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ABSTRACT

Intervention of caesarean section (C-section) is crucial in Pakistan where maternal and neonatal mortality is high. However, its use exceeds World Health Organisation recommendations, suggesting that Pakistan is part of a trend worldwide of having C-sections for non-medical reasons. Private health facilities in the country may be more accommodating of C-sections for non-medical reasons than public ones. To test this hypothesis, we used data from the Pakistan Demographic and Health Survey 2012-13 on the most recent birth for women giving birth 2007-2012. Controlling for medical indications (birth order, age at delivery, pregnancy complications, previous termination, previous C-section, antenatal visits), we examined whether the odds of having a C-section were higher in private health facilities. Since women in Pakistan do not have an equal chance of delivering at a health facility, we modelled delivering at a health facility and having a C-section as a two-step process. In the first or selection equation, place of delivery was a function of the aforementioned medical indications and various sociodemographic and community factors (N=7,354). Women who delivered at a health facility (N=3,886) were included in the second or outcome equation, where C-section was a function of medical indications and a binary variable for type of facility served as predictors. Medical indications for a C-section, being more educated, and living in socioeconomically advantaged households and communities were associated with higher odds of delivering at a health facility, and, after taking into account medical indications for having a C-section, the odds of having one were higher for delivery at a private facility. Findings suggest that the private maternal health sector in Pakistan may be over-medicalising childbirth.

1. INTRODUCTION

The role of Caesarean section (C-section) in saving maternal and neonatal lives is acknowledged worldwide especially in developing countries like Pakistan where the state of maternal and neonatal health is far from satisfactory.[1] Over 50 percent of Pakistani women deliver at home, mostly with the assistance of traditional birth attendants (NIPS [Pakistan] & ICF International, 2013, p.137). However, an increase in the rates of C-section deliveries has been observed, particularly in urban areas of Pakistan. Pakistan Demographic and Health Surveys report 13 percent and 24 percent population based C-section rates in urban areas for the years 2006-2007, and 2012-2013, respectively[2] (NIPS [Pakistan] & ICF International, 2013, p. 137 and p. 139).

In a recent statement on C-section rates, the WHO suggests that at the population level, C-section rates higher than 10 percent are not associated with reduction in maternal or neonatal mortality (WHO, 2015, p. 1). There is a growing debate on the extensive use of the C-section, with some arguing that it is associated with an increase in the probability of negative impacts on mother and child physical and mental health (Torkan et al., 2009; Wagner, 2000). A review of 79 studies comparing outcomes of C-section deliveries versus normal deliveries found C-section deliveries to be at higher risk of future medical complications (Jose et al., 2007). Moreover, high rates of C-section elevate the risk of over-medicalising childbirth, which is a serious concern for resource poor countries (Khawaja, Kabakian-Khasholian, & Jurdi, 2004).[3] Findings from previous research on developing countries suggest that the private medical sector in these countries is augmenting the C-section rate either for financial gain or medically unnecessarily conducting it based on women's choice (Potter et al., 2001; Neuman et al., 2014; Yassin & Saida, 2012). To our knowledge, there has been no study of these issues in Pakistan at the population level using nationally representative surveys, such as the Pakistan Demographic and Health Surveys. Although, Mumtaz, Bahk, and Khang, (2017) used these data from these surveys to examine trends and inequalities in C-section rates in Pakistan, their study had a different focus. Moreover, their study did not take into account the self-selection biases associated C-section delivery, with less than 50 percent of Pakistani women delivering at a health care facility.

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[1]Neonatal mortality rate in Pakistan is 55 deaths per 1000 live birth (NIPS [Pakistan] & ICF International 2013, p. 117) whereas maternal mortality ratio is 276 maternal deaths per 100,000 live births (NIPS [Pakistan] & ICF International 2013, p. xxiv).

[2]The C-section rates at country levels are 7 percent and 14 percent for the years 2006-2007 and 2012-2013 respectively (NIPS [Pakistan] and Macro International Inc. 2008, p. 117; NIPS [Pakistan] & ICF International 2013, p. 139).

[3]A study by Khan & Zaman (2010) reports the cost of normal and Caesarean delivery at a tertiary care hospital in Pakistan. Normal delivery cost US $40 whereas caesarean delivery cost $162 from the hospital side. The study found that cost from the patient's perspective was $79, and $204 for normal and Caesarean deliveries respectively.

Previous inquiries showed that socially and economically less privileged women are more likely to deliver at home than health facilities (Agha & Williams, 2016; Idris, Gwarzo, & Shehu, 2007; Mrisho et al., 2007). The cost of institutional delivery, long distances to health facilities, influence of household decision-makers regarding maternal care, sociocultural norms and traditions related to pregnancy are the main reasons of home births, among many others (Mrisho et al., 2007; Seljeskog, Sundby, & Chimango, 2006). On the other hand, women's empowerment, education, age, spouse's education and work status, and good economic conditions favour women delivering at a health facility (Agha & Carton, 2011; Idris, Gwarzo, & Shehu, 2007; Tey & Lai, 2013).

Literature has established that only a specific sample of women deliver at health facilities in developing countries. Of those women who deliver at facility level, the odds of C-section may vary by the type of facility. A notable amount of hospital-based studies have reported high rates of C-section deliveries in tertiary care public hospitals in Pakistan. However, almost all of them discussed the medical reasons behind the use of the procedure (Bano et al., 2015; Iftikhar, Rizvi, & Ejaz, 2010; Jabeen, Mansoor, & Mansoor, 2013; Khawaja, Yousaf, & Tayyeb, 2004; Rakhshan & Rehan, 2000; Sajjad et al., 2014). Fetal distress and repeated C-section were among the main reported reasons (Iftikhar, Rizvi, & Ejaz, 2010 p. 7, Sajjad et al., 2014 p. 172). High rates of C-section in public tertiary hospitals are often explained by the significant number of referrals from the surrounding public facilities and periphery hospitals. However, reasons behind high rates in private facilities are less clear. It is noteworthy that a reasonable portion of women in Pakistan use private facilities for maternal care. Among all the deliveries, about 48 percent are carried at the health facility; of which, 15 percent in public and 34 percent in private health facilities (NIPS [Pakistan] & ICF International 2013, p. 136). In Pakistan, little is known about the association of having a C-section with type of place of delivery; therefore, this study is not only an important contributor in literature but also a pioneer study that is initiating discussion about this issue in the country.

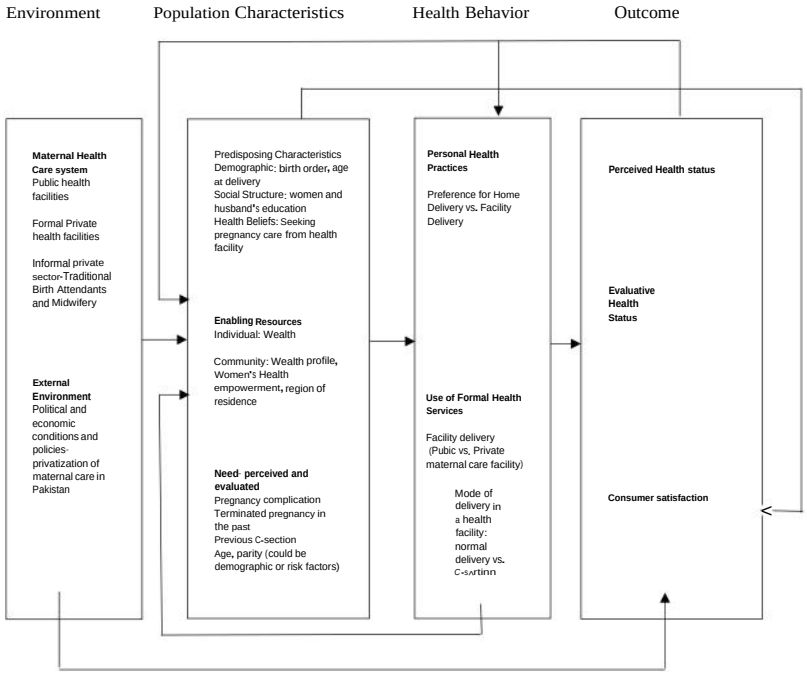
In this particular study, we argue that not all the women have the same probability in Pakistan to deliver at a health facility. Most of the earlier research examined determinants of C-section as a one-step process, which possibly produced bias results. We modelled this study as a two-step process, i.e., likelihood of delivering at a health facility and then having a C-section. This study used a two-step Heckman (1979) probit selection model that takes into account the possible section bias resulting from not considering the population sample who self-selected to deliver at home or health facility. Considering the literature, we hypothesised that women who have better socioeconomic conditions at the personal and household level and who live in relatively wealthy communities where there are fewer perceived barriers to getting medical help are more likely to deliver at a health facility than at home. We also hypothesised that the probability of a C-section varies by place of delivery, i.e. public versus private facility. We further postulated that women who deliver at private facilities have a greater risk of a C-section, which suggests that private medical facilities may be over-medicalising childbirth in Pakistan.

2. STUDY FRAMEWORK

To frame the study, we used Andersen's (1995) revised health behavioural model originally developed in the 1960s to study the use of health services by families and to measure or define equitable health access. Below is given the adapted version of the model for the study of C-section delivery. The model suggests that health behaviour is a function of environmental factors and population characteristics, i.e. people's predisposing characteristics, enabling resources and their needs. Health behaviour includes personal health practices and use of health services, which ultimately determines or predicts health status outcome.

Environmental factors include health care system and external environment, including physical, economic and political settings. In Pakistan, the health sector is privatised, including the maternal health care system. Approximately 64 percent of health expenditures in the country are funded by the private sector, with 89 percent being paid out-of-pocket by households (Pakistan Bureau of Statistics 2018, p. xiii). Ravindran (2010) explained the maternal health care systems in Pakistan, as consisting of three types of setups, i.e., public health facilities, formal private health facilities, and informal private care. In this analysis, we consider all three sectors; however, external environmental factors cannot be incorporated due to the nature of population-based data.

2.1. Conceptual Framework for Determinants and Consequences of C-Section Delivery in Pakistan



Source: Adapted from Andersen (1995).

Under population characteristics, we considered possible predisposing characteristics, enabling resources and need factors that affect utilisation of formal maternal health services in Pakistan. Among the predisposing characteristics, demographic factors that we have considered are mother's age at the time of child's delivery and birth order. Social status includes a range of factors that explain the status of a person in a community (Andersen, 1995). In the study, we considered woman's and her husband's education as proxy for their social status. Andersen (1995) explained how health beliefs can explain how social structure may influence the enabling resources, needs, and use of health services. In this framework, we include seeking antenatal care from health facilities as health belief in pregnancy care which might influence the preference for place of delivery. Previous research showed that antenatal care is a predictor of facility delivery in developing countries (Agha & Williams, 2016).

We included individual wealth status, community wealth status, women health empowerment in community, and region of residence as enabling resources of maternal delivery health utilisation. Research showed wealth and region of residence are predictors of facility-based births (Dickson, Adde, Amu, 2016; Smith, Tawiah, Badasu, 2008). There is research examining selected neighbourhood/community effects on different health outcomes, including place of delivery and the rising rates of C-section delivery (Arcaya et al., 2016; Diez Roux, 2001; O'Campo et al., 2015; Leone, Padmadas, & Matthews, 2008). Consideration of community level characteristics in case of Pakistan is also vital as there is a common affinity of socioeconomic status of communities with women's empowerment and health seeking behaviour. Studies from Pakistan and other developing countries have found women's empowerment to have a significant relation with maternal health care seeking behaviour (Ahmed et al., 2010; Furuta & Salway, 2006, Hou & Ma, 2013).

Andersen (1995) defined need as perceived or evaluated. Perceived need is a social phenomenon which explains the social structure and health beliefs, while evaluated need is professional judgment about people's health status and their need for medical care (Andersen, 1995). In the framework we used terminated pregnancy in the past as perceived need of utilisation of formal maternal health care services. Pregnancy complications and previous C-sections are considered as evaluated needs of health care utilisation.

Environment and population characteristics explain the health behaviour that is personal health practices and use of health services. In this framework, personal health practices show whether a woman prefers home delivery or health facility delivery. If she uses health facility delivery, she has to choose between pubic vs. private health care facilities. Since C-section can only be performed at a health facility, only the women who deliver at a health facility are at risk of delivering via a C-section. Health status outcome cannot be determined by the data; however, it is an important aspect to study if available as it can explain perceived and evaluated health status women and their satisfaction as health consumers after health care utilisation.

3. DATA AND METHODS

3.1. Data Source and Participants

The Pakistan Demographic and Health Survey (PDHS) from 2012-2013 has been used to estimate the determinants of C-section delivery in Pakistan on the national level. PDHS provides comprehensive information on demographic, maternal and child health indicators. The PDHS 2012-13 included 14000 households as the sample size for all the provinces except AJK, FATA and military restricted area. The survey was carried out in a total of 498 primary sampling units (PSUs) or communities (NIPS [Pakistan] and ICF International, 2013).

Analysis was conducted on women (aged 15-49) with their most recent birth in past five years. The total sample size for the study was 7,354 women for the place of delivery analysis and 3,886 for the mode of delivery analysis. Marriage is universal in Pakistan, and almost 100 percent of the reported births are from married couples. This unit of analysis for women with most recent birth, but not all births in last five years has been chosen. Having a previous C-section is an important clinical reason to conduct C-section again to avoid the trail of the scar. So, the women who have the C-section in recent birth, would most probably have C-section in a previous birth—this impact could be captured for clinical reasons. To construct two of the community-level variables, i.e. women's health empowerment profile and the wealth profile of community, we aggregated individual-level data (from all women in the community) to the primary sampling unit (PSU) or community-level. As mentioned earlier, there were 498 PSUs or communities. The average number of participants across communities was 27 women.

3.2. Procedure and Measures

We used the two-step Heckman probit model, which can simultaneously estimate the two multivariate models. The two-step probit model first sets up the selection equation, and then the observation in the first step are included in the outcome equation (Heckman, 1979). As mentioned above, all women in Pakistan do not have an equal chance of delivering their baby at a health facility. Since the C-section can only be performed at a health facility, the self-section to deliver at a health facility introduces a selection bias in the probability of having a C-section. Previous research has established that there are social, economic, and cultural factors that influence women's decisions to deliver at home or at a health facility (Edmonds, Paul & Sibley 2012; Dickson, Adde, Amu 2016; Joseph et al 2016; Rai 2015; Simkhada et al 2008; Zakar et al 2017). This self-selection of the sample would introduce bias results that could challenge the validity of the model (Morrissey et al., 2016). Moreover, routine diagnostic checks did not reveal any issues with multicollinearity.

3.3. Dependent Variable: Selection and Outcome Models

Tables 1 and 2 present a descriptive analysis for all of the variables used in analysis. In the selection model, the dependent variable was place of delivery. The place of the delivery variable was constructed from the question, "Where did you

Table 1

Descriptive and Bivariate Statistics for Variables Used in Place of Delivery Analysis (N = 7,354)

Variable	Mean (SE) or %	% Health Facility Delivery
Place of Delivery		
Home	48.5	
Health facility	51.5	
Medical/Clinical Indications		
Previous C-section		
No	93.9	48.6***
Yes	6.1	95.7
Previous miscarriage, abortion, or stillbirth		
No	66.3	51.2
Yes	33.7	52.1
Mother's age at delivery	28.05 (0.10)	
19 or younger	7.3	50.1***
20-29	57.3	54.5
30 or older	35.4	46.9
Birth order		
1st	19.0	67.9***
2nd	19.7	61.7
3rd	16.7	53.7
4th or higher	44.6	39.0
Number of antenatal visits		
0	24.4	17.0***
1 – 4	48.4	51.7
5 or more	27.2	82.0
Told about signs of pregnancy complications		
No	61.7	41.1***
Yes	38.3	68.2
Personal and Household Socioeconomic Status		
Mother's formal education		
None	55.8	36.9***
Primary	16.5	53.5
Secondary	18.6	74.2
Higher	9.1	90.8
Husband's/partner's formal education		
None	33.2	35.5***
Primary	16.3	44.9
Secondary	34.2	58.8
Higher	16.4	74.9

Continued—

Table 1—(*Continued*)

Household wealth index quintile		
Poorest, 1st quintile	22.9	30.1***
Poorer, 2nd quintile	20.7	36.6
Middle, 3rd quintile	19.7	47.7
Richer, 4th quintile	19.7	66.7
Richest, 5th quintile	16.7	85.1
Mother's Perception of Barrier-Free Medical Care		
Getting permission to go to doctor		
A big problem	20.7	40.3***
Not a big problem	79.3	54.5
Getting money for advice/treatment		
A big problem	32.4	38.5***
Not a big problem	67.6	57.7
Distance to the health facility		
A big problem	40.1	42.4***
Not a big problem	59.9	57.5
Management of transport		
A big problem	43.4	43.2***
Not a big problem	56.6	57.8
Community Characteristics		
Place of residence		
Rural	70.0	43.1***
Urban	30.0	70.9
Province		
Punjab	56.4	52.0***
Sindh	23.1	63.3
Khyber Pakhtunkhwa	14.8	40.8
Balochistan	4.6	18.2
Gilgit Baltistan	0.8	43.7
Islamabad	0.4	88.3
Average household wealth index quintile	1.91 (0.06)	
<= 1.91	52.4	38.2***
> 1.91	47.6	66.1
Average woman's perception of barrier-free medical care	2.67 (0.04)	
<= 2.67 (out of 4) potential barriers free	41.8	39.1***
> 2.67 (out of 4) potential barriers free	58.2	60.3

$+p \leq .10$, $*p \leq .05$, $**p \leq .01$, $***p \leq .001$ (design-based F tests).

Table 2

Descriptive and Bivariate Statistics for Variables Used in Mode of Delivery Analysis (N = 3,886)

Variable	Mean (SE) or %	% Delivered via C-section
Mode of Delivery		
Normal delivery	69.5	
C-section	30.5	
Medical/Clinical Indications		
Previous C-section		
No	88.7	23.2***
Yes	11.3	88.1
Previous miscarriage, abortion, or stillbirth		
No	65.9	31.2
Yes	34.1	29.3
Mother's age at delivery	**27.69 (0.13)**	
19 or younger	7.1	24.0
20 – 29	60.7	31.7
30 or older	32.3	29.8
Birth order		
1st	25.1	37.8***
2nd	23.4	33.7
3rd	17.4	33.4
4th or higher	33.8	21.5
Number of antenatal visits		
0	8.0	12.4***
1 – 4	48.6	24.3
5 or more	43.4	40.9
Told about signs of pregnancy complications		
No	49.3	24.0***
Yes	50.7	36.9
Health Facility		
Type		
Public	29.6	28.9
Private	70.4	31.2

$+p \leq .10$, $*p \leq .05$, $**p \leq .01$, $***p \leq .001$

give birth to (NAME)?." About 52 percent of the women in this sample delivered at a health facility, the remaining 48 percent delivered at home. In the outcome model, the dependent variable was the mode of delivery. i.e. C-section vs. normal delivery, which has been constructed from the question given in PDHS 2012-2013 that "Was (NAME) delivered by caesarean, that is, did they cut your belly open to take the baby out?". In this analysis, about 31 percent of women who delivered their babies at a health facility did so via C-section. As C-sections can only be carried out in a health facility, home births were excluded from the outcome equation.

4. INDEPENDENT VARIABLES

4.1. Socioeconomic and Demographic Factors

Research shows that place of delivery varies by individual and community level factors (Edmonds, Paul, & Sibley, 2012; Dickson, Adde, Amu, 2016; Gage, 2007; Joseph et al., 2016; Rai, 2015; Simkhada et al., 2008; Stephenson et al., 2006; Zakar et al., 2017). In the selection equation, I included woman's education, woman's husband education, and household wealth Index as indicators of socioeconomic status. Considering the low literacy level in country, it is no surprise that about 56 percent of the women in the analysis had no formal education, and only 9 percent had a post-secondary education. Women's husband's or partner's education is also considered as important factor influencing the place of delivery. Women's husbands tended to be more education, with 33 percent having no formal education and 16 percent having a post-secondary education.

The household wealth index was calculated by the PDHS 2012-2013 based on various household assets, including flooring, source of water, availability of electricity, possession of durable consumer goods, etc.), using information collected from the survey and included in the dataset as quintiles (0=poorest, 1=poor, 2=middle, 3=rich, and 4=richest).[4] As Table 1 shows, about 44 percent of the sample lived in households falling into the poor and poorest quintiles.

4.2. Community Factors

At the community-level, we considered place of residence (rural, urban) and province important variables that are likely to influence place of delivery. As evident from the past research, women who live in rural areas are more likely to delivery at home than at a health facility (Dickson, Adde, Amu, 2016; Zakar et al., 2017). The majority (70 percent) of the sample lived in a rural area. About 56 percent of the sample was from the Punjab province.

We included two other community-level variables: women's empowerment in health seeking behaviour in the community and its wealth profile. Women were asked if they find getting medical help for themselves as problematic or not problematic for the following reasons: getting permission to go, getting the money needed for treatment, distance to health facility, and managing transport. For the community-level measure of women's empowerment in health-seeking behaviour, we counted the number of potential barriers that were not a big problem for each woman in the community. The most significant barrier was managing transport, with 43 percent indicating that it was a big problem in getting medical help. At the community level, women in the sample tended to live in a community with moderate levels of women's health empowerment, i.e., where the average women perceived that 2.7 of the 4 potential barriers to getting medical help were not a big problem. To capture the impact of living in a relatively wealthy neighbourhood on place of

[4]NIPS [Pakistan] and ICF International, 2013. Pakistan Demographic and Health Survey, 2012-13. Islamabad, Pakistan, and Calverton, Maryland, USA: NIPS and ICF International.

delivery, we found the average household wealth quintile (coded from 0 to 4) for women in the community. With an average of 1.9, women in the sample tended to live in a community where the average household wealth was about "middle."

4.3. Need or Clinical Reasons

Among the clinical reasons, the following independent variables were included: birth order, mother's age at delivery, having a previous C-section, number of antenatal visits, ever had a terminated pregnancy, been informed of signs of pregnancy complications, and type of health facility. Birth order is a demographic factor which could possibly affect the risk of having a C-section. The literature shows a mixed effect, where most of the studies found that higher birth order has higher risk of C-section, whereas a few studies report the opposite (Kamal, 2013; Padmadas et al., 2000; Gebremedhin, 2014). As Tables 1 and 2 show, the most common birth order in the sample was fourth or higher, at 45 percent for all women and 34 percent for women delivering at a health facility,

Since in this analysis we are interested in most recent birth's mode of delivery, the age of women at the most recent birth has been calculated. The age at delivery distributions did not differ between all women and women who delivered at a health facility. The majority (55 percent and 61 percent) of women in both groups delivered their last child in their twenties. Studies show that having a previous C-section considerably puts the mother at higher risk of C-section for subsequent births (Walker, Turnbull, & Wilkinson, 2004). About 6 percent of all women in the sample had a previous C-section, and 11 percent of women who delivered their last child at a health facility had a previous C-section.

Among the clinical reasons, we constructed variables 'terminated pregnancy in the past' and 'pregnancy complication during the most recent birth'. About one-third (34 percent) of both all women and women who delivered at a health facility reported having had a previously terminated pregnancy. Only about 38 percent of all women were told of signs of pregnancy complications compared to 51 percent of women who delivered at a health facility.

Number of antenatal visits is another important variable among the clinical reasons, as maternal mortality is still high in Pakistan, and a considerable number of women from the rural areas do not visit any health facility for antenatal care. It is possible that women who did not get any antenatal care during pregnancy may end up delivering via C-section, as most traditional birth attendants (who mostly deliver babies when institutional care is not sought) will ask the woman's family to take her to the hospital as when she cannot handle the case. Due to the higher distance to health facilities (mostly in rural areas) and already delayed delivery with no antenatal history, the possibility of having a C-section delivery would likely increase. The WHO recommends minimum of eight antenatal visits now, as compared to the four recommended in the past to reduce the risk of stillbirth during pregnancy.[5] However, literature also shows that an

[5]tip://www.who.int/mediacentre/news/releases/2016/antenatal-care-guidelines/en/

increased number of antenatal visits is also associated with the increased C-section delivery (Yassin and Saida, 2012; Padmadas et al., 2000). About 24 percent of all women in the sample had no antenatal care compared to only 8 percent of women who delivered in a health facility.

In the outcome model, we have included all the clinical factors from the selection model, with the addition of a type of health facility variable. Consistent with previous research, we expected the odds of having a C-section to vary by type of health facility. As Table 2 shows, about 70 percent of women delivering at a health facility delivered at a private one.

5. RESULTS

We estimated the odds of C-section delivery in a two-step process by using the Heckman (1979) probit model, estimating, first, the odds of delivering in a health facility and, then, the odds of C-section delivery. Tables 3 and 4 shows the results of two steps. The coefficient p (rho) is –0.355, which is the correlation between selection and outcome equations; this rejects the null hypothesis that no selection bias exists between the selection and outcome models. Results from the first model determining the place of delivery show expected directions for all variables except for a few.

Clinical-related factors i.e. birth order, previous C-section, age at time of delivery, pregnancy complication, terminated pregnancy and number of antenatal visits had statistically significant effects ($p < .05$). Consistent with previous studies, as compared to first birth order, higher birth orders were less likely to be delivered at a health facility (Rai, 2015). Women who have had a previous C-section, had a terminated pregnancy in past, or been told of signs of a pregnancy complication at their last antenatal visit in their most recent pregnancy were, all, more likely to deliver at a health facility than at home. The likelihood of delivering at a health facility also increased with mother's age ($p < .05$); women in their twenties and thirties were more likely to deliver at a health facility than adolescents. This finding is consistent with the previous studies which possibly indicates the sociocultural norms associated with age affecting the utilisation of health services for births (Edmonds, Paul, & Sibley, 2012; Magadi, Agwanda, & Obare, 2007). Moreover, women who had more visits to a health facility for antenatal care were more likely to deliver at a health facility than women who had no visits.

Among the enabling factors, education and wealth increased the odds of delivering at a health facility versus at home ($p < .05$). Previous studies also showed the same results (Joseph et al., 2016; Rai, 2015; Simkhada et al., 2008; Zakar et al., 2017). For example, compared to no formal education, both women with secondary or higher education and women with husbands/partners with secondary or higher education were more likely to deliver at a health facility. Moreover, women who resided in a household falling in the top two quintiles (richer and richest) of wealth had higher chances of delivering at a health facility than at home.

Table 3

Results of Two-Stage Heckman Probit Regression: Stage 1, Selection, Place of Delivery (N = 7,354)

Variable	Health care facility (versus home) Coefficient	Linearised SE
Medical/Clinical Indications		
Previous C-section (reference: no)		
Yes	1.52***	0.17
Previous miscarriage, abortion, or stillbirth (reference: no)		
Yes	0.11**	0.04
Mother's age at delivery (reference: 19 or younger)		
20 – 29	0.24*	0.10
30 or older	0.36***	0.11
Birth order (reference: 1st)		
2nd	-0.28***	0.08
3rd	-0.48***	0.09
4th or higher	-0.65***	0.08
Number of antenatal visits (reference: 0)		
1 – 4	0.66***	0.07
5 or more	1.13***	0.09
Told about signs of pregnancy complications (reference: no)		
Yes	0.17***	0.05
Personal and Household Socioeconomic Status		
Mother's formal education (reference: none)		
Primary	0.00	0.07
Secondary	0.18*	0.07
Higher	0.57***	0.11
Husband's/partner's formal education (reference: none)		
Primary	0.01	0.06
Secondary	0.13*	0.06
Higher	0.17*	0.07
Household wealth index (reference: poorest, 1st quintile)		
Poorer, 2nd quintile	0.03	0.08
Middle, 3rd quintile	0.10	0.09
Richer, 4th quintile	0.34***	0.10
Richest, 5th quintile	0.50***	0.14
Mother's Perception of Barrier-Free Medical Care		
Getting permission to go to doctor (reference: a big problem)		
Not a big problem	-0.04	0.08
Getting money for advice/treatment (reference: a big problem)		
Not a big problem	0.01	0.06
Distance to the health facility (reference: a big problem)		
Not a big problem	-0.02	0.08
Management of transport (reference: a big problem)		
Not a big problem	-0.10	0.08
Community Characteristics		
Place of residence (reference: rural)		
Urban	-0.19+	0.11
Province (reference: Punjab)		
Sindh	0.61***	0.11
Khyber Pakhtunkhwa	0.22*	0.11
Balochistan	-0.18	0.12
Gilgit Baltistan	0.34+	0.18
Islamabad	0.39***	0.11
Average household wealth index quintile	0.07	0.08
Average woman's perception of barrier-free medical care	0.20***	0.06
Constant	-1.58***	0.21

+$p \leq .10$, *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$ (two-tailed tests).

Table 4

Results of Two-Stage Heckman Probit Regression: Stage 2, Outcome, Mode of Delivery (N = 3,886)

Variable	C-section (versus normal delivery) Coefficient	Linearised SE
Medical/Clinical Indications		
Previous C-section (reference: no)		
Yes	1.93***	0.15
Previous miscarriage, abortion, or stillbirth (reference: no)		
Yes	0.02	0.08
Mother's age at delivery (reference: 19 or younger)		
20 – 29	0.30*	0.14
30 or older	0.59***	0.17
Birth order (reference: 1st)		
2nd	-0.60***	0.09
3rd	-0.52***	0.12
4th or higher	-0.76***	0.13
Number of antenatal visits (reference: 0)		
1 – 4	-0.01	0.15
5 or more	0.22	0.20
Told about signs of pregnancy complications (reference: no)		
Yes	0.22***	0.06
Health Facility		
Type (reference: public)		
Private	0.12+	0.07
Constant	-0.77**	0.28
Rho	-0.34*	0.13
F(11, 410)	23.27***	

Notes: +$p \leq .10$, *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$ (two-tailed tests).

At the community-level, women's health empowerment and province were significant predictors ($p < .05$). Women who live in a community where women's health empowerment is perceived to be high (i.e., facing few big problems, such as getting permission, getting money, being distant, and managing transport, getting medical help) were more likely to deliver at a health facility than at home. The results for province were somewhat unexpected, as women from Sindh, Khyber Pakhtunkhwa, and Gilgit Baltistan, and Islamabad were more likely to deliver at a health facility than women from Punjab. However, results from Islamabad, the capital city, were highly significant, which was expected due to its socioeconomic advantage.

In the second stage, the outcome model included clinical factors and type of health facility. Birth order, previous C-section and age at delivery had significant effects ($p < .05$). Women with higher birth orders were less likely to deliver via C-section. Having a previous history of C-section delivery and being of older age at

delivery were associated with higher odds C-section delivery. The findings match those of previous studies (Leone, Padmadas, & Matthews, 2008; Rachatapantanakorn & Tongkumchum, 2009; Yassin & Saida, 2012). Being told of signs of pregnancy complications during the pregnancy was also associated with higher odds of C-section delivery ($p < .05$). However, antenatal care or having a terminated pregnancy in the past had no significant effects.

Finally, as predicted, controlling for the effects of clinical factors, type of facility was associated with C-section delivery ($p < .05$, one-tailed). The odds of C-section delivery were higher for women delivering at a private facility compared to delivering at a public one. This finding is consistent with the findings of some previous studies (Leone, Padmadas, & Matthews, 2008; Padmadas et al., 2000; Ghosh, 2010; Yassin & Saida, 2012). However, none of these studies took into account selection bias

6. DISCUSSION AND CONCLUSIONS

We used the Pakistan Demographic and Health Survey 2012-2013, which provides comprehensive information on reproductive health of women. The current study was conceived in response to the observation of rising C-section rates in Pakistan. We hypothesised that private health facilities were partially responsible for high C-section rates due to the following reasons. First, health care in Pakistan is heavily privatised, with the private sector funding about 64% of all health expenditures, where 89 percent are paid out of pocket by households.[6] Second, there is a huge difference of C-section cost for patients in public and private facilities. There is a chance that private sectors carry out medically unnecessary C-sections for profit gains or doctors' time management. It is noteworthy that a majority of physicians in Pakistan have two jobs; they work in public hospitals during the day time, and they work part time in the evening in private hospitals and self-owned clinics (Ravindran, Sundari TK, 2010).

Previous studies showed an affinity of chances of having C-sections with socio-economic profiles of women. However, we argued that in the case of Pakistan there is a certain sample of population that utilises formal health care in the first place. To capture this effect, we carried out the analysis as a two-step process. We used Andersen's (1995) revised health behavioural model of health utilisation to guide the analysis of first, who utilised the maternal health care facilities for child delivery and secondly, how the odds of C-section delivery varied at a health facility by the type of health facility, i.e., public versus private.

Results show that population characteristics are important determinants of heath behaviour and affect women's ability to utilise a formal health care system. We found that women's education, husbands' education and household wealth were significant predictors of the place of delivery. Women who were rich or highly educated had increased chances of delivering at a health facility than at home. Previous studies

[6]Retrieved from World bank data; https://data.worldbank.org/indicator/SH.XPD.OOPC.ZS?locations=PK

showed the same results (Joseph et al., 2016; Rai, 2015; Simkhada et al., 2008; Zakar et al., 2017). Considering the low literacy level of women in Pakistan, and the overall patriarchal structure of the society that gives authority of decision making to men or to women of older ages (in this case, the mother-in-law), educated women are expected to be in a better position to negotiate for health service utilisation in pregnancy and for child birth than uneducated women. Smith, Tawiah, Badasu (2008) suggested that the independent status of a woman in a household does not affect her choice for the place of delivery, but it operates through other socioeconomic variables, including women's education, wealth and husband's education.

Community resources are also an enabling factor that affects the health behaviour of the population. For example, in this study, we found that Pakistani women who resided in a community where the average woman perceived few barriers to getting medical care were more likely to delivery at a health facility than at home. In most rural areas in Pakistan, and in some parts of urban areas as well, there is a strong norm of observing 'Pardha', during pregnancy and child birth. Studies from the neighboring countries also discussed the gender or religious norms related to 'Purdha' that generally restrict women's movement outside the home without veiling herself and should be accompanied by a male family member or an older woman (Mumtaz & Salway, 2007; Walton & Schbley, 2013). "Pardha" may also restrict women from being physically examined by a male doctor, during pregnancy or for a childbirth. The cost factor is also a big hurdle for many poor households in accessing maternal health care. Mothers who live a far distance from a health facility, would not reach the facility on time for delivery and this would in turn add a treatment and transportation cost to them.

Province turned out to be a significant factor in this analysis, where women who lived in Islamabad, Gilgit Baltistan, Khyber Pakhtunkhwa and Sindh were more likely to utilise health care for child delivery than women in Punjab. In comparison to Islamabad and Sindh, findings are bit surprising for Khyber Pakhtunkhwa and Gilgit Baltistan. Generally, since the Punjab province has better socioeconomic conditions than Khyber Pakhtunkhwa and Gilgit Baltistan, the finding is unexpected as far as health care utilisation is concerned.

We find all the need or clinical factors highly significant in this analyses which were expected in maternal health care utilisation for child delivery. The analysis shows that population characteristics along with need factors are highly influential in determining who will deliver at home versus who will deliver at a health facility.

In the second stage, we estimated the mode of delivery i.e. normal delivery vs. C-section, for the women in this sample who delivered at a health facility. We included need factors, along with some demographic factors, i.e. mother's age at time of delivery and birth order (both of which could also represent need), at the health facilities level to examine the odds of C-section delivery. We included the variable type of health facility (private, public) to examine if odds of C-section delivery were higher at private facilities, even after controlling for need. It is found that mother's age at time of delivery and birth order were significant predictors of C-

section delivery. Women who aged 20 or more are more likely to have a C-section than women in their teenage years. Here, age of mother can either be a medical or social factor. Medically, women who are in their thirties and above are at greater risk of C-section (Leone, Padmadas, & Matthews, 2008; Rachatapantanakorn & Tongkumchum, 2009; Yassin & Saida, 2012). We also have a strong social justification for age dynamics in reference to health care utilisation. As literature shows, women with older age groups have greater mobility and are more likely to have an institutional birth that increases their chances of having a C-section. Other indicators of need, previous C-section delivery and being told about signs of pregnancy complications during most recent pregnancy, were also associated with higher odds of C-section delivery.

However, as predicted, we find that, controlling for indicators of need for a C-section delivery, women who delivered at a private health facility were more likely to have a C-section. The finding is concerning, and suggests that the private health sector in Pakistan may be over-medicalising child birth. Rates of C-section are well above the WHO recommendation, which suggests that medically unnecessary C-section interventions are occurring in Pakistan (NIPS [Pakistan] and ICF International, 2013, p 137). Unnecessary C-section delivery is a cause of concern from a resource deprivation point of view, but, more importantly, it hurts women's and newborn's physical and mental health and well-being (Jose et al. 2007; Torkan et al., 2009; Wagner, 2000). Studies from Pakistan suggest that women have a negative perception or undesirability of having a C-section in Pakistan (Bano et al., 2015; Qazi, et al., 2013). In the private sector where doctors are responsible for one-to-one care of patients as far as antenatal and delivery care is concerned, doctors mostly have the sole authority to make medical decisions based on patient conditions. Thus, the findings of the study suggest the need for systematic auditing of health facilities.

This study has a few limitations. The PDHS does not provide near birth labour complications history, which would be beneficial in accessing medical indications for C-section delivery more precisely. Secondly, there is a whole spectrum of private health facilities which vary in characteristics and quality of care, e.g., there are self-owned one-room maternal clinics, and one can also find large state-of-the-art private hospitals facilitating child delivery. This level of detail was not included in the PDHS. More detailed information of health facilities could potentially help us find where and to some extent, why unnecessary C-sections are being conducted. Mixed-methods studies, including of health facilities, would be an appropriate option to explore further the dilemma of medically unnecessary C-sections in the country.

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