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ASSESSMENT OF THE PRICE ELASTICITY OF DEMAND FOR HEALTH CARE SERVICES IN THE SMILING SUN FRANCHISE PROGRAM

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ASSESSMENT OF THE PRICE ELASTICITY OF DEMAND FOR HEALTH CARE SERVICES IN THE SMILING SUN FRANCHISE PROGRAM

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EXECUTIVE SUMMARY

USAID/Bangladesh wishes to understand how price increases at Smiling Sun health facilities may have affected service utilization in order to inform future decisions about price levels. In this paper, we analyze longitudinal utilization data to attempt to estimate the price elasticity of demand for these services.

We were provided data on utilization (by month) of various services at all Smiling Sun Franchise facilities for the 5 year period of the previous USAID-supported activities (October 2007 through September 2012). We were provided with the total number of services utilized per month across all facilities and facility types. We have data separated for paying and "poor" users for ANC, PNC, and deliveries, and total number of visits for maternal (general) and child health. The prices charged to users changed in April 2010. The starting prices and price increases were different in urban and rural areas, but the data were not disaggregated to reflect these differences.

Based on the current analysis, the results indicate:

1. The data reviewed do not show any association, and does not support the assumption, that price increase resulted in decrease utilization of antenatal care and post-natal care. The results are more ambiguous for utilization of delivery services, with a decline in utilization after the price increase seen in some models. We would expect some patient reaction to price increases; the lack of association for antenatal and postnatal care is difficult to explain. One possible reason is that the absolute magnitude of the price change for these two services was small in comparison to households' budgets.
2. There was a sharp change in the patterns of utilization about 4 months BEFORE the price increases, which makes it difficult to model changes in utilization at the time of the price increases – it interferes with our ability to establish "pre-increase" time-trends in utilization.

The impact evaluation of SSFP indicated that by 2011, the NGOs had achieved 41% cost recovery; 68% of clients were full paying clients for the three services listed. It was noted that the percentage of costs recovered was increasing over time even though the percentage of patients paying full price was declining over time, and this suggests that the price increase did help with cost recovery. However, if the price increase also negatively impacts demand among the poor (which some of the models developed here indicate may be the case for delivery services), then increasing prices may compromise the mission of NGOs even if revenue does increase. To mitigate this risk, efforts should be made to ensure that those who are poor really are not paying any (or full) fees. Ideally, poverty targeting should happen before patients arrive at the facility.

Finally, utilization grew from February 2009 to January 2010. This corresponds to a period when there were deliberate efforts to renovate facilities and layout branding initiatives, but did not correspond to any price changes. These findings highlight the potential influence on non-price factors in determining market share.

There are multiple limitations to this analysis, which are listed at the end of the report, which should be considered when interpreting the results.

1. INTRODUCTION

The NGO Health Service Delivery Project (NHSDP) is the newest iteration of USAID/Bangladesh's long- standing support to NGO service providers to deliver quality, high-impact services to the poor and underserved populations. Pathfinder International is the new program's prime contractor. The previous project was called the Smiling Sun Franchise Program (SSFP). The Smiling Sun NGO network is made up of 27 NGOs with 325 static clinics and 8,838 satellite areas across 64 districts. An impact evaluation of the SSFP highlighted the difficulties of reaching contradictory objectives of high cost recovery and a high share of clients coming from the poor (and thus getting free services) or underserved[1]. The impact evaluation also mentioned the SSFP NGO losing market shares in urban and rural areas to both public and private providers, especially for antenatal care (ANC). Some reasons put forth for this loss included the strengthening of the public sector programs as well as the pricing policy and structure of SSFP and a lack of community behavior change communication (BCC) efforts to increase utilization.

In April 2010, the third year of operation, Smiling Sun raised the prices it charged to people accessing its services. These price increases were not constant across all services or across geographic areas (that is, prices were originally different and increased at a different rate in urban and rural areas). Those users of Smiling Sun services defined as the 'poorest of the poor', however, were exempted from paying any user fees, while those defined as 'poor' pay a partial fee.

Table 1 lists the prices charged for services by the Smiling Sun franchise health units. The prices in years 1 and 2 of operation (Y1 and Y2) represent the baseline prices, with year 3 (Y3) representing the price established in April of 2010; all are reported in Taka. Prices increases for satellite clinics as well as for fixed clinics. Price changes were announced in April of 2010, with the price changes occurring in April or the next few months at individual clinics. The prices are reported separately for urban and rural areas. The fee for all services remained low (less than 60 Taka, or less than $1) for all services except delivery services and some laboratory and imaging services. For many health services, the relative increase in price was greater in rural areas because prices were lower to start with; the absolute value of the change in prices was the same except for normal deliveries.

1 Lance P., Angeles G, Kamal N. (2012). Smiling Sun Franchise Program (BSSFP) Impact Evaluation Report. Chapel Hill, North Carolina: MEASURE Evaluation.

Table 1: Schedule of prices for Smiling Sun health services

Health Service Pricing						
List of Services	**Urban**		**Rural**			
	Price Min. Y1 and 2	Revised Min. Price Y3	Price Min. Y1 and 2	Revised Min. Price Y3	Percentage increase in Y3 in rural areas	Percentage increase in Y3 in urban areas
Registration fee	10	15	5	10	100%	33%
Child Health						
IMCI	40	60	10	15	50%	50%
EPI	20	30	0	0	None	50%
Maternal Health						
ANC	20	25	10	15	50%	25%
PNC	20	25	10	15	50%	25%
Normal Delivery	600	800	500	600	20%	33%
Cesarean Section	7000	8000	5000	6000	20%	14%
TT	0	0	0	0	None	None
Home Delivery	600	800	500	700	40%	33%
Family Planning						
Oral pill	2	3	2	3	50%	50%
Condom	2	3	2	3	50%	50%
Injection	20	30	10	20	100%	50%
Implant	10	20	10	10	None	100%
IUD	20	25	10	20	100%	25%
Other Services						
RTI/STI	20	40	5	10	100%	100%
Limited Curative Care	20	30	10	20	100%	50%
Lab services	15-150	20-200	15-150	20-200	25%-33%	25%-33%
Ultrasonogram	250	300	200	250	25%	20%

Y = year. Year is defined as starting in October and running through September. Price increases were implemented in April of the third year of operation.
Min. = Minimum
IMCI = Integrated Management of Childhood Illnesses; EPI = Extended program on Immunizations; ANC = Antenatal Care; PNC = Postnatal Care; TT = Tetanus Toxoid; IUD = Intrauterine Device; RTI/STI = Reproductive tract infection / sexually transmitted infection
Prices listed in Taka ($1= about 60 Taka)

USAID/Bangladesh wishes to understand how the price increases may have affected service utilization in order to inform future decisions about price levels. In this paper, we analyze utilization data to estimate the price elasticity of demand for these services. Using longitudinal data analysis, we seek to answer three questions:

1. Is there an association between the price increase in April 2010 and the utilization of services by patients paying full price? If there is a noticeable change in utilization, utilization data can be combined with data from Table 1 to determine the price elasticity of demand.

3. Is there an association between the price increase in April 2010 and the utilization of services by client's not paying full price / those exempt from paying user fees? This analysis could indicate whether price changes affect the 'poor', who pay a partial fee, differentially than they affect clients paying full fees. However, the fact that this category of utilization includes the 'poorest of the poor' who are exempt from paying fees, and therefore should not have any behavior changes as a direct results of user fee increases, may attenuate the results of this analysis.
4. Given the findings to questions 1 and 2 above, what does this data tell us about the possibilities of changing prices in relation to the ability of the NGOs to recover costs from paying customers?

The paper is organized into the following sections. First, we will briefly review the concepts of elasticity of demand and the determinants of demand. This is a very quick overview, and we discuss only the demand for health services (and not the demand for health) in order to motivate the following analyses. Second, we briefly discuss the data available and its limitations. Third, we present brief methods section followed by an exploratory analysis of the data available. Fourth, we conduct a more in-depth analysis addressing questions number 1 and 2 listed above. We end with a discussion of the results and ideas for further study.

2. CONCEPTS

The following equation defines price elasticity of demand, or the relative responsiveness of demand to a change in the price of a good or service:

Price Elasticity of Demand = % Change in Quantity Demanded / % Change in Price

Elastic demand, where the absolute value of this ratio is greater than 1, is characterized by a larger than proportional change in quantity demanded in response to a change in price, while inelastic demand, where the absolute value is between 0 and 1, is characterized by a less than proportional change in demand relative to a change in price[2]. Demand is said to be "unit elastic" when the price elasticity is equal to 1.

If demand is highly price elastic, an increase in the price will result in sharply reduced service utilization, which could reduce total revenue received by the facility. If demand is price inelastic, price increases will not be fully offset by decreased utilization, indicating that revenue will rise.

Demand responds to other factors in addition to the price of one good or service.

1. Demand also depends upon the prices of competitors or substitutes, such as the price of medical services in the government, private, other non-governmental, and informal sectors. If the price of substitutes drops, for example, demand for a good will decline even if the price of the good itself remains the same (and demand may increase if the price of substitutes increases).
2. The price of complements also affects demand; complements are goods or services that go along with the service. For example, laboratory services are a very close complement to maternal health services, but the price of transport (to and from the facility) is also a complementary good (at least for some users). An increase in the price of transportation may result in lower demand for health services, even if the price of the health services itself does not change.
3. Income affects demand for health services; as people's incomes change their propensity to seek care, and to seek care at certain types of facilities, will change.
4. Demand depends on the quality of services offered. For example, the nature of the services offered by Smiling Sun may have changed due to the increased revenue if the increased revenue was used to increase the quality of services provided, connect more closely with the community, etc. Then, the increase in price might be associated with an increase in demand (if the positive response to the increased quality was sufficient to offset the negative response to the increase in price).

For this analysis, we do not have data on any of these other factors. For the analysis to proceed, we must assume that these other factors did not substantively change at or around the same time as Smiling Sun increased it prices, and that changes in these factors is adequately captured in general time trends in utilization.

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[2] Elasticity is generally negative because if prices increase, quantity consumed decreases for most goods. By convention, the sign of the price elasticity is ignored.

Also for consideration is the fact that many goods are more elastic over a longer time horizon because people will search for substitutes over time. Thus, if elasticity is measured in the month following a price increase, different price elasticity may be observed than if elasticity is measured in the year after a price increase.

3. DATA

Table 2 lists the data available by the type of service, with an "X" indicating data have been provided and a "-" indicating that the data have not been provided. Data were provided in aggregate across all NGOs and facilities; thus, an analysis accounting for facility or NGO level effects is not possible. The data represent the total utilization from all facilities (fixed and satellite). Since price changes were different in urban and rural areas, a full breakdown of the data by payment status and urban/rural areas would be desirable, but is not available for any of the services.

Table 2: Data provided

Time series	Total utilization	Urban / rural breakdown[6]	Poor / paying full price breakdown	Poor / paying full price breakdown by urban / rural
Child Health	X	-	-	-
Maternal Health[1]	X	-	-	-
ANC[2,5]	X	X	X	-
PNC[3,5]	X	X	X	-
Deliveries[4,5]	X	X	X	-

[1] The definition of this time series is unclear, but includes more than the total of ANC, PNC, and Deliveries.

[2] ANC = Antenatal Care; total utilization of ANC4 visits also available.

[3] PNC = Postnatal Care.

[4] It is unclear if deliveries include home deliveries or only deliveries at the facility.

5 Further breakdown of urban utilization is available by city corporation, district, and municipality.

[6] At the time of writing, there were 195 urban/peri-urban clinics and 132 rural clinics, but these numbers change over time.

Because of the limited scope of data available, we will start by looking at the data for ANC, PNC, and deliveries. These are the only time series provided which separate out the patients paying full price from the poor and the poorest of the poor; assessing the time series for child or maternal health, we are less likely to find an association with the price increase because they include data only for all people, whether they paid full price, partial price, or paid no fee, so the anticipated effect of the price increase will only have influenced (potentially) part of the population represented in the series. In addition, we can control for time trends by analyzing trends from before the price increase. We also use utilization among those paying a partial fee or exempt from user fees as a separate series.

From Table 1, we see that the price increases for were 25-50%, 25-50%, and 14-40% respectively for ANC, PNC, and deliveries. Also, the prices of some potential complementary services, notably laboratory tests and ultrasonograms also increased, generally in the same order of magnitude. It is unclear if the registration fee is paid every visit or if it is only paid the first time an individual visits a facility.

4. METHODS

We employ a mixed longitudinal model with random intercepts to establish a model for utilization. This model takes the form:

$$Yij = Ui + \beta 0 + \beta 1(M)j + \beta 2(T)j + \varepsilon ij \quad \text{[Equation 1]}$$

$$Ui \sim N(0,\tau 2)$$

$$\varepsilon ij \sim N(0,\sigma 2)$$

Where:

Yij is the observed utilization of service i at time j;

Uj is the random intercept for service j;

β0 is the overall intercept of the model;

β1 is the estimated coefficient for month (not specific to service type), where there are separate dummy variables for each month, to control for seasonality;

β2 is the estimated coefficient for time (not specific to service type) measured in one month increments;

εij is the difference from the average utilization for observation of service type i at time j;

and, the residuals ε and the random intercepts U take on a normal distribution with variances σ2 and τ2, respectively.

We then add variables to represent trends after the price increase, reworking equation 1 to be:

$$Yij = Ui + \beta 0 + \beta 1(M)j + \beta 2(T)j + \beta 3(PI)j + \beta 4(T*PI)j + \varepsilon ij \quad \text{[Equation 2]}$$

$$Ui \sim N(0,\tau 2)$$

$$\varepsilon ij \sim N(0,\sigma 2)$$

Where:

PI is an indicator variable taking on a value of 1 if the price has increased and 0 otherwise, and

T*PI is the interaction term between time and PI.

These are the variables of interest for this evaluation; they measure if utilization is different after the price increase compared to before the price increase, controlling for seasonality (month) and overall time-trends. The price increase was implemented over the course of a few months. Therefore, we also explore the use of two indicator variables to assess the impact of the user fee increase: PIP and PIF (for price increase partially implemented and price increase fully implemented), with PIP assessing the period

April, May, and June 2010, and PIF assessing the period from July 2010 onwards. The interaction term T*PI will be used only for T*PIF in this analysis.

Finally, as is common with these types of data, we may decompose the error term (ε_{ij}) further if there is serial correlation, such that:

$$\varepsilon_{ij} = W_{i(tij)}, \text{ with} \qquad \text{[Equation 3]}$$

$Corr(\varepsilon_{ij}, \varepsilon_{ik})$ taking on a parametric structure.

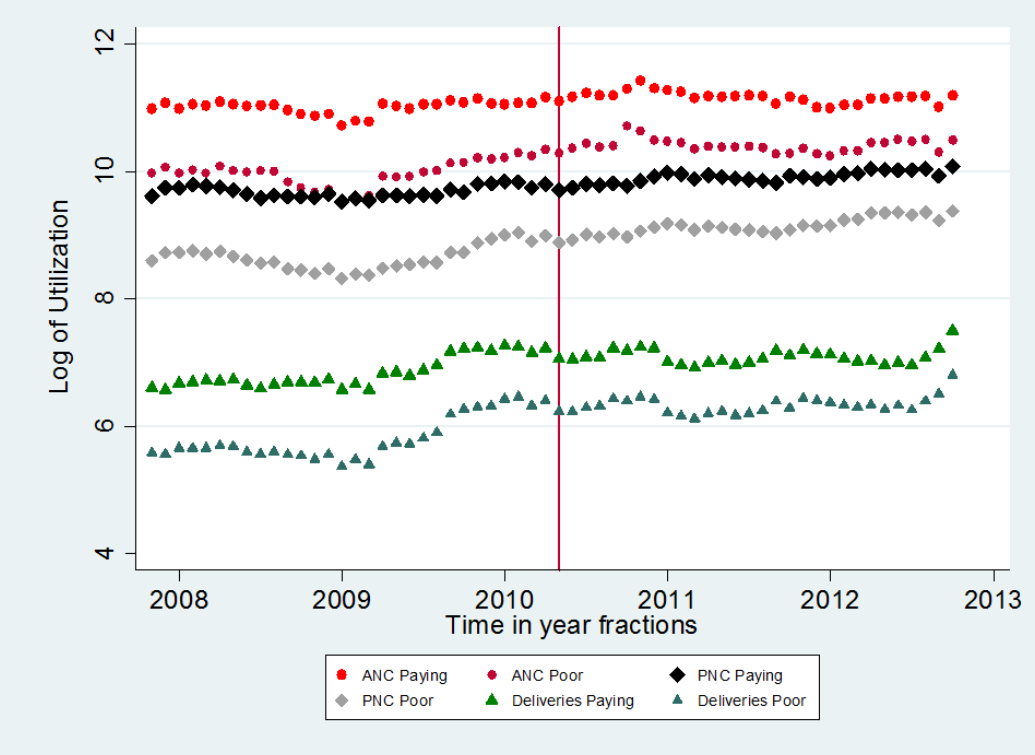
This equation no longer assumes that the residuals of a regression are independent of each other by allowing correlation between them.

We use likelihood ratio tests and the Akaike Information Criterion to determine overall model fit; we explore transformation of the variables and non-linear patterns in the time trends to ensure best fit. We use the t-test on the coefficients for $\beta 3$ and $\beta 4$ to determine changes in utilization that occurred after the price increase. We use $\alpha<0.05$ to determine statistical significance.

5. DATA EXPLORATION

Figure 1 displays the total utilization trends for six kinds of patients (ANC patients paying full price, poor ANC patients, patients for deliveries paying full price, poor patients for deliveries, PNC patients paying full price, and poor PNC patients). It shows the total number of patients seeking care across all SSFP clinics in each month. In order to show the trend for all three types of services, utilization is presented in the logarithmic scale.

Figure 1: Log of total utilization over time by service and payment status

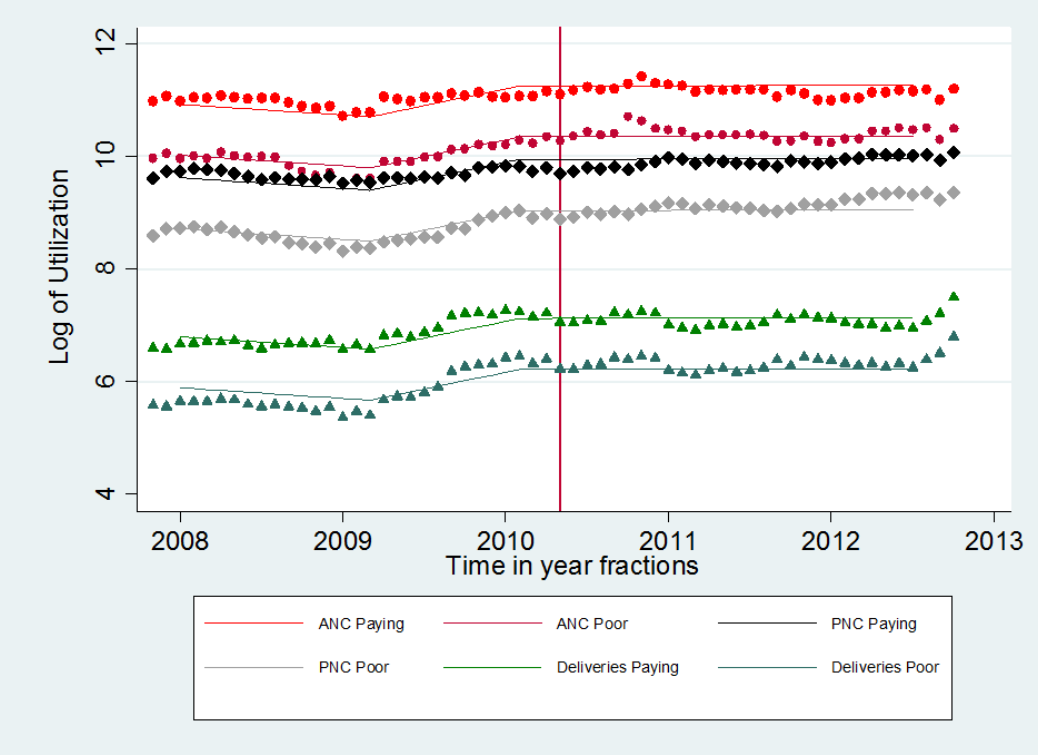


From Figure 1, it appears that utilization of all services followed roughly parallel trends, with utilization declining slightly from the start of the program in October 2007 through about February 2009 for all services excepting patients paying full fees for deliveries. From March 2009 through January 2010, utilization then increased fairly rapidly for ANC, deliveries and postnatal care among the poor and poorest of the poor; utilization of ANC and PNC among those paying full fees increased only slightly. Both of these trends appear to be sharper for the poor and poorest of the poor patients than for patients paying full fees (especially for ANC and PNC care), indicating that demand from patients paying

full fees may be a bit steadier over time than from non-paying patients[3]. After January 2010, utilization leveled off, although cyclic trends are apparent. The overall trend described above is shown illustratively for the number of deliveries among poor and the poorest of the poor patients with a red dashed line. Given the generally similar trends across the utilization types, we propose to include all six service/payment types in a single model, with random intercepts for each type. It is also worth noting that any change in utilization around the time of the price increase (shown with the vertical red line) does not appear to be very large in Figure 1.

The price increase occurred just a few months after the leveling off in the trend in utilization. This makes it more difficult for us to distinguish between overall trends and changes resulting from the price increase, since it leaves little time before the price increase to establish the 'new' trend. In order to deal with this, we propose using splines to model the secular trends: (1) a linear trend from October 2007 to January 2009, followed by (2) a linear spline from February 2009 until January 2010, and a final linear trend after January 2010. Figure 2 illustrates the simple predictions of utilization with this spline structure and random intercepts. Adding the three spine sections improves model fit based on the likelihood ratio test ($p > chi2 < 0.001$).

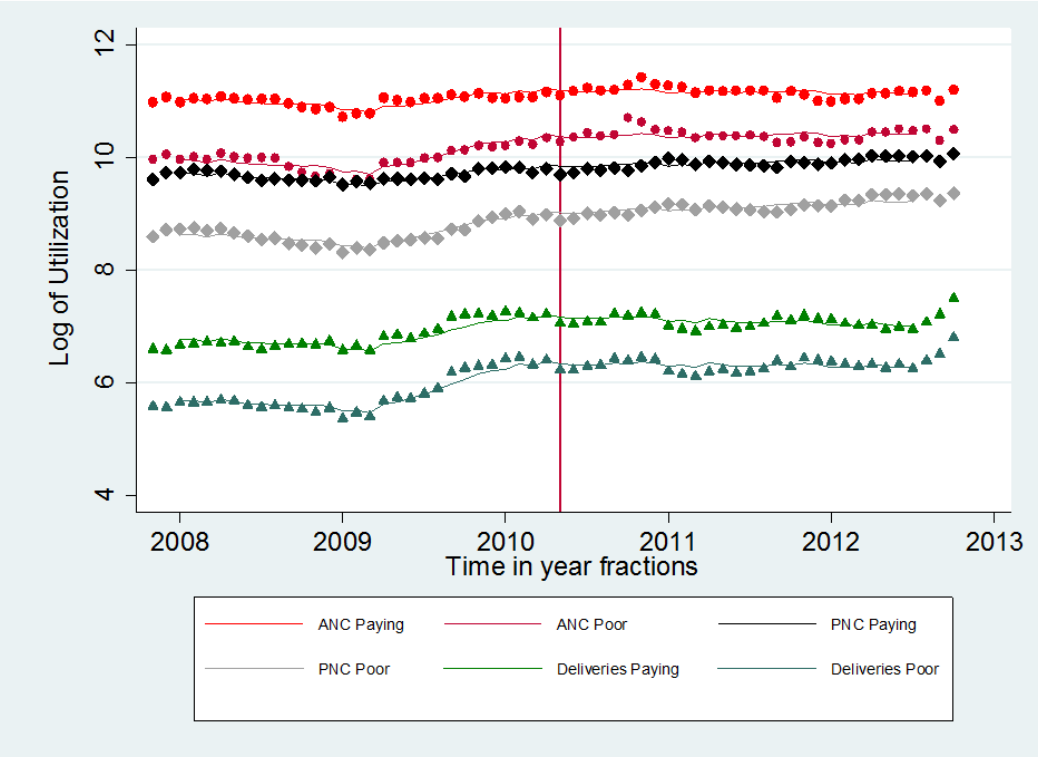
Figure 2: Predicted utilization in first secular trend model



[3] Annex one shows this trend for the three service types by looking at the percentage change in utilization from the previous month.

Note that in this simple model, we exclude the first two months of data (to account for start-up) and the last three (due to a sudden increase in utilization that is likely unrelated to the question of interest). The prediction lines do a reasonable job of predicting trends, but definitely do better for some time series (e.g., ANC paying) than other (e.g., Deliveries Poor). For this reason, we add a random slope component for each series, as well a fixed effect for monthly variation in usage. Figure 3 shows these results.

Figure 3: Predicted utilization with random slopes and monthly fixed effect



This does a better, although not perfect, job of predicting utilization than the model shown in Figure 2 ($p < 0.001$), especially for ANC and PNC care. The results of the model indicate that the random slope for all three components of the spline are statistically significantly different across the six groupings ($p<0.05$). However, for deliveries in particular, the time trend model proposed seems to under-predict utilization just before the time of the price increase; a separate model will also be run for deliveries to assess if the model combining all the services together skews the results for deliveries in particular.

Further, we note that there appears to be an autoregressive pattern to the residuals, with clumps of months either over- or under-predicted. For this reason, we propose to include moving average of the residuals in the structure of the covariance matrix. We will also re-run the random effects models using generalized linear models with autoregressive correlations as a sensitivity analysis.

6. EXPLORATION OF THE RESULTS

6.1 Is there an association between the price increase and utilization?

In order to assess if there is a shift in utilization after the price increases on utilization, we include a dummy variables for all time points incurred after the implementation of the price increases – one for May and June 2010, and another for July 2010 and after (Annex 2 presents the results if we include only one dummy variable for all points May 2010 and after). We do this in two ways. First, we include the dummy only for patients paying the full fee. As noted above, in the absence of concomitant other changes, we would expect a price increase to be associated with lower utilization. Second, we include two dummies, one for patients paying full fees and one for all patients. This helps to assess if there was an overall change in utilization after the price increase among all users, and if this change was different for patients paying full price.

Table 3 shows the results for the dummy variables from 6 models. Since utilization is used in these models in logarithm transformations, the interpretation of the coefficients is in terms of percentage. For example, model 1 shows that there was an increase of 4% (see "For May/June 2010") immediately after the price increase was announced across all the service types in the time period for May and June after the price increase as compared to before it, after accounting for the time trend and seasonality. This result is not statistically significantly different than no change in utilization, however. The interpretation of model 2 is that there was a 5% (0.05) increase in utilization amongst all clients in the period of May and June after the price increase, but this was (0.05+(-0.005) ~= 0.04) only about 4% among the paying customers. The first two models utilize all of the data in question, the third and fourth model focus on ANC and PNC utilization, and the fifth and sixth model use only data on deliveries. Results are substantively the same using generalized linear models.

These results suggest that after the price increase, there was no statistically significant change in utilization of ANC, or PNC visits. There was a non-significant upward shift in utilization of ANC and PNC services amongst all patients on the order of 6% in May and June 2010, and possibly a small decrease in utilization (compared to the period before the price announcement) after June 2010 among all patients (although it was positive among patients paying the full fee) . For deliveries, utilization among all patients decreased about 11% ($p<0.05$) in both periods under consideration. The decrease in utilization was greater among patients paying full price in the period from July 2010 onwards ($p<0.05$). These differences are not found if the two time periods are combined (see Annex 2).

Table 3: Results of model with dummy variable included after price increase

Variable	Model 1: All types of utilization, dummy for paying customers only	Model 2: All types of utilization, dummy for paying and poor customers	Model 3: ANC & PNC only, dummy for paying customers only	Model 4: ANC & PNC only, dummy for paying and poor customers	Model 5: Deliveries only, dummy for paying customers only	Model 6: Deliveries only, dummy for paying and poor customers
Estimated change in log of utilization after price increase, paying full fee customers						
For May/June 2010	0.04	-0.005	0.06	0.01	-0.09	-0.06
Standard Error	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)
For July 2010 onwards	-0.005	-0.007	0.03	0.04	-0.19	-0.20
Standard Error	(0.05)	(0.06)	(0.06)	(0.08)	(0.07)**	(0.08)*
Estimated change in log of utilization after price increase, all customers						
For May/June 2010		0.05		0.06		-0.11
Standard Error		(0.04)		(0.04)		(0.05)*
For July 2010 onwards		-0.001		-0.01		-0.11
Standard Error		(0.05)		(0.06)		(0.09)

Dependent variable: Log of utilization

*Statistically significant at $p<0.05$

**Statistically significant at $p<0.01$

6.2 Is there a longer term association between the price increase and utilization?

To assess whether these is a longer term association between the price increase and utilization, we now assess if there is a shift in the trend of utilization after the price increase. We do this by adding an interaction term between the dummy variable used in the previous section and the time for the 18 months after the price increase (under the assumption that 18 months is long enough for patients to adapt to the price change). If the estimated coefficient for this interaction variable is significant, it indicates that the slope of utilization with respect to time changed after the price increase. Table 4 shows the results for the dummy variables and interaction variables.

None of the models for ANC and PNC in Table 4 indicate that there was a change in the trends in utilization after the 18 months after the price increase, either amongst patients paying the full fee for services or amongst all patients. If there was a change, models 1 through 4 suggest it was an increased growth rate of very modest proportions. The results for the dummy variables do not change substantively from the previous analyses reported in Table 3 for Models 1 and 2. For Models 3 and 4, the results indicate there may have been a negative change in utilization July 2010 and afterwards for clients paying full price, although this is again not close to be statistically significant.

For deliveries, this model no longer shows a statistically significant decrease in utilization among all patients for the period May and June 2010. It does however, maintain a decreased utilization of about 21% among paying customers for the period July 2010 onwards. It also indicates the possibility that the growth in utilization of services for deliveries slowed during the period July 2010 onwards compared to the period before the price increase was announced. This last finding is the only finding that holds if the period May and June 2010 is combined with the period July 2010 onwards (see Annex 2).

Table 4: Results of model with changes in the time-trend of utilization after price increase

Variable	Model 1: All types of utilization, dummy for paying customers only	Model 2: All types of utilization, dummy for paying and poor customers	Model 3: ANC & PNC only, dummy for paying customers only	Model 4: ANC & PNC only, dummy for paying and poor customers	Model 5: Deliveries only, dummy for paying customers only	Model 6: Deliveries only, dummy for paying and poor customers
Estimated change in log of utilization after price increase, paying customers						
May/June Indicator (SE)	0.04 (0.04)	-0.01 (0.05)	0.05 (0.04)	-0.01 (0.05)	-0.11 (0.04)**	-0.08 (0.05)
July onwards Indicator (SE)	-0.02 (0.05)	-0.02 (0.07)	-0.01 (0.06)	-0.01 (0.08)	-0.21 (0.06)**	-0.22 (0.07)**
July onwards Interaction (SE)	0.002 (0.002)	0.001 (0.002)	0.003 (0.002)	0.002 (0.003)	-0.004 (0.002)	<0.001 (0.003)
Estimated change in log of utilization after price increase, all customers						
May/June Indicator (SE)		0.05 (0.04)		0.06 (0.04)		-0.04 (0.05)
July onwards Indicator (SE)		-0.01 (0.05)		-0.01 (0.06)		-0.005 (0.08)
July onwards Interaction (SE)		<0.001 (0.002)		0.002 (0.002)		-0.005 (0.002)*

Dependent variable: Log of utilization

*Statistically significant at $p<0.05$

**Statistically significant at $p<0.01$

7. DISCUSSION

The data reviewed did not show a statistically significant association between the price increase and utilization of ANC or PNC services. Finding no change in utilization indicates the price elasticity of demand is inelastic (the demand dropped by a lower percentage than the percentage increase in price) among clients paying full price; in fact, the non-significant estimated coefficients for changes in utilization after the price increase generally suggest an increase (with deliveries being the exception) in utilization. Some models indicate a decrease in the utilization of delivery services, especially among clients paying full price, although this result is sensitive to model specification. It is estimated that utilization decreased about 20%, compared to a price increase between 20% and 40%.

Why is there no apparent relationship between prices and utilization for ANC and PNC?

There are several possible explanations for these findings:

1. The sharp shift in growth rate of utilization 4 months before the price increase creates difficulties in developing the statistical model. This may limit our power to detect a difference at the time of the price increase. It should be kept in mind, for example, that the effort to detect changes in the growth rate in services presented in Table 4 only are in comparison to the 4 months before the price increase; the data from before January 2010 are assessed to have different growth rates than after January 2010.
2. The sharp shift in the growth rate of utilization 4 months before the price increase also indicates that there were factors influencing demand outside of price which have a large, possibly larger, influence on demand than price. The fact that these are not measured and were happening at a time very close to the time of the price increase indicate that there may be factors influencing demand which conceal the effect of price on demand.
3. The price increase was small relative to clients' incomes and / or the price of competitors. If the price increase is a small proportion of households' incomes, the demand for services may be relatively inelastic – people can bear the [relatively rare] expenses of ANC and PNC without too much trauma to their overall budgets. Further, if the prices at SSFP were still low relative to other competitors (such as the private sector), people may have little choice in their utilization patterns, which would be especially true if the price increase was modest compared to their incomes.

Why would there be a decrease in the utilization of deliveries but not for ANC and PNC?

1. The results for utilization of deliveries is not consistent (comparing Tables 3 and 4 to Annex 2) across model specifications. Thus, the finding that there was a decrease is utilization among patients paying full price in the period July 2010 and onwards cannot be viewed as definitive.
2. If the finding is true, this likely because the increase in the price of deliveries was an order of magnitude greater for deliveries than for ANC and PNC visits (and increase of 200 Taka for deliveries and 1000 Taka for Caesarian Sections versus an increase of 5 Taka for ANC and PNC). Thus, while the percentage increase is similar, the effect on households' budgets may be greater. Alternatively, SSFP prices for deliveries may be less different from competitors' prices than it is for ANC and PNC.

3. Some of the patients included in the 'poor' category paid partial user fees, and these clients would be expected to react to price changes. This may help explain why we find a decrease in utilization among all clients in some models.

The results may be the results of a random fluctuation in the data or outside factors affecting demand not captured in our model.

How do these findings relate to cost recovery?

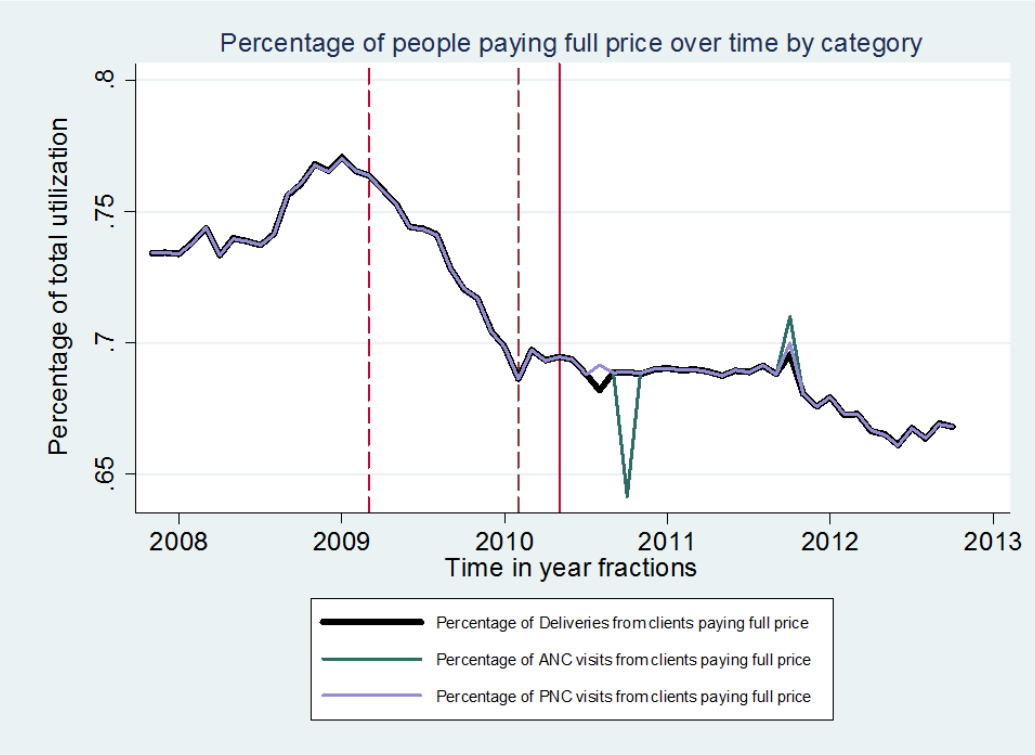
Increased cost recovery is possible by raising prices on fee paying clients if the increased price generates more revenue than is lost due to decreased utilization. However, if the price increase also negatively impacts demand among the poor (as discussed for deliveries above), then increasing prices may compromise the mission of NGOs even if revenue does increase. To mitigate this risk, efforts should be made to ensure that those who are poor really are not paying any fees. Ideally, poverty targeting should happen before patients arrive at the facility.

Poor clients may face uncertainty in whether and to what extent they will pay fees. The impact evaluation of the SSFP stated that only 10% of the catchment population had health benefit cards, while other clients' eligibility for fee exemptions was determined after they arrived at the facility. Thus, many poor clients might not have been certain whether or to what extent they would pay a fee. A decrease in demand after the price increase may be expected due to the fact that they anticipated they might pay the increased fee – they were responding to a perceived price rather than to their actual price.

Figure 6 shows the patients paying full price as a percentage of total patients, by the three service types where these data are available, over time. The first notable thing about this graph is that the rate of fee exemption was exactly identical across the three types of services, with 3 small exceptions. This calls into question our understanding of the data; we can find no plausible explanation for this finding since it is highly unlikely that the proportion of women utilizing services would be identical in terms of the proportion eligible for exemptions or reduced fees. Further, it does not appear that a certain, set proportion of women were granted fee-exempt status, since the proportion exempted over the total number of patients fluctuates over time in a random way. This finding causes us to be concerned both about our understanding of the data and about the overall quality of data.

The impact evaluation of SSFP indicated that by 2011, these NGOs had achieved 41% cost recovery; 68% of clients were full paying clients for the three services listed. It was noted that the percentage of costs recovered was increasing over time even though the percentage of patients paying full price was declining (in fits and starts) over time, and this suggests that the price increase did help with cost recovery.

Figure 6: Patients paying full price as a percentage of total patients, by service type over time



The two dashed vertical lines represent the periods when utilization trends appeared to change; the first line represents when utilization started to increase after initial decline, while the second line shows when utilization appeared to stop growing. The solid vertical line represents the time when prices were increased.

The relationship between utilization and market share

Based on Figure 1 and Annex 1, we see that from 2011 onwards ANC care utilization was largely not growing, PNC utilization was growing slightly, and deliveries were not growing until mid-2012. Rural ANC visits were about 50% of all ANC visits during this period, rural PNC visits were about 52% of all visits during this period, and deliveries in rural areas were about 38% of all deliveries during this period (with about 40% of facilities located in rural areas).[4] The trend in growth rates was not substantially different between urban and rural areas during this time (although ANC care visits in rural areas had spiked dramatically from September to December 2010). From this data, it is not clear if facilities were

[4] Note that rural facilities has almost a proportional share of deliveries (i.e., 38% is almost comparable to 40% of facilities in rural areas), but a much smaller proportion of rural facilities provide delivery services compared to urban facilities.

operating at full capacity, or if this were true for rural and / or urban areas. However, if facilities are already very busy, then increasing utilization with respect to market share and population growth could be problematic.

Finally, Figure 1 and Annex 1 show that utilization did grow from February 2009 to January 2010. This corresponds to a period when there were deliberate efforts to renovate facilities and layout branding initiatives, and again did not correspond to any price changes. These findings again highlight the potential influence on non-price factors in determining market share.

8. LIMITATIONS

This analysis has multiple limitations, which need to be kept in mind when interpreting the findings.

1. The data would ideally be sorted into 6 groups: urban patients paying full fees, urban patients paying partial fees, urban patients not paying any fee, rural patients paying full fees, rural patients paying partial fees, and rural patients not paying any fee, in addition to the separation by service delivery type. We also lack a comparison group where prices did not change. Having data in these classifications would reflect the fact the price increases were different in urban and rural areas.
2. Since some of the 'poor' patients did, in fact, pay on a gradient scale, then separating patients that pay full fees, partial fees, and received free services would enable the effects of the price increase to be more fully captured. Currently, we can only include a single, binary variable to capture the effect of the price increase, which may not be appropriate or may limit our ability to detect an association between price and utilization.
3. Having data on only 2 prices (before and after the price increase) allows us to estimate only one small part of the demand curve. As noted above, the price elasticity of demand changes in different areas of the demand curve. Therefore, it is difficult to determine, for example, what the effect of a further price increase may be on demand.
4. Ideally, we would have data across time for all facilities for all services, and for all patient types (i.e., paying full price, poor, poorest of the poor). This would allow for controlling facility level effects as well as improve our ability to model secular trends.
5. As noted in the introduction, the current models do not have any ability to control or adjust for the prices of complements, competitors, or income growth.

These limitations suggest that more data would be helpful in developing a more complete analysis. However, we are cognizant that not all of the ideal data are available from the SSFP. There are inherent problems with estimating the price elasticity of demand across a range of prices because within the NGO networks, there are only two prices (in urban and rural areas), and the types, quality, and accessibility of other health services may not be fully comparable to those within the network.

Price elasticity of demand and pricing decisions are often assessed through the use of coupons or vouchers. These are particularly useful when introducing a new product or entering a new market, or when considering a price reduction. They are less useful in assessing the effects of price increases of an existing product in an existing market (since coupons and vouchers only allow for price reductions of existing products). Therefore, these types of studies may not be very useful in determining price elasticity of demand or assessing pricing options in this case.

Other options for assessing price responsiveness tend to be more hypothetical in nature. They have the advantage, however, of allowing for price to be assessed alongside other variables or factors that may affect demand. One example of these kinds of analyses is contingent valuation. Contingent valuation studies assess the relative importance of a set of variables, factors, or domains in determining how people decide where to seek health care services. By offering each respondent a series of choices, the aggregate influence of each variable on the preferred choice can be determined, and the researcher is able to rank factors by likelihood of influencing prospective clients' choice of health care provider. As

such, contingent valuation studies should generate actionable information about how to price services in such a way as to attract more clients and increase service volume.

ANNEX 1: MONTHLY GROWTH RATES

Percentage change in utilization from the previous month

For each graph below, a 6-month bandwidth is used to predict a smoothed trend in the percentage change in utilization relative to the previous month. The two dashed vertical lines represent the periods when utilization trends appeared to change; the first line represents when utilization started to increase after initial decline, while the second line shows when utilization appeared to stop growing. The solid vertical line represents the time when prices were increased.

Figure A1: The monthly growth rate in ANC service utilization over time

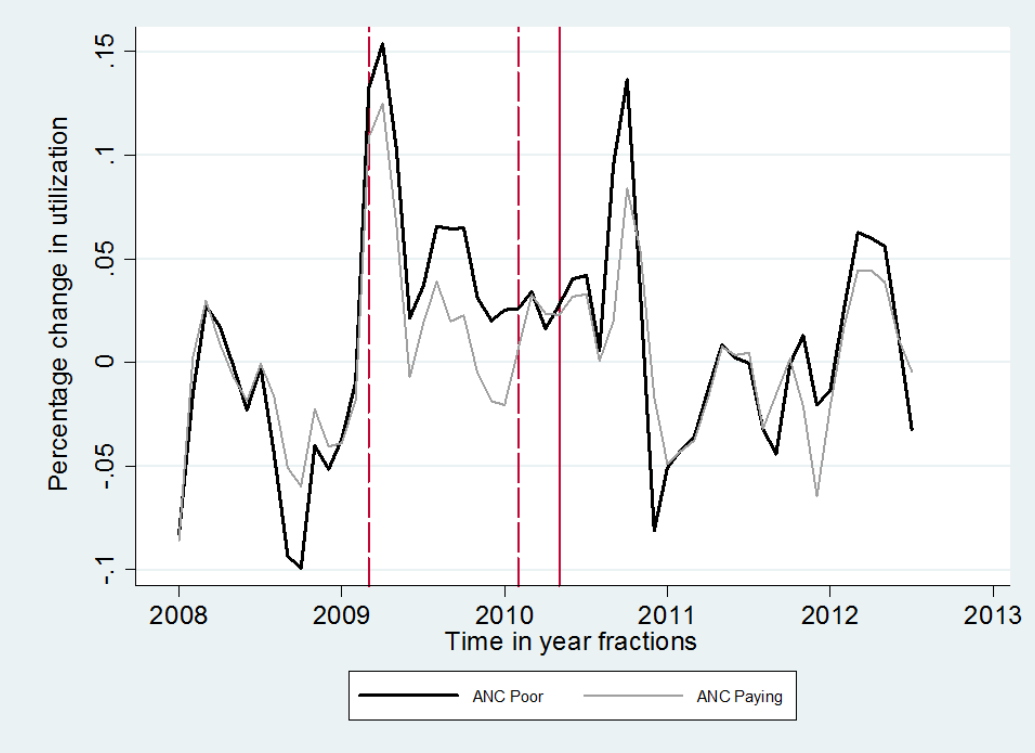


Figure A2: The monthly growth rate in PNC service utilization over time

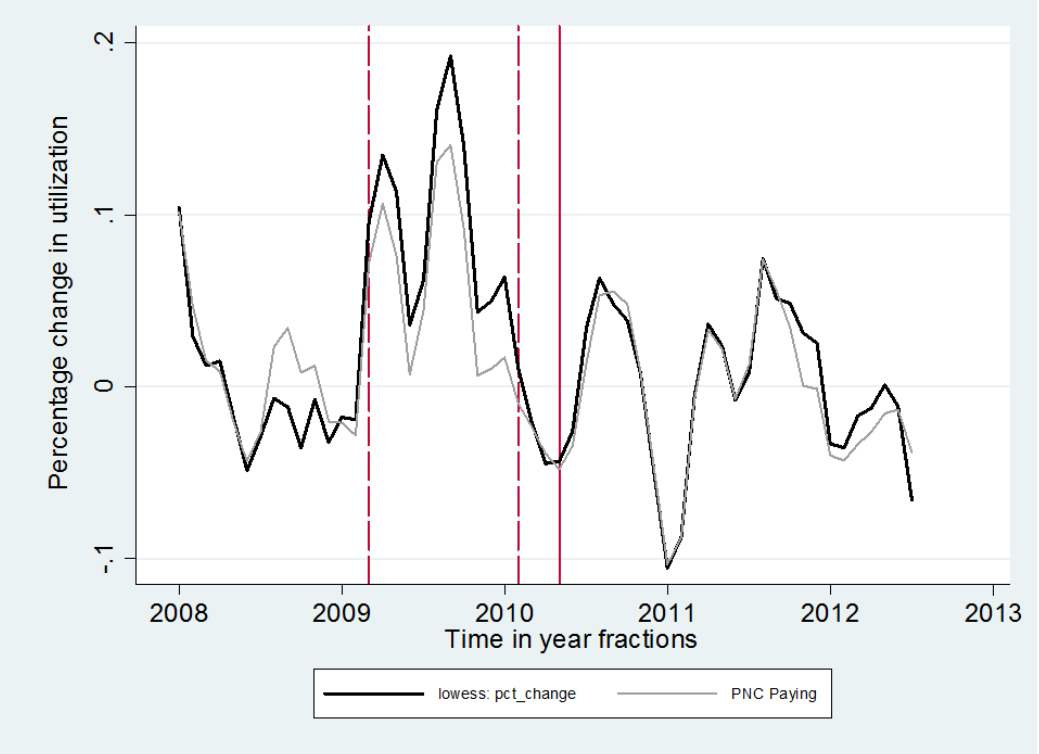
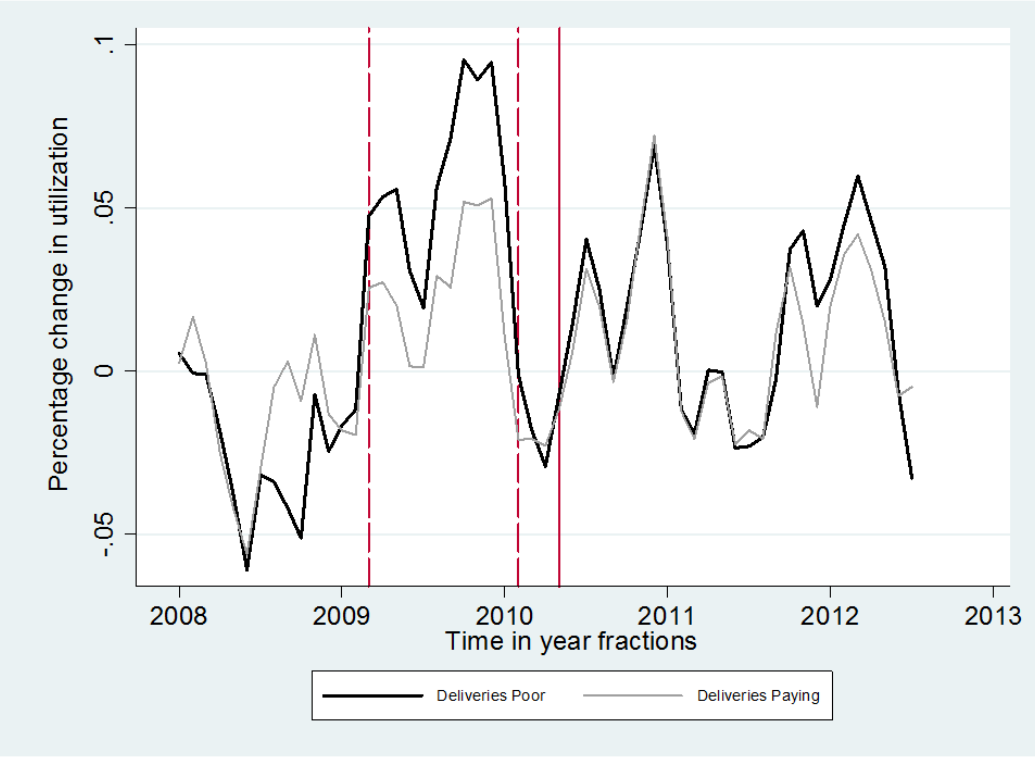


Figure A3: The monthly growth rate in delivery utilization over time



Notes:

1. In all cases, during the period of decreasing utilization (to the left of the first dashed vertical line), the decrease in utilization was lower among paying patients than among poor patients, while during the period of increasing utilization (between the two dashed vertical lines) the increase in utilization was greater among poor patients than it was among paying patients.
2. After the price increase (to the right of the solid vertical line), there was a convergence in the growth rates among paying and poor clients, with the possible exception of ANC care. The reasons for this are not clear.
3. The graphs, similar to the findings in the main paper, do not show a marked difference in the growth rates before and after the price increase (although it would be hidden to some extent by the 6-month smoothing period).

ANNEX 2: RESULTS FOR ENTIRE PERIOD AFTER USER FEE INCREASE

Table A1: Results of model with dummy variable included after price increase

Variable	Model 1: All types of utilization, dummy for paying customers only	Model 2: All types of utilization, dummy for paying and poor customers	Model 3: ANC & PNC only, dummy for paying customers only	Model 4: ANC & PNC only, dummy for paying and poor customers	Model 5: Deliveries only, dummy for paying customers only	Model 6: Deliveries only, dummy for paying and poor customers
After price increase, paying full fee customers						
Estimated value for May 2010 onward	0.04	-0.01	0.06	-0.01	-0.02	-0.03
Standard Error	0.04	0.05	0.04	0.05	0.05	0.05
After price increase, all customers						
Estimated value for May 2010 onward		0.05		0.07		0.01
Standard Error		0.04		0.04		0.05

Dependent variable: Log of utilization

*Statistically significant at p<0.05

**Statistically significant at p<0.01

Table A2: Results of model with changes in the time-trend of utilization after price increase

Variable	Model 1: All types of utilization, dummy for paying customers only	Model 2: All types of utilization, dummy for paying and poor customers	Model 3: ANC & PNC only, dummy for paying customers only	Model 4: ANC & PNC only, dummy for paying and poor customers	Model 5: Deliveries only, dummy for paying customers only§	Model 6: Deliveries only, dummy for paying and poor customers§
After price increase, paying customers						
May onwards Indicator (SE)	0.03 (0.04)	0.01 (0.05)	0.04 (0.04)	-0.02 (0.05)	-0.01 (0.05)	0.02 (0.05)
May onwards Interaction (SE)	0.001 (0.002)	0.001 (0.002)	0.003 (0.002)	0.002 (0.003)	>-0.001 (0.003)	-0.001 (0.003)
After price increase, all customers						
May onwards Indicator (SE)		0.05 (0.04)		0.06 (0.04)		-0.05 (0.05)
May onwards Interaction (SE)		<0.001 (0.002)		0.002 (0.002)		-0.005 (0.002)*

Dependent variable: Log of utilization

§ Random slope for the time period October 2007 to January 2009 omitted due to limited number of data series

*Statistically significant at p<0.05

**Statistically significant at p<0.01

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