Caesarean section delivery in private and public facilities in Tunisia

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Abstract: Based on WHO threshold, the rate of caesarean section delivery in Tunisia is hight (34%). This paper aims to estimate and analyse the effects of caesarean section determinants in both healthcare sectors: private and public.

The use of caesarean section delivery was estimated using a representative sample of 1090 puerperal women extracted from the national household's survey of budget, consumption, and living standards in 2015. The estimation was performed using logistic regression model.

Caesarean section occurrence is much more observed in private facilities. It is associated with different factors in private and in public facilities. In private facilities, advanced maternal age and numbers of antenatal care visits are the main influencing factors. However, in public facilities, caesarean section delivery is higher for women aged above 35, with chronic disease, living in urban areas.

Caesarean section occurrence is very high in private facilities without being closely associated to risky deliveries. Policymakers should provide mechanisms of control and reduction of unwanted caesarean sections.

I. INTRODUCTION

Tunisia has opted since its independence for health policies for all the population and has set up national health programs aiming to improve maternal and child health through greater use of care,

better medical cover of pregnancy, etc. Consequently, Tunisia has experienced a great development in health indicators. According to MICS 6 (2018), 99.5% of deliveries are attended by qualified personnel (99.7% in urban areas against 99.1% in rural areas) and 99.7% are done in a health facility (99.9% in urban areas against 99.2% in rural areas).

In particular, the maternal mortality and the infant mortality rates were reduced respectively from 66.0 to 44.8 per 100 000 live births (LB) in 2000-2019 and from 24.9‰ to 14.5‰ LB in the same period . However, this ratio is higher than the upper middle-income countries and the European countries' average ratios (resp. 7‰ and 2‰ LB in 2019). Ratios vary from simple to double depending on the region.

Caesarean section is a common surgical intervention which can prevent maternal and perinatal mortality and morbidity when medically indicated, but this procedure can also lead to short-term and long-term health effects for women and children (Sandall, Tribe et al. 2018).

Based on the WHO systematic review, increases in caesarean section rates up to 10-15% at the population level are associated with decreases in maternal, neonatal and infant mortality (Betran, Torloni et al. 2015). Above this level, increasing the rate of caesarean section is no longer associated with reduced mortality. However, the association between higher rates of caesarean section and lower mortality weakened or even disappeared in studies that controlled for socioeconomic factors (Althabe, Sosa et al. 2006, Ye, Betrán et al. 2014). The WHO worldwide ecologic study found that a substantial part of the crude association between caesarean section rate and mortality appears to be explained by socioeconomic factors (Ye, Zhang et al. 2016). The improvement in the quality of care leads to a decrease in maternal deaths, in neonatal deaths and in stillbirths (Chou, Walker et al. 2019). While the risk of infection and complications from surgery are potentially dangerous especially when the right conditions of performing surgery safely are not available.

In Tunisia, caesarean section (CS) rate was 34% in 2015 and it keeps increasing. In private health facilities, caesarean section costs double for the social health insurance fund and also for household (2011-2015).

Given that it is more expensive to give birth in private sector than in public sector especially when it is caesarean section delivery, studying disparities in CS use with detecting socio-economic factors associated with CS decision in private and public facilities allows us to understand the reasons of the increase of this practice and take the necessary measures to limit the exaggerated and sometimes harmful use of CS delivery.

The rest of the paper is organized as follows: in the section 2, we explain the method and the data used for the analysis, section 3 presents the logistic results, section 4 is intended to the discussion of the results and the final section provides a conclusion with some recommendations proposed for political decision-makers.

II. METHOD AND DATA

Because of the nature of the dependent variable, which is dichotomous, logistic regression is applied to study the factors associated to CS delivery. To study determinants of CS delivery by type of health care facility, two other regressions were added by distinguishing between the private and the public health sectors. Then, the model can be written:

$$\ln\left(\frac{P(y)}{1 - P(y)}\right) = b_0 + b_1 X_1 + b_2 X_2 + \cdots + b_T X_T$$

where $P(y)$ is the probability of delivering using caesarean section, b_0 is a constant and $X_1, .., X_T$ is a set of explanatory variables for which odds ratios were estimated.

Data were analyzed using STATA software version 14 and we apply sampling weights to avoid biased population estimates.

The data came from the National Household Survey (SBCLS 2015). Our analysis covers all live deliveries performed during the survey period. Thus, our sample includes 1090 puerperal women. It was generated through a two-stage random stratified cluster.

The survey provides various health condition variables and socio-economic variables such as demography, education, occupation, health insurance coverage, and living standard situation.

In this study, the variable of interest is the childbirth delivery option. It is divided into two categories: the first category indicates that the delivery was performed by caesarean section and the second category indicates that the delivery was vaginal (natural).

For the association of Caesarean section option with maternal characteristics, individual and household's independent variables were considered.

The individual characteristics were described through the age of the puerperal woman, her education level, her health status, her antenatal care (ANC) utilization, her the health insurance coverage and the area of residence. The maternal age was grouped into two groups: ≤ 35 and >35. Education was categorized into three categories: primary school and below, secondary school and high school and above. The health proxy variable was "woman with at least one chronic disease". The ANC utilization variable was defined as "the number of visits done during the pregnancy period". World Health Organization recommends that pregnant women complete at least four antenatal care visits. Aiming to reduce its ratios, Tunisia covers four antenatal visits through its health insurance system. Thus, this variable was divided into three criteria, namely: 0 visit, 1-3 visits and ≥4. The health insurance was categorized into three categories: uninsured, health coverage for poor and pro-poor (HCP) and social health insurance (SHI). The area of residence is grouped into urban and rural areas. According to the survey questionnaire, urban residents are households living in communal and metropolitan areas while rural residents are households living in non-communal areas. Covariates have also included the health facility sector where puerperal woman has given birth. It is divided into two sectors: private health sector and public health sector.

Table 1 presents descriptive statistics for various variables used in the study. Of the total sample of women who gave birth during the year of the survey, 29.1% reported delivering their last birth by caesarean section. 19.2% of total births were given in a private health facility whereas 80.8% were given in a public health facility. The average age of the women in the sample is 31.5 ± 16.6 years. 74.9% are below 35 years old and 25.0% are above 35 years old. Education level rates are respectively 44.5% for primary school or below, 28.1% for secondary school and 27.3% for high school level and above. Only 3.2% of women have chronic disease. About 67% made at least the four visits recommended by WHO. About 88% of women are covered either by HCP (18.36%) or SHI insurance (69.07%). Households were unequally distributed by geographic area (58.5% in urban vs. 41.5% in rural).

Table1: Mode of delivery for puerperal women and characteristics (N=1090)

		Percentage	Standard error
Mode of delivery			
	Caesarean	29.14	1.35
	Vaginal	70.85	1.35
Age (years)			
	≤35	74.96	1.30
	>35	25.04	1.30
Education level			
	Primary school and below	44.57	1.505
	Secondary school	28.07	1.34
	High school and above	27.36	1.33
Chronic disease			
	Yes	3.20	0.52
	No	96.80	0.52
ANC visits			
	0	7.31	0.77
	1-3	25.75	1.30
	≥4	66.93	1.40
Type of health insurance			
	Not covered	12.56	0.99
	HCP (Health coverage for poor)	18.36	1.15
	SHI (social health insurance)	69.07	1.38
Area of residence			
	Urban	58.46	1.47
	Rural	41.53	1.47
Health facility			
	Private	19.17	1.19
	Public	80.83	1.19

III. RESULTS

Details on the distribution of CS delivery rate are displayed in Table 2. The national average of CS delivery rate is 34.0%. CS delivery rate increases with maternal age. This increase is observable in both private and public health facilities. In private health sector, women among secondary school level have the lowest use of CS delivery. However, in public health facilities, women among that category have the highest use of CS option. In both health sectors, the CS delivery use is higher for women with chronic disease. The difference is much more observable in the public sector showing the rates of 41.6% and 24.5% respectively for women with and without chronic disease. In private facilities, CS delivery use increases with the number of ANC visits from 17.5% for women who did not make any ANC visits during their pregnancy period to 62.3% for those who made more than three ANC visits, but this is not the case in public facilities where the rate of CS use drops after four ANC visits.

As for health insurance, CS is much used for women enrolled on SHI coverage comparing to women with HCP coverage. In private sector, CS option is particularly frequent among women enrolled on HCP (71.8%). However, in public sector, this option is frequent among women enrolled on SHI (26.3%). Finally, a difference exists between the rates of CS delivery use in the urban and rural areas. These rates are equal to 38.7%, 58.3% and 28.7% respectively for the full sample, in private facilities and in public facilities of the urban areas. As for, groups of women who lived in rural areas, the rates are respectively 24.2%, 53.5% and 19.8%. Results confirm that in private sector CS delivery use is higher than in public sector.

Table 2: Caesarean section distribution among women characteristics in private and public health facilities

	Total		Private		Public	
	Percent	**Standard error**	**Percent**	**Standard error**	**Percent**	**Standard error**
Age (years)						
≤35	32.636	2.036	55.265	4.370	23.143	2.055
>35	38.727	3.636	70.869	8.651	31.678	3.788
Education level						
Primary school and below	26.078	2.403	56.476	9.275	22.789	2.409
Secondary school	34.103	3.339	50.565	8.085	29.530	3.540
High school and above	44.579	3.568	60.276	5.174	25.666	4.296
Chronic disease						
Presence	47.566	9.658	62.703	19.475	41.612	11.313
Absence	33.386	1.805	57.352	4.048	24.564	1.821
ANC visits						
0	24.850	6.806	17.580	12.666	26.889	7.896
1-3	30.963	3.471	47.604	9.206	26.960	3.679
≥4	35.856	2.166	62.376	4.446	24.455	2.152
Type of health insurance						
Not covered	28.813	4.864	61.173	11.630	21.106	4.962
HCP (Health coverage for poor)	25.793	3.702	71.870	17.446	25.034	3.733
SHI (social health insurance)	36.601	21.572	57.054	4.236	26.357	2.269
Area of residence						
Urban	38.760	2.352	58.350	4.417	28.768	2.581
Rural	24.219	2.332	53.549	8.509	19.847	2.254
Total	34.000	1.779	57.594	39.519	25.287	1.816
N	1090		209		881	

Table 3 gives the results of logistic regression used to determine the factors associated to CS delivery use. For the overall model, it shows that the type of the health sector (private/public) has a significant effect on CS delivery use. The probability of using CS for delivery increased by 3.7 times in private facilities. It is also increased by the maternal age and this increase is significant in both sectors. In private sector (resp. in public sector), women being more than 35 years old use 2.4 times (resp.1.5 times) more the CS option than the ones who are younger. Education level does not have any significant effect on CS use. The effect of chronic disease on CS use only appears in public sector. Results show that in public facilities, women with chronic disease use 2.2 times more CS delivery. In contrast, the effect of ANC visits only appears in private sector. Women who made at least 4 ANC visits and giving birth in private facilities are more likely to use CS delivery, comparing to no one visit. There is no significant correlation between the type of health insurance and the CS use among the three groups studied. Globally, women living in urban areas are more likely to use CS delivery

than those in rural, this result is particularly significant in private health facilities with an odd ratio equal to 1.5.

Table 3: Determinants of caesarean delivery in private and public health facilities

	Total		Private		Public	
	Coeff.	OR	Coeff.	OR	Coeff.	OR
Age (ref: ≤35)						
>35	0.503***	1.653	0.880*	2.411	0.412*	1.509
	(0.193)		(0.532)		(0.214)	
Education level (ref: Primary school and below)						
Secondary school	0.207	1.230	0.084	1.087	0.289	1.335
	(0.209)		(0.556)		(0.224)	
High school and above	0.200	1.221	0.354	1.425	0.082	1.085
	(0.228)		(0.513)		(0.277)	
Chronic disease (ref: absence)						
Presence	0.671	1.956	-0.115	0.890	0.797*	2.219
	(0.463)		(0.830)		(0.481)	
ANC visits (ref :0)						
1-3	0.409	1.504	1.386	4.000	0.087	1.090
	(0.435)		(0.872)		(0.423)	
≥4	0.518	1.679	2.077***	7.984	-0.022	0.978
	(0.404)		(0.796)		(0.388)	
Type of health insurance (ref: Not covered)						
HCP (Health coverage for poor)	0.186	1.203	0.247	1.280	0.341	1.406
	(0.314)		(1.013)		(0.353)	
SHI (social health insurance)	0.083	1.086	-0.277	0.758	0.301	1.350
	(0.258)		(0.519)		(0.310)	
Area of residence (ref: Rural)						
Urban	0.367**	1.443	0.108	1.113	0.427**	1.533
	(0.177)		(0.489)		(0.194)	
Health facility (ref: public)						
Private	1.314***	3.722				
	(0.212)					
_cons	-2.136***	0.118	-1.759*	0.172	-1.884***	0.152
	(0.485)		(0.995)		(0.493)	
N	1090		209		881	

Standard errors in parentheses / * Significant at p<0.1, ** significant at p<0.05, *** significant at p<0.01

IV. DISCUSSION

This paper is using a national representative survey for a considerable sample of puerperal women. Considering the high rate of CS delivery in Tunisia (34%) and specially in private healthcare sector (57%) which is at the same time risky and expensive mode, studying the factors behind this high rate could provide for policymakers a better understanding of this trend to take the adequate measures for controlling and optimizing the CS use.

This work is the first empirical study which examines the determinants of caesarean section occurrence in Tunisia and concentrates on the difference between factors effect in private and in public healthcare sectors.

The findings of this study show the considerable increase of the caesarean section rate in Tunisia as it was incurred by 34%. The distribution by health sector subgroups is respectively 57.6% and 25.3% in private and public sectors. This finding is in line with other studies in developing countries showing that caesarean sections are mainly performed in for-profit private facilities (Potter, Berquó et al. 2001, Mishra and Ramanathan 2002, Sreevidya and Sathiyasekaran 2003, Begum, Rahman et al. 2017). Considering the close relationship between the use of the private sector and socioeconomic status of puerperal women (Fig.1), it is then mainly the wealthy category that is more likely to have caesarean deliveries which is confirmed by similar studies as in Bangladesh and Brazil (Paris, Monteschio et al. 2014, Souza and Pileggi-Castro 2014, da Costa Lino and Diniz 2015, Begum, Rahman et al. 2017). As mentioned above, CS delivery is more profitable for private facilities which could explain the high occurrence of CS delivery in these facilities.

In both sectors, the maternal age constitutes a significant factor in favour of CS decision, particularly above 35 years. Like the findings of this study, the influence of an advanced maternal age on the occurrence of CS delivery appears in other studies (Ecker, Chen et al. 2001, Al-Farsi, Brooks et al. 2010, Bayrampour and Heaman 2010, Begum, Rahman et al. 2017). This result is explained by complications risk which increases with the maternal age. In the same context, findings show that decision for CS in public healthcare sector is based on the presence of chronic disease, so that CS delivery is linked to the exposition to complications risk due to vulnerable maternal health. In the public sector, CS occurrence is often associated with complications during pregnancy and delivery (Domingues, Dias et al. 2014, Leal, Pereira et al. 2014, Souza and Pileggi-Castro 2014, Weidle, Medeiros et al. 2014).

The prenatal assistance influences the decision to make CS delivery in private sector. This finding could be explained, in one hand, by the overestimation of the risks of vaginal delivery during prenatal care visits in private sector where the follow-up is performed by only one doctor unlike in public sector where consultations are alternated between doctor and nurse. Insecurity feeling could discourage vaginal delivery choice (Weidle, Medeiros et al. 2014). In another hand, CS delivery becomes a convenience way for pregnant women and doctors to schedule the delivery for a specific date (Klimpel and Whitson 2016) or to avoid the pain of childbirth. Generally, women who choose private sector for delivering, are assisted by private healthcare and therefore, have greater decision-making power. Indeed, the system in private healthcare sector allows scheduling of caesarean sections, the choice of the healthcare provider and even the staff. Women education level and insurance affiliation did not have any effect on the CS use. In public health sector, CS delivery occurrence is higher in urban than in rural areas. This finding was also documented in other studies (Mishra and Ramanathan 2002). Note that, in Tunisia, the healthcare offer in rural areas, is based on the public sector. For better assistance, high-risk pregnancies are transferred to second and third level facilities which are located exclusively in urban areas.

Another significant cultural factor is the popular belief that vaginal delivery is riskier for the unborn child than a CS mode, which is contradictory to scientific evidence (Reis, Lage et al. 2014, Renfrew, McFadden et al. 2014). Several studies report that the unawareness of women about the risks and benefits of delivery modes could result in choosing caesarean rather than vaginal delivery (Chen and Hancock 2012, Loke, Davies et al. 2015).

To stop the rising trends especially for private facilities, the government needs to develop prevention measures for unnecessary C-sections. Prenatal education is an efficient measure to raise the awareness of pregnant women and health providers about the risks related to C-sections and consequently to decrease caesarean delivery rates (Milcent and Zbiri 2018).
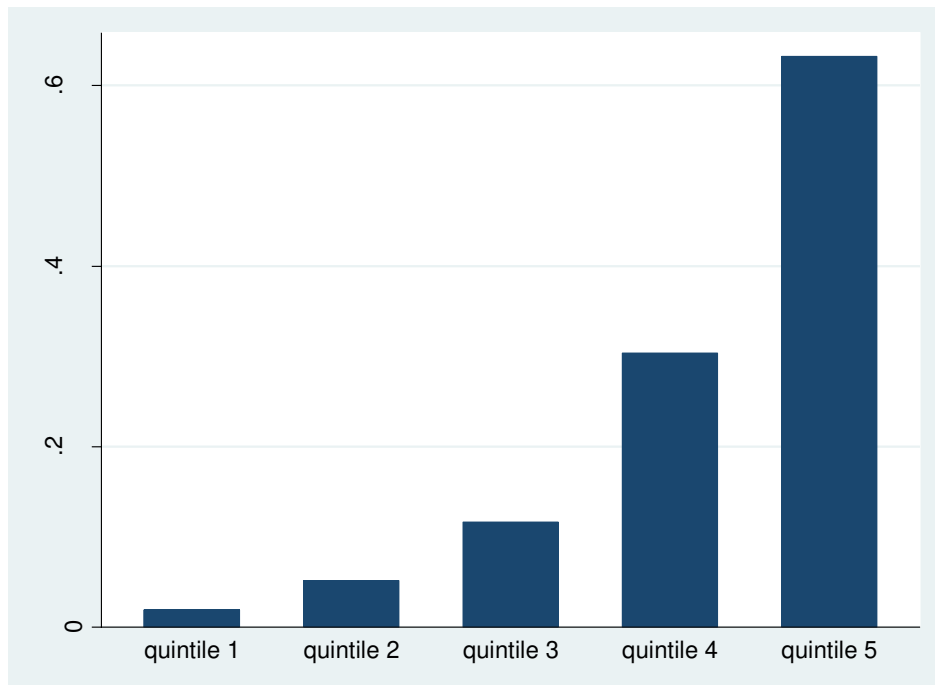
Figure 1: Childbirth rate by economic status in the private sector

V. CONCLUSION

Caesarean section delivery rate is quite high in Tunisia, especially in private facilities where CS use is not associated to health need. Over time, caesarean sections have stopped representing a procedure to improve childbirth and maternal outcomes and have become a consumer product by performing inappropriate interventions. The government should limit the use of caesarean section to need cases. This can be achieved if health providers follow Robson classification to decide about the choice of the delivery procedure (Organization 2015). In private health facilities, antenatal care visits contribute to increase caesarean sections instead of lowering it. Prenatal education could be an efficient way to reverse the impact of ANC visits and decrease CS overuse which is a barrier to universal coverage (Gibbons, Belizán et al. 2010).

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