1 and 2 illustrate the mean and standard error of each quality of service and quality of care score after standardization to a scale of 0 to 100. However, because outliers can heavily influence the mean, the median and inter-quartile range (IQR) can provide a more robust picture of the distribution of the scores. These are shown in box plots in Appendix Figures 2a through 3c.

#### 3.3.1. *Quality of service*

Table 6 presents the percent agreement and Cohen's kappa statistic for quality of service and illustrates the level of agreement according to the kappa statistic, which could be good, moderate, fair, poor, or worse than chance. In Haiti, a comparison of the three quality of service indices indicated fair to good agreement, with the highest percent agreement between the simple additive and the PCA indices (82%) and a significant kappa statistic of 0.73 (p-value <0.001). There was fair agreement between the weighted additive and both the simple additive and PCA (around 60%), with significant (p<0.001) kappa statistics around or less than 0.40. In Malawi, the percent agreement between the simple additive and weighted additive indices was about 60% (kappa = 0.40, p-value <0.05). The lowest agreement was between the weighted additive and the PCA (poor agreement), with a 43% agreement (kappa = 0.14, p-value <0.001). The highest agreement, which ranged from moderate to good, occurred in Tanzania. The simple additive and PCA again had the highest level of agreement, at 84%, which is considered good agreement (kappa = 0.74, p-value <0.001). In each country, comparisons between the weighted additive and PCA-based scores produced the lowest kappa statistic.

**Table 6. Percent agreement and Cohen's kappa coefficient among three quality of service scores among health facilities in Haiti, Malawi, and Tanzania**

| **Haiti (n = 756)** | | | | |
|---|---|---|---|---|
| | Simple additive | | Weighted additive | |
| | % Agreement | Kappa | % Agreement | Kappa |
| Simple additive | | | | |
| Weighted additive | 60.3 | 0.40*** | | |
| PCA | 81.9 | 0.73*** | 57.8 | 0.37*** |

| **Malawi (n = 809)** | | | | |
|---|---|---|---|---|
| | Simple additive | | Weighted additive | |
| | % Agreement | Kappa | % Agreement | Kappa |
| Simple additive | | | | |
| Weighted additive | 61.0 | 0.41** | | |
| PCA | 41.2 | 0.21*** | 43.0 | 0.14** |

| **Tanzania (n = 945)** | | | | |
|---|---|---|---|---|
| | Simple additive | | Weighted additive | |
| | % Agreement | Kappa | % Agreement | Kappa |
| Simple additive | | | | |
| Weighted additive | 65.5 | 0.45*** | | |
| PCA | 84.1 | 0.74*** | 64.1 | 0.42*** |

* p<.05, ** p<.01, *** p <.001

Good agreement
Moderate agreement
Fair agreement
Poor
Worse than chance

### 3.3.2. *Quality of care*

Table 7 presents the agreement comparisons for the quality of care indices. When we compared the quality of care indices, we found fair to moderate levels of agreement among the scoring mechanisms in Haiti. The simple additive had moderate agreement with both the weighted additive and the PCA scores, around 70% for both, with significant kappa statistics ($p<0.001$) just under 0.60. In Malawi, the simple additive moderately agreed with both the weighted additive and the PCA scores, while there was poor agreement between the weighted additive and PCA scores. In Tanzania, the highest agreement was also found between the simple additive and PCA scores, with good agreement (85% agreement, kappa = 0.74, p-value <0.001). Again, within each country, the lowest agreement occurred between the weighted additive and PCA scores.

**Table 7. Percent agreement and Cohen's kappa coefficient among three quality of care scores among health facilities in Haiti, Malawi, and Tanzania**

**Haiti (n=405)**

| | Simple additive | | Weighted additive | |
|---|---|---|---|---|
| | % Agreement | Kappa | % Agreement | Kappa |
| Simple additive | | | | |
| Weighted additive | 69.6 | 0.54*** | | |
| PCA | 71.1 | 0.57*** | 57.0 | 0.36*** |

**Malawi (n=371)**

| | Simple additive | | Weighted additive | |
|---|---|---|---|---|
| | % Agreement | Kappa | % Agreement | Kappa |
| Simple additive | | | | |
| Weighted additive | 64.0 | 0.46** | | |
| PCA | 51.2 | 0.27*** | 39.7 | 0.10** |

**Tanzania (n=398)**

| | Simple additive | | Weighted additive | |
|---|---|---|---|---|
| | % Agreement | Kappa | % Agreement | Kappa |
| Simple additive | | | | |
| Weighted additive | 41.2 | 0.20*** | | |
| PCA | 85.3 | 0.77*** | 36.6 | 0.14*** |

* p<.05, ** p<.01, *** p <.001

Good agreement
Moderate agreement
Fair agreement
Poor
Worse than chance

### 3.3.3. *Agreement between quality of service and quality of care*

To explore whether the inclusion of client and observation data affected the categorization of facilities, we also computed the percent agreement and Cohen's kappa statistic between the quality of service and quality of care for each scoring mechanism. Since quality of care indices can be only calculated for facilities with observation and client data, we restricted the agreement analysis to the subsample of facilities with both facility and observation data. To ensure comparability, we recategorized the two additive measures for quality of service into terciles, and restricted them to the subsample of facilities with observation data. We also recalculated the PCA scores for the quality of service, and restricted the sample to those facilities with observation data[5]. Table 8 shows the results of the agreement comparisons between quality of care and quality of service.

[5] The PCA analysis for creating the quality of service scores with the subsample of facilities that have observation data produced similar factor loadings on the first component, the eigenvalue of the first component, and the proportion of variance explained (results not shown.)

We found less agreement when comparing the indices between the two types of quality measures. The levels of agreement generally fell between poor and fair, with one instance in Malawi of two scores with moderate agreement (the weighted additive quality of service and the simple additive quality of care score: 61% agreement, kappa = 0.41, p-value <0.001). Also in Malawi, agreement was worse than chance when comparing the PCA-based scores for quality of service to the quality of care scores drawn from simple additive and PCA scoring mechanisms.

**Table 8. Percent agreement and Cohen's kappa coefficient comparing agreement between quality of service and quality of care scores among health facilities in Haiti, Malawi, and Tanzania**

**Haiti (n=405)**

| | | Quality of service | | | | | |
|---|---|---|---|---|---|---|---|
| | | Simple additive | | Weighted additive | | PCA | |
| | | % Agreement | Kappa | % Agreement | Kappa | % Agreement | Kappa |
| Quality of care | Simple additive | 56.3 | 0.34*** | 54.1 | 0.31*** | 58.8 | 0.38*** |
| | Weighted additive | 48.2 | 0.22*** | 52.1 | 0.28*** | 49.9 | 0.25*** |
| | PCA | 42.7 | 0.14*** | 42.0 | 0.13** | 48.2 | 0.22*** |

**Malawi (n=371)**

| | | Quality of service | | | | | |
|---|---|---|---|---|---|---|---|
| | | Simple additive | | Weighted additive | | PCA | |
| | | % Agreement | Kappa | % Agreement | Kappa | % Agreement | Kappa |
| Quality of care | Simple additive | 60.5 | 0.40*** | 60.8 | 0.41*** | 31.2 | -0.03 |
| | Weighted additive | 41.1 | 0.12*** | 46.4 | 0.20*** | 38.7 | 0.08* |
| | PCA | 43.7 | 0.15*** | 39.1 | 0.09** | 17.7 | -0.24 |

**Tanzania (n=398)**

| | | Quality of service | | | | | |
|---|---|---|---|---|---|---|---|
| | | Simple additive | | Weighted additive | | PCA | |
| | | % Agreement | Kappa | % Agreement | Kappa | % Agreement | Kappa |
| Quality of care | Simple additive | 60.2 | 0.37*** | 55.9 | 0.31*** | 58.9 | 0.34*** |
| | Weighted additive | 44.1 | 0.14*** | 45.7 | 0.17*** | 42.2 | 0.10*** |
| | PCA | 54.7 | 0.28*** | 51.1 | 0.23*** | 54.7 | 0.27*** |

* p<.05, ** p<.01, *** p <.001

Good agreement
Moderate agreement
Fair agreement
Poor
Worse than chance

Overall, there were higher levels of agreement in Haiti and Tanzania than Malawi. The lowest levels of agreement appear when comparing the weighted additive and PCA scores for both the quality of service and quality of care scores. Across all three countries, there was little agreement between quality of service and quality of care. This indicated that adding client and observation data affected the categorization of quality of family planning services.

### 3.4. Quality by Facility Background Characteristics

The quality of family planning services can differ substantially depending on the facility's background characteristics. Tables 9 and 10 show the distribution of facilities by their characteristics (type of facility, managing authority, and urban/rural location) and compares these distributions by quality of service (Table 9) and quality of care (Table 10), according to the three types of scoring mechanisms.

### 3.4.1. *Quality of service*

In Haiti, as expected, there was a higher proportion of hospitals compared with lower level health facilities in the high quality category for each scoring mechanism. The distribution of public and private facilities was more even across the three categories by each of the scoring mechanisms, except for within the weighted additive score where there were more high ranking public facilities compared with private facilities. There was a slightly higher proportion of facilities ranked as high in urban areas versus low by each of the scoring mechanisms, and a higher proportion of facilities in rural areas ranked low versus high.

In Malawi, the two additive scores followed a pattern similar to that in Haiti, where more hospitals were in the high-quality group, and distribution was more even by public versus private, and more high ranking facilities in urban areas compared with rural areas. However, we saw these trends reverse when the facility categorization used the PCA scores. For these PCA scores, more health centers, dispensaries, and other facilities were high quality (35%) versus hospitals (19%), more public facilities were highly ranked (51%) than private facilities (11%), and more rural facilities were ranked as high (44%) versus urban facilities (7%).

In Tanzania, we saw the largest disparities, although the trends in quality of service by facility characteristics are similar to those in Haiti for all three scoring mechanisms. About three-quarters or more of hospitals were high quality compared with less than one-third of other types of facilities, and less than 5% of hospitals were ranked as low quality by each scoring mechanism. More private facilities were high quality of service than public facilities, and more urban facilities had high scores compared with rural facilities. The most pronounced differences appeared when comparing background characteristics with the PCA scores.

### 3.4.2. *Quality of care*

For quality of care, we found that across all three countries and scoring mechanisms, more hospitals were high-ranking than lower level facilities. Private and public facilities in Haiti were again evenly distributed. In Malawi, the PCA ranked more of the private facilities as high quality compared with the two additive scores. In Tanzania, more privately managed facilities were high quality compared with public facilities, by each scoring mechanism. The differences by urban and rural residence were inconsistent across scoring mechanism and country.

**Table 9. Percent distribution of facilities by facility background characteristic and level of quality of service, Haiti, Malawi, Tanzania**

| Haiti | Simple additive | | | | Weighted additive | | | | PCA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Medium | High | Total | Low | Medium | High | Total | Low | Medium | High | Total | N |
| **Facility Type** | | | | | | | | | | | | | |
| Hospital | 7.1 | 29.4 | 63.5 | 100.0 | 18.8 | 25.9 | 55.3 | 100.0 | 1.2 | 24.7 | 74.1 | 100.0 | 85 |
| Health center, dispensary, other | 39.5 | 33.1 | 27.4 | 100.0 | 36.2 | 33.4 | 30.3 | 100.0 | 37.4 | 34.4 | 28.2 | 100.0 | 671 |
| **Managing Authority** | | | | | | | | | | | | | |
| Public | 34.8 | 33.5 | 31.7 | 100.0 | 28.5 | 30.8 | 40.7 | 100.0 | 32.9 | 35.1 | 32.0 | 100.0 | 319 |
| Private | 36.7 | 32.0 | 31.3 | 100.0 | 38.5 | 33.9 | 27.6 | 100.0 | 33.7 | 32.0 | 34.3 | 100.0 | 437 |
| **Locale** | | | | | | | | | | | | | |
| Rural | 39.6 | 34.6 | 25.9 | 100.0 | 36.3 | 33.1 | 30.6 | 100.0 | 40.2 | 35.2 | 24.6 | 100.0 | 484 |
| Urban | 29.3 | 29.3 | 41.4 | 100.0 | 30.8 | 31.5 | 37.7 | 100.0 | 21.3 | 30.0 | 48.7 | 100.0 | 273 |
| Total | 35.9 | 32.6 | 31.5 | 100.0 | 34.3 | 32.6 | 33.1 | 100.0 | 33.4 | 33.3 | 33.3 | 100.0 | 756 |
| **Malawi** | | | | | | | | | | | | | |
| | **Simple additive** | | | | **Weighted additive** | | | | **PCA** | | | | |
| | Low | Medium | High | Total | Low | Medium | High | Total | Low | Medium | High | Total | **N** |
| **Facility Type** | | | | | | | | | | | | | |
| Hospital | 7.4 | 17.5 | 75.1 | 100.0 | 14.9 | 19.9 | 65.2 | 100.0 | 8.9 | 71.5 | 19.6 | 100.0 | 79 |
| Health center, dispensary, other | 38.4 | 34.9 | 26.7 | 100.0 | 35.3 | 35.0 | 29.7 | 100.0 | 36.0 | 29.3 | 34.7 | 100.0 | 730 |
| **Managing Authority** | | | | | | | | | | | | | |
| Public | 28.2 | 38.5 | 33.4 | 100.0 | 22.4 | 39.2 | 38.4 | 100.0 | 12.1 | 37.2 | 50.7 | 100.0 | 451 |
| Private | 44.6 | 26.5 | 28.9 | 100.0 | 47.1 | 26.3 | 26.6 | 100.0 | 60.1 | 28.6 | 11.3 | 100.0 | 358 |
| **Locale** | | | | | | | | | | | | | |
| Rural | 35.0 | 35.9 | 29.1 | 100.0 | 30.2 | 38.2 | 31.6 | 100.0 | 22.5 | 33.4 | 44.1 | 100.0 | 572 |
| Urban | 36.5 | 26.5 | 37.0 | 100.0 | 40.8 | 22.1 | 37.1 | 100.0 | 59.5 | 33.5 | 7.0 | 100.0 | 237 |
| Total | 35.4 | 33.2 | 31.4 | 100.0 | 33.3 | 33.5 | 33.2 | 100.0 | 33.4 | 33.4 | 33.2 | 100.0 | 809 |
| **Tanzania** | | | | | | | | | | | | | |
| | **Simple additive** | | | | **Weighted additive** | | | | **PCA** | | | | |
| | Low | Medium | High | Total | Low | Medium | High | Total | Low | Medium | High | Total | **N** |
| **Facility Type** | | | | | | | | | | | | | |
| Hospital | 2.5 | 13.3 | 84.2 | 100.0 | 3.6 | 23.0 | 73.4 | 100.0 | 1.0 | 10.8 | 88.2 | 100.0 | 34 |
| Health center, dispensary, other | 39.7 | 29.8 | 30.6 | 100.0 | 34.9 | 34.6 | 30.5 | 100.0 | 34.6 | 34.1 | 31.3 | 100.0 | 914 |
| **Managing Authority** | | | | | | | | | | | | | |
| Public | 40.3 | 30.2 | 29.5 | 100.0 | 34.1 | 35.1 | 30.8 | 100.0 | 35.5 | 35.5 | 29.0 | 100.0 | 825 |
| Private | 25.3 | 22.2 | 52.5 | 100.0 | 31.8 | 28.1 | 40.1 | 100.0 | 19.0 | 18.7 | 62.3 | 100.0 | 123 |
| **Locale** | | | | | | | | | | | | | |
| Rural | 42.5 | 29.4 | 28.1 | 100.0 | 37.2 | 33.8 | 29.0 | 100.0 | 37.4 | 35.1 | 27.4 | 100.0 | 773 |
| Urban | 19.6 | 28.4 | 51.9 | 100.0 | 18.5 | 36.0 | 45.5 | 100.0 | 15.4 | 25.2 | 59.5 | 100.0 | 174 |
| Total | 38.3 | 29.2 | 32.5 | 100.0 | 33.8 | 34.2 | 32.0 | 100.0 | 33.4 | 33.3 | 33.3 | 100.0 | 947 |

**Table 10. Percent distribution of facilities by facility background characteristic and level of quality of care, Haiti, Malawi, and Tanzania**

| | Simple additive | | | | Weighted additive | | | | PCA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Haiti** | Low | Medium | High | Total | Low | Medium | High | Total | Low | Medium | High | Total | N |
| **Facility Type** | | | | | | | | | | | | | |
| Hospital | 11.5 | 42.3 | 46.2 | 100.0 | 19.2 | 30.8 | 50.0 | 100.0 | 15.4 | 30.8 | 53.8 | 100.0 | 52 |
| Health center, dispensary, other | 40.0 | 35.7 | 24.3 | 100.0 | 35.5 | 33.7 | 30.8 | 100.0 | 36.1 | 33.7 | 30.2 | 100.0 | 353 |
| **Managing authority** | | | | | | | | | | | | | |
| Public | 38.6 | 38.6 | 22.8 | 100.0 | 37.1 | 32.5 | 30.4 | 100.0 | 34.6 | 34.0 | 31.4 | 100.0 | 197 |
| Private | 34.3 | 34.6 | 31.1 | 100.0 | 29.9 | 34.1 | 36.0 | 100.0 | 32.3 | 32.7 | 35.0 | 100.0 | 208 |
| **Locale** | | | | | | | | | | | | | |
| Rural | 44.2 | 37.1 | 18.7 | 100.0 | 35.9 | 36.6 | 27.5 | 100.0 | 42.2 | 36.2 | 21.6 | 100.0 | 240 |
| Urban | 24.9 | 35.8 | 39.3 | 100.0 | 29.8 | 28.5 | 41.7 | 100.0 | 20.7 | 29.1 | 50.2 | 100.0 | 165 |
| **Total** | 36.4 | 36.5 | 27.1 | 100.0 | 33.4 | 33.3 | 33.3 | 100.0 | 33.4 | 33.3 | 33.2 | 100.0 | 405 |
| **Malawi** | | | | | | | | | | | | | |
| | Simple additive | | | | Weighted additive | | | | PCA | | | | |
| | Low | Medium | High | Total | Low | Medium | High | Total | Low | Medium | High | Total | N |
| **Facility type** | | | | | | | | | | | | | |
| Hospital | 12.2 | 24.6 | 63.2 | 100.0 | 26.2 | 36.9 | 36.8 | 100.0 | 17.5 | 29.9 | 52.6 | 100.0 | 55 |
| Health center, dispensary, other | 41.7 | 31.0 | 27.3 | 100.0 | 34.6 | 32.9 | 32.5 | 100.0 | 36.3 | 33.9 | 29.9 | 100.0 | 316 |
| **Managing authority** | | | | | | | | | | | | | |
| Public | 35.2 | 32.1 | 32.8 | 100.0 | 28.5 | 34.1 | 37.5 | 100.0 | 45.9 | 35.6 | 18.5 | 100.0 | 237 |
| Private | 41.1 | 26.5 | 32.3 | 100.0 | 42.0 | 32.5 | 25.5 | 100.0 | 11.7 | 29.2 | 59.1 | 100.0 | 134 |
| **Locale** | | | | | | | | | | | | | |
| Rural | 39.0 | 30.8 | 30.2 | 100.0 | 28.4 | 36.1 | 35.4 | 100.0 | 43.2 | 38.3 | 18.5 | 100.0 | 261 |
| Urban | 33.3 | 28.3 | 38.4 | 100.0 | 45.0 | 27.3 | 27.7 | 100.0 | 10.7 | 21.5 | 67.8 | 100.0 | 110 |
| **Total** | 37.3 | 30.1 | 32.6 | 100.0 | 33.4 | 33.5 | 33.1 | 100.0 | 33.5 | 33.3 | 33.3 | 100.0 | 371 |
| **Tanzania** | | | | | | | | | | | | | |
| | Simple additive | | | | Weighted additive | | | | PCA | | | | |
| | Low | Medium | High | Total | Low | Medium | High | Total | Low | Medium | High | Total | N |
| **Facility type** | | | | | | | | | | | | | |
| Hospital | 9.0 | 25.2 | 65.8 | 100.0 | 18.1 | 40.0 | 41.9 | 100.0 | 7.7 | 15.4 | 76.9 | 100.0 | 26 |
| Health center, dispensary, other | 41.6 | 28.4 | 30.0 | 100.0 | 34.8 | 32.9 | 32.3 | 100.0 | 35.2 | 34.7 | 30.2 | 100.0 | 372 |
| **Managing authority** | | | | | | | | | | | | | |
| Public | 41.1 | 29.5 | 29.5 | 100.0 | 33.7 | 34.6 | 31.7 | 100.0 | 33.8 | 34.8 | 31.4 | 100.0 | 346 |
| Private | 28.9 | 19.5 | 51.6 | 100.0 | 33.5 | 24.8 | 41.6 | 100.0 | 30.2 | 24.3 | 45.5 | 100.0 | 52 |
| **Locale** | | | | | | | | | | | | | |
| Rural | 41.3 | 29.4 | 29.3 | 100.0 | 35.6 | 30.0 | 34.5 | 100.0 | 35.4 | 31.9 | 32.7 | 100.0 | 286 |
| Urban | 34.9 | 24.9 | 40.2 | 100.0 | 29.0 | 42.0 | 29.0 | 100.0 | 28.1 | 37.2 | 34.7 | 100.0 | 112 |
| **Total** | 39.5 | 28.2 | 32.4 | 100.0 | 33.7 | 33.3 | 33.0 | 100.0 | 33.3 | 33.4 | 33.3 | 100.0 | 398 |

## 3.5. The Relationship between Use of Family Planning Services and Quality

To analyze how use of family planning services is related to quality of service and quality of care in family planning, we aggregated the quality scores to the cluster level for Haiti and Malawi since the SPA survey is a census. For Tanzania, we aggregated the scores to the regional level because the SPA data is sample based. Appendix Figures 3a through 4c illustrate the range, median, and 25th and 75th percentiles of the cluster/regional-level quality of service and quality of care scores, separately for urban and rural areas for each country. We then categorized the clusters as high, medium, or low quality environment respective to each scoring method. We analyzed the relationship between the use of family planning services and the quality environment by each scoring mechanism among women age 15-49 with a desire for family planning. These women represented about half or more of women of reproductive age (47% in Haiti, 61% in Malawi, and 49% in Tanzania). We used a proximate measure of family planning services use, which was whether the woman had visited a health care facility in the past year and discussed family planning with the provider.

### 3.5.1. *Characteristics of women with a need for family planning*

Table 11 presents the distribution of background characteristics of urban and rural women with a desire to use family planning to limit or space births, or as we have defined, a need for family planning services. In Haiti, the urban sample excluded women in Port-au-Prince, and in Malawi, the urban sample excluded women in Lilongwe. Among women with a need for family planning in Haiti (1,228 in urban areas and 3,245 in rural areas), we found that less than one-third of these women visited a health facility and discussed

family planning with a provider—28% of women in urban areas and 31% in rural areas. In urban areas, women who had a need for family planning were most often age 25-34 (40%), had secondary or higher education (60%), worked in professional occupations (53%), belonged to the fourth highest wealth group (40%), were Catholic (48%), married (75%), and had 1-4 children (67%), were exposed to family planning messaging (55%), and were not using any method of family planning (47%). In rural areas, the distribution of background characteristics of women with a need for family planning was similar, except that most often women had a primary education (45%), were in the second wealth quintile (34%), were Protestant (47%), and had no exposure to family planning messaging (58%).

The urban-rural gap in the need for family planning is widest in Malawi compared with the other study countries (urban, 1,600 women; rural, 12,063 women). The percentage of rural women with a need for family planning who made use of family planning services (35%) is higher than that of urban women (25%). In urban areas, 52% of women had secondary or higher education, and 69% had primary education. The majority of women in rural areas worked in agriculture (66%), while the highest employment category for urban women was "unemployed" (35%). Seventy-five percent of women in urban areas belonged to the highest wealth quintile, while there was a more balanced distribution among women in rural areas. In both types of residences, over 70% of women with a need for family planning were Christian, over 80% were married, two-thirds or more had 1-4 children, and over 40% were using a short-acting family planning method. As in Haiti, a larger proportion of women in urban areas were exposed to family planning messages (64%) than in rural areas (42%).

In Tanzania, there were 2,456 women with a need for family planning in urban areas and 4,075 women with need in urban areas. Of these, 23% of women in urban areas spoke with a provider about family planning, while 30% of women did so in rural areas. Seventy percent of women in rural areas had a primary education, while 57% in urban areas had a primary education. There is a notable difference in occupation in Tanzania—80% of rural women work in agriculture compared with 47% of women in urban areas. As in Malawi, the urban/rural wealth disparities were large, with the majority of women in urban areas being in the highest wealth quintile (63%) and only 5% of rural women at that rank. In both areas, the majority of women with a need for family planning were married, had 1-4 children, received some family planning messaging, and were using some form of modern contraception.

**Table 11. Percent distribution of women with a need for family planning by background characteristics, Haiti, Malawi, and Tanzania**

| | Haiti | | | | Malawi | | | | Tanzania | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | | Rural | | Urban | | Rural | | Urban | | Rural | |
| | % | N | % | N | % | N | % | N | % | N | % | N |
| **Visited a health facility in the past year and discussed family planning** | | | | | | | | | | | | |
| No | 71.7 | 881 | 69.4 | 2,253 | 75.3 | 1,204 | 65.0 | 7,845 | 77.2 | 1,896 | 70.3 | 2,865 |
| Yes | 28.3 | 347 | 30.6 | 992 | 24.7 | 396 | 35.0 | 4,218 | 22.8 | 560 | 29.7 | 1,211 |
| **Age** | | | | | | | | | | | | |
| 15-24 | 32.4 | 398 | 30.7 | 995 | 28.5 | 456 | 31.5 | 3,794 | 30.0 | 737 | 28.9 | 1,178 |
| 25-34 | 40.2 | 494 | 35.2 | 1,142 | 42.8 | 685 | 37.4 | 4,514 | 39.5 | 970 | 34.9 | 1,422 |
| 35-49 | 27.4 | 337 | 34.1 | 1,107 | 28.7 | 459 | 31.1 | 3,755 | 30.5 | 749 | 36.2 | 1,475 |
| **Education** | | | | | | | | | | | | |
| None | 8.1 | 99 | 27.0 | 877 | 4.4 | 70 | 14.7 | 1,779 | 6.6 | 163 | 19.4 | 791 |
| Primary | 31.5 | 387 | 45.2 | 1,468 | 43.3 | 693 | 68.9 | 8,313 | 57.4 | 1,410 | 69.6 | 2,837 |
| Secondary or higher | 60.4 | 742 | 27.7 | 900 | 52.3 | 837 | 16.3 | 1,972 | 36.0 | 883 | 11.0 | 447 |
| **Occupation** | | | | | | | | | | | | |
| Unemployed | 38.9 | 478 | 37.7 | 1,223 | 37.8 | 605 | 25.8 | 3,108 | 24.0 | 588 | 12.4 | 505 |
| Agricultural/Manual | 3.3 | 41 | 10.3 | 333 | 25.8 | 413 | 66.1 | 7,975 | 47.3 | 1,163 | 80.6 | 3,283 |
| Professional | 52.8 | 648 | 50.4 | 1,634 | 30.1 | 481 | 6.7 | 802 | 8.3 | 204 | 2.1 | 87 |
| Other | 5.0 | 61 | 1.7 | 55 | 6.3 | 101 | 1.5 | 178 | 20.4 | 500 | 4.9 | 200 |
| **Wealth quintile** | | | | | | | | | | | | |
| Lowest | | | 31.5 | 1,021 | | | 22.4 | 2,701 | | | 22.7 | 924 |
| Second | | | 33.8 | 1,098 | | | 24.3 | 2,929 | | | 26.6 | 1,083 |
| Middle | | | 22.7 | 737 | | | 22.6 | 2,724 | | | 26.7 | 1,088 |
| Lowest-middle (urban only) | 21.3 | 262 | | | 9.4 | 150 | | | 9.9 | 243 | | |
| Fourth | 40.2 | 494 | 9.1 | 294 | 15.4 | 246 | 20.4 | 2,463 | 26.8 | 658 | 19.4 | 790 |
| Highest | 38.5 | 473 | 2.9 | 95 | 75.3 | 1,204 | 10.3 | 1,245 | 63.3 | 1,555 | 4.7 | 191 |
| **Religion (Haiti)** | | | | | | | | | | | | |
| Catholic | 47.8 | 587 | 42.3 | 1,374 | | | | | | | | |
| Protestant | 45.8 | 562 | 47.1 | 1,529 | | | | | | | | |
| Other | 6.5 | 80 | 10.5 | 342 | | | | | | | | |
| **Religion (Malawi)** | | | | | | | | | | | | |
| Catholic | | | | | 16.9 | 270 | 18.3 | 2,203 | | | | |
| Christian | | | | | 74.2 | 1,187 | 70.1 | 8,450 | | | | |
| Muslim | | | | | 8.9 | 143 | 11.7 | 1,410 | | | | |
| **Marital Status** | | | | | | | | | | | | |
| Never married | 21.4 | 263 | 12.4 | 404 | 9.7 | 156 | 5.2 | 630 | 18.8 | 463 | 8.6 | 349 |
| Currently married | 74.6 | 917 | 84.5 | 2,740 | 80.8 | 1,293 | 84.2 | 10,158 | 67.9 | 1,668 | 80.9 | 3,297 |
| Formerly married | 3.9 | 48 | 3.1 | 101 | 9.4 | 151 | 10.6 | 1,275 | 13.2 | 325 | 10.5 | 429 |
| **Number of living kids** | | | | | | | | | | | | |
| 0 | 23.5 | 288 | 12.6 | 410 | 7.5 | 120 | 5.1 | 617 | 13.9 | 341 | 5.5 | 224 |
| 1-4 | 67.4 | 828 | 63.7 | 2,065 | 79.0 | 1,264 | 67.9 | 8,186 | 72.9 | 1,791 | 61.0 | 2,484 |
| 5+ | 9.1 | 112 | 23.7 | 769 | 13.5 | 216 | 27.0 | 3,260 | 13.2 | 323 | 33.6 | 1,367 |
| **Exposure to family planning messages** | | | | | | | | | | | | |
| No exposure | 45.1 | 554 | 58.2 | 1,890 | 35.7 | 571 | 58.4 | 7,046 | 18.0 | 441 | 35.9 | 1,461 |
| Some exposure | 54.9 | 674 | 41.8 | 1,355 | 64.3 | 1,029 | 41.6 | 5,017 | 82.0 | 2,014 | 64.2 | 2,614 |
| **Current contraceptive use** | | | | | | | | | | | | |
| None | 46.9 | 576 | 51.4 | 1,667 | 23.6 | 378 | 25.1 | 3,029 | 27.0 | 662 | 38.5 | 1,568 |
| Traditional | 4.7 | 58 | 3.2 | 104 | 1.5 | 24 | 1.1 | 137 | 16.6 | 407 | 7.3 | 296 |
| Short-acting | 43.5 | 535 | 40.1 | 1,302 | 44.7 | 715 | 44.0 | 5,313 | 41.1 | 1,009 | 34.8 | 1,418 |
| Long-acting or permanent | 4.9 | 60 | 5.3 | 172 | 30.1 | 482 | 29.7 | 3,584 | 15.4 | 378 | 19.5 | 793 |
| **Number of women** | | 1,228 | | 3,245 | | 1,600 | | 12,063 | | 2,456 | | 4,075 |
| **Number of clusters (Haiti, Malawi)** | | 83 | | 241 | | 159 | | 650 | | | | |
| **Number of regions (Tanzania)** | | | | | | | | | | 30 | | 29 |

Note: Haiti excludes women in the Port-au-Prince urban area, and Malawi excludes women in the Lilongwe urban area.

### 3.5.2. *The association between quality environment and use of family planning services*

***Bivariate relationship***

*Quality of service*

Figures 2a-2c show the relationship between the use of family planning services and the quality of service environment by each of the three scoring mechanisms. In Haiti, we observed an overall tendency for increased use of family planning services within higher quality of service environments, particularly for the weighted additive score in rural areas. According to most scoring mechanisms in both urban and rural areas of Haiti, the confidence intervals appear to overlap, which indicates non-significant differences. In Malawi, the relationship between the use of family planning services and the quality of service environment differed in urban and rural areas. In urban areas of Malawi, women were more likely to use family planning services in higher quality of service environments according to each scoring mechanism. In rural areas, the relationship is less apparent. In Tanzania, we observed no consistent relationship between the use of family planning services and the quality of service environment in both the urban and rural samples. However, the high quality category for the simple additive scores for both urban and rural areas appeared to be significantly associated with the lower use of services.

**Figure 2a. Percent of women in need of family planning who attended a health facility and discussed family planning in the 12 months before the survey, by quality of service environment and place of residence, according to three scoring mechanisms, Haiti DHS 2012**

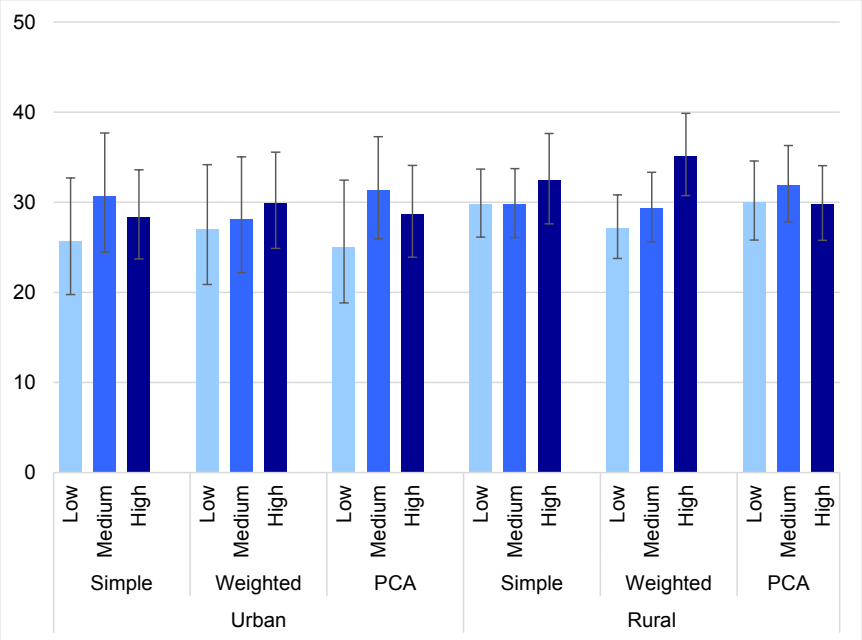


**Figure 2b. Percent of women in need of family planning who attended a health facility and discussed family planning in the 12 months before the survey, by quality of service environment and place of residence, according to three scoring mechanisms, Malawi DHS 2015-16**

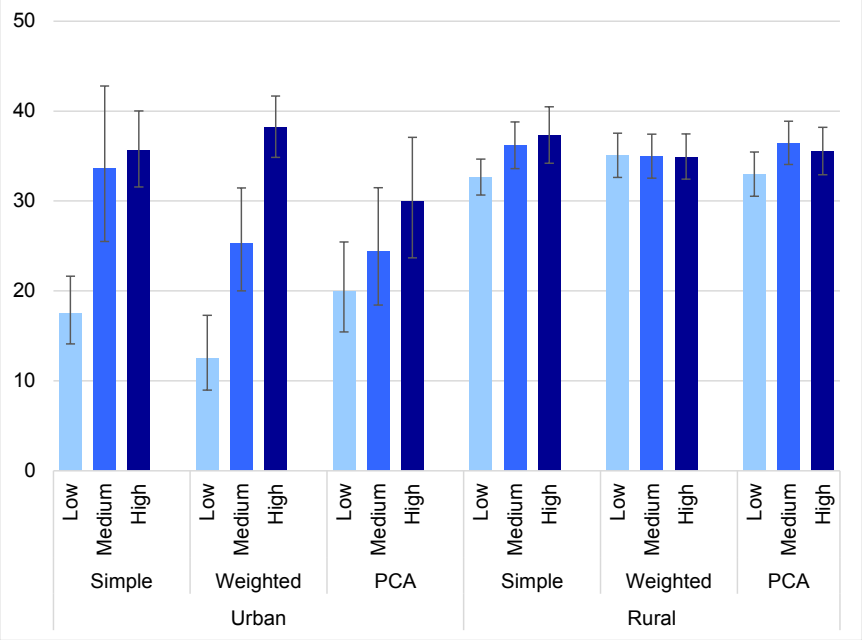
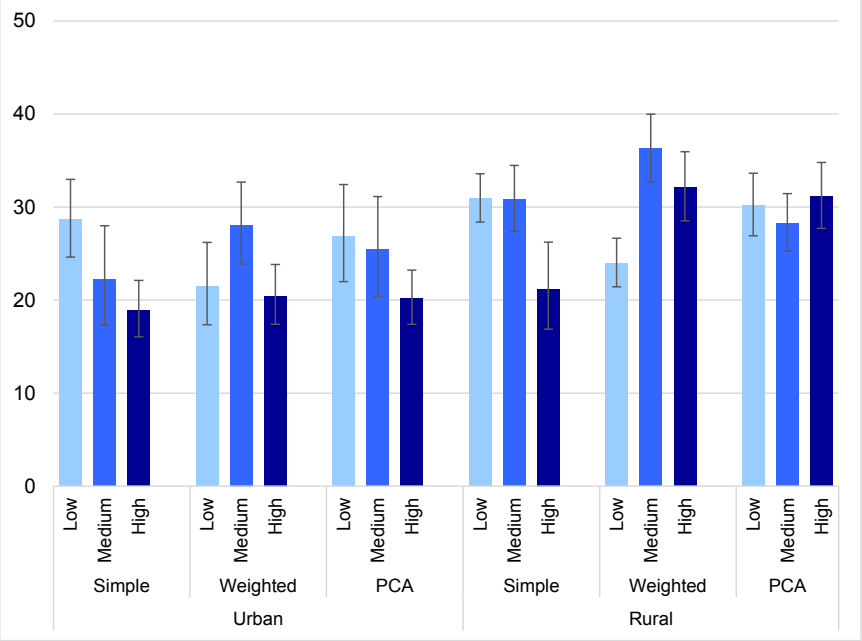



**Figure 2c. Percent of women in need of family planning who attended a health facility and discussed family planning in the 12 months before the survey, by quality of service environment and place of residence, according to three scoring mechanisms, Tanzania DHS 2015-16**



*Quality of care*

Figures 3a-3c show the bivariate relationship between the use of services with family planning and the quality of care environment. In Haiti, there seemed to be a positive association between the use of family planning services and quality of care environments in both urban and rural areas. In Malawi, there was a very large difference in the proportion of women who attend health facilities and discuss family planning by quality of care environment in urban areas only. We found this when calculating quality of care with the two additive indices but not the PCA. In rural areas, there were no apparent differences in service use by quality of care environment. In Tanzania, as seen for the quality of service environment, there was no consistent relationship between regional quality of care environment and the use of services for family planning.

**Figure 3a. Percent of women in need of family planning who attended a health facility and discussed family planning in the 12 months before the survey, by quality of care environment and place of residence, according to three scoring mechanisms, Haiti**

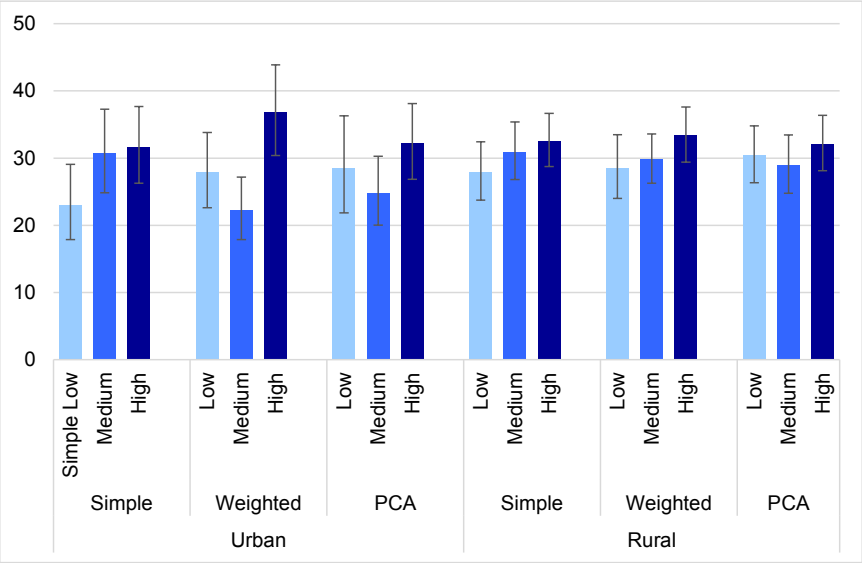


**Figure 3b. Percent of women in need of family planning who attended a health facility and discussed family planning in the 12 months before the survey, by quality of care environment and place of residence, according to three scoring mechanisms, Malawi DHS 2015-16**

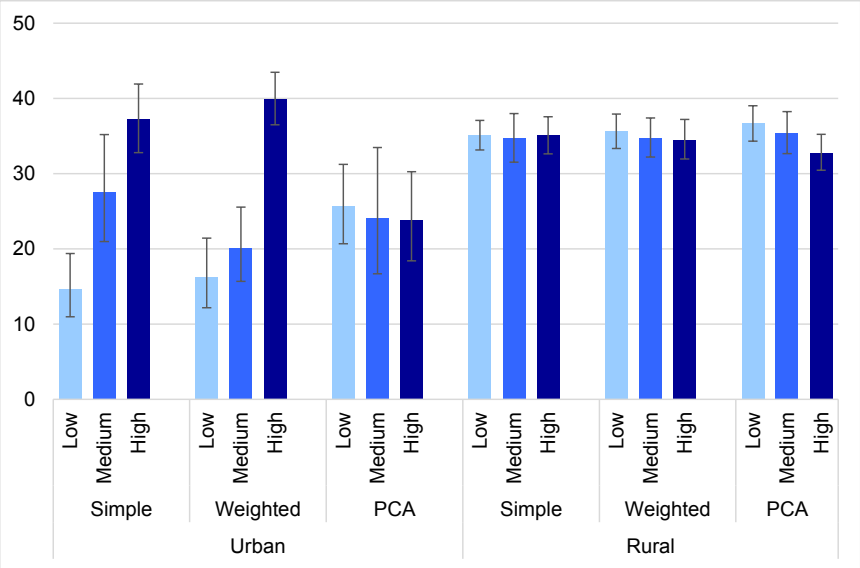
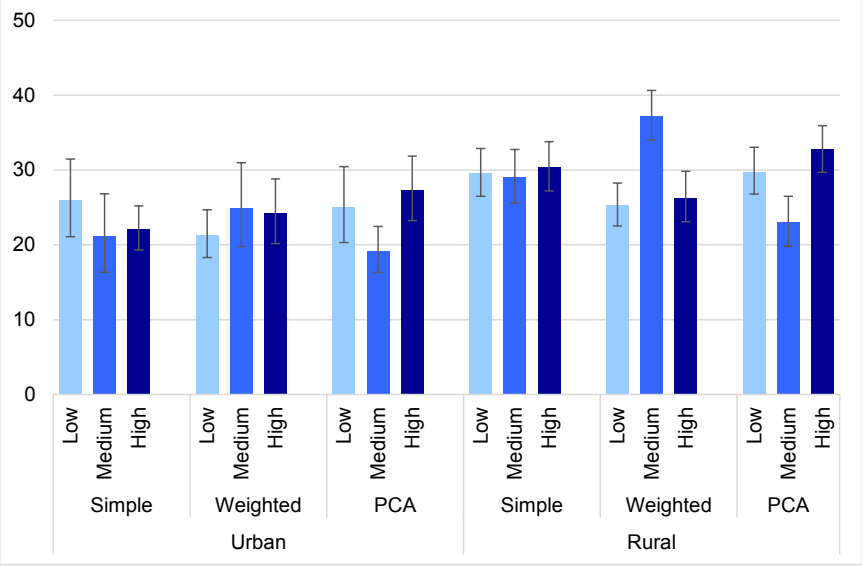



**Figure 3c. Percent of women in need of family planning who attended a health facility and discussed family planning in the 12 months before the survey, by quality of care environment and place of residence, according to three scoring mechanisms, Tanzania DHS 2015-16**




### *Multivariable analysis*

We used multilevel, multivariable random-effects logistic regressions to analyze whether the quality of family planning environment from each scoring mechanism predicts service utilization differently. The model partitions variance in the outcome within clusters or regions as a factor of women's individual and household level characteristics, and between clusters or regions as a factor of cluster or regional level

variables, which in this study is the quality of care environment. We report the results as odds ratios. We also report the ICC for the individual level model to indicate what proportion of total variance in the outcome is due to between-regional variance and the ICC for the full model to indicate how much of the between-group variance is explained by differences in the quality of service or quality of care environment. We ran separate models for each scoring mechanism and conducted the analyses separately for urban and rural areas. This resulted in 12 models per country. Our models controlled for common covariates of health care utilization and included education, occupation, wealth, religion (Haiti and Malawi only), marital status, number of living children, exposure to family planning messages, and current use of a method of family planning. We excluded age from the multivariable analysis because age was highly correlated with the number of living children.

Figures 4a-4c illustrate the adjusted odds ratios for the quality of service environment. Figures 5a-5c show the adjusted odds ratios for the quality of care environment. Appendix Tables 3-5 include the full results. The Appendix tables also provide the *rho* statistics or the ICC for the individual models and each of the full models, which include the cluster-level measure of quality of service or quality of care. The results indicate that the between-cluster variation explains between 7% and 15% of the total variation in discussing a family planning method in urban areas. In rural areas, between-cluster variation accounts for 7%–10% of total variation in the outcome of interest. The *rho* from each of the full models can be compared against the rho from the individual level model to assess the additional between-cluster/region variance explained by including the quality environment variables.[6] The rho changed little between the two types of models, which indicates that the family planning quality environment does not explain the additional between-cluster variation. The following sections describe the results of the multilevel multivariable regressions for the quality of service and quality of care.

*Individual and household effects*

Appendix Tables 3-5 illustrate the full results of the multilevel logistic regressions for Haiti, Malawi, and Tanzania. The results indicate some similarities in the individual and household level characteristics that statistically explain the likelihood of a woman discussing family planning with her provider. The results also point to differences within countries between urban and rural clusters, and between countries.

In Haiti, as illustrated in Appendix Table 3, in both urban and rural clusters, having one or more children is associated with higher odds of discussing family planning with a provider than having no children. Similarly, in both urban and rural areas, women who were using a short-acting method of contraception were more likely to discuss a family planning method than women using no contraception. Exposure to family planning messages was associated with a higher probability of discussing family planning in both urban and rural clusters. In urban clusters, currently married women were more likely to discuss family planning than never married women, while in rural clusters of Haiti, both currently married and formerly married women were more likely to do so when compared with never-married women. The odds of discussing a family planning method did not differ by household wealth status except in the urban sample and only among women in the highest quintile compared with women in the lowest quintile. In both urban and rural clusters, religion and level of education did not correlate with the odds of discussing a family planning method.

In Malawi, as seen in Appendix Table 4, the covariates that were statistically associated with the probability of discussing a family planning method generally differ between urban and rural clusters with a few exceptions. Women who resided in households in the fourth and highest quintiles of wealth in rural areas, compared with the lowest quintile, and in the highest quintile in urban areas, compared with the lowest to

[6] The percentage of the between-cluster variation in the family planning outcome that can be explained by the quality of service or quality of care environment is calculated as follows: $\frac{1-rho_{full\ model}}{rho_{individual-level}}$.

middle group, were more likely to discuss a family planning method. In both urban and rural clusters, Muslim women were less likely to discuss a family planning method compared with Catholic women. Women in urban and rural clusters who were using a long-acting method of contraception were less likely to have discussed a method of family planning with their provider during their last visit. We observed a positive effect of education on increasing the odds of discussing a family planning method only in rural clusters. Working in agriculture or in the professional sector was associated with higher odds of discussing family planning compared with not working at all, but only in rural areas. In both urban and rural clusters, marital status and exposure to family planning messaging were not statistically significant correlates of the outcome.

Appendix Table 5 shows the full results of the multilevel multivariable logistic regressions for Tanzania. Similar to Haiti and Malawi, the number of children and exposure to family planning messaging predicted service utilization for both urban and rural women in Tanzania. Urban women in higher wealth quintiles were less likely to use family planning services compared with the lowest to middle group. Formerly married rural women compared with never married women had significantly reduced odds of seeking services.

*Quality of service*

Figures 4a-4c show the adjusted odds ratios of discussing family planning with a provider by the level of quality of service. We present the results disaggregated by scoring mechanism and by urban and rural residence. The results were inconsistent and indicate that, in some contexts and depending on the methodology of scaling, the quality of services may predict a woman's probability of discussing a method of family planning with her service provider.

In Haiti and Tanzania, women's use of family planning services was generally unrelated to the quality of service environment, with a few exceptions. In rural clusters in Haiti, women who resided in clusters with a high level of quality of service environment had 56% higher odds (95% CI 1.15–2.12, $p < 0.01$) of discussing family planning with a provider during their last visit than women who lived in clusters with a low quality of service environment, as defined by the weighted additive index. In rural regions of Tanzania, living in high quality of service environments, as calculated with the weighted additive index, was associated with higher odds of discussing family planning than living in regions with low quality of services (AOR = 1.77, 95% CI = 1.16–2.69, $p < 0.01$). In urban regions in Tanzania, there was an inverse relationship between use of family planning services and the quality of service, according to the simple additive score. Women who reside in high quality of service regions, as calculated with the simple additive index, were less likely to use health services for family planning than women in low quality urban regions (AOR = 0.68, 95% CI = 0.48–0.96, $p < 0.05$). However, women living in regions with high quality service environments, as calculated with the weighted additive index, were more likely to use services than rural women in the low quality regions (AOR = 1.77, 95% CI = 1.16–2.69, $p < 0.01$).

In Malawi, the relationship between quality of service and the outcome of interest varied depending on the scoring methodology and place of residence. In urban areas of Malawi, the quality of service consistently predicted use of services regardless of the scoring methodology. The strongest predictor, including the covariates (as seen in Appendix Table 3), was the quality of service index calculated with the weighted additive scoring mechanism. The results for the regression, which included the weighted additive index, indicate that women living in high quality clusters had nearly five times the odds of attending a health facility and discussing family planning with a provider compared with women who reside in proximity of low quality of service facilities (AOR = 4.76, 95% CI = 2.4–7.69, $p < 0.001$). In rural clusters in Malawi, differences in the outcome did not differ statistically by the quality of service environment for any scoring mechanism.

**Figure 4a. Adjusted odds ratios and 95% confidence intervals of women who attended a health facility and discussed family planning on level of quality of service environment, by urban and rural residence, Haiti DHS 2012**

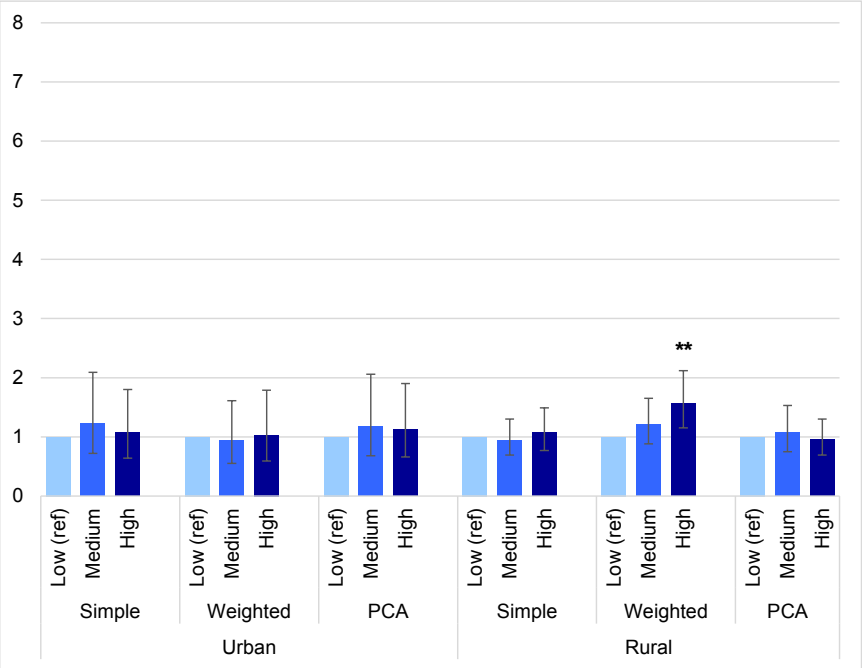



**Figure 4b. Adjusted odds ratios and 95% confidence intervals of women who attended a health facility and discussed family planning on level of quality of service environment, by urban and rural residence, Malawi DHS 2015-16**

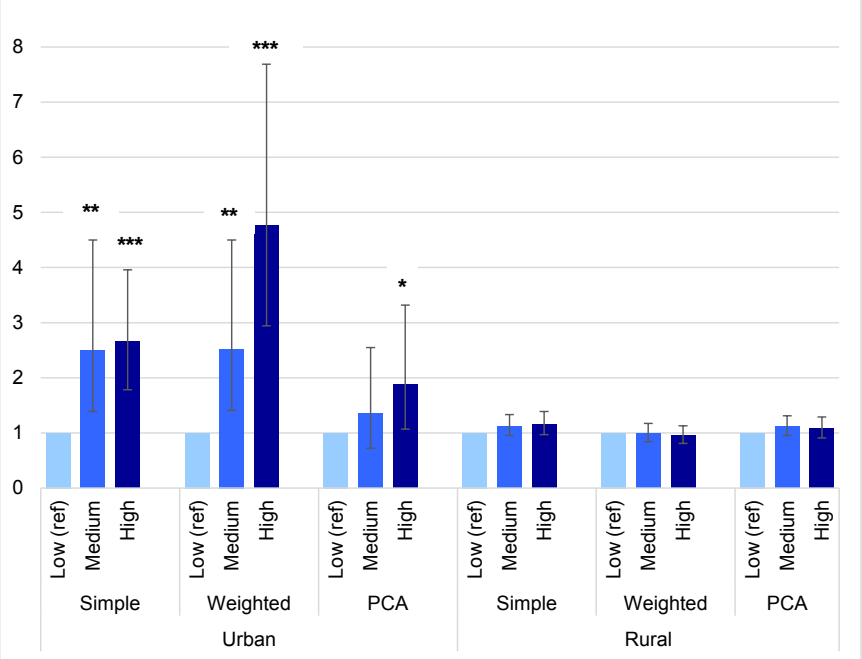
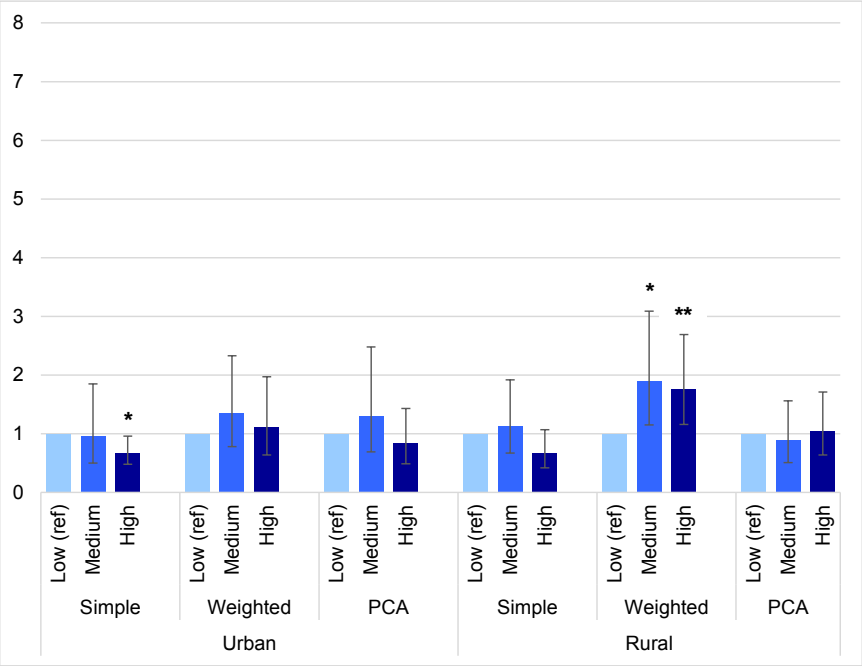


**Figure 4c. Adjusted odds ratios and 95% confidence intervals of women who attended a health facility and discussed family planning on level of quality of service environment, by urban and rural residence, Tanzania DHS 2015-16**




*Quality of care*

Figures 5a-5c show the adjusted odds ratios of discussing family planning with a provider by the level of quality of care. We present the results disaggregated by scoring mechanism and place of residence. Similar to the results when quality of service is used, in Haiti and Tanzania, the odds of discussing family planning generally did not differ by the level of quality of care with a few exceptions, although they differ significantly in urban areas in Malawi for two of the three scoring mechanisms.

In urban areas in Haiti, the simple additive quality of care index was the only index that significantly predicted the use of family planning services. Women who lived in clusters with high quality of care had 61% higher odds of discussing family planning at a health facility than women in the low quality of care clusters (AOR: 1.61, 95% CI: 1.00 – 2.58, p <0.05).

In Malawi, the quality of care environment was associated with discussing family planning at health facilities among women in urban clusters but not among women in rural clusters. This was observed when the quality of care was scaled with the simple and weighted additive approaches but not PCA. For the additive methods, the odds of discussing family planning services were about 3.5 times higher among women in urban clusters with high quality of care compared with women in a low quality of care environment (simple additive: AOR: 3.53, 95% CI 2.17 – 5.75, p < 0.001; weighted additive: AOR: 3.65, 95% CI 2.37 – 5.61, p < 0.001).

**Figure 5a. Adjusted odds ratios and 95% confidence intervals of women who attended a health facility and discussed family planning on level of quality of care environment, by urban and rural residence, Haiti DHS 2012**

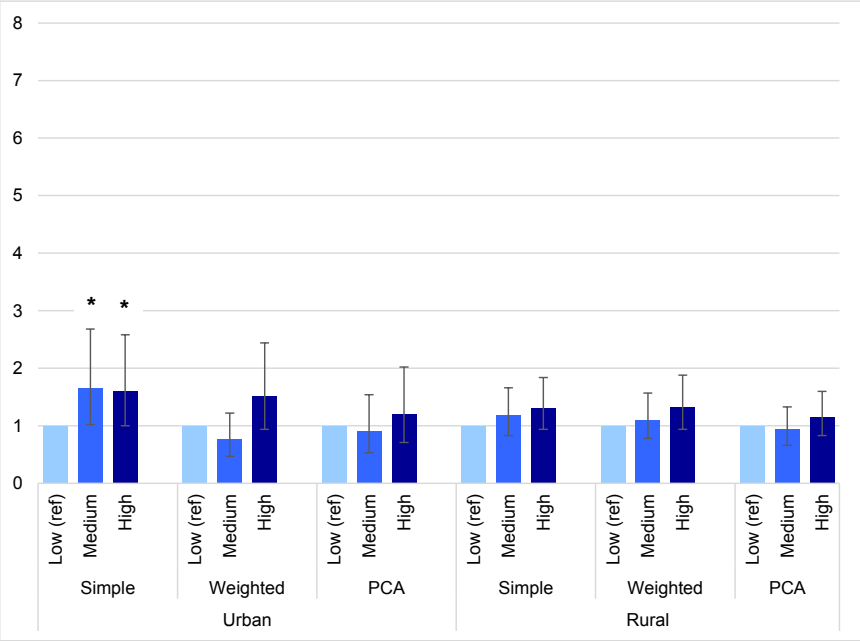



**Figure 5b. Adjusted odds ratios and 95% confidence intervals of women who attended a health facility and discussed family planning on level of quality of care environment, by urban and rural residence, Malawi DHS 2015-16**

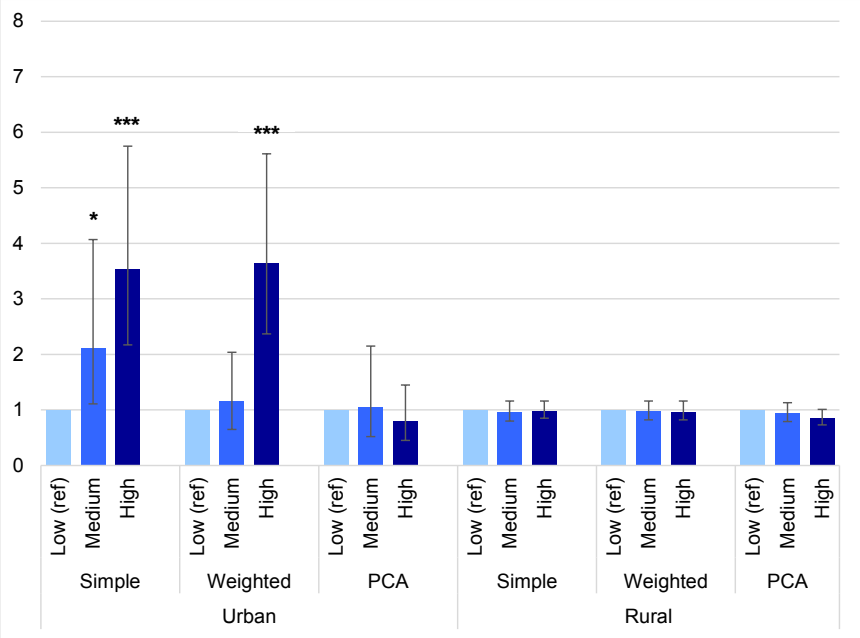
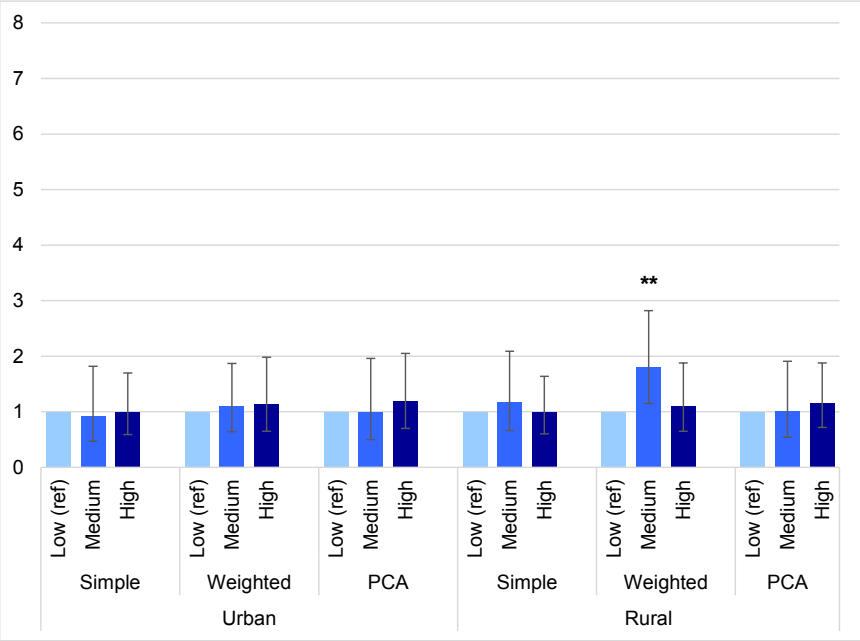


**Figure 5c. Adjusted odds ratios and 95% confidence intervals of women who attended a health facility and discussed family planning on level of quality of care environment, by urban and rural residence, Tanzania DHS 2015-16**



# 4. Discussion

This study computed summary measures of quality of service and quality of care with three techniques: the simple additive, the weighted additive, and PCA-based indices. We assessed the agreement between the techniques in terms of ranking facilities to different levels of quality of care and quality of service. In addition, we examined the impact of the inclusion of observation and client data on measuring the quality of care. Finally, we compared differences in each score's ability to predict a theoretically related outcome. In this discussion, we present the advantages and disadvantages of each scoring mechanism, the key findings, limitations of the study, recommendations for future research, and concluding remarks.

## 4.1. Advantages and Disadvantages of Scoring Mechanisms

Additive indices— both simple additive and weighted additive—are generally easier to construct than the PCA-based indices because the former is a simple average of a set of indicators. Additive measures are also more intuitive to interpret when compared with PCA-based summary measures. It is easy to understand that with each additional component of quality within a facility, the higher the quality. However, additive scales can create non-normal distributions with heapings around groups of scores, which can be problematic when categorizing scores into quantiles (Bellows et al. 2016). Another drawback of the simple additive approach to index creation is the underlying assumption of unidimensionality, which assigns equal weights to each indicator and domain. Because quality of care may be a multidimensional rather than a unidimensional concept (Bruce 1990), a simple additive summary score is not always conceptually meaningful and may not accurately portray overall quality of care (Brown et al. 1995). This method may also give rise to problems with collinearity of indicators, in which the redundancy of numerous variables that estimate a similar domain may overemphasize, or give more weight to, that one domain.

A mathematically simple solution to address the issues that arise with the use of a simple additive summary score (unidimensionality and collinearity) is the weighted additive measure. This technique, which reduces the relative importance of variables within a domain while equally weighing domains, is simple to calculate and interpret. However, the weighted additive scoring mechanism is based on a pre-determined, dimensional conceptualization. Since a weighted additive index has not been validated, there are still remaining assumptions that the dimensions do in fact carry equal weights.

The third and most mathematically complex summary technique is the PCA. The loadings of each variable on the first component account for the different contributions of items to the most dominant latent factor. Unlike the weighted additive scoring measures, the weights assigned with PCA reflect the underlying variation of the data or the relative importance of each indicator to the latent construct and are not preemptively determined. Because of the differences in each set of observations or dataset, PCA will not produce reliably consistent results across different contexts, as seen in our study. PCA is also used to define the dimensions of the concept and identifies which items relate to which domains, and which items within those domains carry the most weight. As in our study, using a PCA-based index created from the first component only assumes that quality of service is a unidimensional concept. In addition, the interpretation is difficult. Understanding "the best linear combination of variables that explains the most variance" is not intuitive to those without knowledge of this technique.

The PCA analysis requires a sound understanding of the analytic procedure as well as statistical software packages. When conducting PCA, it is important to take into account key diagnostics of the analysis, such as the proportion of variance explained by the relevant component. This is particularly important when creating a PCA-based score with the factor loadings of the first component only. In a critique of using PCA to create asset-based wealth indices, Sharker et al. (2014) found that this scoring mechanism resulted in a misclassification of over 50% of households into the wrong wealth quintile when the first component

explained less than 30% of the total variance. This suggests that the first component alone may not sufficiently capture the variability or dimensionality of household wealth. Sharker et al. recommend removing items with low loading or items that load negatively when creating a PCA-based score, although there is a paucity of research about this topic (Sharker et al. 2014).

In a study of quality of care of family planning using data from continuous SPA surveys in Senegal from 2012-2014, Assaf, Wang, and Mallick (2015) conducted PCA to create an index for three domains of quality of services. However, they only included one index in the multivariable analysis since the first component of the other two indices explained less than 30% of the total variance. In another study, Gage and Zomahoun (2017) used several scoring mechanisms to summarize different domains of quality of care, including two indices constructed with PCA. They noted that the eigenvalues of the first component explained 70% and 61% of the total variance for the indices. They suggest considering the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the proportion of variance explained by the eigenvalue of the first component when using PCA to construct a score (Gage and Zomahoun 2017). These complex considerations make using and understanding a score created from PCA unrealistic for policy makers or lay persons.

### 4.2. Discussion of Findings

In our study, we compared three types of scoring mechanisms in three countries. We found that the agreement between the scores—the extent to which the assignment of facility to a category of quality is consistent—varies by the methodology used to construct the summary measure, by country, and depending on whether observation and client data are included (quality of care) or only facility data are used (quality of service). For both definitions of quality—service and care—there was better agreement in Haiti and Tanzania than Malawi. In both Haiti and Tanzania, for both quality of service and quality of care, the highest agreement was between the simple additive and PCA-based scores. This may be partially explained by the overall low loadings in Haiti and Tanzania, which contributed to the lack of variation in weights applied when calculating the PCA-based scores, and which made the score more similar to the simple additive score where each item was weighted equally. In Malawi, there was more variation in the factor loadings, with many items loaded negatively. Most often, the lowest agreement occurred between the weighted additive and PCA scores, which may be partially explained by the above mentioned issues of the lack of variation in the loadings on the first component. The results of our study are consistent with the one study, to the authors' knowledge, which reported analyzing the agreement between scoring mechanisms (Bellows et al. 2016). This study, which only compared a simple additive and PCA-based approach for quality of service indicators, found a high correlation between scores, although they found some differences after they categorized the scores into quintiles (Bellows et al. 2016).

To our knowledge, this was the first study to examine the impact of the addition of quality of care indicators to indices of quality of service. SPA surveys include observations of providers' consultations and examinations of clients, as well as client exit interviews. These data allowed us to create quality of care measurements that incorporate both the structure (facility level) and process (client level) components of the quality of care. While many facilities possessed essential infrastructure and equipment, providers performed poorly on the standards of acceptable content and quality in all three countries. A low percentage of providers asked about the client's reproductive history and fertility intentions, or assessed the client's physical health condition, both of which are important factors for making appropriate recommendations of contraceptive methods. The gap between the availability of structural attributes and providers' adherence to standards of quality practice contributed to the different categorizations of facilities between quality of service scores (based on only facility level indicators) and quality of care scores. When comparing the quality of care measurements with the quality of service measurements, we found low agreement between them in all three countries. Among the three scoring mechanisms, the agreement in facility categorization was the highest for the simple additive, followed by the weighted additive. PCA-based scores are associated

with the poorest agreement between quality of care and quality of services. These findings highlight the impact of the inclusion of indicators that gauge the actual service delivery process. A facility categorized as having a high level of quality of service may not necessarily provide a high level of quality of care. A study that assessed the quality of care in Kenya, Namibia, and Senegal based on SPA data found that facilities that possess better structural attributes might not necessarily outperform other facilities in adhering to standards of care during service delivery (Wang et al. 2014).

Finally, this study explored whether the methodology for constructing summary measures of quality of care or services affects the ability of summative measures to predict family planning behaviors, and we found this to be the case. Only one scoring mechanism had the most significant relationships: the weighted additive measure. We found that the weighted additive scoring mechanisms predicted service utilization most often across both the quality of service and quality of care indices in both urban and rural localities. Of twelve regressions conducted with a covariate of the quality environment that used any type of weighted additive measure, the quality environment significantly predicted the use of services five times (42%), compared with 25% of the regressions with simple additive measures and 8% of regressions with a PCA-based measure of quality environment. However, these associations were not consistent across countries and places of residence. This study also found that the quality of care-based rankings of the quality environment did not predict the use of services more often than quality of service-based scores.

The most notable finding of the regression analysis linking service environment to service utilization was that both the quality of service and quality of care environment, calculated by any scoring mechanism (except quality of care using PCA), predicted service utilization in urban clusters in Malawi but not in rural clusters. This finding sheds light on the importance of the quality environment in relation to the local context. Early research in the field speculated that in rural areas, or places with limited access to health facilities, women determined to use contraception will seek services or obtain a method, regardless of quality, and that women may use family planning services less often as fertility desires increase in rural areas (Bruce 1990). In these cases, quality of service or quality of care may have no bearing on a woman's use of services. In rural areas, quality of care at health facilities may not be important where there is an inadequate or inconsistent supply of contraceptives to motivate facility attendance or there are strong outreach programs that deliver contraception to those with less access (Skiles et al. 2015). In Malawi, for example, Marie Stopes oversees a program called Banja La Mtsogolo, a mobile outreach program that provides much of the country's modern contraceptives. In addition, there may be other outlets in both urban and rural areas that attract family planning users, such as pharmacies, community health workers, or other informal outlets. Users may obtain their contraceptives from these locations, and not formal health facilities, which could explain the lack of associations in this study. In Haiti in particular, the Ministry of Health has worked to decentralize family planning at health facilities by promoting the community health worker program via *agents de santé communitaire polyvalents* (multipurpose community health agents) (Ward, Santiso-Galvez, and Bertrand 2015). In Tanzania, we face the limitation that we linked only at the regional level, which is not a sufficiently refined measure of the service environment.

### 4.3. Limitations of the Study

First, the validity of our comparisons across three measurements of quality of service or care depends on an underlying unidimensional structure of the data. We create our PCA-based scores based on the first component. When quality of care in family planning services is multidimensional, multiple components from the PCA analysis should be considered. Experts suggest that we examine associations with outcomes by keeping the components separate as different dimensions may relate to the outcomes differently (RamaRao and Jain 2016; Rani, Bonu, and Harvey 2007; Reise, Waller, and Comrey 2000).

Second, to facilitate the comparisons among three types of scoring methods, especially the comparisons of the PCA-based score with the simple additive and weighted additive scores, we categorize the facilities into

three categories with low, medium, and high level quality based on score terciles. This is because the PCA score is a relative summary. However, the Cohen's kappa agreement could be associated with the number of categories, with categorizations less likely to agree with each other with a higher number of categories. We chose to classify facilities into three categories of quality to examine the differences among facilities while maintaining simplicity in interpretation.

Another limitation is the instrument used to collect observation data to measure quality of care. The SPA survey only solicits observation data for some of the indicators of quality of care, and only for clients who left the facility with a method or prescription. Women who did not leave with a method may have not received the same quality of care as those who did. They may have received a low quality of care and perhaps did not discuss a method of family planning. Therefore, there is potential selection bias in the quality of care indices that were created with data only on women who received a method. Moreover, the observed clients include both new and returning clients. Providers may not need to conduct all consultations or examinations for returning clients who came to the facility for a prescription refill as they would do for new clients.

Finally, the reader should note several caveats when interpreting the findings on the association between the use of family planning services and quality of care. Our outcome—having discussed family planning with a health provider at a recent visit to a health facility—was a proxy measurement for the use of family planning services. Women could discuss family planning during visits not intended for family planning services such as ANC or PNC visits or even during visits for a sick child. Thus, the family planning environment would not predict the outcome for these women. Moreover, the existence of other modes of health service delivery, such as community health workers and mobile clinics, could also explain the lack of correlation between the outcome with the quality environment, especially in rural and remote areas because the SPA surveys collect data from formal health facilities only. Digitale et al. (2017) also found that financial accessibility to methods could affect contraceptive use more than the physical availability and quality of services. We used a straight line distance buffer to define the service environment. This does not take into account the mountainous terrain or the road conditions, which could hinder women's access to health facilities. In addition, women may choose to seek family planning services in facilities outside of the buffer zone defined in this study. This study designated facilities within a 5-kilometer buffer zone for urban clusters and 10-kilometer buffer zone for rural clusters (Burgert and Prosnitz 2014; Do et al. 2016; Wang et al. 2015). If the quality of care is very low, women may seek health care beyond this buffer. We measured the quality environment in Tanzania at the regional level by the median quality score of all facilities in the region because, unlike the other two study countries, the SPA was sample based rather than a census of all facilities. This measurement may not represent the service environment of all women in the region because of the heterogeneity in quality of care among facilities in the region.

### 4.4. Suggestions for Future Research

An alternative approach to circumvent issues of dimensionality and collinearity, in the case of additive measures, or complexity, in calculation in the case of PCA-based measures, is the use of additive measures or PCA to create sub-scales and include them separately in an analysis. For example, Hutchinson, Do, and Agha (2011) assessed the outcome of client satisfaction for associations with several indicators of quality of care. These indicators were examined separately and were not combined into one single index. However, while most of these indicators were binary, some variables were a simple additive measure of a number of items in a construct, such as the variable for physical infrastructure, which was a sum of a number of amenities available at the facility (Hutchinson, Do, and Agha 2011). Gage and Zomahoun (2017) used PCA-based scores where appropriate and additive measures for other subscales. If the preference is to use simple additive measures, it benefits the researcher to examine collinearity between items and to consider reducing the items to a smaller set of nonredundant items. PCA is also one tool used for data reduction that can complement the creation of an additive score in this way.

Additional quantitative as well as qualitative research can improve the base of knowledge on indices of quality of service and care in family planning. The extensive list of indicators of quality of service and care for family planning can potentially hinder data collection and complicate summary indices. Thus, the field of study in quality of family planning services and care could benefit from an abbreviated list of key indicators. PCA is one tool that is useful for reducing data or defining items that group together in key domains, although, as seen in our study, this did not produce consistent results across the three countries. Latent class analysis could complement our research by providing insight into which items of quality might be associated with the latent group of high quality facilities. Qualitative methodologies, such as the Delphi method, which relies on interviews with experts in this field of research, could also help to determine a reduced list of indicators. Further, while this study is one example of a type of criterion validity assessment, a complete evaluation of the criterion validity of using direct outcome measures could benefit the literature. For example, we are limited to an analysis of only women who left the facility with a contraceptive method or prescription. However, a more detailed recording of the observation of visits that document a provider's interaction with the client for all clients—irrespective of whether they left with a contraceptive method—may allow for the validation of whether these process indicators relate to adoption of a method. Jain (2016) suggested that research examine the providers' delivery of services for inequities by client background characteristics. This outcome of whether a client adopts a method or not may be more indicative of quality of service and care versus whether a client visited a facility and discussed family planning.

### 4.5. Conclusions

The utility of summary scores results from simplifying complex data to a smaller set of variables for comparison or benchmarking purposes (Askew, Mensch, and Adewuyi 1994; Bellows et al. 2016; RamaRao and Jain 2001). Any tool used to collect information on the quality of care should allow researchers to construct easily understandable output that can help ascertain levels of quality and ultimately lead to quality improvements (Sprockett 2016). Researchers criticize simple additive scores as unsophisticated; these scores fail to consider the higher relative importance of some variables over other. Thus, we compared simple additive scores against more comprehensive methods that address those limitations, such as the weighted additive and PCA-based scores.

Because of the low loadings, the PCA produced scores most similar to simple additive measures, resulting in consistency between simple additive and PCA based scores in their ranking of the quality of facilities. The PCA results also indicate that the constructs of quality are multi-dimensional concepts, meaning that researchers should use sub-scales where possible. If a composite score must be used, we suggest using the more simple approach, with consideration of the collinearity of variables. The quality environment, as calculated by the weighted additive measures, most often predicted use of family planning services. This suggests that a weighted additive summary measure may be more useful from a program planning perspective and may be simpler to construct and interpret than a PCA-based summary measure while still addressing issues of dimensionality

# References


Ahmed, S., Q. Li, L. Liu, and A.O. Tsui. 2012. "Maternal Deaths Averted by Contraceptive Use: An Analysis of 172 Countries." *The Lancet* 380(9837):111-125.

Aiken, L. S., S. G. West, and R. R. Reno. 1991. *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA: Sage.

Arends-Kuenning, M., and F. L. Kessy. 2007. "The Impact of Demand Factors, Quality of Care and Access to Facilities on Contraceptive Use in Tanzania." *Journal of Biosocial Science* 39(1):1-26.

Askew, I., B. Mensch, and A. Adewuyi. 1994. "Indicators for Measuring the Quality of Family Planning Services in Nigeria." *Studies in Family Planning* 25(5):268-283.

Assaf, S., W. Wang, and L. Mallick. 2015. *Quality of Care in Family Planning Services at Health Facilities in Senegal*. DHS Analytical Studies No. 55. Rockville, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/AS55/AS55.pdf.

Assaf, S., W. Wang, and L. Mallick. 2016. *Provider Counseling and Knowledge Transfer in Health Facilities of Haiti, Malawi, and Senegal*. DHS Analytical Studies No. 60. Rockville, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/AS60/AS60.pdf.

Behrman, J. A., and A. Weitzman. 2016. "Effects of the 2010 Haiti Earthquake on Women's Reproductive Health." *Studies in Family Planning* 47(1):3-17.

Bellows, B., R. Behl, T. Abuya, A. Muriuki, A. Bajracharya, and Y. Choi. 2016. "Benchmarking to Assess Quality of Family Planning Services: Construction and Use of Indices for Family Planning Readiness in Kenya with Data from 2010 and 2014." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by A. Sprockett, S. H. Leisher, K. Longfield, and D. Montagu. Oakland, California,USA: Metrics for Measurement.

Bertrand, J. T., R. J. Magnani, and J. C. Knowles. 1994. *Handbook of Indicators for Family Planning Program Evaluation*. Chapel Hill, NC, USA: Carolina Population Center.

Bessinger, R. E., and J. T. Bertrand. 2001. "Monitoring Quality of Care in Family Planning Programs: A Comparison of Observations and Client Exit Interviews." *International Family Planning Perspectives* 25(2):63-70.

Bradley, S. E. K., T. N. Croft, J. D. Fishel, and C. F. Westoff. 2012. *Revising Unmet Need for Family Planning*. DHS Analytical Studies No. 25. Calverton, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/AS25/AS25.pdf.

Brown, L., M. Tyane, J. Bertrand, D. Lauro, M. Abou-Ouakil, and L. Demaria. 1995. "Quality of Care in Family Planning Services in Morocco." *Studies in Family Planning* 26(3):154-168.

Bruce, J. 1990. "Fundamental Elements of the Quality of Care: A Simple Framework." *Studies in Family Planning* 21(2):61-91.

Burgert, C. R., J. Colston, T. Roy, and B. Zachary. 2013. *Geographic Displacement Procedure and Georeferenced Data Release Policy for the Demographic and Health Surveys*. DHS Spatial Analysis Reports No. 7. Calverton, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/SAR7/SAR7.pdf.

Burgert, C. R., and D. Prosnitz. 2014. *Linking DHS Household and SPA Facility Surveys: Data Considerations and Geospatial Methods*. DHS Spatial Analysis Reports No. 10. Rockville, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/SAR10/SAR10.pdf.

Campbell, S., J. Braspenning, A. Hutchinson, and M. Marshall. 2002. "Research Methods Used in Developing and Applying Quality Indicators in Primary Care." *Quality and Safety in Health Care* 11(4):358-364.

Cayemittes, M., M. F. Busangu, J. D. Bizimana, B. Barrère, and B. Sévère. 2013. *Haïti Enquête Mortalité, Morbidité Et Utilisation Des Services 2012*. Calverton, Maryland, USA: Ministère de la Santé Publique et de la Population - MSPP/Haïti, l'Institut Haïtien de l'Enfance - IHE and ICF International. http://dhsprogram.com/pubs/pdf/FR273/FR273.pdf.

Chakraborty, N., L. Mehrain, and S. Poyer. 2016. "Options for Measuring the Quality of Family Planning Programs: The Experience of Social Franchisor." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by A.Sprockett, S. H. Leisher, K. Longfield, and D. Montagu. Oakland, California, USA: Metrics for Measurement.

Chapman, S., and D. Montagu. 2016. "Steps toward Improving Quality of Care in Private Franchises." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by A. Sprockett, S. H. Leisher, K. Longfield, and D. Montagu. Oakland, California, USA: Metrics for Measurement.

Cleland, J., A. Conde-Agudelo, H. Peterson, J. Ross, and A. Tsui. 2012. "Contraception and Health." *The Lancet* 380(9837):149-156.

Cuéllar, C., C. Quijada, and S. Callahan. 2016. "The Evolution of Strategies and Measurement Methods to Assess the Quality of Family Planning Services." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by A. Sprockett, S. H. Leisher, K. Longfield, and D. Montagu. Oakland, California, USA: Metrics for Measurement.

Digitale, J., S. Psaki, E. Soler-Hampejsek, and B. S. Mensch. 2017. "Correlates of Contraceptive Use and Health Facility Choice among Young Women in Malawi." *The ANNALS of the American Academy of Political and Social Science* 669(1):93-124.

Do, M., A. Micah, L. Brondi, H. Campbell, T. Marchant, T. Eisele, and M. Munos. 2016. "Linking Household and Facility Data for Better Coverage Measures in Reproductive, Maternal, Newborn, and Child Health Care: Systematic Review." *Journal of Global Health* 6(2): 020501.

Do, M. P., and M. A. Koenig. 2007. "Effect of Family Planning Services on Modern Contraceptive Method Continuation in Vietnam." *Journal of Biosocial Science* 39(2):201-220.

Donabedian, A. 1966. "Evaluating the Quality of Medical Care." *The Milbank Memorial FundQquarterly* 44(3):166-206.

Donabedian, A. 1988. "The Quality of Care: How Can It Be Assessed?" *JAMA* 260(12):1743-1748.

Dunteman, G. H. 1989. *Principal Components Analysis*. Newbury Park, CA: Sage.

Filmer, D., and L. H. Pritchett. 2001. "Estimating Wealth Effects without Expenditure Data—or Tears: An Application to Educational Enrollments in States of India." *Demography* 38(1):115-132.

Gage, A. D., H. H. Leslie, A. Bitton, J. G. Jerome, R. Thermidor, J. P. Joseph, and M. E. Kruk. 2017. "Assessing the Quality of Primary Care in Haiti." *Bulletin of the World Health Organization* 95(3):182.

Gage, A. J., and D. L. Zomahoun. 2017. "Influence of the Service Delivery Environment on Family Planning Outcomes in Nigeria." *African Population Studies* 31(1).

Gelman, A., and D. K. Park. 2009. "Splitting a Predictor at the Upper Quarter or Third and the Lower Quarter or Third." *The American Statistician* 63(1):1-8.

Helzner, J., J. Bruce, and L. Cuervo. 1990. *Report of the Subcommittee on Quality Indicators in Family Planning Service Delivery*. Submitted to the USAID's Task Force on Standardization of Family Planning Program Performance Indicators. New York: International Planned Parenthood Federation/Western Hemisphere Region.

Hong, R., L. Montana, and V. Mishra. 2006. "Family Planning Services Quality as a Determinant of Use of IUDs in Egypt." *BMC Health Services Research* 6(1):79.

Howse, K. 2014. *Contraceptive Methods by Younger Women: Latin America and Caribbean*. Oxford: Population Horizons.

Hozumi, D., N. Fronczak, S. Minichiello, B. Buckner, and B. Fapohunda. 2006. *Profiles of Health Facility Assessment Methods*. Arlington, Virginia, USA: MEASURE Evaluation.

Hutchinson, P. L., M. Do, and S. Agha. 2011. "Measuring Client Satisfaction and the Quality of Family Planning Services: A Comparative Analysis of Public and Private Health Facilities in Tanzania, Kenya and Ghana." *BMC Health Services Research* 11(1):203.

IHE, and ICF International. 2014. *Haïti Évaluation de la Prestation des Services de Soins de Santé 2013*. Rockville, Maryland, USA: Institut Haïtien de l'Enfance - IHE and ICF International. http://dhsprogram.com/pubs/pdf/SPA19/SPA19.pdf.

Jain, A. 2016. "Examining Progress and Equity in Information Received by Women Using a Modern Method in 25 Developing Countries." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by A. ,S. H. Leisher, K. Longfield, and D. Montagu. Oakland, California: Metrics for Measurement.

Jayachandran, V., G. Chapotera, and W. Stones. 2016. "Quality of Facility-Based Family Planning Services for Adolescents in Malawi: Findings from a National Census of Health Facilities." *Malawi Medical Journal* 28(2):48-52.

Kaiser, H.F. 1960. "The Application of Electronic Computers to Factor Analysis." *Educational and Psychological Measurement* 20(1):141-151.

Kim, J., and C. Mueller. 1978. *Factor Analysis: Statistical Methods and Practical Issues. Vol. 14*. Newbury Park, California, USA: Sage.

Landis, J. R., and G. G. Koch. 1977. "The Measurement of Observer Agreement for Categorical Data." *Biometrics* 33(1):159-174.

Leisher, S., A. Sprockett, K. Longfield, and D. Montagu. 2016. *Quality Measurement in Family Planning: Past Present Future: Papers from the Bellagio Meeting on Family Planning Quality October 2015*. Oakland, California, USA: Metrics for Management.

MacCallum, R. C., S. Zhang, K. J. Preacher, and D. D. Rucker. 2002. "On the Practice of Dichotomization of Quantitative Variables." *Psychological Methods* 7(1):19.

Mant, J. 2001. "Process versus Outcome Indicators in the Assessment of Quality of Health Care." *International Journal for Quality in Health Care* 13(6):475-480.

Mensch, B., M. Arends-Kuenning, and A. Jain. 1996. "The Impact of the Quality of Family Planning Services on Contraceptive Use in Peru." *Studies in Family Planning* 27(2):59-75.

Miller, R., A. Fisher, K. Miller, L. Ndhlovu, N. Maggwa, I. Askew, D. Sanogo, and P. Tapsoba. 1997. *The Situation Analysis Approach to Assessing Family Planning and Reproductive Health Services: A Handbook*. New York: Population Council.

MoH Malawi, and ICF International. 2014. *Malawi Service Provision Assessment 2013-14*. Lilongwe, Malawi: Ministry of Health - MoH/Malawi and ICF International. http://dhsprogram.com/pubs/pdf/SPA20/SPA20.pdf.

MoHCDGEC et al. 2016. *Tanzania Demographic and Health Survey and Malaria Indicator Survey 2015-2016*. Dar es Salaam, Tanzania: Ministry of Health, Community Development, Gender, Elderly Children - MoHCDGEC/Tanzania Mainland, Ministry of Health - MoH/Zanzibar, National Bureau of Statistics - NBS/Tanzania, Office of Chief Government Statistician - OCGS/Zanzibar, ICF. http://dhsprogram.com/pubs/pdf/FR321/FR321.pdf.

MoHSW/Tanzania et al. 2016. *Tanzania Service Provision Assessment Survey 2014-2015*. Dar es Salaam, Tanzania: Ministry of Health and Social Welfare/Tanzania, Ministry of Health/Zanzibar, National Bureau of Statistics/Tanzania, Office of Chief Government Statistician/Tanzania, ICF International,. http://dhsprogram.com/pubs/pdf/SPA22/SPA22.pdf.

Montana, L., R. Bessinger, and S. Curtis. 2001. *Linking Health Facility and Population Level Data in Kenya Using Geogrpahic Information Systems*. Calverton, Maryland, USA: ORC Macro.

NSO/Malawi and ICF. 2017. *Malawi Demographic and Health Survey 2015-16*. Zomba, Malawi: National Statistical Office/Malawi and ICF. http://dhsprogram.com/pubs/pdf/FR319/FR319.pdf.

RamaRao, S., and A. Jain. 2001. *Quality of Services: Issues of Measurement*. Paper read at IUSSP General Population Conference, in Salvador, Brazil.

RamaRao, S., and A. Jain. 2016. "Constructing Indicators for Measurement and Improvement of the Quality of Family Planning." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by A. Sprockett, S. H. Leisher, K. Longfield, and D. Montagu. Oakland, California, USA: Metrics for Measurement.

RamaRao, S., M. Lacuesta, M. Costello, B. Pangolibay, and H. Jones. 2003. "The Link between Quality of Care and Contraceptive Use." *International Family Planning Perspectives* 29(2):76-83.

Rani, M., S. Bonu, and S. Harvey. 2007. "Differentials in the Quality of Antenatal Care in India." *International Journal for Quality in Health Care* 20(1):62-71.

Raudenbush, S.W., and A.S. Bryk. 2002. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Vol. 1: Newbury Park, California, USA: Sage.

Reise, S., N. Waller, and A. Comrey. 2000. "Factor Analysis and Scale Revision." *Psychological Assessment* 12(3):287-297.

Roemer, M. I., and C. Montoya-Aguilar. 1988. *Quality Assessment and Assurance in Primary Health Care*. Geneva: World Health Organization.

Rutstein, S. O. 2005. "Effects of Preceding Birth Intervals on Neonatal, Infant and under-Five Years Mortality and Nutritional Status in Developing Countries: Evidence from the Demographic and Health Surveys." *International Journal of Gynecology & Obstetrics* 89:S7-S24.

Rutstein, S. O., and K. Johnson. 2004. *The DHS Wealth Index*. Calverton, Maryland, USA: ORC Macro, MEASURE DHS.

Shahidzadeh-Mahani, A., S. Omidvari, H. R. Baradaran, and S. A. Azin. 2008. "Factors Affecting Quality of Care in Family Planning Clinics: A Study from Iran." *International Journal for Quality in Health Care* 20(4):284-290.

Sharker, M. Y., M. Nasser, J. Abedin, B. F. Arnold, and S. P. Luby. 2014. "The Risk of Misclassifying Subjects within Principal Component Based Asset Index." *Emerging Themes in Epidemiology* 11(1):6.

Skiles, M. P., C. R. Burgert, S. L. Curtis, and J. Spencer. 2013. "Geographically Linking Population and Facility Surveys: Methodological Considerations." *Population Health Metrics* 11(1):14.

Skiles, M. P., M. Cunningham, A. Inglis, B. Wilkes, B. Hatch, A. Bock, and J. Barden-O'Fallen. 2006. "The Effect of Service Environment on Demand and Use of Injectable Contraceptives in Malawi." *The Lancet* 41(1):69-79.

Skiles, M. P., M. Cunningham, A. Inglis, B. Wilkes, B. Hatch, A. Bock, and J. Barden-O'Fallon. 2015. "The Effect of Service Environment on Demand and Use of Injectable Contraceptives in Malawi." *International Perspectives on Sexual and Reproductive Health* 41(1):20.

Sprockett, A. 2016. "Family Planning Quality Assessment Tools Used in Low-and Middle-Income Countries: Review for Application In." In *Quality Measurement in Family Planning: Past, Present, Future: Papers from the Bellagio Meeting on Family Planning Quality, October 2015*, edited by Sprockett A., S. H. Leisher, K. Longfield, and D. Montagu. Oakland, CA: Metrics for Measurement.

Stephenson, R., A. Baschieri, S. Clements, M. Hennink, and N. Madise. 2007. "Contextual Influences on Modern Contraceptive Use in Sub-Saharan Africa." *American Journal of Public Health* 97(7):1233-1240.

Sullivan, T.M., and J. T. Bertrand. (eds.) 2000. "Monitoring Quality of Care in Family Planning by the Quick Investigation of Quality (QIQ): Country Reports." *Measure Evaluation Project Technical Report Series 5,* University of North Carolina, Chapel Hill, NC: Carolina Population Center.

Tessema, G. A., C. O. Laurence, M. A. Mahmood, and J. S. Gomersall. 2016. "Factors Determining Quality of Care in Family Planning Services in Africa: A Systematic Review Protocol." *JBI Database of Systematic Reviews and Implementation Reports* 14(8):103-114.

Tsui, A. O., R. McDonald-Mosley, and A. E. Burke. 2010. "Family Planning and the Burden of Unintended Pregnancies." *Epidemiologic Reviews* 32(1):152-174.

Tumlinson, K., B. W. Pence, S.L. Curtis, S.W. Marshall, and I.S. Speizer. 2015. "Quality of Care and Contraceptive Use in Urban Kenya." *International Perspectives on Sexual and Reproductive Health* 41(2):69.

USAID, A.B. 2012. *Three Successful Sub-Saharan Africa Family Planning Programs: Ethiopia, Malawi, Rwanda*. Washington, DC: USAID.

Wang, W., M. Do, J. Hembling, and P. Ametepi. 2014. *Assessing the Quality of Care in Family Planning, Antenatal, and Sick Child Services at Health Facilities in Kenya, Namibia, and Senegal*. DHS Analytical Studies No. 44. Rockville, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/AS44/AS44.pdf.

Wang, W., S. Wang, T. Pullum, and P. Ametepi. 2012. *How Family Planning Supply and the Service Environment Affect Contraceptive Use: Findings from Four East African Countries*. DHS Analytical Studies No. 26. Calverton, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/AS26/AS26.pdf.

Wang, W., R. Winter, L. Mallick, L. Florey, C. Burgert-Brucker, and E. Carter. 2015. *The Relationship between the Health Service Environment and Service Utilization: Linking Population Data to Health Facilities Data in Haiti and Malawi*. DHS Analytical Studies No. 51. Rockville, Maryland, USA: ICF International. http://dhsprogram.com/pubs/pdf/AS51/AS51.pdf.

Ward, V., R. Santiso-Galvez, and J. Bertrand. 2015. *Family Planning in Haiti: The Achievements of 50 Years*. Chapel Hill, North Carolina, USA: MEASURE Evaluation.

WHO. 2006. *Quality of Care: A Process for Making Strategic Choices in Health Systems*. Geneva: World Health Organization.

WHO. 2015a. *Health and Human Rights: Factsheet No. 323*. Geneva: World Health Organization.

WHO. 2015b. *Service Availability and Readiness Assessment (Sara): An Annual Monitoring System for Service Delivery, Reference Manual*. Geneva: World Health Organization.

World Bank. 2010. *Haiti Earthquake PDNA (Post-Disaster Needs Assessment) : Assessment of Damage, Losses, General and Sectoral Needs*. Washington, DC: World Bank.

# Appendix Tables

**Table A1. Summary of standardized family planning quality scores, Haiti, Malawi, and Tanzania**

| | Haiti | | Malawi | | Tanzania | | | |
|---|---|---|---|---|---|---|---|---|
| | mean | SE | mean | SE | mean | SE | lb | ub |
| Quality of service | | | | | | | | |
| Simple additive | 57.8 | 0.4 | 60.7 | 0.4 | 63.4 | 0.4 | 62.6 | 64.2 |
| Weighted additive | 38.1 | 0.7 | 48.8 | 0.6 | 45.9 | 0.8 | 44.3 | 47.4 |
| PCA | 53.4 | 0.6 | 64.8 | 1.0 | 38.7 | 0.7 | 37.4 | 40.0 |

**Table A2. Summary of standardized family planning quality scores, Haiti, Malawi, and Tanzania**

| | Haiti | | Malawi | | Tanzania | | | |
|---|---|---|---|---|---|---|---|---|
| | mean | SE | mean | SE | mean | SE | lb | ub |
| Quality of care | | | | | | | | |
| Simple additive | 52.0 | 0.5 | 55.5 | 0.5 | 58.4 | 0.6 | 57.2 | 59.6 |
| Weighted additive | 54.1 | 0.7 | 58.6 | 0.6 | 62.1 | 0.9 | 60.4 | 63.9 |
| PCA | 33.3 | 0.9 | 37.7 | 0.9 | 38.4 | 1.0 | 36.3 | 40.4 |

**Table A3. Results of multilevel, multivariable logistic regressions of women's attendance of a health facility for family planning, by urban and rural residence, Haiti DHS 2012; adjusted odds ratios and 95% confidence intervals**

| | | | | | | | Urban | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Quality of service environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | 1.22 | 0.72 - 2.09 | | | | | | | | | | |
| High | | | 1.07 | 0.64 - 1.80 | | | | | | | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | 0.94 | 0.55 - 1.61 | | | | | | | | |
| High | | | | | 1.03 | 0.59 - 1.79 | | | | | | | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | 1.18 | 0.68 - 2.06 | | | | | | |
| High | | | | | | | 1.12 | 0.66 - 1.90 | | | | | | |
| Quality of care environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | 1.66* | 1.02 - 2.68 | | | | |
| High | | | | | | | | | 1.61* | 1.00 - 2.58 | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | 0.76 | 0.47 - 1.22 | | |
| High | | | | | | | | | | | 1.51+ | 0.94 - 2.44 | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | | | 0.90 | 0.53 - 1.54 |
| High | | | | | | | | | | | | | 1.20 | 0.71 - 2.02 |
| Education (ref = none) | | | | | | | | | | | | | | |
| Primary | 0.75 | 0.45 - 1.25 | 0.75 | 0.45 - 1.25 | 0.75 | 0.45 - 1.25 | 0.75 | 0.45 - 1.25 | 0.76 | 0.46 - 1.27 | 0.77 | 0.47 - 1.27 | 0.76 | 0.46 - 1.26 |
| Secondary or higher | 1.03 | 0.58 - 1.85 | 1.03 | 0.57 - 1.83 | 1.03 | 0.57 - 1.86 | 1.03 | 0.58 - 1.85 | 1.05 | 0.58 - 1.88 | 1.05 | 0.60 - 1.87 | 1.05 | 0.59 - 1.88 |
| Occupation (ref =unemployed) | | | | | | | | | | | | | | |
| Agricultural/Manual | 1.00 | 0.50 - 1.97 | 0.98 | 0.49 - 1.96 | 1.00 | 0.51 - 1.98 | 0.99 | 0.49 - 1.97 | 0.96 | 0.49 - 1.91 | 1.01 | 0.51 - 1.98 | 1.00 | 0.50 - 1.96 |
| Professional | 1.17 | 0.79 - 1.73 | 1.17 | 0.79 - 1.73 | 1.17 | 0.79 - 1.73 | 1.17 | 0.79 - 1.73 | 1.17 | 0.79 - 1.73 | 1.17 | 0.79 - 1.73 | 1.17 | 0.79 - 1.73 |
| Other | 2.63** | 1.33 - 5.22 | 2.63** | 1.32 - 5.22 | 2.63** | 1.33 - 5.21 | 2.61** | 1.32 - 5.19 | 2.56** | 1.29 - 5.11 | 2.64** | 1.33 - 5.25 | 2.64** | 1.33 - 5.26 |
| Wealth quintile | | | | | | | | | | | | | | |
| Lowest | | | | | | | | | | | | | | |
| Second | | | | | | | | | | | | | | |
| Middle | | | | | | | | | | | | | | |
| Lowest-middle | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref |
| Fourth | 0.73 | 0.49 - 1.09 | 0.73 | 0.49 - 1.08 | 0.74 | 0.50 - 1.09 | 0.73 | 0.50 - 1.09 | 0.72+ | 0.49 - 1.06 | 0.74 | 0.50 - 1.08 | 0.74 | 0.50 - 1.09 |
| Highest | 0.50* | 0.28 - 0.89 | 0.50* | 0.28 - 0.90 | 0.50* | 0.28 - 0.91 | 0.51* | 0.29 - 0.90 | 0.49* | 0.28 - 0.87 | 0.52* | 0.30 - 0.91 | 0.51* | 0.29 - 0.89 |
| Religion (ref = Catholic) | | | | | | | | | | | | | | |
| Christian | 0.96 | 0.67 - 1.37 | 0.95 | 0.67 - 1.36 | 0.96 | 0.67 - 1.37 | 0.96 | 0.67 - 1.37 | 0.96 | 0.67 - 1.37 | 0.97 | 0.68 - 1.40 | 0.96 | 0.67 - 1.37 |
| Muslim | 0.64+ | 0.38 - 1.08 | 0.64+ | 0.38 - 1.08 | 0.64+ | 0.38 - 1.08 | 0.65 | 0.38 - 1.10 | 0.63+ | 0.37 - 1.06 | 0.66 | 0.39 - 1.11 | 0.65 | 0.39 - 1.09 |
| Marital status (ref = never married) | | | | | | | | | | | | | | |
| Currently married | 2.11* | 1.09 - 4.10 | 2.11* | 1.09 - 4.08 | 2.11* | 1.09 - 4.11 | 2.12* | 1.09 - 4.14 | 2.18* | 1.12 - 4.25 | 2.15* | 1.10 - 4.20 | 2.13* | 1.09 - 4.15 |
| Formerly married | 1.60 | 0.67 - 3.82 | 1.61 | 0.68 - 3.85 | 1.59 | 0.66 - 3.81 | 1.62 | 0.67 - 3.90 | 1.64 | 0.69 - 3.90 | 1.64 | 0.67 - 4.02 | 1.62 | 0.67 - 3.90 |
| Number of living kids (ref = 0) | | | | | | | | | | | | | | |
| 1-4 | 2.17* | 1.13 - 4.17 | 2.17* | 1.14 - 4.15 | 2.16* | 1.12 - 4.19 | 2.15* | 1.11 - 4.15 | 2.11* | 1.09 - 4.09 | 2.11* | 1.08 - 4.09 | 2.14* | 1.10 - 4.14 |
| 5+ | 1.62 | 0.72 - 3.65 | 1.62 | 0.72 - 3.63 | 1.62 | 0.71 - 3.69 | 1.60 | 0.71 - 3.64 | 1.62 | 0.71 - 3.68 | 1.58 | 0.70 - 3.60 | 1.61 | 0.71 - 3.65 |
| Exposure to family planning messages (ref = none) | | | | | | | | | | | | | | |
| Yes | 2.25*** | 1.57 - 3.24 | 2.23*** | 1.55 - 3.20 | 2.26*** | 1.57 - 3.24 | 2.23*** | 1.55 - 3.21 | 2.23*** | 1.56 - 3.20 | 2.21*** | 1.54 - 3.18 | 2.23*** | 1.54 - 3.22 |
| Current contraceptive use (ref = none) | | | | | | | | | | | | | | |
| Traditional | 0.96 | 0.49 - 1.89 | 0.96 | 0.49 - 1.88 | 0.96 | 0.49 - 1.89 | 0.95 | 0.49 - 1.87 | 0.95 | 0.48 - 1.86 | 0.95 | 0.49 - 1.83 | 0.95 | 0.49 - 1.86 |
| Short-acting | 1.56* | 1.07 - 2.28 | 1.56* | 1.06 - 2.29 | 1.56* | 1.07 - 2.28 | 1.55* | 1.06 - 2.27 | 1.54* | 1.06 - 2.24 | 1.56* | 1.07 - 2.27 | 1.56* | 1.07 - 2.28 |
| Long-acting or permanent | 0.99 | 0.52 - 1.89 | 0.98 | 0.52 - 1.87 | 0.98 | 0.51 - 1.88 | 0.98 | 0.51 - 1.86 | 0.96 | 0.50 - 1.85 | 1.01 | 0.52 - 1.94 | 1.00 | 0.52 - 1.91 |
| Rho | | | | | | | | | | | | | | |
| Number of women | 0.1110 | | 0.1089 | | 0.1085 | | 0.1109 | | 0.1065 | | 0.0928 | | 0.1103 | |
| Number of clusters | 1,228 | | 1,228 | | 1,228 | | 1,228 | | 1,228 | | 1,228 | | 1,228 | |
| Quality of service environment | 83 | | 83 | | 83 | | 83 | | 83 | | 83 | | 83 | |

Note: Regressions performed on women in urban areas exclude women from the metro Port-au-Prince area; p-value: +<0.10, *<0.05, **<0.01, ***<0.001

**(Continued…)**

Table A3. – *Continued*

| | Rural | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Quality of service environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | 0.94 | 0.69 - 1.30 | | | | | | | | | | |
| High | | | 1.07 | 0.77 - 1.49 | | | | | | | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | 1.21 | 0.88 - 1.65 | | | | | | | | |
| High | | | | | 1.56** | 1.15 - 2.12 | | | | | | | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | 1.07 | 0.75 - 1.53 | | | | | | |
| High | | | | | | | 0.95 | 0.69 - 1.30 | | | | | | |
| Quality of care environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | 1.18 | 0.83 - 1.66 | | | | |
| High | | | | | | | | | 1.31 | 0.94 - 1.84 | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | 1.10 | 0.78 - 1.57 | | |
| High | | | | | | | | | | | 1.33 | 0.94 - 1.88 | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | | | 0.94 | 0.66 - 1.33 |
| High | | | | | | | | | | | | | 1.15 | 0.83 - 1.60 |
| Education (ref = none) | | | | | | | | | | | | | | |
| Primary | 1.37** | 1.09 - 1.72 | 1.37** | 1.09 - 1.72 | 1.36** | 1.08 - 1.70 | 1.37** | 1.09 - 1.72 | 1.36** | 1.08 - 1.71 | 1.36** | 1.09 - 1.71 | 1.37** | 1.09 - 1.72 |
| Secondary or higher | 1.32 | 0.93 - 1.87 | 1.32 | 0.93 - 1.87 | 1.31 | 0.93 - 1.85 | 1.32 | 0.93 - 1.87 | 1.31 | 0.93 - 1.86 | 1.30 | 0.92 - 1.84 | 1.33 | 0.94 - 1.88 |
| Occupation (ref =unemployed) | | | | | | | | | | | | | | |
| Agricultural/Manual | 1.22 | 0.87 - 1.70 | 1.22 | 0.88 - 1.70 | 1.23 | 0.88 - 1.71 | 1.22 | 0.88 - 1.70 | 1.23 | 0.88 - 1.72 | 1.23 | 0.88 - 1.71 | 1.22 | 0.87 - 1.70 |
| Professional | 1.36* | 1.05 - 1.78 | 1.36* | 1.05 - 1.78 | 1.37* | 1.05 - 1.77 | 1.36* | 1.04 - 1.78 | 1.37* | 1.05 - 1.78 | 1.37* | 1.05 - 1.78 | 1.36* | 1.04 - 1.77 |
| Other | 0.76 | 0.30 - 1.93 | 0.76 | 0.30 - 1.93 | 0.74 | 0.29 - 1.89 | 0.76 | 0.30 - 1.95 | 0.76 | 0.30 - 1.90 | 0.77 | 0.31 - 1.94 | 0.76 | 0.30 - 1.92 |
| Wealth quintile | | | | | | | | | | | | | | |
| Lowest | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref |
| Second | 0.89 | 0.73 - 1.07 | 0.89 | 0.73 - 1.08 | 0.89 | 0.74 - 1.08 | 0.89 | 0.73 - 1.07 | 0.88 | 0.73 - 1.07 | 0.89 | 0.74 - 1.09 | 0.89 | 0.73 - 1.07 |
| Middle | 0.86 | 0.65 - 1.13 | 0.86 | 0.65 - 1.13 | 0.88 | 0.67 - 1.15 | 0.85 | 0.65 - 1.13 | 0.84 | 0.63 - 1.11 | 0.86 | 0.65 - 1.14 | 0.85 | 0.64 - 1.13 |
| Lowest-Middle | | | | | | | | | | | | | | |
| Fourth | 0.76 | 0.46 - 1.24 | 0.76 | 0.46 - 1.25 | 0.80 | 0.49 - 1.31 | 0.75 | 0.46 - 1.23 | 0.73 | 0.44 - 1.20 | 0.77 | 0.48 - 1.25 | 0.74 | 0.44 - 1.24 |
| Highest | 0.69 | 0.29 - 1.62 | 0.69 | 0.29 - 1.63 | 0.70 | 0.30 - 1.67 | 0.69 | 0.29 - 1.62 | 0.66 | 0.28 - 1.57 | 0.70 | 0.29 - 1.65 | 0.67 | 0.28 - 1.61 |
| Religion (ref = Catholic) | | | | | | | | | | | | | | |
| Christian | 0.96 | 0.77 - 1.21 | 0.97 | 0.77 - 1.21 | 0.97 | 0.77 - 1.21 | 0.96 | 0.77 - 1.20 | 0.97 | 0.78 - 1.21 | 0.97 | 0.77 - 1.21 | 0.96 | 0.77 - 1.20 |
| Muslim | 1.19 | 0.76 - 1.88 | 1.19 | 0.76 - 1.87 | 1.21 | 0.77 - 1.90 | 1.19 | 0.76 - 1.87 | 1.19 | 0.76 - 1.87 | 1.19 | 0.75 - 1.89 | 1.19 | 0.76 - 1.88 |
| Marital status (ref = never married) | | | | | | | | | | | | | | |
| Currently married | 1.53+ | 0.98 - 2.37 | 1.53+ | 0.99 - 2.37 | 1.53+ | 0.98 - 2.38 | 1.52+ | 0.98 - 2.36 | 1.54+ | 0.99 - 2.39 | 1.53+ | 0.99 - 2.35 | 1.55+ | 1.00 - 2.40 |
| Formerly married | 2.56* | 1.09 - 6.01 | 2.56* | 1.09 - 6.04 | 2.55* | 1.07 - 6.04 | 2.55* | 1.09 - 5.99 | 2.59* | 1.11 - 6.05 | 2.57* | 1.10 - 6.00 | 2.60* | 1.11 - 6.07 |
| Number of living kids (ref = 0) | | | | | | | | | | | | | | |
| 1-4 | 2.91*** | 1.65 - 5.15 | 2.92*** | 1.65 - 5.16 | 2.93*** | 1.65 - 5.17 | 2.90*** | 1.64 - 5.13 | 2.90*** | 1.64 - 5.12 | 2.91*** | 1.65 - 5.13 | 2.90*** | 1.64 - 5.12 |
| 5+ | 3.24*** | 1.76 - 5.97 | 3.24*** | 1.76 - 5.97 | 3.24*** | 1.76 - 5.98 | 3.23*** | 1.76 - 5.95 | 3.24*** | 1.76 - 5.96 | 3.24*** | 1.77 - 5.95 | 3.23*** | 1.75 - 5.94 |
| Exposure to family planning messages (ref = none) | | | | | | | | | | | | | | |
| Yes | 2.22*** | 1.74 - 2.83 | 2.22*** | 1.74 - 2.83 | 2.24*** | 1.75 - 2.85 | 2.22*** | 1.74 - 2.84 | 2.23*** | 1.75 - 2.84 | 2.24*** | 1.76 - 2.87 | 2.23*** | 1.74 - 2.84 |
| Current contraceptive use (ref = none) | | | | | | | | | | | | | | |
| Traditional | 0.89 | 0.46 - 1.72 | 0.89 | 0.46 - 1.72 | 0.89 | 0.46 - 1.72 | 0.89 | 0.45 - 1.72 | 0.91 | 0.47 - 1.75 | 0.91 | 0.47 - 1.76 | 0.90 | 0.47 - 1.73 |
| Short-acting | 1.50** | 1.18 - 1.91 | 1.50** | 1.18 - 1.91 | 1.49** | 1.17 - 1.89 | 1.50** | 1.18 - 1.90 | 1.49** | 1.17 - 1.90 | 1.49** | 1.17 - 1.90 | 1.50** | 1.18 - 1.91 |
| Long-acting or permanent | 1.04 | 0.67 - 1.61 | 1.03 | 0.67 - 1.61 | 1.01 | 0.65 - 1.57 | 1.04 | 0.67 - 1.61 | 1.02 | 0.65 - 1.58 | 1.02 | 0.66 - 1.58 | 1.03 | 0.66 - 1.60 |
| Rho | 0.1024 | | 0.1028 | | 0.0990 | | 0.1014 | | 0.1001 | | 0.0974 | | 0.0986 | |
| Number of women | 3,245 | | 3,245 | | 3,245 | | 3,245 | | 3,245 | | 3,245 | | 3,245 | |
| Number of clusters | 241 | | 241 | | 241 | | 241 | | 241 | | 241 | | 241 | |

Note: Regressions performed on women in urban areas exclude women from the metro Port-au-Prince area; p-value: +<0.10, *<0.05, **<0.01, ***<0.001

**Table A4. Results of multilevel, multivariable logistic regressions of women's attendance of a health facility for family planning, by urban and rural residence, Malawi DHS 2015-16; adjusted odds ratios and 95% confidence intervals**

| | Urban | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Quality of service environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | 2.50** | 1.39 - 4.50 | | | | | | | | | | |
| High | | | 2.65*** | 1.78 - 3.96 | | | | | | | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | 2.52** | 1.41 - 4.50 | | | | | | | | |
| High | | | | | 4.76*** | 2.94 - 7.69 | | | | | | | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | 1.36 | 0.72 - 2.55 | | | | | | |
| High | | | | | | | 1.88* | 1.07 - 3.32 | | | | | | |
| Quality of care environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | 2.12* | 1.11 - 4.07 | | | | |
| High | | | | | | | | | 3.53*** | 2.17 - 5.75 | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | 1.16 | 0.65 - 2.04 | | |
| High | | | | | | | | | | | 3.65*** | 2.37 - 5.61 | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | | | 1.05 | 0.52 - 2.15 |
| High | | | | | | | | | | | | | 0.81 | 0.45 - 1.45 |
| Education (ref = none) | | | | | | | | | | | | | | |
| Primary | 0.90 | 0.33 - 2.41 | 0.90 | 0.33 - 2.44 | 0.93 | 0.35 - 2.46 | 0.90 | 0.34 - 2.42 | 0.92 | 0.34 - 2.48 | 0.87 | 0.33 - 2.29 | 0.89 | 0.33 - 2.40 |
| Secondary or higher | 1.20 | 0.48 - 3.00 | 1.23 | 0.49 - 3.09 | 1.22 | 0.50 - 3.01 | 1.20 | 0.48 - 3.00 | 1.24 | 0.49 - 3.13 | 1.17 | 0.48 - 2.88 | 1.19 | 0.48 - 2.96 |
| Occupation (ref =unemployed) | | | | | | | | | | | | | | |
| Agricultural/Manual | 1.10 | 0.76 - 1.59 | 1.09 | 0.76 - 1.56 | 1.02 | 0.71 - 1.46 | 1.09 | 0.76 - 1.58 | 1.10 | 0.76 - 1.59 | 1.13 | 0.78 - 1.62 | 1.11 | 0.77 - 1.60 |
| Professional | 0.78 | 0.57 - 1.07 | 0.80 | 0.58 - 1.10 | 0.76+ | 0.56 - 1.05 | 0.79 | 0.57 - 1.09 | 0.79 | 0.57 - 1.09 | 0.79 | 0.58 - 1.08 | 0.78 | 0.56 - 1.07 |
| Other | 1.04 | 0.64 - 1.70 | 1.06 | 0.64 - 1.76 | 0.98 | 0.61 - 1.57 | 1.04 | 0.64 - 1.69 | 1.16 | 0.69 - 1.92 | 1.10 | 0.66 - 1.81 | 1.03 | 0.64 - 1.67 |
| Wealth quintile | | | | | | | | | | | | | | |
| Lowest | | | | | | | | | | | | | | |
| Second | | | | | | | | | | | | | | |
| Middle | | | | | | | | | | | | | | |
| Lowest-middle | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref |
| Fourth | 0.83 | 0.55 - 1.24 | 0.80 | 0.54 - 1.19 | 0.87 | 0.59 - 1.27 | 0.81 | 0.55 - 1.21 | 0.87 | 0.59 - 1.29 | 0.79 | 0.54 - 1.18 | 0.82 | 0.55 - 1.22 |
| Highest | 0.41*** | 0.25 - 0.66 | 0.41*** | 0.26 - 0.66 | 0.45** | 0.28 - 0.73 | 0.40*** | 0.25 - 0.64 | 0.45** | 0.28 - 0.73 | 0.39*** | 0.24 - 0.63 | 0.40*** | 0.25 - 0.64 |
| Religion (ref = Catholic) | | | | | | | | | | | | | | |
| Christian | 0.71+ | 0.50 - 1.02 | 0.72+ | 0.51 - 1.03 | 0.74+ | 0.52 - 1.05 | 0.71+ | 0.50 - 1.02 | 0.73+ | 0.51 - 1.05 | 0.72+ | 0.50 - 1.02 | 0.71+ | 0.50 - 1.02 |
| Muslim | 0.55** | 0.36 - 0.82 | 0.52** | 0.34 - 0.78 | 0.50** | 0.33 - 0.75 | 0.53** | 0.36 - 0.79 | 0.54** | 0.35 - 0.83 | 0.56** | 0.37 - 0.83 | 0.55** | 0.37 - 0.82 |
| Marital atatus (ref = never married) | | | | | | | | | | | | | | |
| Currently married | 1.67 | 0.78 - 3.56 | 1.62 | 0.75 - 3.52 | 1.63 | 0.75 - 3.56 | 1.69 | 0.79 - 3.61 | 1.61 | 0.73 - 3.55 | 1.65 | 0.75 - 3.63 | 1.67 | 0.78 - 3.57 |
| Formerly married | 1.46 | 0.59 - 3.66 | 1.39 | 0.55 - 3.52 | 1.45 | 0.56 - 3.75 | 1.49 | 0.60 - 3.68 | 1.41 | 0.55 - 3.62 | 1.40 | 0.55 - 3.59 | 1.46 | 0.59 - 3.65 |
| Number of living kids (ref = 0) | | | | | | | | | | | | | | |
| 1-4 | 2.02+ | 0.88 - 4.63 | 2.09+ | 0.92 - 4.73 | 2.12+ | 0.95 - 4.74 | 2.02+ | 0.88 - 4.64 | 2.11+ | 0.92 - 4.84 | 2.04+ | 0.89 - 4.68 | 2.01+ | 0.88 - 4.63 |
| 5+ | 1.72 | 0.61 - 4.89 | 1.76 | 0.63 - 4.89 | 1.73 | 0.64 - 4.73 | 1.71 | 0.60 - 4.88 | 1.81 | 0.64 - 5.07 | 1.70 | 0.61 - 4.78 | 1.71 | 0.60 - 4.88 |
| Exposure to family planning messages (ref = none) | | | | | | | | | | | | | | |
| Yes | 1.33 | 0.94 - 1.88 | 1.34+ | 0.95 - 1.88 | 1.32 | 0.94 - 1.87 | 1.33 | 0.94 - 1.89 | 1.28 | 0.91 - 1.80 | 1.33 | 0.95 - 1.87 | 1.33 | 0.94 - 1.88 |
| Current contraceptive use (ref = none) | | | | | | | | | | | | | | |
| Traditional | 0.43 | 0.14 - 1.30 | 0.45 | 0.15 - 1.34 | 0.41 | 0.14 - 1.23 | 0.43 | 0.14 - 1.30 | 0.43 | 0.14 - 1.31 | 0.42 | 0.14 - 1.26 | 0.43 | 0.14 - 1.30 |
| Short-acting | 1.01 | 0.70 - 1.46 | 0.99 | 0.69 - 1.44 | 0.99 | 0.68 - 1.44 | 1.01 | 0.70 - 1.46 | 1.02 | 0.71 - 1.47 | 1.01 | 0.70 - 1.46 | 1.02 | 0.71 - 1.46 |
| Long-acting or permanent | 0.62* | 0.41 - 0.94 | 0.62* | 0.41 - 0.95 | 0.60* | 0.40 - 0.91 | 0.62* | 0.41 - 0.95 | 0.63* | 0.41 - 0.97 | 0.64* | 0.42 - 0.97 | 0.62* | 0.41 - 0.94 |
| Rho | 0.1463 | | 0.1349 | | 0.1217 | | 0.1430 | | 0.1282 | | 0.1327 | | 0.1448 | |
| Number of women | 1,600 | | 1,600 | | 1,600 | | 1,600 | | 1,600 | | 1,600 | | 1,600 | |
| Number of clusters | 159 | | 159 | | 159 | | 159 | | 159 | | 159 | | 159 | |

Note: Regressions performed on women in urban areas exclude women from the urban Lilongwe; p-value: +<0.10, *<0.05, **<0.01, ***<0.001

**(Continued…)**

Table A4. – *Continued*

| | Rural | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Quality of service environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | 1.12 | 0.95 - 1.33 | | | | | | | | | | |
| High | | | 1.16 | 0.97 - 1.39 | | | | | | | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | 0.99 | 0.84 - 1.17 | | | | | | | | |
| High | | | | | 0.96 | 0.81 - 1.13 | | | | | | | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | 1.12 | 0.95 - 1.31 | | | | | | |
| High | | | | | | | 1.08 | 0.91 - 1.29 | | | | | | |
| Quality of care environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | 0.96 | 0.80 - 1.16 | | | | |
| High | | | | | | | | | 0.99 | 0.85 - 1.16 | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | 0.98 | 0.82 - 1.16 | | |
| High | | | | | | | | | | | 0.97 | 0.82 - 1.16 | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | | | 0.94 | 0.79 - 1.13 |
| High | | | | | | | | | | | | | 0.86+ | 0.73 - 1.01 |
| Education (ref = none) | | | | | | | | | | | | | | |
| Primary | 1.28** | 1.10 - 1.49 | 1.27** | 1.10 - 1.48 | 1.28** | 1.10 - 1.49 | 1.28** | 1.10 - 1.49 | 1.28** | 1.10 - 1.49 | 1.28** | 1.10 - 1.49 | 1.28** | 1.10 - 1.49 |
| Secondary or higher | 1.69*** | 1.36 - 2.10 | 1.68*** | 1.36 - 2.08 | 1.69*** | 1.37 - 2.10 | 1.69*** | 1.36 - 2.09 | 1.69*** | 1.36 - 2.10 | 1.69*** | 1.36 - 2.10 | 1.69*** | 1.37 - 2.10 |
| Occupation (ref= unemployed) | | | | | | | | | | | | | | |
| Agricultural/Manual | 1.38*** | 1.20 - 1.59 | 1.39*** | 1.20 - 1.59 | 1.38*** | 1.20 - 1.58 | 1.38*** | 1.20 - 1.58 | 1.38*** | 1.20 - 1.59 | 1.38*** | 1.20 - 1.59 | 1.38*** | 1.20 - 1.58 |
| Professional | 1.35* | 1.04 - 1.75 | 1.35* | 1.04 - 1.75 | 1.35* | 1.04 - 1.74 | 1.35* | 1.05 - 1.75 | 1.35* | 1.04 - 1.75 | 1.35* | 1.04 - 1.75 | 1.36* | 1.05 - 1.76 |
| Other | 1.35 | 0.90 - 2.02 | 1.36 | 0.91 - 2.03 | 1.35 | 0.90 - 2.02 | 1.36 | 0.91 - 2.03 | 1.35 | 0.90 - 2.02 | 1.35 | 0.90 - 2.02 | 1.36 | 0.91 - 2.03 |
| Wealth quintile | | | | | | | | | | | | | | |
| Lowest | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref |
| Second | 0.99 | 0.85 - 1.15 | 0.99 | 0.85 - 1.15 | 0.99 | 0.85 - 1.15 | 0.99 | 0.85 - 1.15 | 0.99 | 0.85 - 1.15 | 0.99 | 0.85 - 1.15 | 0.99 | 0.85 - 1.15 |
| Middle | 0.84* | 0.72 - 0.98 | 0.84* | 0.72 - 0.98 | 0.84* | 0.72 - 0.98 | 0.84* | 0.72 - 0.98 | 0.84* | 0.72 - 0.98 | 0.84* | 0.72 - 0.98 | 0.84* | 0.72 - 0.98 |
| Lowest-middle | | | | | | | | | | | | | | |
| Fourth | 0.82* | 0.70 - 0.96 | 0.82* | 0.69 - 0.96 | 0.82* | 0.70 - 0.96 | 0.82* | 0.70 - 0.97 | 0.82* | 0.70 - 0.96 | 0.82* | 0.70 - 0.96 | 0.82* | 0.70 - 0.97 |
| Highest | 0.52*** | 0.41 - 0.65 | 0.52*** | 0.41 - 0.65 | 0.52*** | 0.41 - 0.65 | 0.52*** | 0.41 - 0.65 | 0.52*** | 0.41 - 0.65 | 0.52*** | 0.41 - 0.65 | 0.52*** | 0.41 - 0.66 |
| Religion (ref = Catholic) | | | | | | | | | | | | | | |
| Christian | 1.01 | 0.88 - 1.16 | 1.01 | 0.88 - 1.16 | 1.01 | 0.88 - 1.16 | 1.01 | 0.88 - 1.16 | 1.01 | 0.88 - 1.16 | 1.01 | 0.88 - 1.16 | 1.01 | 0.88 - 1.16 |
| Muslim | 0.69*** | 0.56 - 0.85 | 0.70** | 0.56 - 0.86 | 0.69*** | 0.56 - 0.85 | 0.69*** | 0.56 - 0.85 | 0.69*** | 0.56 - 0.85 | 0.69*** | 0.56 - 0.86 | 0.69*** | 0.56 - 0.86 |
| Marital Status (ref = never married) | | | | | | | | | | | | | | |
| Currently married | 1.35+ | 0.98 - 1.86 | 1.35+ | 0.98 - 1.86 | 1.35+ | 0.98 - 1.86 | 1.35+ | 0.98 - 1.86 | 1.35+ | 0.98 - 1.86 | 1.35+ | 0.98 - 1.86 | 1.35+ | 0.98 - 1.86 |
| Formerly married | 1.11 | 0.80 - 1.55 | 1.11 | 0.80 - 1.54 | 1.12 | 0.80 - 1.55 | 1.11 | 0.80 - 1.55 | 1.11 | 0.80 - 1.55 | 1.11 | 0.80 - 1.55 | 1.11 | 0.80 - 1.55 |
| Number of living kids (ref = 0) | | | | | | | | | | | | | | |
| 1-4 | 2.81*** | 1.96 - 4.03 | 2.81*** | 1.96 - 4.02 | 2.81*** | 1.96 - 4.03 | 2.81*** | 1.96 - 4.03 | 2.81*** | 1.96 - 4.03 | 2.81*** | 1.96 - 4.03 | 2.82*** | 1.97 - 4.05 |
| 5+ | 2.99*** | 2.07 - 4.33 | 2.98*** | 2.06 - 4.32 | 2.99*** | 2.07 - 4.33 | 2.99*** | 2.07 - 4.33 | 2.99*** | 2.07 - 4.34 | 2.99*** | 2.07 - 4.33 | 3.00*** | 2.07 - 4.35 |
| Exposure to family planning messages (ref = none) | | | | | | | | | | | | | | |
| Yes | 1.80*** | 1.61 - 2.01 | 1.80*** | 1.61 - 2.00 | 1.80*** | 1.61 - 2.01 | 1.80*** | 1.61 - 2.01 | 1.80*** | 1.61 - 2.01 | 1.80*** | 1.61 - 2.01 | 1.80*** | 1.61 - 2.01 |
| Current contraceptive use (ref = none) | | | | | | | | | | | | | | |
| Traditional | 1.08 | 0.68 - 1.73 | 1.08 | 0.68 - 1.74 | 1.08 | 0.68 - 1.73 | 1.08 | 0.67 - 1.73 | 1.08 | 0.68 - 1.73 | 1.08 | 0.68 - 1.73 | 1.08 | 0.68 - 1.73 |
| Short-acting | 0.98 | 0.87 - 1.10 | 0.98 | 0.87 - 1.10 | 0.98 | 0.87 - 1.10 | 0.98 | 0.87 - 1.10 | 0.98 | 0.87 - 1.10 | 0.98 | 0.87 - 1.10 | 0.98 | 0.87 - 1.10 |
| Long-acting or permanent | 0.59*** | 0.51 - 0.68 | 0.59*** | 0.51 - 0.68 | 0.59*** | 0.51 - 0.68 | 0.59*** | 0.51 - 0.68 | 0.59*** | 0.51 - 0.68 | 0.59*** | 0.51 - 0.68 | 0.59*** | 0.51 - 0.68 |
| Rho | 0.0801 | | 0.0786 | | 0.0801 | | 0.0786 | | 0.0801 | | 0.0799 | | 0.0786 | |
| Number of women | 12,063 | | 12,063 | | 12,063 | | 12,063 | | 12,063 | | 12,063 | | 12,063 | |
| Number of clusters | 650 | | 650 | | 650 | | 650 | | 650 | | 650 | | 650 | |

Note: P-value: +<0.10, *<0.05, **<0.01, ***<0.001

**Table A5. Results of multilevel, multivariable logistic regressions of women's attendance of a health facility for family planning, by urban and rural residence, Tanzania DHS 2015-16; adjusted odds ratios and 95% confidence intervals**

| | Urban | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Quality of service environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | 0.96 | 0.50 - 1.85 | | | | | | | | | | |
| High | | | 0.68* | 0.48 - 0.96 | | | | | | | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | 1.35 | 0.78 - 2.33 | | | | | | | | |
| High | | | | | 1.12 | 0.64 - 1.97 | | | | | | | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | 1.31 | 0.69 - 2.48 | | | | | | |
| High | | | | | | | 0.84 | 0.49 - 1.43 | | | | | | |
| Quality of care environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | 0.93 | 0.47 - 1.82 | | | | |
| High | | | | | | | | | 1.00 | 0.59 - 1.70 | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | 1.10 | 0.64 - 1.87 | | |
| High | | | | | | | | | | | 1.13 | 0.65 - 1.98 | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | | | 0.99 | 0.50 - 1.96 |
| High | | | | | | | | | | | | | 1.20 | 0.70 - 2.05 |
| Education (ref = none) | | | | | | | | | | | | | | |
| Primary | 1.16 | 0.67 - 2.02 | 1.17 | 0.68 - 2.03 | 1.16 | 0.67 - 2.01 | 1.16 | 0.66 - 2.03 | 1.16 | 0.67 - 2.02 | 1.16 | 0.67 - 2.02 | 1.17 | 0.67 - 2.03 |
| Secondary or higher | 1.17 | 0.66 - 2.08 | 1.18 | 0.67 - 2.08 | 1.16 | 0.66 - 2.06 | 1.16 | 0.65 - 2.07 | 1.17 | 0.66 - 2.07 | 1.16 | 0.66 - 2.06 | 1.17 | 0.66 - 2.08 |
| Occupation (ref= unemployed) | | | | | | | | | | | | | | |
| Agricultural/Manual | 0.78 | 0.56 - 1.09 | 0.78 | 0.56 - 1.09 | 0.79 | 0.56 - 1.10 | 0.78 | 0.56 - 1.09 | 0.79 | 0.56 - 1.10 | 0.78 | 0.56 - 1.09 | 0.79 | 0.56 - 1.10 |
| Professional | 1.09 | 0.62 - 1.92 | 1.09 | 0.62 - 1.92 | 1.09 | 0.62 - 1.92 | 1.09 | 0.62 - 1.91 | 1.09 | 0.62 - 1.92 | 1.09 | 0.62 - 1.92 | 1.09 | 0.62 - 1.92 |
| Other | 0.73+ | 0.52 - 1.01 | 0.73+ | 0.52 - 1.01 | 0.73+ | 0.52 - 1.02 | 0.72+ | 0.52 - 1.01 | 0.73+ | 0.52 - 1.01 | 0.73+ | 0.52 - 1.02 | 0.73+ | 0.52 - 1.01 |
| Wealth quintile | | | | | | | | | | | | | | |
| Lowest | | | | | | | | | | | | | | |
| Second | | | | | | | | | | | | | | |
| Middle | | | | | | | | | | | | | | |
| Lowest-middle | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref |
| Fourth | 0.85 | 0.53 - 1.37 | 0.86 | 0.54 - 1.37 | 0.85 | 0.53 - 1.34 | 0.85 | 0.53 - 1.36 | 0.86 | 0.54 - 1.36 | 0.85 | 0.54 - 1.35 | 0.86 | 0.54 - 1.37 |
| Highest | 0.61** | 0.43 - 0.88 | 0.62** | 0.43 - 0.89 | 0.60** | 0.42 - 0.85 | 0.61** | 0.42 - 0.87 | 0.61** | 0.43 - 0.88 | 0.61** | 0.43 - 0.86 | 0.61** | 0.43 - 0.88 |
| Marital status (ref = never married) | | | | | | | | | | | | | | |
| Currently married | 1.26 | 0.80 - 1.98 | 1.26 | 0.80 - 1.98 | 1.26 | 0.80 - 1.97 | 1.26 | 0.80 - 1.97 | 1.25 | 0.80 - 1.97 | 1.26 | 0.80 - 1.98 | 1.26 | 0.80 - 1.98 |
| Formerly married | 0.79 | 0.47 - 1.32 | 0.79 | 0.47 - 1.32 | 0.79 | 0.47 - 1.32 | 0.79 | 0.48 - 1.33 | 0.79 | 0.47 - 1.32 | 0.79 | 0.47 - 1.32 | 0.79 | 0.47 - 1.32 |
| Number of living kids (ref = 0) | | | | | | | | | | | | | | |
| 1-4 | 2.76** | 1.46 - 5.24 | 2.75** | 1.45 - 5.22 | 2.75** | 1.45 - 5.21 | 2.76** | 1.46 - 5.25 | 2.76** | 1.46 - 5.24 | 2.76** | 1.45 - 5.24 | 2.75** | 1.45 - 5.23 |
| 5+ | 2.40** | 1.26 - 4.56 | 2.38** | 1.25 - 4.54 | 2.37** | 1.25 - 4.51 | 2.39** | 1.25 - 4.54 | 2.40** | 1.26 - 4.56 | 2.39** | 1.25 - 4.55 | 2.40** | 1.26 - 4.55 |
| Exposure to family planning messages (ref = none) | | | | | | | | | | | | | | |
| Yes | 1.99*** | 1.65 - 2.39 | 1.99*** | 1.67 - 2.38 | 2.00*** | 1.66 - 2.40 | 1.99*** | 1.66 - 2.39 | 1.99*** | 1.65 - 2.38 | 1.99*** | 1.65 - 2.39 | 1.98*** | 1.65 - 2.38 |
| Current contraceptive use (ref = none) | | | | | | | | | | | | | | |
| Traditional | 0.78 | 0.54 - 1.13 | 0.78 | 0.54 - 1.13 | 0.78 | 0.54 - 1.13 | 0.78 | 0.54 - 1.13 | 0.78 | 0.54 - 1.13 | 0.78 | 0.54 - 1.13 | 0.78 | 0.54 - 1.13 |
| Short-acting | 0.90 | 0.68 - 1.18 | 0.90 | 0.68 - 1.18 | 0.90 | 0.68 - 1.18 | 0.89 | 0.68 - 1.17 | 0.90 | 0.68 - 1.18 | 0.90 | 0.68 - 1.18 | 0.90 | 0.68 - 1.18 |
| Long-acting or permanent | 0.78 | 0.57 - 1.07 | 0.78 | 0.57 - 1.07 | 0.79 | 0.58 - 1.07 | 0.78 | 0.57 - 1.06 | 0.78 | 0.57 - 1.07 | 0.78 | 0.57 - 1.07 | 0.78 | 0.57 - 1.07 |
| Rho | 0.0703 | | 0.0613 | | 0.0653 | | 0.0627 | | 0.0696 | | 0.0704 | | 0.0681 | |
| Number of women | 2,456 | | 2,456 | | 2,456 | | 2,456 | | 2,456 | | 2,456 | | 2,456 | |
| Number of regions | 30 | | 30 | | 30 | | 30 | | 30 | | 30 | | 30 | |

Note: P-value: +<0.10, *<0.05, **<0.01, ***<0.001

**(Continued…)**

Table A5. – *Continued*

| | Rural | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Quality of service environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | 1.14 | 0.67 - 1.92 | | | | | | | | | | |
| High | | | 0.67+ | 0.42 - 1.07 | | | | | | | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | 1.89* | 1.15 - 3.09 | | | | | | | | |
| High | | | | | 1.77** | 1.16 - 2.69 | | | | | | | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | 0.90 | 0.51 - 1.56 | | | | | | |
| High | | | | | | | 1.04 | 0.64 - 1.71 | | | | | | |
| Quality of care environment | | | | | | | | | | | | | | |
| Simple (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | 1.17 | 0.66 - 2.09 | | | | |
| High | | | | | | | | | 0.99 | 0.60 - 1.64 | | | | |
| Weighted (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | 1.80** | 1.15 - 2.82 | | |
| High | | | | | | | | | | | 1.11 | 0.65 - 1.88 | | |
| PCA (ref = low) | | | | | | | | | | | | | | |
| Medium | | | | | | | | | | | | | 1.02 | 0.54 - 1.91 |
| High | | | | | | | | | | | | | 1.16 | 0.72 - 1.88 |
| Education (ref = none) | | | | | | | | | | | | | | |
| Primary | 1.07 | 0.84 - 1.36 | 1.07 | 0.84 - 1.36 | 1.07 | 0.84 - 1.36 | 1.07 | 0.84 - 1.36 | 1.07 | 0.84 - 1.36 | 1.06 | 0.84 - 1.36 | 1.07 | 0.84 - 1.36 |
| Secondary or higher | 1.25 | 0.80 - 1.94 | 1.25 | 0.80 - 1.94 | 1.23 | 0.80 - 1.91 | 1.25 | 0.80 - 1.94 | 1.25 | 0.80 - 1.94 | 1.24 | 0.80 - 1.94 | 1.25 | 0.80 - 1.94 |
| Occupation (ref= unemployed) | | | | | | | | | | | | | | |
| Agricultural/Manual | 0.98 | 0.73 - 1.32 | 0.97 | 0.73 - 1.30 | 0.99 | 0.74 - 1.34 | 0.98 | 0.73 - 1.32 | 0.98 | 0.73 - 1.32 | 0.97 | 0.73 - 1.31 | 0.99 | 0.73 - 1.32 |
| Professional | 0.81 | 0.42 - 1.58 | 0.80 | 0.41 - 1.56 | 0.82 | 0.42 - 1.60 | 0.81 | 0.42 - 1.58 | 0.81 | 0.42 - 1.57 | 0.81 | 0.42 - 1.56 | 0.81 | 0.41 - 1.58 |
| Other | 0.85 | 0.56 - 1.31 | 0.85 | 0.56 - 1.30 | 0.86 | 0.56 - 1.32 | 0.86 | 0.56 - 1.31 | 0.85 | 0.56 - 1.31 | 0.85 | 0.56 - 1.30 | 0.85 | 0.56 - 1.31 |
| Wealth quintile | | | | | | | | | | | | | | |
| Lowest | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref | ref |
| Second | 1.18 | 0.96 - 1.45 | 1.18 | 0.96 - 1.45 | 1.18 | 0.96 - 1.45 | 1.18 | 0.96 - 1.45 | 1.18 | 0.96 - 1.45 | 1.18 | 0.96 - 1.46 | 1.18 | 0.96 - 1.45 |
| Middle | 1.07 | 0.79 - 1.47 | 1.07 | 0.79 - 1.46 | 1.07 | 0.78 - 1.46 | 1.07 | 0.78 - 1.46 | 1.07 | 0.79 - 1.47 | 1.07 | 0.78 - 1.47 | 1.07 | 0.78 - 1.47 |
| Lowest-middle | | | | | | | | | | | | | | |
| Fourth | 0.87 | 0.61 - 1.23 | 0.87 | 0.62 - 1.23 | 0.86 | 0.61 - 1.21 | 0.86 | 0.61 - 1.23 | 0.87 | 0.61 - 1.23 | 0.87 | 0.61 - 1.24 | 0.87 | 0.61 - 1.24 |
| Highest | 0.68 | 0.43 - 1.09 | 0.69 | 0.43 - 1.09 | 0.65+ | 0.41 - 1.04 | 0.68 | 0.43 - 1.09 | 0.68 | 0.43 - 1.09 | 0.67+ | 0.41 - 1.07 | 0.68 | 0.43 - 1.10 |
| Marital status (ref = never married) | | | | | | | | | | | | | | |
| Currently married | 0.80 | 0.56 - 1.13 | 0.80 | 0.56 - 1.13 | 0.80 | 0.57 - 1.14 | 0.80 | 0.56 - 1.13 | 0.80 | 0.56 - 1.13 | 0.80 | 0.56 - 1.14 | 0.80 | 0.56 - 1.13 |
| Formerly married | 0.48*** | 0.34 - 0.68 | 0.48*** | 0.34 - 0.68 | 0.49*** | 0.34 - 0.69 | 0.48*** | 0.34 - 0.68 | 0.48*** | 0.34 - 0.68 | 0.49*** | 0.34 - 0.69 | 0.48*** | 0.34 - 0.68 |
| Number of living kids (ref = 0) | | | | | | | | | | | | | | |
| 1-4 | 3.48*** | 1.83 - 6.62 | 3.50*** | 1.84 - 6.64 | 3.43*** | 1.80 - 6.54 | 3.48*** | 1.83 - 6.62 | 3.49*** | 1.84 - 6.63 | 3.48*** | 1.83 - 6.61 | 3.48*** | 1.83 - 6.61 |
| 5+ | 2.82** | 1.47 - 5.41 | 2.84** | 1.48 - 5.44 | 2.77** | 1.44 - 5.33 | 2.82** | 1.47 - 5.42 | 2.82** | 1.47 - 5.42 | 2.81** | 1.47 - 5.40 | 2.82** | 1.46 - 5.42 |
| Exposure to family planning messages (ref = none) | | | | | | | | | | | | | | |
| Yes | 1.54*** | 1.21 - 1.97 | 1.54*** | 1.21 - 1.96 | 1.55*** | 1.21 - 1.98 | 1.54*** | 1.21 - 1.96 | 1.54*** | 1.21 - 1.97 | 1.54*** | 1.20 - 1.97 | 1.54*** | 1.21 - 1.97 |
| Current contraceptive use (ref = none) | | | | | | | | | | | | | | |
| Traditional | 0.96 | 0.77 - 1.21 | 0.97 | 0.77 - 1.21 | 0.96 | 0.76 - 1.21 | 0.96 | 0.77 - 1.21 | 0.96 | 0.77 - 1.21 | 0.97 | 0.77 - 1.22 | 0.96 | 0.77 - 1.21 |
| Short-acting | 1.09 | 0.89 - 1.34 | 1.09 | 0.89 - 1.33 | 1.10 | 0.90 - 1.34 | 1.09 | 0.89 - 1.34 | 1.09 | 0.89 - 1.34 | 1.10 | 0.90 - 1.34 | 1.09 | 0.89 - 1.34 |
| Long-acting or permanent | 0.90 | 0.64 - 1.28 | 0.90 | 0.63 - 1.27 | 0.90 | 0.64 - 1.28 | 0.90 | 0.64 - 1.27 | 0.90 | 0.64 - 1.27 | 0.90 | 0.64 - 1.28 | 0.90 | 0.64 - 1.27 |
| Rho | 0.0767 | | 0.0687 | | 0.0556 | | 0.0758 | | 0.0759 | | 0.0584 | | 0.0750 | |
| Number of women | 4,075 | | 4,075 | | 4,075 | | 4,075 | | 4,075 | | 4,075 | | 4,075 | |
| Number of regions | 29 | | 29 | | 29 | | 29 | | 29 | | 29 | | 29 | |

Note: P-value: +<0.10, *<0.05, **<0.01, ***<0.001

# Appendix Figures

**Figure A1a. Distribution of family planning quality of service scores among facilities with family planning services, Haiti SPA 2013**

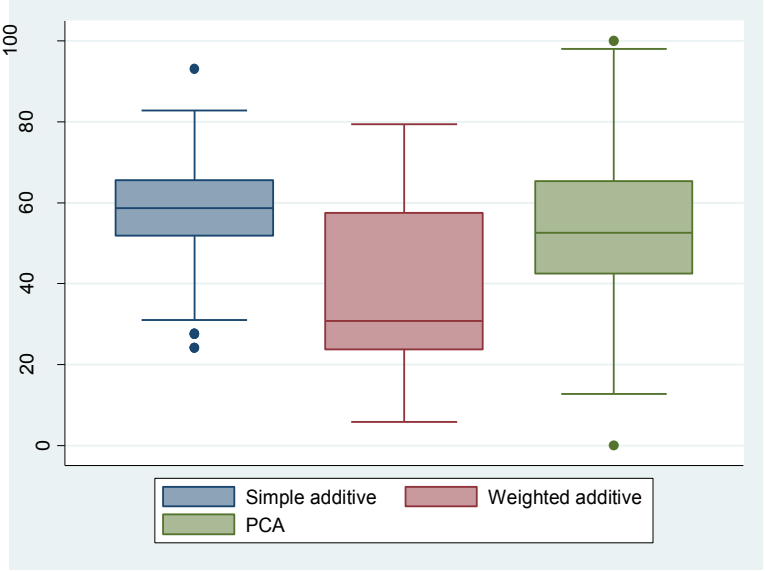



**Figure A1b. Distribution of family planning quality of service scores among facilities with family planning services, Malawi SPA 2014-15**

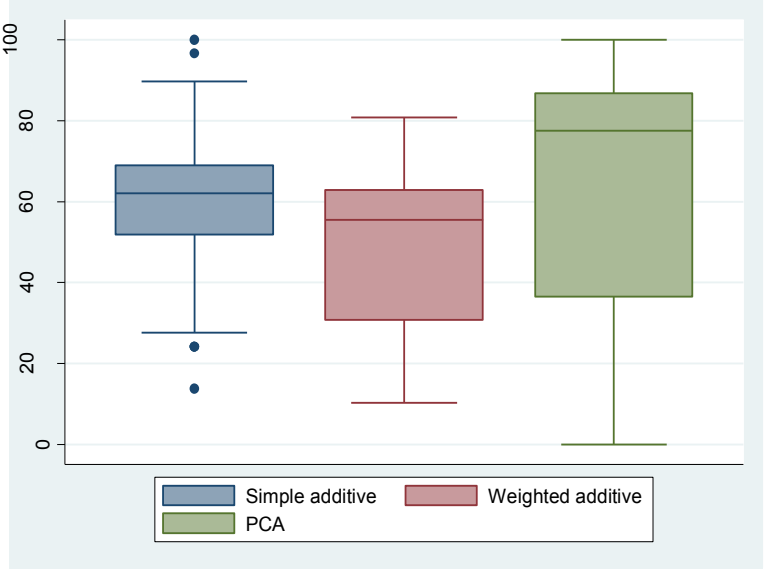


**Figure A1c. Distribution of family planning quality of service scores among facilities with family planning services, Tanzania SPA 2014-15**

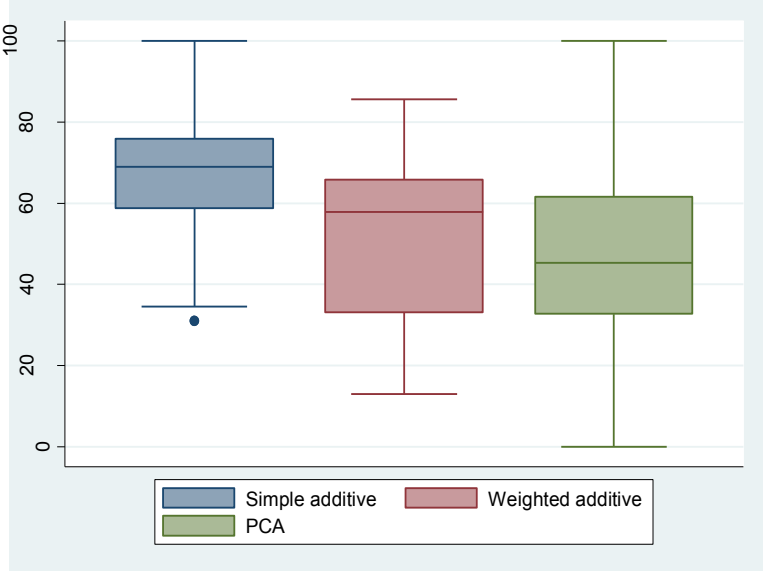



**Figure A2a. Distribution of family planning quality of care scores among facilities with family planning services, Haiti SPA 2013**

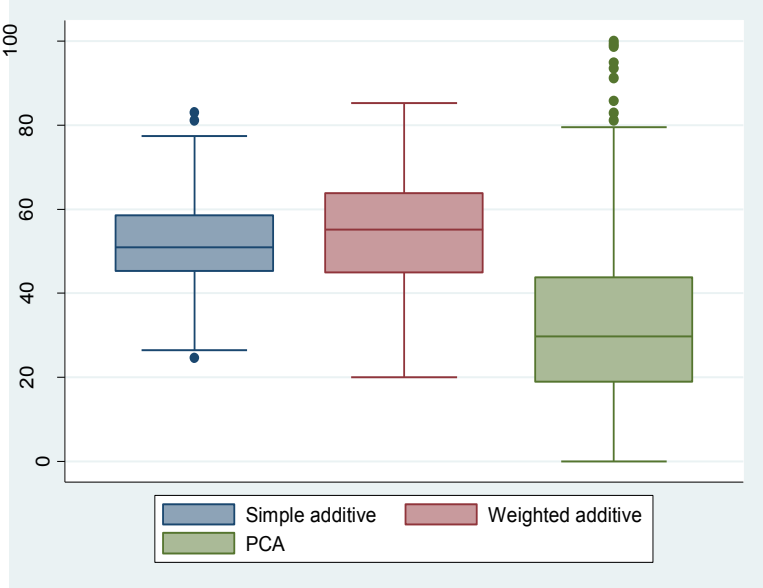


**Figure A2b. Distribution of family planning quality of care scores among facilities with family planning services, Malawi SPA 2013-14**

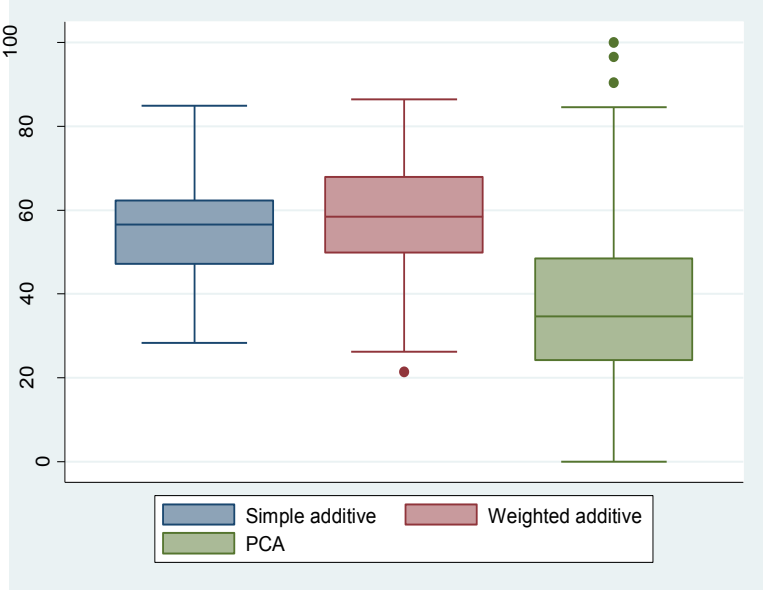



**Figure A2c. Distribution of family planning quality of care scores among facilities with family planning services, Tanzania SPA 2014-15**

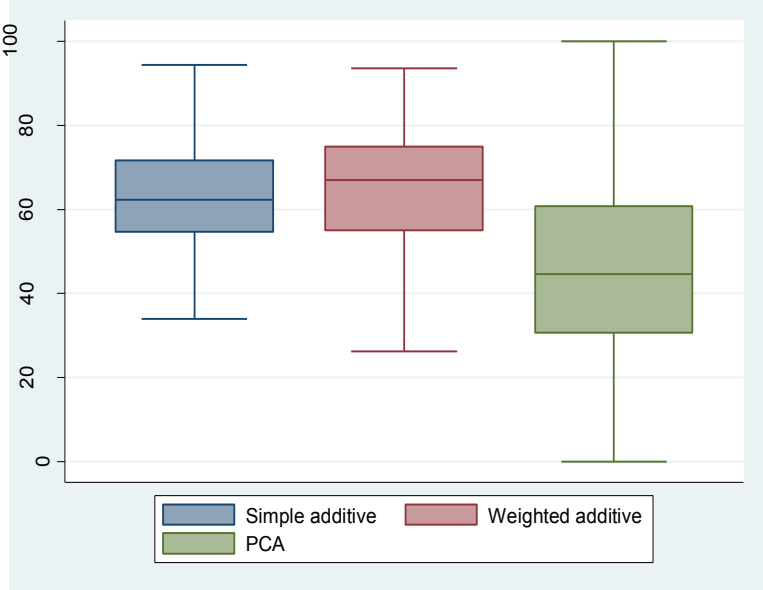


**Figure A3a. Cluster-level scores for quality of service environment, by scoring mechanism and residence type, Haiti DHS 2012**

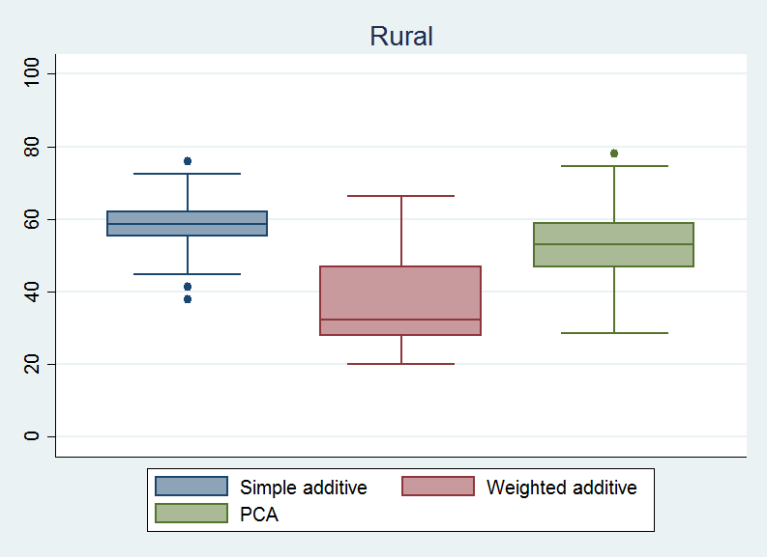
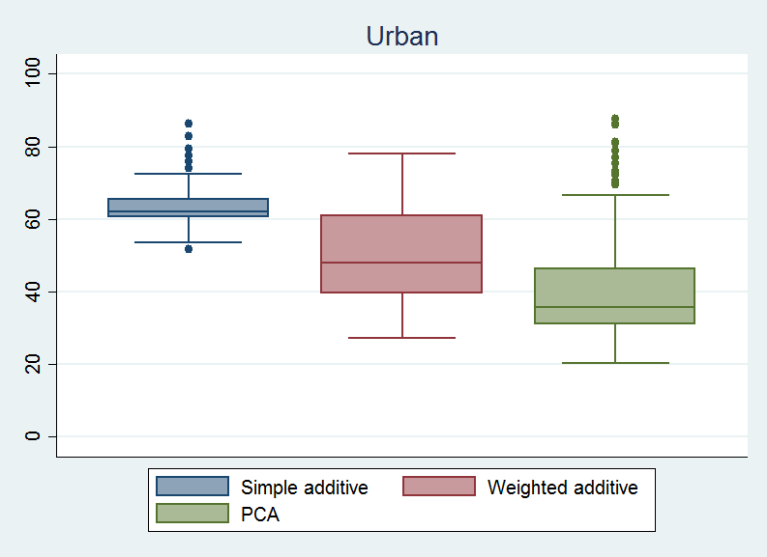



**Figure A3b. Cluster-level median scores for quality of service environment, by scoring mechanism and residence type, Malawi DHS 2015-16**



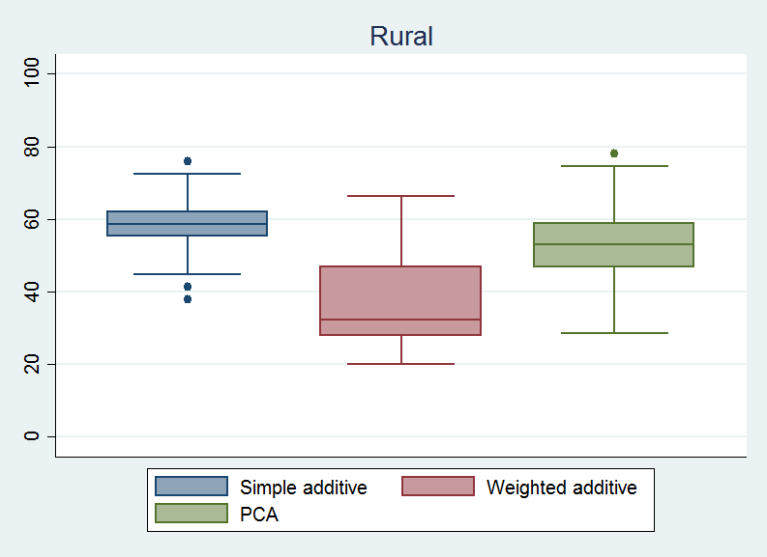



**Figure A3c. Regional-level median scores for quality of service environment, by scoring mechanism and residence type, Tanzania DHS 2015-16**

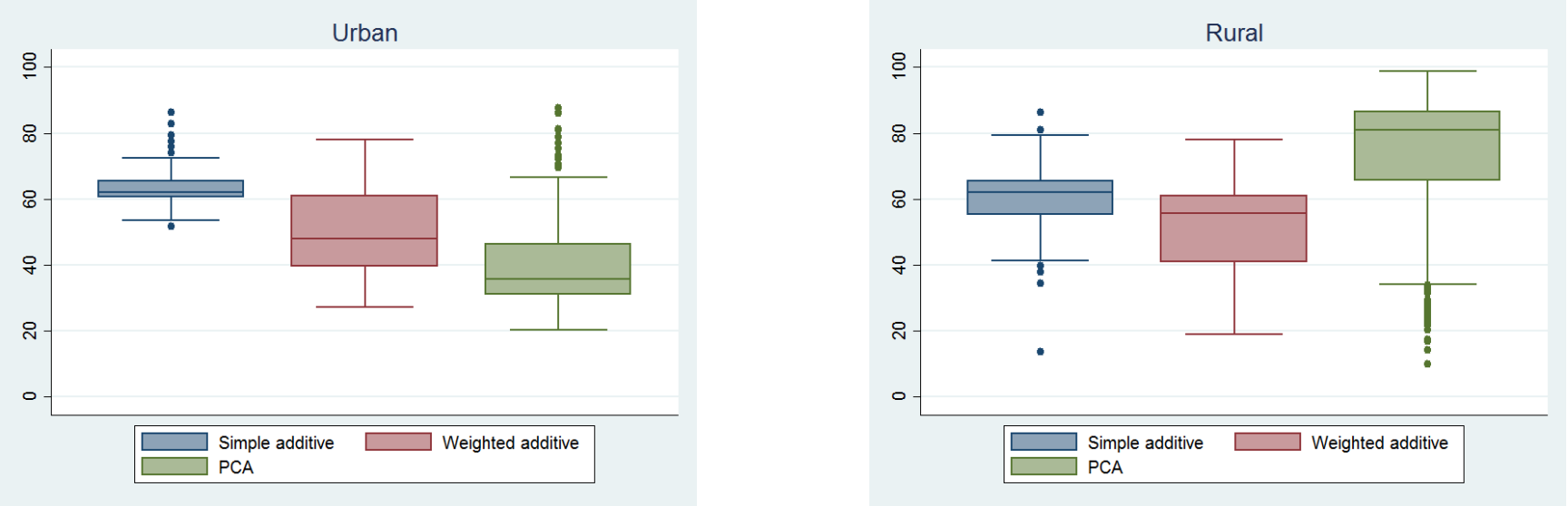
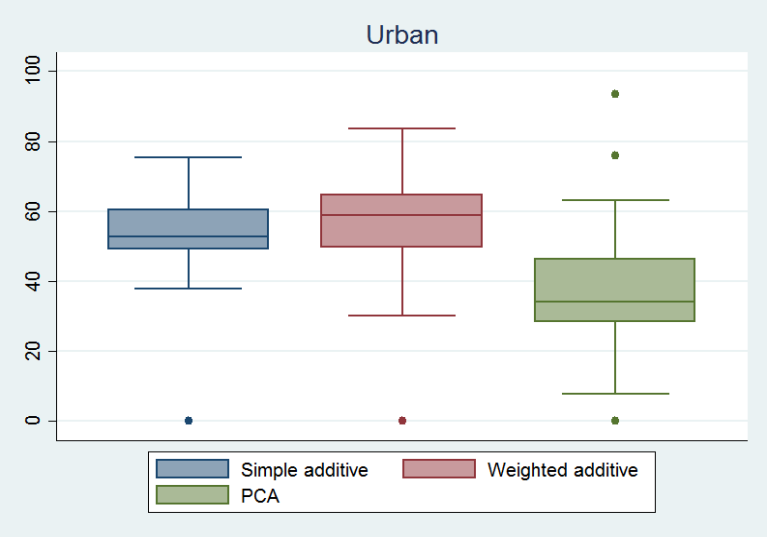


**Figure A4a. Cluster-level scores for quality of care environment, by scoring mechanism and residence type, Haiti DHS 2012**



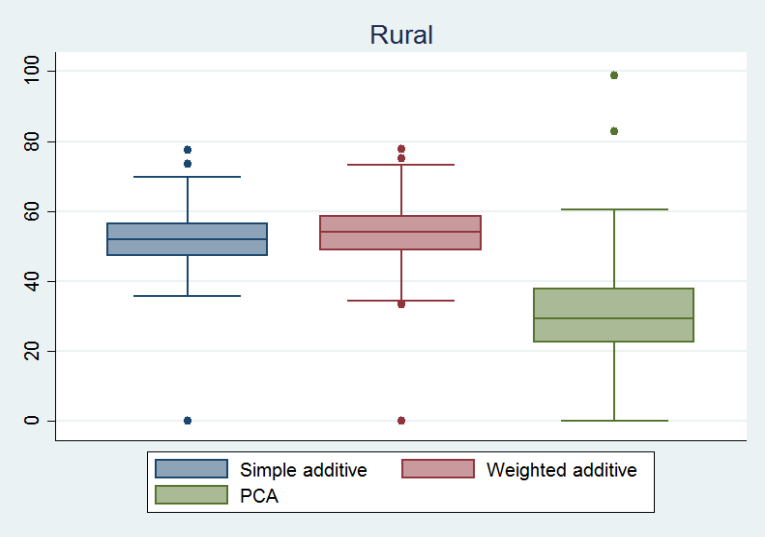



**Figure A4b. Cluster-level median scores for quality of care environment, by scoring mechanism and residence type, Malawi DHS 2015-16**

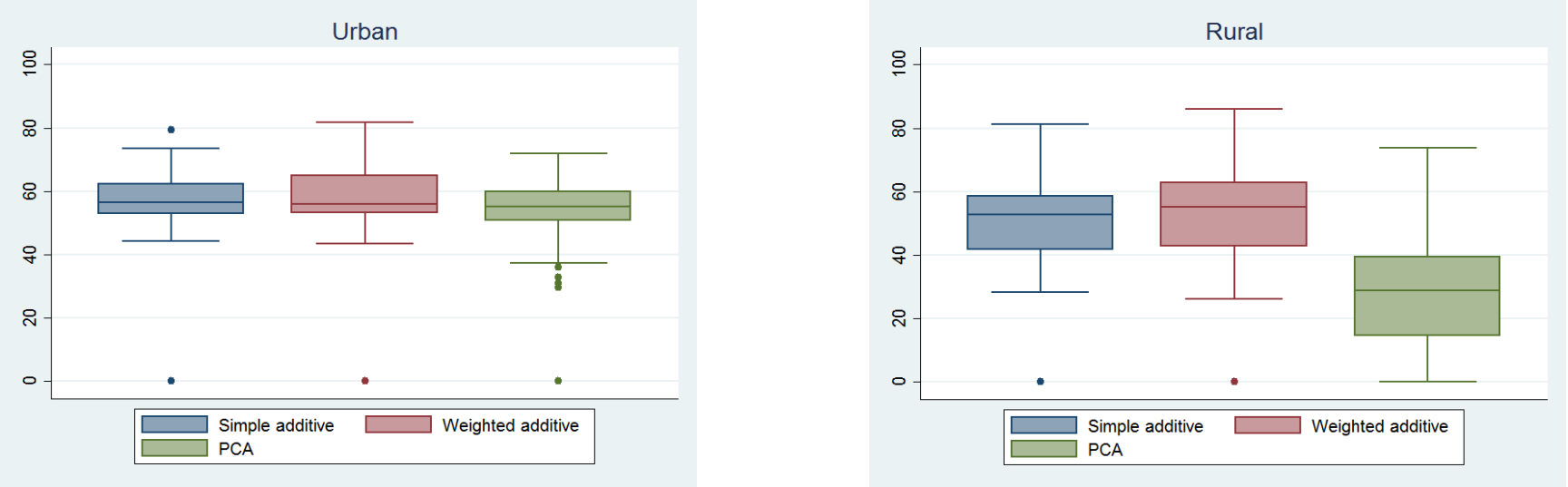



**Figure A4c. Regional-level median scores for quality of care environment, by scoring mechanism and residence type, Tanzania DHS 2015-16**