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Ahcène Zehnati, Marwân-al-Qays Bousmah and Mohammad Abu-Zaineh

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Public-private differentials in health care delivery: The case of cesarean deliveries in Algeria

Ahcène Zehnati
Centre de Recherche en Economie Appliquée pour le Développement (CREAD).
Rue Djamel Eddine El-Afghani, El Hammadia Bouzaréah, BP.197, Rostomia, Bouzaréah, Alger, Algeria.

Marwân-al-Qays Bousmah *
Aix-Marseille Univ, INSERM, IRD, SESSTIM, and Aix-Marseille School of Economics (AMSE), CNRS & EHESS. 5-9 Boulevard Bourdet, CS 50498, 13205 Marseille Cedex 1, France.

Mohammad Abu-Zaineh
Aix-Marseille Univ, INSERM, IRD, SESSTIM, and Aix-Marseille School of Economics (AMSE), CNRS & EHESS. 5-9 Boulevard Bourdet, CS 50498, 13205 Marseille Cedex 1, France.

*** Corresponding author: Marwân-al-Qays Bousmah. Tel.: +33 4 13 55 26 09. Fax: +33 4 13 55 26 09. E-mail: marwan-al-qays.bousmah@univ-amu.fr.**

Abstract

Akin to other developing countries, Algeria has witnessed an increasing role of the private health sector in the past two decades. Our study sheds light on the public-private overlap and the phenomenon of physician dual practice in the provision of health care services using the particular case of cesarean deliveries in Algeria. Existing studies have reported that, compared to the public sector, delivering in a private health facility increases the risk of enduring a cesarean section. While confirming this result for the case of Algeria, our study also reveals the existence of public-private differentials in the effect of medical variables on the probability of cesarean delivery. After controlling for selection in both sectors, we show that cesarean deliveries in the private sector tend to be less medically justified compared with those taking place in the public sector, thus, potentially leading to maternal and neonatal health problems. As elsewhere, the contribution of the private health sector to the unmet need for health care in Algeria hinges on an appropriate legal framework that better coordinates the activities of the two sectors and reinforces their complementarity.

Keywords: public-private differentials; physician dual practice; Algeria; cesarean delivery.

JEL classification: I11; I18; K32.

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1. Introduction

Ensuring universal access to reproductive health while reducing under-five child mortality rate by two-thirds and maternal mortality rate by three-quarters have been amongst the United Nations 2015 Millennium Development Goals (MDG 4 and MDG 5). The recently adopted Sustainable Development Goals (SDGs 2015-2030) have urged all countries to intensifying their efforts to further reduce the global maternal mortality ratio to less than 70 per 100,000 live births, to end preventable deaths of newborns and children under 5 years of age and to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5-mortality to at least as low as 25 per 1,000 live births by 2030 (United Nations, 2015). Akin to other developing countries, Algeria – an upper-middle-income country undergoing a rapid demographic and epidemiological transition – has made a remarkable progress in this domain, with significant reductions in both infant mortality rate (from 39.7‰ in 1990 to 21.9‰ in 2015) and maternal mortality rate (from 216 per 100,000 live births in 1990 to 140 in 2015) (World Health Organization et al., 2015).

Over the past two decades, Algeria has witnessed an increasing role of the private health sector and physician dual practice in health care delivery. Although encouraged by the government in order to reduce spatial inequalities in health, this increasing complementarity between public and private health sectors may lead to adverse medical and economic effects. This article contributes to the literature on the public-private differential and physician dual practice in health care delivery using the case of cesarean deliveries in Algeria. We investigate the factors influencing the cesarean section deliveries using data from the latest Multiple Indicator Cluster Survey (MICS) conducted in 2012-2013. This study examines whether the determinants of cesarean delivery differ according to the place of delivery (whether public or private).

The case of cesarean delivery is interesting in its own right. The cesarean section rate has grown considerably over the last decade, especially in developing countries (Porreco and Thorp, 1996; Flamm, 2000). Stanton and Holtz (2006) estimate cesarean rates in the developing world at 12% with variable regional rates from 3% to 26%. Arab countries are no exception to this "epidemic of cesarean sections" (Khawaja et al., 2009; Mikki et al., 2009; Betrán et al., 2016). This issue is particularly important form both medical and economic perspectives. The strong increase in cesarean sections raises a question about the determinants of this practice. On the medico-clinical level, professional recommendations to assist healthcare professionals in decision-making on cesarean section have been developed (Di Renzo and Malvasi, 2016). However, such recommendations are rather indicative, leaving greater discretion to health care professionals to decide whether or not to practice a cesarean section. Furthermore, there is no consensus on an "optimal rate" of cesarean sections, even if the World Health Organization (1985; 2015) and others (Ye et al., 2014; Betrán et al., 2015) consider a rate of 10 to 15% above which cesarean sections may be deemed medically unjustified and may not necessarily be associated with a reduction in maternal and neonatal mortality. A variety of non-medical factors pertaining to the demand for medical care (e.g., socio-economic and socio-demographic characteristics of women) and the supply of medical care (e.g., characteristics of the health care system) are shown to play an important role in the decision to rescue to cesarean sections (Baubeau and Buisson, 2003).[1] Cesarean indications are often medically unjustified. Although cesarean section is a common procedure, it is not uncommon to observe a complication that darkens the fetal and maternal prognosis. However, the argument generally put forward by the doctor is the fetal and/or maternal rescue. In reality, is this the case? Health professionals do not communicate enough with mothers about the risks incurred after the cesarean section. It is naive to think that all information disseminated by doctors is unbiased and expresses an opinion based on their experience (Penna and Arulkumaran, 2003). The costs of the negatives effects of cesarean section may be significant in comparison with normal delivery (Filippi et al., 2015). Research between 2000 and 2005 shows evidence of very small numbers of women requesting a cesarean section (McCourt et al., 2007). In economic terms, the significant remuneration differences between cesarean delivery and vaginal delivery may explain the high incidence of cesarean section.

The remainder of the paper is organized as follows. The following Section features the Algerian healthcare system. Section 3 presents the methodology and the dataset used in the econometric analysis. The results are presented in Section 4 and discussed in Section 5 along with some recommendations.

2. The Algerian context

The Algerian health care system is a dual public-private sector. The Ministry of Health, Population and Hospital Reform (MHPHR) runs the public sector and regulates the rapidly

[1] Demand-side factors include the role of social network (Leone et al., 2008) or the fear of vaginal delivery (Fritel, 2015), while supply-side factors are mainly related to financial motives (McGuire and Pauly, 1991; Gruber and Owings, 1996; Gruber et al., 1999; Milcent and Rochut, 2009; Triunfo and Rossi, 2009; Cavalieri et al., 2014; Johnson and Rehavi, 2016).

evolving private-for-profit sector (MSPRH, 2001). Health care expenditures are mainly funded through general tax revenues, social security funds and out-of-pocket payments. Available data indicate that total health expenditure (THE) represented 7.2% of GDP in 2014. Although the share of THE in GDP has significantly increased over the last two decades (from 3.7% in 1995 to 7.2% in 2014), the share of public health expenditure in THE has fallen from 77.4% in 2001 to 72.7% in 2014 (World Health Organization, 2017). This reflects a gradual shift of health financing towards private sources. As a result the share of health care expenditure borne by households was as high as 26.5% in 2014 (Tlilane, 2004; Lamri, 2014). The relatively high share of household direct expenditures on health care can also be explained by the small share of medical costs covered by the social security, especially for private sector health services. Although in the case of Algeria no empirical evidence has been made available to date on the effect of health care expenditure on household welfare, the relatively high financial burden associated with ill-health may well alert on the risk of catastrophic and impoverishing health expenditures.

De facto complementarity between the public and the private providers with a phenomenon of dual practice have informally developed from an attempt to raise practitioners' remunerations. *De jure* complementarity between the two sectors have been endorsed by the "*décret exécutif n° 99-236 du 19 octobre 1999*". These dual practices have further been reinforced by a new legislation ("*circulaire n° 001 MSPRH/MIN du 31 mars 2010*"). Accordingly, public-sector's practitioners are allowed to combine public-sector work with a fee-for-service in the private sector – the so-called "*profitable activities*". These reforms are meant to tackle the spatial inequalities in the distribution of health care services across the different regions. Consequently, the MHPHR has started to contract private sector practitioners to cover areas that have deficits of doctors in certain specialties. The private health care sector encompasses private physicians and private clinics with or without hospital beds. The role and number of private physicians has grown rapidly during the last two decades particularly in some specialties such as gynecology, ophthalmology or otorhinolaryngology. In 2012, the private-public ratios for these three specialties were estimated at 75: 25%, 70: 30% and 65: 35%, respectively (Zehnati, 2014). The deficit of specialist physicians in the public sector is more pronounced for gynecology.

Algeria undergoes a rapid demographic and epidemiological transition as is shown by the steady increase in the population (39.7 million as per 2015), the falling infant mortality (from 33.9‰ in 2000 to 21.9‰ in 2015) and the improvement in life expectancy at birth (a gain of 22 years between 1975 and 2015). A review of the epidemiological profile shows that noncommunicable diseases such as cardiovascular diseases and cancers are the main causes of morbidity and mortality (73.8% of deaths) (World Bank, 2017). Free access to different types of health care services are guaranteed to all citizens in the Algerian constitution (Article 66). In practice, however, patients' health care pathways can vary depending on the different financing and reimbursement modalities as well as the physician's referral strategies (Zehnati, 2014). In effect, the decree of 1999 that allows practitioners to exercise in both sectors has offered the physicians more liberty to refer patients and decide on their therapeutic itineraries. Given the large public-private differentials in terms of remunerations, referrals to private sector may well be ruled by the physicians' incentives where public sector hospitals is regarded as a source of generating a fee-for-service private clientele (Zehnati and Peyron, 2013). Anecdotal evidence on heterogeneous referral practices (preferential and quicker referrals) are often reported, particularly for the case of surgeries in public hospitals where inefficiency and nepotism appear to burden such referral practices. Indeed, patients are generally confronted with two entry barriers: a relational barrier to get appropriate access to the needed services in the public sector and a financial barrier to access the private sector (Zehnati, 2014). The rapid growth of private health providers and the public-private dual practice may have increased the financial burden of health care. A recent study indicated that the referral practices are rather driven by practitioners' financial incentives who seek to maximize their gains through modifying patients' therapeutic pathways (Zehnati, 2014). For instance, in the particular case of birth delivery, the study shows that about 72% of cesarean section surgeries in two districts of Algeria, Algiers and Béjaia, took place at the private sector clinics, representing about 50% of their revenue.

3. Material and methods

3.1 Data

This paper uses the latest available data from the Multiple Indicator Cluster Survey (MICS) conducted in Algeria in 2012-2013 (UNICEF, 2015). The MICS is a national representative survey that provides detailed data on maternal and infant health, in addition to a set of socio-demographic and socio-economic characteristics of households. A sample of 28000 Algerian households, distributed according to seven regions, has been selected using a two-stage stratified cluster-random sampling procedure.

This study uses individual-level data pertaining to adult women of reproductive age (15-49). The target population comprises a sub-sample of 5,278 adult women who have delivered in a public or a private health facility in the two years prior to the survey. Table 1 provides a detailed description of the main variables used in our study. The variable of interest is a binary variable taking on a value of 1 if a woman had a cesarean delivery and zero otherwise. A set of explanatory variables, which are shown to be potentially important associates with cesarean delivery, are identified and included in the analysis (Stivanello et al., 2014). On all deliveries, about 15.3% were cesarean, and 7.4% took place in a private health facility, as shown in Table 1. As far as public-private differential is concerned, data shows that while only 7% of women who delivered in a public health facility had a cesarean section, about 53% of deliveries taking place in a private health facility were cesarean.

3.2 Methodology

The methodology employed involves three steps. First, a baseline logit model of cesarean delivery is estimated. Secondly, we estimate a bivariate probit model to investigate whether the decisions about the mode of delivery and the place of delivery are correlated. Note that the descriptive analysis indicates that these two outcomes are strongly positively correlated ($\rho = 0.29, p < 0.001$), thus, a joint-specification of the two binary variables is called for. A bivariate probit model allow us to jointly estimates two binary probit models and allows for correlation between the error terms of both equations (Cameron and Trivedi, 2009). A test for error term correlation (Wald test of $\rho = 0$) is then performed. Such joint estimation with a bivariate probit model is needed in the case where the hypothesis that ρ=0 is rejected.

Thirdly, we examine whether the factors associated with cesarean delivery differ according to the place of delivery. To do so, we need to estimate the determinants of the mode of delivery separately for the two sectors (deliveries in a public *versus* private health facility). The aforementioned correlation between the mode and the place of delivery alerts on the potential presence of self-selection: women are unlikely to be randomly distributed across places of delivery (public *versus* private). We suspect that giving birth in a private health facility is positively correlated with cesarean delivery. Scrutinizing the factors associated with cesarean delivery according to the place of delivery requires, therefore, controlling for potential selection. The latter is addressed here using the propensity score matching (PSM) technique (cf. Garrido et al., 2014). The PSM allows to adjust for pre-treatment observable differences between the treatment group (women who delivered in a private facility) and the control group (women who delivered in a public facility). Using a probit model, we estimate in a first step the propensity scores of the treatment group on the set of explanatory variables except the mode of delivery. Then, a kernel matching procedure is implemented, with cesarean delivery specified as outcome variable, using the Epanechnikov kernel function with a bandwidth of 0.06 and the conditional treatment probability (the propensity scores) estimated in the first step. As a result, women who delivered in the public or private sector are matched based on their propensity scores. Finally, two probit models are estimated separately on the two sub-samples of women with the same set of explanatory variables, and using the matching weights from the propensity scores. It is, thus, possible to compare the results of the two models. Lastly, it is worth mentioning that in all regressions, standard errors are clustered at the primary sampling unit (PSU) level to account for the possible autocorrelation in the residuals.

4. Results

Results of the multivariate analysis, using logistic regression, of the factors associated with the risk of having a cesarean delivery are presented in Table 2. As shown, the probability of cesarean section is significantly positively associated with the place of delivery, with an odds ratio (OR) for private health facility of 7.338 ($p < 0.001$). The probability of cesarean delivery also increases with the number of prenatal visits, with an OR of 1.564 for ten or more prenatal visits ($p < 0.05$). By contrast, the probability of cesarean section tend to decrease with the birth order of the newborn, being the lowest for a birth order of 5 or more (OR = 0.168, $p < 0.001$). Expectedly, the probability of cesarean delivery appears to be lower for the average size of a newborn compared with both very small, larger than average and very large. Among the other medical factors, women who had, during the pregnancy, a high blood pressure, a facial or body edema, or gestational diabetes appear to be more exposed to have a cesarean section. Nonetheless, no significant association is found for women who had, during the pregnancy, vaginal bleeding, vaginal infection or burning urination. Place of living appears to be a contributor to the probability of having cesarean delivery with women living in urban areas and in the northeast and northwest regions being at higher risk of having a cesarean delivery than their rural and north-center region counterparts. The probability of cesarean section tend also to increase with maternal age and for mothers who had ever experienced the death of a child. Interestingly, the results show a socio-economic gradient in enduring a cesarean section. In comparison with women belonging to the poorest wealth quintile, those belonging to the higher (third and fourth) wealth quintile appear to be at lower risk of enduring a cesarean section. However, quite a reverse gradient is observed when considering mother's level of education, with those with higher education being more likely to endure a cesarean delivery.

Table 3 shows the results for the bivariate probit model of enduring a cesarean section and delivering in a private health facility estimated using the same set of explanatory variables as before. Overall, the coefficient estimates for the cesarean section equation are broadly similar to those obtained suing the binary logistic model. The socio-economic gradient is once again apparent for cesarean section with those in the highest income quintiles are less likely to endure a cesarean section. Interestingly, however, the coefficient estimates for the private sector delivery equation shows the opposite trend with those belonging to the higher income quintiles are more likely to go private compared with the worst-off (with an OR of 1.847 for women belonging the richest wealth quintile). More importantly, result of the Wald test, which allows to estimate and test for the potential correlation between the error terms of the two equations, strongly rejects the hypothesis that $\rho = 0$. The estimate for the correlation coefficient is $\rho = 0.556$ and the chi-squared test of 196.20, showing that this estimate is significantly different from zero. This indicates that the decisions about the mode of delivery and the place of delivery are jointly influenced by unobservable factors, which are positively related to the mode and the place of delivery.

The previous findings motivate the use of the PSM technique in order to account for potential selection bias before estimating separately the determinants of cesarean delivery in the two sectors. In a probit model, we, first, estimate the propensity scores of the treated group (women giving birth in a private health facility) on the same set of explanatory variables, except the mode of delivery. Results show that the balancing property is satisfied.[2] The resulting propensity scores are then used to perform the matching. A test assessing the comparability between the two matched samples is performed. Results show that most of the pre-matching bias is considerably reduced after matching.[3] Then, the matching weights from the propensity

[2] The results, which are not shown here for reasons of space, are available from the authors upon request.
[3] Before and after the matching, and for each variable, we perform a t-test of mean equality between the two groups. The results, which are not shown here for reasons of space, are available from the authors upon request.

scores are used to estimate separately a model explaining the factors associated with the risk of having a cesarean section as per the public and private sectors. Results, which are presented in Table 4 are broadly similar for both sub-samples with regard to the birth order, the number of prenatal visits, the maternal age as well as the wealth quintile. These results are also in line with those of the baseline model (Table 2).

Quite interestingly, the results reveal a substantial public-private differential concerning a number of medical factors. In particular, compared to smaller or larger newborns' size, the average size of newborns is significantly negatively associated with the probability of enduring a cesarean delivery at a public sector facility, while no significant association is found for the case of the private sector. Also of note, the probability of enduring a cesarean delivery appears to be higher in the public sector for women who had, during their pregnancy, gestational diabetes or a facial or body edema. However, none of these variables emerge to be significant for cesarean section delivery taking place in the private sector. The only complication during the pregnancy which increases the probability of a cesarean section in both public and private sectors is high blood pressure. Finally, the socio-economic gradient – as captured by the women's education level – appears to be only significant in the case of public sector: women with higher education are more likely to give a cesarean birth at public facility. However, once again, opposite socio-economic gradient is observed in relation to the wealth quintile: those belonging to the higher (forth quintile) are significantly less likely to give a cesarean birth at both public and private sectors facilities compared with the worst-off quintile.

5. Discussion

This study sheds light on the public-private overlap and the phenomenon of dual practice in the provision of health care services using the particular case of cesarean deliveries in Algeria. Unless appropriately regulated, the public-private overlap coupled with physician dual practice may hinder the efficient provision of health care services and impose additional financial and non-financial barriers on households. This may also have adverse consequences on population health. In this study, we show that cesarean deliveries in the private sector are not determined by medical factors only, which goes against the WHO guidelines (World Health Organization, 1985; 2015).

The hypertrophy of the private medical sector is an essential characteristic of the Algerian health system. The private sector is very much present in large metropolises as well as in the underserved regions. However, its role remains limited in the economically less developed regions such as the western highlands and the south, where the public sector dominates. Our results support the hypothesis that cesarean sections taking place at the private facilities are rather driven by non-medical factors. The absence of appropriate regulations, the overloaded public facilities and the dual practice of public sector physicians all contribute to such medically-unjustified practices. Clearly, existing guidelines for cesarean sections, though necessary, remains insufficient to limit such practices, particularly in the context of the rapidly growing private medical sector, the inadequate supply in the public sector and the high fertility rates. Appropriate legislations that reinforce the public-private complementarity and the surveillance of private medical practices are required in order to improve maternal and neonatal care delivery in Algeria.

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Tables

Table 1: Variables description

Variable	**Type**	**Definition**	**Percentage of sample**
Cesarean delivery (dependent variable)	Binary	Vaginal delivery (=base category); cesarean delivery	84.69; 15.31
Place of delivery	Binary	Public health facility (=base category); private health facility	92.63; 7.37
Birth order	Discrete	Order of the index delivery: 1 (=base category); 2; 3; 4; 5 or more	29.39; 25.01; 19.67; 12.58; 13.36
Number of prenatal visits	Discrete	<=4 (=base category); >=5 and <=9; >=10	59.28; 37.32; 3.39
Infant size at birth	Discrete	Very small (=base category); smaller than average; average; larger than average; very large.	4.36; 10.78; 66.71; 13.45; 4.70
Complications during the pregnancy			
Vaginal bleeding	Binary	No (=base category); Yes	91.44; 8.56
High blood pressure	Binary	No (=base category); Yes	92.88; 7.12
Facial or body edema	Binary	No (=base category); Yes	90.17; 9.83
Vaginal infection	Binary	No (=base category); Yes	87.70; 12.30
Burning urination	Binary	No (=base category); Yes	89.09; 10.91
Gestational diabetes	Binary	No (=base category); Yes	98.18; 1.82
Mother's characteristics			
Region	Discrete	North Center (=base category); Northeast; Northwest; Highlands Center; Highlands East; Highlands West; South	13.26; 10.78; 12.28; 16.31; 14.99; 15.61; 16.77
Area	Binary	Rural (=base category); urban	34.14; 65.86
Maternal age	Continuous	In years	
Mother ever had a child who died	Binary	No (=base category); Yes	93.26; 6.74
Wealth quintile	Discrete	1st (poorest) quintile (=base category); 2nd; 3rd; 4th; 5th (richest)	

Formal education	Discrete	Elementary school or less (=base category); middle school; high school; higher	34.98; 30.28; 23.57; 11.18

Table 2: Results of the logit model of the factors associated with the risk of enduring a cesarean delivery

Logit model (dependent variable = cesarean delivery)	Coefficient estimates	OR
Place of delivery (ref. = public health facility)		
Private health facility	1.993***	7.338***
	(0.136)	(1.000)
Birth order (ref. = 1)		
2	-0.492***	0.611***
	(0.107)	(0.065)
3	-1.187***	0.305***
	(0.145)	(0.044)
4	-1.262***	0.283***
	(0.177)	(0.050)
5 or more	-1.786***	0.168***
	(0.213)	(0.036)
Number of prenatal visits (ref. = <=4)		
>=5 and <=9	0.232*	1.261*
	(0.093)	(0.118)
>=10	0.447*	1.564*
	(0.207)	(0.323)
Infant size at birth (ref. = very small)		
Smaller than average	0.057	1.059
	(0.235)	(0.248)
Average	-0.409^{+}	0.664^{+}
	(0.212)	(0.141)
Larger than average	0.516*	1.676*
	(0.228)	(0.382)
Very large	0.498^{+}	1.645^{+}
	(0.282)	(0.463)
Complications during the pregnancy		
Vaginal bleeding	-0.202	0.817
	(0.154)	(0.126)
High blood pressure	0.826***	2.285***
	(0.140)	(0.319)
Facial or body edema	0.338*	1.403*
	(0.141)	(0.198)
Vaginal infection	-0.173	0.841
	(0.155)	(0.131)
Burning urination	0.024	1.025

	(0.161)	(0.165)
Gestational diabetes	0.795**	2.214**
	(0.279)	(0.617)
Region (ref. = North Center)		
Northeast	0.299^{+}	1.348^{+}
	(0.176)	(0.237)
Northwest	0.446**	1.562**
	(0.170)	(0.266)
Highlands Center	-0.042	0.959
	(0.172)	(0.165)
Highlands East	-0.122	0.885
	(0.168)	(0.149)
Highlands West	0.129	1.138
	(0.162)	(0.185)
South	0.028	1.028
	(0.173)	(0.178)
Urban area (ref. = rural)	0.190^{+}	1.210^{+}
	(0.115)	(0.139)
Maternal age	0.073***	1.076***
	(0.009)	(0.010)
Mother ever had a child who died	0.423*	1.527*
	(0.182)	(0.278)
Mother's wealth quintile (ref. = 1st (poorest) quintile)		
2nd quintile	-0.010	0.990
	(0.133)	(0.131)
3rd quintile	-0.264^{+}	0.768^{+}
	(0.149)	(0.115)
4th quintile	-0.435**	0.647**
	(0.162)	(0.105)
5th (richest) quintile	-0.218	0.804
	(0.174)	(0.140)
Mother's formal education (ref. = elementary school or less)		
Middle school	0.153	1.165
	(0.115)	(0.133)
High school	0.394**	1.483**
	(0.120)	(0.178)
Higher	0.450**	1.569**
	(0.156)	(0.244)

Constant	-3.916*** (0.377)	0.020*** (0.008)
Log pseudolikelihood	-1903.087	
Wald test p-value	0.0000	
Pseudo R2	0.158	
N	5278	

Notes: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Clustered standard errors computed at the primary sampling unit (PSU) level in parenthesis.

Table 3: Results of the bivariate probit model

Bivariate probit model	Dep. var. = cesarean delivery		Dep. var. = delivery in a private health facility	
	Coefficient estimates	OR	Coefficient estimates	OR
Birth order (ref. = 1)				
2	-0.276***	0.759***	-0.135^{+}	0.874^{+}
	(0.058)	(0.044)	(0.074)	(0.064)
3	-0.617***	0.540***	-0.168*	0.846*
	(0.075)	(0.040)	(0.086)	(0.072)
4	-0.681***	0.506***	-0.252*	0.778*
	(0.091)	(0.046)	(0.116)	(0.090)
5 or more	-0.948***	0.388***	-0.303*	0.739*
	(0.109)	(0.042)	(0.134)	(0.099)
Number of prenatal visits (ref. = <=4)				
>=5 and <=9	0.180***	1.197***	0.267***	1.306***
	(0.049)	(0.058)	(0.063)	(0.082)
>=10	0.312**	1.366**	0.326*	1.386*
	(0.111)	(0.151)	(0.139)	(0.192)
Infant size at birth (ref. = very small)				
Smaller than average	0.010	1.010	-0.119	0.888
	(0.122)	(0.123)	(0.145)	(0.129)
Average	-0.248*	0.780*	-0.205^{+}	0.815^{+}
	(0.107)	(0.084)	(0.123)	(0.100)
Larger than average	0.266*	1.305*	-0.011	0.989
	(0.117)	(0.153)	(0.133)	(0.132)
Very large	0.295*	1.343*	0.136	1.146
	(0.145)	(0.194)	(0.160)	(0.183)
Complications during the pregnancy				
Vaginal bleeding	-0.078	0.925	0.082	1.085
	(0.081)	(0.075)	(0.090)	(0.098)
High blood pressure	0.410***	1.507***	-0.120	0.887
	(0.080)	(0.120)	(0.107)	(0.095)
Facial or body edema	0.179*	1.196*	0.039	1.039
	(0.078)	(0.093)	(0.094)	(0.097)
Vaginal infection	-0.086	0.917	-0.009	0.991
	(0.081)	(0.075)	(0.093)	(0.092)
Burning urination	0.014	1.014	0.044	1.045

	(0.087)	(0.088)	(0.109)	(0.113)
Gestational diabetes	0.435**	1.545**	-0.008	0.992
	(0.153)	(0.237)	(0.190)	(0.188)
Region (ref. = North Center)				
Northeast	0.129	1.137	-0.085	0.918
	(0.094)	(0.107)	(0.109)	(0.100)
Northwest	0.179^{+}	1.196^{+}	-0.187^{+}	0.829^{+}
	(0.093)	(0.111)	(0.109)	(0.091)
Highlands Center	-0.079	0.924	-0.262*	0.770*
	(0.088)	(0.081)	(0.109)	(0.084)
Highlands East	-0.008	0.992	0.218*	1.243*
	(0.089)	(0.089)	(0.103)	(0.128)
Highlands West	-0.056	0.945	-0.582***	0.559***
	(0.087)	(0.083)	(0.128)	(0.071)
South	-0.081	0.922	-0.483***	0.617***
	(0.090)	(0.083)	(0.123)	(0.076)
Urban area (ref. = rural)	0.105^{+}	1.111^{+}	0.004	1.004
	(0.060)	(0.067)	(0.074)	(0.074)
Maternal age	0.039***	1.040***	0.011^{+}	1.011^{+}
	(0.005)	(0.005)	(0.007)	(0.007)
Mother ever had a child who died	0.247**	1.280**	0.147	1.159
	(0.093)	(0.119)	(0.119)	(0.138)
Mother's wealth quintile (ref. = 1st (poorest) quintile)				
2nd quintile	-0.008	0.992	0.032	1.032
	(0.071)	(0.070)	(0.103)	(0.106)
3rd quintile	-0.096	0.908	0.268*	1.307*
	(0.079)	(0.072)	(0.107)	(0.140)
4th quintile	-0.176*	0.839*	0.320**	1.377**
	(0.084)	(0.071)	(0.106)	(0.146)
5th (richest) quintile	0.019	1.019	0.613***	1.847***
	(0.091)	(0.093)	(0.108)	(0.199)
Mother's formal education (ref. = elementary school or less)				
Middle school	0.109^{+}	1.115^{+}	0.141*	1.151*
	(0.059)	(0.065)	(0.071)	(0.082)
High school	0.221***	1.248***	0.082	1.085
	(0.063)	(0.078)	(0.085)	(0.092)

Higher	0.354*** (0.083)	1.425*** (0.118)	0.432*** (0.093)	1.541*** (0.144)
Constant	-2.087*** (0.199)	0.124*** (0.025)	-1.934*** (0.248)	0.145*** (0.036)
ρ (robust standard error)	0 .556 (0.031)			
Wald test of ρ=0	chi2(1) = 196.207 Prob > chi2 = 0.0000			
Log pseudo-likelihood	-3129.527			
Wald test p-value	0.0000			
N	5278			

Notes: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Clustered standard errors computed at the primary sampling unit (PSU) level in parenthesis.

Table 4: Factors associated with the risk of enduring a cesarean section according to the place of delivery

Logit model (dependent variable = cesarean delivery)	Public health facility		Private health facility	
	Coefficient estimates	OR	Coefficient estimates	OR
Birth order (ref. = 1)				
2	-0.354*	0.702*	-0.068	0.934
	(0.144)	(0.101)	(0.315)	(0.295)
3	-1.144***	0.318***	-1.226**	0.293**
	(0.194)	(0.062)	(0.384)	(0.113)
4	-1.042***	0.353***	-1.157*	0.315*
	(0.228)	(0.081)	(0.474)	(0.149)
5 or more	-1.638***	0.194***	-1.462*	0.232*
	(0.258)	(0.050)	(0.589)	(0.136)
Number of prenatal visits (ref. = <=4)				
>=5 and <=9	0.163	1.177	0.400	1.492
	(0.117)	(0.137)	(0.249)	(0.371)
>=10	0.518*	1.678*	1.029^{+}	2.798^{+}
	(0.245)	(0.412)	(0.573)	(1.603)
Infant size at birth (ref. = very small)				
Smaller than average	-0.077	0.926	0.648	1.911
	(0.286)	(0.265)	(0.620)	(1.186)
Average	-0.517*	0.596*	0.468	1.596
	(0.253)	(0.151)	(0.532)	(0.849)
Larger than average	0.437	1.547	0.735	2.085
	(0.271)	(0.420)	(0.586)	(1.221)
Very large	0.469	1.598	0.375	1.455
	(0.336)	(0.537)	(0.715)	(1.040)
Complications during the pregnancy				
Vaginal bleeding	-0.271	0.763	0.005	1.005
	(0.204)	(0.156)	(0.379)	(0.381)
High blood pressure	0.832***	2.297***	0.999*	2.716*
	(0.187)	(0.429)	(0.499)	(1.356)
Facial or body edema	0.529**	1.697**	0.018	1.018
	(0.175)	(0.297)	(0.382)	(0.389)
Vaginal infection	0.089	1.093	-0.208	0.812
	(0.208)	(0.227)	(0.386)	(0.313)
Burning urination	0.038	1.039	0.421	1.524
	(0.217)	(0.226)	(0.409)	(0.623)
Gestational diabetes	0.642^{+}	1.901^{+}	1.357	3.883

	(0.349)	(0.664)	(0.940)	(3.652)
Region (ref. = North Center)				
Northeast	0.214	1.238	1.216**	3.373**
	(0.218)	(0.270)	(0.437)	(1.473)
Northwest	0.225	1.252	1.200*	3.321*
	(0.205)	(0.257)	(0.496)	(1.649)
Highlands Center	-0.098	0.907	0.257	1.293
	(0.220)	(0.200)	(0.463)	(0.599)
Highlands East	-0.436+	0.647+	0.628+	1.873+
	(0.232)	(0.150)	(0.363)	(0.681)
Highlands West	0.134	1.144	0.285	1.330
	(0.209)	(0.239)	(0.532)	(0.708)
South	-0.163	0.850	0.384	1.468
	(0.210)	(0.178)	(0.527)	(0.773)
Urban area (ref. = rural)	0.151	1.163	0.131	1.140
	(0.157)	(0.182)	(0.349)	(0.398)
Maternal age	0.079***	1.082***	0.063*	1.065*
	(0.012)	(0.013)	(0.027)	(0.029)
Mother ever had a child who died	0.568*	1.764*	-0.330	0.719
	(0.220)	(0.389)	(0.514)	(0.370)
Mother's wealth quintile (ref. = 1st (poorest) quintile)				
2nd quintile	-0.031	0.969	-0.125	0.882
	(0.158)	(0.153)	(0.483)	(0.426)
3rd quintile	-0.224	0.800	-0.632	0.532
	(0.182)	(0.145)	(0.509)	(0.270)
4th quintile	-0.396*	0.673*	-1.162*	0.313*
	(0.197)	(0.133)	(0.518)	(0.162)
5th (richest) quintile	-0.146	0.864	-0.882+	0.414+
	(0.204)	(0.176)	(0.536)	(0.222)
Mother's formal education (ref. = elementary school or less)				
Middle school	0.162	1.176	0.083	1.087
	(0.144)	(0.169)	(0.339)	(0.368)
High school	0.616***	1.852***	-0.221	0.801
	(0.144)	(0.267)	(0.367)	(0.294)
Higher	0.565**	1.760**	0.417	1.518
	(0.196)	(0.345)	(0.394)	(0.598)

Constant	-4.089*** (0.496)	0.017*** (0.008)	-2.287* (1.078)	0.102* (0.109)
Log pseudo-likelihood	-149.635		-234.504	
Pseudo R2	0.109		0.128	
Wald test p-value	0.0000		0.0020	
N	4889		389	

Notes: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Clustered standard errors computed at the primary sampling unit (PSU) level in parenthesis. Regressions are weighted by the propensity scores computed previously to account for sample selection bias.