INTRODUCTION

In a woman’s life span, pregnancy is a critical period being recognized as welcome event for successful womanhood, while delivery is one of the most crucial period of pregnancy culminating in birth of baby. Modes of delivery can be either the natural (vaginal) or by surgical intervention (Cesarean section; CS). The rate of Cesarean section (CSR) is continuously rising in many countries around the globe and has exceeded the level of 10–15% which is recommended by World Health Organization. Unnecessary CS may be associated with an increased risk of maternal and neonatal mortality, long-term health of child and mothers as well as future pregnancies.

Pakistan is the 5th largest contributor to worldwide maternal mortality and an overall 6% of the world’s maternal deaths occur here. One of the important objectives of Millennium Development Goals (MDGs) is to reduce maternal and child mortality which may be addressed by understanding the determinants of maternal and obstetric well-being.
resource deficient countries with inadequate access to health facilities, it is vital to prioritize areas of interventions and vulnerable patient population. To this end, this study was carried out with the aim to elucidate the prevalence-pattern and risk factors associated with CS in a multiethnic Pakistani cohort.

METHODS

This study was carried out at the Mother-Child Health Centre (MCH), Pakistan Institute of Medical Sciences (PIMS), Islamabad. The study was approved by ethical committee of (Ref: DAS/13-HG-6, Dated: June3, 2013) Quaid-i-Azam University and PIMS.

The study subjects were pregnant women delivering at MCH during 2013-2017. Only the current pregnancy was included in the analyses. All deliveries, i.e., vaginal and CS, either term/preterm/postdated, singleton/multiple, and nulliparous/multiparous, were included. Data of women giving incomplete information and few of the highly risky or complicated pregnancies brought to the critical-care unit were not included. Data regarding socio-demographic variables, obstetric complications, birth parameters and perinatal outcomes were obtained on a structured proforma.

Statistical analyses: Descriptive statistics involving frequency and percentages was employed to characterize the sample. Bivariate and multivariate logistic regression analyses were used to ascertain the association between dependent variable (CS) and independent variables (STATA, ver.11). Multivariate analyses were performed by employing all variables in a step-by-step approach and only the significant variables were retained in the final model. Results were expressed by crude odd ratio (COR) and adjusted odd ratio (AOR).

RESULTS

Sample characteristics: A total of 5,275 women were recruited (mean age 28.8±5.1 years). There was highest representation of participants from twin cities Islamabad/Rawalpindi (46%), urban origin (63%), speaking Punjabi language (62%), literate (79%), housewives (96%), and belonging to middle economic quintile (42%) and joint family system (58%).

Socio-demographic differentials of CS: CS was observed in 43% of the deliveries and normal deliveries were 57%. There was high variation in CSR in various socio-demographic attributes of the subjects.

Multivariable logistic regression analyses revealed that four out of eight socio-demographic variables, i.e., province, mother tongue, age category and women’s occupational status were significant predictors of CS (Table-I). Women originating from Azad Jammu-Kashmir (AJK) (AOR:1.33; 95% CI:0.97-1.81) and Sindh province (AOR:1.32; 95% CI:0.88-1.97) were more likely to deliver children by CS. Likewise, women speaking Potohari (AOR:1.47; 95% CI: 1.03-2.10), Urdu (AOR:1.35; 95% CI: 0.96-1.92), Pahari (AOR:1.34; 95% CI: 0.99-1.83) and Saraiki (AOR:1.34; 95% CI: 0.85-2.11) languages were more likely to have CS. The women with advanced age (AOR: 2.25; 95% CI: 1.85-2.75) had the higher risk of delivering children by CS. Further, women who were housewives (AOR:1.58; 95% CI:1.19-2.08) had higher risk of CS compared to women engaged in certain professions. The variables like rural/urban residence, subject education, economic quintile and household type were statistically not significant (data not shown).

Birth outcome, pregnancy and delivery related predictors of CS: The likelihood of CS was 8% higher in pregnancies bearing daughters as compared to sons (COR:1.08; 95% CI:0.96-1.21) (Table-II). CS had significantly lower odds in prenatal mortality (COR:0.37; 95% CI: 0.26-0.52) but increased likelihood of postnatal mortality (COR: 2.12; 95% CI:1.09-4.14). The odds of CS were 23% higher in multiparous women as compared to nulliparous women (COR:1.23; 95% CI:1.09-1.38). Further, women with previous history of fetal/prenatal loss had 20% higher risk of CS (COR:1.20; 95% CI: 1.06-1.36) (Table-II).

There was a higher risk of CS multiple pregnancy as compared to singleton (58% vs. 43, respectively; COR:1.82; 95% CI: 1.31-2.52). In order to assess the predictors of CS, multivariable logistic regression analyses were performed in two tires. In the first round, four variables were analyzed, i.e., gender of neonate, pregnancy outcome, parity and history of fetal/prenatal loss. In these analyses, no variable appeared significant. In the second round, the remaining factors were taken simultaneously. Here, seven variables emerged significant (Table-II). The highest predictors of CS were fetal distress (AOR:25.26; 95% CI:13.57-47.01), followed by previous scar (AOR:16.32; 95% CI: 11.01-24.20) and breech (AOR: 8.59; 95% CI:5.98-12.33). Interestingly, duration of pregnancy (>37 weeks) also emerged as significant predictor (AOR:0.72; 95% CI: 0.63-0.81).
DISCUSSION

It is first detailed study from Pakistan reporting a large number of socio-demographic, obstetric and birth outcome variables associated with CSR. This study showed that the prevalence of CS was 43%. A wide variability has been witnessed in CSR in various cultures. For instance, 50% in Iran,6 and 28% in Brazil.7 In Pakistan, CSR was reported to range from 47% in Abbottabad to 65% in Hyderabad.8,9 Differentials in the sociocultural and economic factors and available resources may account for this variability.

Multivariable analyses revealed that four socio-demographic variables were significantly associated with CS, i.e., province, mother tongue, age category and occupational status were significant predictors of CS. Here, the women from AJK and Sindh had the highest prevalence of CS. Previously, Manzoor et al. also reported a high rate of CS in AJK. Further, the highest prevalence of CS is in Potohari speaking subjects (48%), while lowest in Pushto speaking women.10 This is contrary to a prior Pakistani study by Mumtaz et al. in which the rate of CS was highest in Urdu speaking women (29%) followed by Punjabi speaking women.

Table-I: Socio-demographic differentials in birth type and risk of CS.

| Variable*               | Normal birth (%) | Cesarean section (%) | Total (n) | Adjusted OR | 95% CI | P-value |
|-------------------------|------------------|----------------------|-----------|-------------|--------|---------|
| **Origin (province)**   |                  |                      |           |             |        |         |
| Khyber Pakhtunkhwa     | 60               | 40                   | 847       |             |        |         |
| Islamabad/Rawalpindi   | 57               | 43                   | 2,415     | 1.00        | 0.80-1.25 | 0.997   |
| Punjab (Upper)         | 56               | 44                   | 1,111     | 1.02        | 0.80-1.30 | 0.892   |
| Azad Jammu Kashmir     | 49               | 51                   | 388       | 1.33        | 0.97-1.81 | 0.073   |
| Punjab (Southern)      | 60               | 40                   | 330       | 0.84        | 0.61-1.16 | 0.281   |
| Sindh                   | 51               | 49                   | 127       | 1.32        | 0.88-1.97 | 0.177   |
| Others                 | 64               | 36                   | 57        | 0.88        | 0.47-1.65 | 0.681   |
| **Total**              | **57**           | **43**               | **5,275** |             |        |         |
| **Mother tongue**      |                  |                      |           |             |        |         |
| Pushto                  | 63               | 37                   | 619       |             |        |         |
| Punjabi                | 56               | 44                   | 3,271     | 1.33        | 1.05-1.69 | 0.018   |
| Pahari                 | 54               | 46                   | 403       | 1.34        | 0.99-1.83 | 0.062   |
| Potohari               | 52               | 48                   | 222       | 1.47        | 1.03-2.10 | 0.032   |
| Urdu                   | 55               | 45                   | 218       | 1.35        | 0.96-1.92 | 0.088   |
| Hindko                 | 56               | 44                   | 215       | 1.30        | 0.95-1.80 | 0.105   |
| Saraiki                | 60               | 40                   | 129       | 1.34        | 0.85-2.11 | 0.214   |
| Kashmiri               | 56               | 44                   | 95        | 1.08        | 0.66-1.79 | 0.751   |
| Others                 | 59               | 41                   | 103       | 1.16        | 0.72-1.87 | 0.537   |
| **Age category (yrs)** |                  |                      |           |             |        |         |
| 19-24                  | 66               | 34                   | 1,720     |             |        |         |
| 25-34                  | 53               | 47                   | 3,004     | 1.67        | 1.48-1.89 | <0.0001 |
| >34                    | 47               | 53                   | 551       | 2.25        | 1.85-2.75 | <0.0001 |
| **Mother occupation**  |                  |                      |           |             |        |         |
| Working women          | 64               | 36                   | 233       |             |        |         |
| Housewife              | 56               | 44                   | 5,000     | 1.58        | 1.19-2.08 | 0.001   |
| _cons                  |                  |                      | 0.26      | 0.18-0.36   |        | <0.0001 |

Ref.=Reference category; *only significant variables have been reported.
The high CSR in subject from AJK, who mostly observed Potohari and Pahari languages, could be explained due to the fact that AJK region is deprived of advanced medical care facilities and the earthquake and other natural disasters in the recent past have heavily damaged the tertiary care hospitals. Hence, the women from the adjoining regions of AJK having pregnancy complications are inclined to visit MCH, PIMS.

The prevalence of CS was observed to be increasing with increasing maternal age. In another study carried out in Pakistan, the likelihood of caesarean deliveries was associated with mothers aged more than 24 years. Furthermore, CSR was observed to be higher in housewives as compared to working women which is consistent with the observation of Mumtaz et al.11

Obstetric complications have been known to increase the risk of CS; however, the combination of obstetric factors detrimental to CS vary across populations. The multivariable analyses revealed that nearly all studied obstetric factors were

| Variable                                      | Normal delivery (%) | Cesarean section (%) | Total (n) | Crude OR | 95% CI   | P-value |
|-----------------------------------------------|---------------------|----------------------|-----------|----------|----------|---------|
| **Birth outcome/history**                     |                     |                      |           |          |          |         |
| Gender of neonate                              |                     |                      |           |          |          |         |
| Son                                           | 57                  | 43                   | 2,509     | 1.08     | 0.96-1.21| 0.020   |
| Daughter                                      | 55                  | 45                   | 2,391     | 1.08     | 0.96-1.21| 0.020   |
| Total                                         | 57                  | 43                   | 4,900     | 1.08     | 0.96-1.21| 0.020   |
| **Pregnancy outcome**                         |                     |                      |           |          |          |         |
| Alive                                         | 56                  | 44                   | 4,900     | Ref.     | 0.00001  |         |
| Prenatal mortality                            | 78                  | 22                   | 189       | 0.37     | 0.26-0.52| <0.0001 |
| Postnatal mortality                           | 38                  | 62                   | 37        | 2.12     | 1.09-4.14| 0.032   |
| **Parity**                                    |                     |                      |           |          |          |         |
| Nulliparous                                    | 60                  | 40                   | 1,714     | Ref.     | 0.0001   |         |
| Multiparous                                    | 55                  | 45                   | 3,565     | 1.23     | 1.09-1.38| <0.0001 |
| **History of fetal/prenatal loss**            |                     |                      |           |          |          |         |
| No                                            | 58                  | 42                   | 3,769     | Ref.     | 0.0001   |         |
| Yes                                           | 54                  | 46                   | 1,357     | 1.20     | 1.06-1.36| 0.013   |
| **Obstetric complication#**                   |                     |                      |           |          |          |         |
| Adjusted OR                                   |                     |                      |           |          |          |         |
| Multiple pregnancy                            |                     |                      |           |          |          |         |
| Singleton                                     | 57                  | 43                   | 5,125     | Omitted  |          |         |
| Multiple pregnancy                            | 42                  | 58                   | 154       |          |          |         |
| Breech*                                       | 17                  | 83                   | 258       | 8.59     | 5.98-12.33| <0.0001 |
| Fetal distress*                               | 7                   | 93                   | 207       | 25.26    | 13.57-47.01| <0.0001 |
| Oligohydroamniosis*                           | 31                  | 69                   | 331       | 2.26     | 1.71-3.00 | <0.0001 |
| Preeclampsia*                                 | 32                  | 68                   | 129       | 2.70     | 1.79-4.09 | <0.0001 |
| Previous scar*                                | 10                  | 90                   | 321       | 16.32    | 11.01-24.20| <0.0001 |
| Duration of pregnancy (>37 weeks)*            | 57                  | 43                   | 2,233     | 0.72     | 0.63-0.81 | <0.0001 |
| Bleeding                                      | 60                  | 40                   | 112       | 0.89     | 0.61-1.30 | 0.554   |
| _cons                                         | 0.58                |                      |           | 0.53-0.63| <0.0001  |

Ref.=Reference category; #=included in multivariable logistic regression; *=significant in multivariable logistic regression.
contributing to the risk of CS. It is nonetheless, interesting to see the differential contribution of variables in the final model (Table-II). The highest risk was imposed by fetal distress, previous scar, and breech position. On the other hand, the duration of pregnancy (long) was observed in to reduce the risk of CS. Curiously however, this study showed no association of CS and bleeding. Bleeding may be an indication of serious pregnancy condition particularly in women with previous history of obstetric complications.

In addition to the socio-demographic and obstetric variables, potentially other confounding factors such as women choice, women fear, psychological factors, and doctors’ preference are also responsible for the higher CSR. As suggested in the MDGs, it is possible to minimize the CSR by adequate awareness, proper prenatal and perinatal counseling of the patients, monitoring of feto-maternal parameters, careful selection of the patient who have previous CS and promoting institutional deliveries.14 Thus, CS should be performed when medically necessary, ascertained by the healthcare providers caring for the woman on a case-by-case basis.9

Limitations of the study: Since, it is a hospital-based study and mostly the complicated cases that need CS visit here; therefore, such cases may be overrepresented in these data. In the rural areas of Pakistan, home deliveries by traditional birth attendants are a cultural norm. Hence, there may not be full representation of subjects from rural and remote areas in this sample.

CONCLUSIONS
This study witnessed high variability in CSR in various Pakistani socio-demographic strata and helps identify the potential areas of intervention. For instance, women from AJK and Sindh should be provided proper perinatal counseling and pregnancy monitoring. The obstetric complications may the focus of intervention programs intended to increase women well-being and reducing the CSR.

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Authors Contribution:
SM: Conceived, designed and planned the study, performed statistical analyses and is responsible for the integrity of study.
MC & SN: Helped in data collection.
KM: Prepared initial draft; helped analyze the data.
KM, MC, SN & SM: Edited, reviewed and approved the manuscript.