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The effect of service environment on demand and use of injectable contraceptives in Malawi

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Abstract

Context—Previous studies have identified positive relationships between geographic proximity to family planning services and contraceptive use but have not accounted for the effect of contraceptive supply reliability or the diminishing influence of facility access as distance increases.

Methods—We used kernel density estimation to geographically link a woman’s use of injectable contraceptives and demand for birth spacing/limiting in Malawi with routine contraceptive logistics data from family planning service delivery points. Using linear probability models, we estimated the associations between access to services, measured by distance alone and distance adjusted by supply reliability, and injectable use and demand for birth spacing or limiting in rural and urban environments.

Results—Access to services is an important predictor of injectable use. Women in rural communities with the most access by both measures were over 7 percentage points more likely to report injectable use than women with the least access. In urban environments, women with more reliable contraceptive supplies reported up to 18.3 percentage points higher demand for birth spacing or limiting than women with the least distance-and-supply access.

Conclusions—Our findings highlight the importance of product availability in the local service environment, and its relationship with demand for and use of family planning. Constructing facility service environments using kernel density estimation provides a refined means of linking women with services that takes into account distance decay and supply reliability. Distinct urban and rural results highlight the importance of considering both urban and rural service environments when working to improve modern contraceptive use.

Introduction

According to the World Bank, “Every day, nearly 800 women across the globe die due to complications during pregnancy and childbirth; 99 percent of these deaths occur in developing countries.”¹ Although the global maternal mortality rate fell by nearly half between 1990 and 2010, it remains well short of the Millennium Development Goal 5 of a 75 percent reduction by 2015.² In sub-Saharan Africa, where maternal mortality is highest, rates fell by less than 42 percent from 1990 to 2010.²

One of the most basic methods of avoiding maternal deaths is primary prevention—that is, preventing pregnancy, particularly unplanned and unwanted pregnancies.³ For decades, family planning programs have worked to reduce unplanned and unwanted pregnancies. Despite advances in the use of family planning, it is estimated that up to 26 percent of married women in sub-Saharan Africa have an unmet need for family planning; i.e. they want to delay or avoid childbearing but are not using any family planning method.⁴ Satisfying unmet need could reduce the number of maternal deaths each year by an estimated 25 to 40 percent.^{3,5} Understanding and reducing barriers of access to, and increasing the availability of, family planning services and contraceptive supplies are therefore essential.

Increasing access to family planning services encompasses improvements to the affordability, geographic proximity, and quality of services provided. Increases in all of these are associated with increased contraceptive use.^{6,7,8,9} Research has shown that prevalence of contraceptive use within a country is directly correlated with measures of access to individual contraceptive methods as well as a wider choice of method options.^{8,10,11} Wang and colleagues linked contraceptive use with availability of contraceptive products at the subnational level in East Africa using national-level household and health facility surveys, while Ngabo and colleagues showed similar associations using national-level household surveys and district-level logistics data.^{8,12} These studies, however, have focused predominately on the ecological level and thus have not been able to establish a direct relationship between individual contraceptive use and contraceptive availability in a person’s service environment.

Understanding access barriers to family planning at the individual level is critical. At the individual level, product satisfaction and availability are known drivers of repeat consumerism. The costs in terms of time and money spent acquiring contraceptive supplies have been shown to be important determinants in contraceptive use, given an existing level of demand for contraception.⁹ Within households, men and women apply the same rational decision making to family planning commodities as they do to other household goods; users

expect to be able to purchase or receive quality products when desired.^{13,14} When the product is not available, consumers may decide to substitute the desired item, delay the purchase, forgo the purchase, or search elsewhere. Commodity stockouts affect future consumer shopping behaviors.^{15,16,17} In developing countries, where many family planning consumers from rural areas face long distances and high relative costs when seeking contraceptives, it stands to reason that future patronage of a clinic is likely compromised if consumers find that the clinic is out of stock. Even in areas where contraceptives are provided to clients free of charge, a reliable supply of commodities may be an important factor in decisions about whether or not to seek and use family planning services.

Understanding the relationship between facility factors and a woman's choice to seek family planning services at a particular facility requires establishing a link between individual women and the individual facilities visited. Creating this link is a challenge in the absence of self-reported facility use. Connecting women with a facility requires data that include geographic coordinates for the woman's location and the facility location, which may be difficult to obtain.¹⁸ Studies have linked individuals and clusters of households with the geographically closest facility,^{19–24} yet this implicit assumption that the closest facility is the one used likely introduces substantial misclassification error.²⁵ Another common method, based on Euclidean distance measurements, has been to link a woman or cluster with one or more facilities within a specific buffer or polygon.^{8,26} While this approach may reduce the misclassification error, the size of the buffer or polygon has implications for analysis and interpretation.

Another method to operationalize a link to services uses kernel density estimation (KDE), a spatial technique that distributes a discrete point value over a continuous surface.^{27,28} KDE allows the user to consider facility attributes that may influence the use of services along with distance decay (the decline in a facility's influence on an individual's behavior the further the individual is from the facility) to estimate a facility's geographic reach. KDE has been used to assess availability of health services in Nicaragua,²⁹ link Demographic and Health Survey (DHS) household survey data with facility data in Rwanda,²⁵ and evaluate access to sexual and reproductive health care in rural Mozambique.⁷ KDE applies an underlying assumption that a facility serves a continuous catchment area covering a certain geographic space, with higher use among those living closer to the facility. For locations near multiple facilities, catchment areas for each are summed, providing better representation of the total service environment.

This study builds on existing evidence for a relationship between access to contraceptives and contraceptive prevalence by directly linking use of family planning methods with the availability of contraceptive supplies in the local service environment. In an effort to understand the role that facilities and product supply have on a woman's contraceptive use and demand for services in Malawi, we applied KDE to incorporate timely contraceptive supply data into our access measure. This use of routinely collected contraceptive logistics data (such as quantities of supplies dispensed monthly and monthly closing supply balances) creates a more refined estimation of the service environment available to consumers.^{7,25,30}

Malawi Context

In Malawi, the family planning service environment has been developing and maturing over recent decades. The modern contraceptive prevalence rate among all women of reproductive age increased from 6 percent in 1992 to 33 percent in 2010,³¹ with corresponding declines in maternal mortality, which fell from 1,100 to 460 deaths per 100,000 live births.³² Among women using modern contraception, the most popular method reported was injectables (59 percent), followed by female sterilization (23 percent), male condoms (8 percent), and oral contraceptives (6 percent).³¹

Malawi's public sector is the dominant family planning service provider, serving 74 percent of all modern contraceptive users.³¹ Among users of injectable contraceptives, 84 percent are served in the public sector.³¹ An additional 9 percent of injectable users are seen at facilities operated by the Christian Health Association of Malawi (CHAM), a nongovernmental organization that routinely orders contraceptives and other commodities through the public sector logistics system.³¹ Women using Depo Provera, the injectable provided through the public sector in Malawi, as their main source of contraception must visit a provider every quarter for a new injection. Condoms, pills, and injectables are provided free of charge at public health centers and hospitals and through community-based distribution (CBD) agents as part of the essential health package. In 2010, all trained providers (regardless of cadre) could administer injectables at facilities. CBD agents were allowed to provide once they received training. As training was being scaled up in 2010, though some CBD agents could provide injections, most could not. Consequently, while CBD agents are authorized to provide condoms, pills, and injectables during door-to-door visits, the proportion of the population that received injectables from a CBD agent in 2010 was negligible.³¹

Facilities receive family planning and other commodities directly from regional medical stores. The supply chain management system tracks commodities requested by and distributed to each facility. To examine the relationship between a woman's use of family planning methods and her local service environment, we focused exclusively on injectables as the most widely used method requiring routine access to service delivery sites. We targeted public and CHAM sites given their dominant market share for injectables.

Methodology

Data

This analysis relied on three datasets from Malawi: 1) 2010 contraceptive logistics management information system (LMIS) data; 2) the 2009 Malawi master health facility list; and 3) the 2010 Malawi Demographic and Health Survey (2010 MDHS).

The USAID | DELIVER PROJECT has been electronically collecting routine logistics data on contraceptive commodities at public and CHAM health facilities in Malawi since 2008. Using Supply Chain Manager v3 (Arlington, VA), an open source LMIS software, quantities of product dispensed at each health facility and the closing balance of commodities in stock at each facility are recorded monthly. This allows for the assessment of commodity availability at the end of any given month. For our analysis, we restricted the LMIS dataset

to health facilities that reported either having or distributing injectable contraceptives (Depo Provera®) any time in 2010. In total, we identified 483 health facilities as injectable contraceptive service delivery sites with unique facility identification codes.

The 2009 master health facility list identified 930 public and private health facilities by name and geographic coordinates in Malawi as of 2009.³³ We merged the facility file with the LMIS data to create a facility dataset with the geographic coordinates of facilities with and without injectable contraceptive services. We excluded facilities if they lacked a unique identifier (n=234), which was typical for private facilities, or if no valid geographic coordinates were available (n=125). In total, we included 571 facilities; 423 of these were injectable contraceptive service delivery sites.

The 2010 MDHS was a national population-based household survey implemented by the National Statistical Office of Malawi and ICF Macro from June to November 2010.³¹ Approximately 27,000 households participated, providing information on individual and household characteristics and routine health topics, including family planning practices and use of health services. The 2010 MDHS sample was selected from the 2008 national census enumeration areas using a stratified two-stage cluster design. Locations of sampled clusters were recorded at the centroid of each cluster with global positioning system (GPS) receivers. To protect survey respondent confidentiality, the DHS Program routinely displaces GPS coordinates for urban and rural clusters.³⁴ For the 2010 MDHS, urban clusters were randomly displaced up to 2 km, and rural clusters were displaced up to 5 km, with 1 percent of rural clusters displaced up to 10 km. The total 2010 MDHS sample included 849 clusters; 827 of those with valid displaced geographic coordinates were included in this analysis.

Dependent Variables

The two primary outcomes, current use of an injectable contraceptive and demand for birth spacing or limiting, are dichotomous variables created from the woman's individual recode file from the 2010 MDHS.

In the 2010 MDHS, women aged 15 to 49 years were asked about current contraceptive method use. We coded women reporting current injectable contraceptive use as current users. We coded women reporting either no method use or use of another reversible method (e.g., condom, pill, traditional method, withdrawal, or abstinence) as non-users of injectable contraceptives. The objective was to compare women using injectables with those women who are potential injectable users whom a family planning program might target. We excluded women from the analysis who reported using long-acting or permanent methods or reported being infecund on the basis that they were neither current nor potential users of injectable contraceptives.

The 2010 MDHS also asked women about their desire to have more children now or in the future. We coded women as having demand for birth spacing or limiting if they reported an interest in delaying a pregnancy by more than two years or desired no more children. We coded women as not having demand for spacing or limiting if they desired a child within the next two years, were unsure about the timing of the next pregnancy, or were undecided about a next pregnancy. We excluded women who reported being sterile or infecund. Since

demand for birth spacing or limiting is independent of reported use of contraception, reported demand includes both women currently using contraceptives as well as those not using any family planning method.

Independent Variables

We defined the independent variable, access to injectable family planning services, in two ways: 1) distance to one or more injectable service sites based on kernel density mapping (henceforth distance only) and 2) a broader conceptualization that encompassed distance to one or more injectable service sites as well as the reliability of injectable supplies at those sites (henceforth distance and supply).

Constructing each access variable required linking 2010 MDHS clusters with health facilities from the master facility dataset using KDE. We incorporated a distance decay function into the KDE and created a KDE surface representing access defined by distance only as follows. We defined the kernel size as 10 km around every mapped health facility regardless of type of facility or location. This was based on the assumptions that visits to acquire injectable contraceptives center on product availability rather than facility type, and that urban facilities have similar geographic draw for nearby peri-urban communities as rural facilities have for their communities. We set the density variable to 1 for all injectable service delivery points and 0 for facilities not providing injectable services. We set the grid cell size to 500 meters. Figure 1a presents an example of the KDE surfaces generated for health facilities 1–3. Access (shown by blue to yellow shading) is limited to a 10 km diameter around each facility, with the intensity of access diminishing as one moves further from the facility, representing the distance decay effect. Overlapping KDE surface areas from facilities 1 and 2 show a higher intensity of service access for the combined service environment typical in an urban area. Next we superimposed the 2010 MDHS clusters over the KDE surface, drawing buffers around each cluster as recommended when linking clusters to surface data.³⁰ We used 5-km buffers around urban clusters and 10-km buffers around rural clusters to minimize misclassification error created by DHS cluster displacement (see figure 1b).^{25,30} We generated an average KDE value summing all pixels within the buffered area around each cluster and divided the average KDE values for all clusters into quintiles, creating a relative access variable ranging from the least access (1) to the most access (5)^{1*}. Finally, we assigned the quintile value for each cluster to all women residing in that cluster.

We next assessed the reliability of injectable supplies for each facility as follows. We assigned a score of 1 for a given month to facilities that had available supply of injectable contraceptives during that month. We assigned a facility a monthly score of 0.5—indicating the likely availability of injectable contraceptives—if it lacked data on its closing monthly balance but had been dispensing stock for the month in question, the previous month, and the subsequent month. We assigned a score of 0 to facilities that did not meet the above criteria for any given month. We then summed the monthly scores to create a 2010 annual

^{1*} Changes in value of a continuous KDE variable are not readily interpretable. By creating quintiles, we consider relative access from one cluster to other clusters. This is akin to the DHS Wealth Index, where the value itself is uninformative but wealth quintiles are frequently used.

supply reliability score for each facility. Reliability scores ranged from 0 to 12, with a mean of 6.25 and a median of 6.

To operationalize access as defined by distance and supply reliability, we repeated the KDE process using the annual supply reliability score as the density variable. We then repeated all other steps including buffering and creating a relative quintile score with the distance-and supply-access KDE.

Analysis

Among modern contraceptive methods, our analysis is restricted to injectable contraceptives for three reasons. First, as indicated above, injectable contraceptives were the most widely used method reported by the 2010 MDHS among modern contraceptive users (59percent).³¹ Second, use of injectables in Malawi in 2010 required quarterly visits to a health facility, making routine access an important consideration when choosing a method. Lastly, the link between the distribution of injectable contraceptives and actual use is assumed to be stronger than for other commodities. Whereas oral contraceptives and condoms, once they are distributed, may or may not ultimately be used by the client, injectable contraceptives are generally distributed by a trained health provider and “used” the moment they are distributed.

We generated descriptive statistics of the study population and maps representing the two access definitions. We completed all spatial linking and geographic analyses in ArcGIS v10.1 (Redlands, CA).

After spatially linking the sample of women with the mapped health facilities and assigning values for the two access measures based on the cluster location, we used the above access measures in four regression models. We ran bivariate and multivariate linear probability models for each of the two outcome variables, use of injectable contraception and demand for birth spacing or limiting. Control variables included maternal age, education, marital status, parity, wealth, religion, rural residence and region of residence, reported exposure to family planning messaging, reported home visit from a health worker advocating family planning, and desire for more children. We used weighted 2010 MDHS data and produced robust standard errors for all regression models using STATA SE v12 (College Station, TX).

For each outcome variable, multivariate models were built to examine the effect of access defined by distance only and defined by distance and supply. We ran each model for all women of reproductive age; both combined and stratified by rural/urban residence. Additionally we ran each model for married women only, as they frequently have different contraceptive intentions and patterns of use.

Results

The 2010 MDHS sample used in this analysis included 22,480 women 15 to 49 years of age from 827 mapped MDHS clusters. Nineteen percent of the women reported current use of injectable contraceptives, 70 percent had demand for family planning, and almost all (96percent) lived within 10 km of an injectable service delivery site (Table 1). Over half of

the women (60 percent) reported exposure to family planning media messages, although less than a fifth (14 percent) had received a home visit from a family planning worker in the previous year. A majority of women lived in rural communities (82 percent), were currently married (67 percent), and reported at minimum some primary schooling (85 percent). Urban women tended to be better educated, have fewer children, were wealthier, and lived closer to an injectable delivery site than rural women.

As described previously, using KDE, we created two variables to define access based on proximity and supply reliability within the local service environment: distance only and distance and supply. We mapped the potential geographic catchment area for facilities for distance only (Figure 2a) and when incorporating the value of injectable supply reliability—distance and supply (Figure 2b). The distance-only map presents the ideal scenario if all facilities had a reliable monthly supply of injectables available. The distance-and-supply map presents a picture of service access once supply reliability is taken into account. When comparing the two maps, we see areas with potential gaps in service access, such as the Central Region, where the injectable supply was less reliable.

In both multivariate regression models, access to injectable contraceptive service delivery sites was a positive predictor of injectable use in the total sample of women (Table 2). The probability of using injectables, when considering distance only, was 5.6 to 5.7 percentage points higher among women with more and most access to delivery sites compared with those with the least access, holding all other factors constant. Likewise, when considering access based on distance and supply reliability, the probability of using injectables showed a similar pattern for women with average, more, and most access to services with an estimated 3.3, 4.4, and 5.2 percentage point higher probability of using injectables compared with women with the least access. Other predictors in the models demonstrated expected effects, with desire for more children, age, marital status, and parity, all influential in a woman's choice to use injectables (data not shown). Compared with women living in the Northern Region, women in the Central and Southern Regions were more likely to use injectables. The second outcome, demand for birth spacing or limiting, was only associated with access among those in the highest quintile for the entire sample (Table 2).

Following stratification of the population by rural and urban residence, we found that the relationship between access and use strengthened for women from rural communities. This relationship disappeared in the analysis of women from urban environments. In contrast, the association between distance-and-supply access and demand for spacing or limiting childbirth among the urban population of women is substantial, but this relationship virtually disappeared when we considered the rural population only. Given these results, we focus on the full models for access and use in rural areas and for access and demand in urban areas.

As seen in Table 3, the probability of injectable use among rural women with the best distance-and-supply access to injectable service delivery sites was 7.5 percentage points higher than among their counterparts with the least access. Demand-generation activities, such as receiving a family planning visit in the past year and media messaging had mixed results; home visits were predictive of use (3.2 percentage points) while media exposure to family planning messaging had no effect. Desire for spacing or limiting childbirth as well as

increasing parity were positively associated with use. Other predictors included age, marital status, wealth, and region.

On the other hand, the probability for having some demand for birth spacing or limiting among urban women with the most distance-and-supply-defined access was 18.3 percentage points higher than it was for those with the least access (Table 4). The association between access and demand was not evident when defining access by distance only. In both models, women who reported a family planning home visit had between a 6.8 and 7.4 percentage point higher demand than those receiving no visits, while media exposure had no measurable effect. Other predictors of demand included age, parity and region. Interestingly, education, marital status and wealth status were not predictive of demand among urban women.

We found similar regression results when we restricted the data to married women only (data not shown).

Discussion

The dynamics between access and use of contraceptives and between access and demand for birth spacing or limiting are different in urban and rural environments. Access to injectable family planning services in the local service environment was predictive of a higher probability of injectable use among rural residents in our models, confirming the important role service availability plays in contraceptive use in developing contexts.^{7,8,19,35} However, measuring access by distance and reliability of injectable supplies did not improve upon the distance-only access model for the rural population. This suggests that in rural environments, access to facilities defined by distance is more salient in limiting use than reliability of supply. The predictive effect size of distance-only access among rural women is comparable to the effect size seen with improving education, increasing wealth, or receiving a family planning home visit (Table 3). These results suggest that programs designed to improve rural women's proximity to family planning services, including expanding CBD agents, service locations, and provision of services through the private sector, are practical methods of improving family planning use from a health system perspective.

This same relationship between either access variable and injectable use was not found among urban women in any access category. This may be attributable to more homogeneity across access categories for urban women. The assignment to quintiles for the access variables was performed with the total sample of clusters to create the two access variables for the entire country. When we focused only on urban women, we found that greater than 95 percent had average or better access (quintiles 3, 4, and 5) and 100 percent of urban women lived within 10 km of an injectable service delivery point. In an urban environment where proximity is less of a barrier, other factors play a larger role in predicting use. These findings reinforce recommendations to look deeper into rural/urban differences to understand population and health outcomes.³⁶

Our findings relating access with demand for birth spacing or limiting tell a different story. Among rural women, access to injectable family planning services had no measurable relationship with spacing or limiting births. This was not an entirely surprising outcome;

availability of contraceptives likely is not adequate to generate demand. Rather, efforts to increase demand for limiting family size or spacing births through education and outreach remain a necessary complement to efforts to increase access.

A more surprising finding was the strong relationship between access and demand in the urban environment. This relationship was evident only for the distance-and-supply access variable. The effect size for best distance-and-supply access was larger than that attributed to education or family planning home visits (Table 4). Using DHS data with only one time point, it is not possible to tease out the direction of this relationship. One possible explanation is that reliable supply at a facility increases demand, possibly by influencing neighborhood norms in urban communities. Alternatively, communities with perceived high demand for family planning may have been prioritized for supply chain improvements; hence, reliable supply is available to meet the demand. Understanding the motivations and deterrents to family planning use in urban environments remains a challenge given the traditional DHS data on which we rely for analyses.

Our study's use of KDE and focus on contraceptive supply logistics also reveals substantial gaps in supply reliability and illustrates the ideal scenario if supply were constant. These maps suggest potential geographic priority areas for supply chain improvements, such as the Central Region that suffered from unreliable supply.

As noted earlier, when assessing supply reliability, incomplete facility reporting required certain assumptions (based on field experience) which may have led to some over- or underestimation. Moreover, analyses a priori excluded private sites and dropped public sites with missing facility geographic coordinates; these omissions have two potential consequences. The exclusion of private facilities may result in an omitted variable limitation more likely in the urban areas. This omission may bias our results for the urban analyses; however, with over 90% of injection users reporting public-sector supplies, the threat to the estimates is deemed low. Analysis of the 60 (12%) dropped public facilities found comparable routine stockout rates across included and excluded public facilities, as well as an equivalent distribution of dropped facilities across the districts. We cannot assume public facilities were missing at random, however, because the health centers dropped due to missing geographical coordinates were more likely to have smaller injectable supplies. This may introduce limited bias to our estimates. It is also worth considering how well the measurements of access were operationalized. Without survey data on specific facilities used, it is unwise to link women with the closest facilities, and linking with large administrative units may distort or mask potential relationships^{7,8,25,30,35,37} We used the census of facilities providing injectables to create a service environment using KDE with distance decay properties and then averaged KDE values for a buffered area around each DHS cluster. This allowed us to link women to all the injectable facilities in their service environment, thereby minimizing misclassification error when linking.^{25,30} In generating local service environments, the KDE method distributes facility reach such that a facility has less influence on an individual's behavior the further the individual is from the facility. Moreover, KDE allows the researcher to include other facility characteristics—in our case supply reliability—deemed influential in an individual's decision to visit a facility.

Finally, our study matched, in time and location, routinely collected contraceptive supply data from a census of facilities with population-based household survey data measuring contraceptive use and demand. Previous studies have used a more nuanced service quality score based on a variety of measures of facility, provider, and service availability^{7,8,38} but relied on measurement at a single point in time. Exploring methods to combine the richness of facility survey data with the timeliness of supply logistics data may eliminate the tradeoff between breadth and depth, providing a fruitful avenue for further study.

Conclusion

KDE enabled us to create a refined definition of access to a family planning service environment that incorporates measures of service availability, proximity, and contraceptive supply reliability. This allowed us to probabilistically link a woman's family planning use and demand with her local services. Future research could apply this methodology to other family planning commodities provided by the health sector.

Our findings add to the growing body of evidence illustrating the importance of robust contraceptive supply chain and product availability in the local service environment and their relationships with use of and demand for modern contraception. We found that among rural women, reported use of injectable contraceptives was strongly associated with access to services, defined both by distance alone and distance and supply reliability. In urban settings, demand for birth spacing or limiting was positively associated with distance-and-supply access, while distance alone was not predictive of use or demand. These two different stories reinforce the need to address rural and urban population and service environment differences in order to improve health outcomes. Moreover, given the rise in private sector family planning providers and community-based distribution alternatives; exploring their differential effects on urban and rural environments in future analyses may provide useful knowledge about factors influencing family planning uptake. As the global community continues working to reduce maternal mortality and strengthen reproductive health services, further research is needed to capture and clarify the causal pathways between contraceptive access and use.

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Figure 1.

Figure 1a and 1b. KDE Illustration with sample facilities and clusters

Figure 2. Figure 2a and 2b. Access to injectable services represented using kernel density estimation techniques

Table 1

Characteristics of women 15–49 years old living in Malawi, 2010

Characteristics	Rural	Urban	Total
Modern contraceptive prevalence rate (mCPR)	31.7	36.8	32.6
Injectable contraceptive user	19.4	17.8	19.1
Demand for spacing/limiting	70.2	69.5	70.1
Living within 10 km of an injectable delivery site	95.6	100.0	96.4
Access: Distance only			
Least access	21.4	0.0	17.8
Most access	12.4	75.3	24.0
Access: Distance and supply reliability			
Least access	25.4	0.0	21.5
Most access	10.1	73.7	21.8
Media exposure to family planning messages *	58.8	64.3	59.8
Family planning home visit in past 12 months *	15.5	6.7	13.9
Desire for more children			
Want within 2 years	10.4	11.4	10.6
Want in more than 2 years	36.2	37.5	36.4
No more wanted	42.9	41.3	42.6
Undecided	10.4	9.7	10.3
Mean number of children (number)	2.5	2.2	2.4
Mean age (years)	27.2	28.2	28.0
Currently married	68.6	62.4	67.5
Education			
No formal schooling	17.0	7.0	15.2
Primary school	68.8	47.0	64.8
Secondary/postsecondary school	14.2	46.0	20.0
Wealth Status			
Lowest	22.1	2.7	18.5
Second	22.5	2.7	18.8
Middle	22.6	6.3	19.6
Fourth	20.1	17.3	19.6
Highest	12.7	71.1	23.4
Religion *			
Protestant	64.5	67.6	65.1
Catholic	20.8	20.2	20.7
Muslim	13.5	11.1	13.0
Region			
Northern	13.0	6.5	11.8
Central	43.2	44.5	43.5
Southern	43.8	49.0	44.7

Characteristics	Rural	Urban	Total
Number of women	18,362	4,122	22, 483

Note: All values are percentages unless otherwise indicated.

* Denominator for media exposure and family planning home visit is 22,476 women

** Denominator for religion is 22,469 women

Table 2

Estimated effect of access to services on reported injectable use and demand for spacing/limiting children for the entire sample and stratified by urban and rural locations

	Injectable Use		Demand for Spacing/Limiting	
	Access: Distance Coef (SE)	Access: Distance+Supply Coef (SE)	Access: Distance Coef (SE)	Access: Distance+Supply Coef (SE)
Total Sample				
Access to Services (ref=least access)				
Less access	0.018 (0.013)	0.021 (0.012)	0.003 (0.014)	0.014 (0.013)
Average access	0.027 (0.014)	0.033 ** (0.012)	0.001 (0.014)	0.006 (0.013)
More access	0.056 *** (0.014)	0.044 ** (0.014)	0.004 (0.014)	0.019 (0.014)
Most access	0.057 *** (0.015)	0.052 *** (0.015)	0.041 ** (0.016)	0.043 ** (0.017)
Number of women	20,068	20,068	20,339	20,339
pseudo R-sq	0.161	0.160	0.148	0.148
Rural Only				
Access to Services (ref=least access)				
Less access	0.020 (0.013)	0.021 (0.013)	0.001 (0.014)	0.008 (0.013)
Average access	0.027 (0.015)	0.035 ** (0.012)	0.002 (0.014)	0.000 (0.014)
More access	0.048 *** (0.014)	0.045 ** (0.014)	−0.001 (0.014)	0.012 (0.015)
Most access	0.072 *** (0.015)	0.075 *** (0.016)	0.035 * (0.016)	0.021 (0.017)
Number of women	17,516	17,516	17,674	17,674
pseudo R-sq	0.156	0.156	0.155	0.154
Urban Only				
Access to Services (ref=least access)				
Less access	−0.074 ** (0.027)	−0.006 (0.037)	0.049 (0.143)	0.140 * (0.062)
Average access	−0.073 (0.038)	0.050 (0.034)	0.026 (0.144)	0.128 (0.066)
More access	−0.010 (0.027)	−0.005 (0.032)	0.100 (0.145)	0.133 * (0.056)
Most access	−0.040 * (0.019)	−0.011 (0.028)	0.133 (0.144)	0.183 *** (0.053)
Number of women	2,552	2,552	2,665	2,665
pseudo R-sq	0.208	0.207	0.142	0.145

p<0.001,

**
p<0.01,

*
p<0.05

Table 3

Predictors of injectable contraceptive use among women 15–49 years of age living in rural areas

	Injectable Use	
	Access: Distance Coef (SE)	Access: Distance+Supply Coef (SE)
Access to services (ref=least access)		
Less access	0.020 (0.013)	0.021 (0.013)
Average access	0.027 (0.015)	0.035 ** (0.012)
More access	0.048 *** (0.014)	0.045 ** (0.014)
Most access	0.072 *** (0.015)	0.075 *** (0.016)
Family planning home visit in past year	0.033 ** (0.012)	0.032 ** (0.012)
Media exposure to family planning messages	0.013 (0.008)	0.013 (0.008)
Desire for more children (ref=want in < 2yrs)		
Want in >=2 yrs	0.113 *** (0.013)	0.113 *** (0.013)
No more wanted	0.076 *** (0.013)	0.076 *** (0.013)
Undecided	0.067 *** (0.014)	0.066 *** (0.014)
Age (ref=15–19 years old)		
20–24	0.007 (0.013)	0.007 (0.013)
25–29	–0.005 (0.018)	–0.005 (0.018)
30–34	–0.071 *** (0.020)	–0.070 *** (0.020)
35–39	–0.100 *** (0.020)	–0.098 *** (0.020)
40–44	–0.194 *** (0.022)	–0.192 *** (0.022)
45–49	–0.275 *** (0.019)	–0.273 *** (0.019)
Education (ref=no schooling)		
Primary	0.031 ** (0.011)	0.031 ** (0.011)
Secondary	0.030 (0.015)	0.031 * (0.015)
Postsecondary	0.009 (0.043)	0.009 (0.043)
Marital status (ref= married)		
Formerly married	–0.130 *** (0.011)	–0.129 *** (0.011)
Never married	–0.092 *** (0.012)	–0.091 *** (0.012)
Parity (ref= no children)		
1–2 children	0.218 *** (0.012)	0.218 *** (0.012)
3–4 children	0.314 *** (0.015)	0.313 *** (0.015)
>=5 children	0.351 *** (0.018)	0.350 *** (0.018)
Wealth (ref=lowest)		
Second	0.025 * (0.012)	0.025 * (0.012)
Middle	0.032 ** (0.011)	0.032 ** (0.011)
Fourth	0.043 *** (0.012)	0.043 *** (0.011)
Highest	0.030 * (0.014)	0.029 * (0.014)

	Injectable Use	
	Access: Distance Coef (SE)	Access: Distance+Supply Coef (SE)
Religion (ref=Protestant)		
Catholic	−0.003 (0.010)	−0.003 (0.010)
Muslim	−0.071 *** (0.011)	−0.067 *** (0.011)
Other	−0.068 (0.038)	−0.062 (0.037)
Region (ref=Northern)		
Central	0.086 *** (0.014)	0.106 *** (0.014)
Southern	0.093 *** (0.014)	0.100 *** (0.014)
Constant	−0.156 *** (0.021)	−0.169 *** (0.021)
Number of women	17,516	17,516
pseudo R ²	0.156	0.156

p<0.001,

**
p<0.01,

*
p<0.05

Table 4

Predictors of demand for spacing and/or limiting births among women 15–49 years of age living in urban areas

	Demand for Spacing/Limiting	
	Access: Distance Coef (SE)	Access: Distance+Supply Coef (SE)
Access to services (ref=least access)		
Less access	0.049 (0.143)	0.140 * (0.062)
Average access	0.026 (0.144)	0.128 (0.066)
More access	0.100 (0.145)	0.133 * (0.056)
Most access	0.133 (0.144)	0.183 *** (0.053)
Family planning home visit in past year	0.074 * (0.029)	0.068 * (0.029)
Media exposure to family planning messages	−0.017 (0.024)	−0.011 (0.024)
Age (ref=15–19 years old)		
20–24	−0.084 * (0.035)	−0.086 * (0.034)
25–29	−0.226 *** (0.044)	−0.231 *** (0.044)
30–34	−0.312 *** (0.040)	−0.315 *** (0.039)
35–39	−0.268 *** (0.051)	−0.267 *** (0.051)
40–44	−0.155 *** (0.045)	−0.157 *** (0.045)
45–49	−0.149 ** (0.047)	−0.152 *** (0.046)
Education (ref=no schooling)		
Primary	0.019 (0.044)	0.014 (0.043)
Secondary	0.084 (0.052)	0.076 (0.050)
Postsecondary	0.136 * (0.066)	0.122 (0.064)
Marital status (ref= married)		
Formerly married	−0.001 (0.025)	−0.004 (0.025)
Never married	0.025 (0.043)	0.021 (0.043)
Parity (ref= no children)		
1–2 children	0.317 *** (0.037)	0.318 *** (0.037)
3–4 children	0.541 *** (0.045)	0.537 *** (0.044)
>=5 children	0.592 *** (0.044)	0.591 *** (0.043)
Wealth (ref=lowest)		
Second	0.025 (0.076)	0.015 (0.071)
Middle	−0.047 (0.063)	−0.047 (0.061)
Fourth	−0.074 (0.056)	−0.076 (0.054)
Highest	−0.042 (0.056)	−0.048 (0.054)
Religion (ref=Protestant)		
Catholic	−0.002 (0.024)	−0.005 (0.024)
Muslim	−0.035 (0.027)	−0.039 (0.027)
Other	0.034 (0.092)	0.030 (0.092)

	Demand for Spacing/Limiting	
	Access: Distance Coef (SE)	Access: Distance+Supply Coef (SE)
Region (ref=Northern)		
Central	0.098 * (0.038)	0.114 *** (0.034)
Southern	0.079 * (0.039)	0.087 ** (0.034)
Constant	0.420 ** (0.157)	0.377 *** (0.086)
Number of women	2,665	2,665
pseudo R ²	0.142	0.145

p<0.001,

**
p<0.01,

*
p<0.05