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Original Article

Regional Variation in Trends in C-Section Delivery: Results from Pakistan Demographic and Health Survey Data (1990-2019)

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Abstract: Background: The rate of Caesarean section (C-section) deliveries has been rising globally, and Pakistan is no exception. Understanding regional differences is crucial for identifying inequities in maternal healthcare provision. This study examined the regional variation in C-section trends in Pakistan using five rounds of the Pakistan Demographic and Health Survey (PDHS) conducted between 1990 and 2019. **Methods:** This study analyzed secondary data from PDHS 1990-1991, 2006-2007, 2012-2013, 2017-2018, and 2019. Only those women who reported to the question of mode of delivery during last birth were included, resulting in a total sample of 29,936 women. Trends were assessed across survey years and regions to explore changes in the C-section as a delivery mode over time. **Results:** The findings show a substantial increase in C-section delivery across Pakistan over the three-decade period. While all regions experienced rising rates, the pace of increase differed significantly. Urban areas consistently exhibited higher C-section prevalence compared to rural areas. Certain regions showed rapid growth, reflecting shifts in healthcare access, institutional delivery patterns, and maternal health-seeking behaviors. **Conclusion:** C-section delivery has increased markedly in Pakistan from 1990 to 2019, with notable regional disparities. These variations suggest differences in healthcare access, clinical decision-making, and socioeconomic context. Targeted policies are required to promote appropriate use of C-sections and ensure equitable, evidence-based maternal care across all regions of Pakistan.

Keywords: PDHS, C-Section, Pregnancy, Delivery Mode.

1. Introduction

C-section delivery is a delivery method conducted when vaginal birth is supposed to threaten the baby's or the mother's life. In this method, stratification of the uterus and abdomen is carried out for delivery. C-section, no doubt considered a life-saving intervention but is also associated with complications. Therefore, it is recommended to perform a C-section only when no other option remains (Rana et al., 2024). A lot of reasons contribute to C-section birth, including demographic, social, and educational improvements, but still, this increasing phase is not justifiable (Verma et al., 2020). C-section delivery, no doubt, in some cases, becomes an essential option to save mother and child health (Betran et al., 2021), but both extremes represent harmful effects. Very low C-section rates indicate a lack of access to C-section for women in need, leading to maternal mortality and morbidity (Boatin et al., 2018), while overuse of C-section delivery causes harm along with waste of resources, including both, financial and human (Betran et al., 2021).

C-section rates are defined as, fraction of women who undergo C-section delivery method among total childbirths in a specified time period and within a specific geographical area (Verma et al., 2020). Rate of deliveries by C-Section has increased over the past few years (Amyx et al., 2024), despite of the fact that international health care community, World Health Organization that more than 10-15 percent rates of C section was not justified from medical point of view in any region (Amjad et al., 2020; Betran et al., 2021; Sengupta et al., 2021). Both developed and developing countries show a rising trend of Cesarean section delivery method (Sengupta et al., 2021; Verma et al., 2020). The last decade is marked by a significant rise in C C-section trend (Verma et al., 2020). WHO reports mention, about 6.2 million unnecessary C-sections were performed

annually (*The Global Numbers and Costs of Additionally Needed and Unnecessary Caesarean Sections Performed per Year: Overuse as a Barrier to Universal Coverage*, n.d.). A study mentions that among 154 countries, about 21.1 percent of the population has C-section deliveries. A continuously increasing trend in countries having a percentage range from 5 to 43 percent among countries around the globe was observed (Rana et al., 2024). Literature mentioned the pattern of C-section deliveries was found to be More than half of the deliveries in Brazil, Egypt, and Turkey, and about one in three pregnant women United States of America, Germany, and Australia underwent C-section delivery in 2018 (Amjad et al., 2020; Niino, 2011). A study of Nepal indicates that the cesarean section rate has increased from 0.9 percent in 1996 to 26.3 percent in 2016 (Bhandari et al., 2020).

Another study conducted to analyze C-section trend indicates that C-section births increase uniformly in all regions, and the rate was about 15 percent, specifically in Pakistan (Harrison et al., 2020). In Pakistan also C-section ratio is also being found to increase continuously in the past. A study of Pakistan using PDHS data showed that the rate of deliveries by C-section increased continuously from percentage of 3.2 percent in 1990-91 to 19.6 percent in 2017-18. Richest mothers over 24 years from Punjab were most likely to undergo C-section deliveries. Mothers with their first child in order, mothers having 5 or more children, mothers having more antenatal care visits, and delivery in private hospitals were more likely to deliver babies by C-section (Amjad et al., 2020). Another study mentioned that Pakistan observed a sharp rise in C C-section trend from 13.7-66.3 percent and 2.7-22.3 percent from 1990 to 2017(Rana et al., 2024).

This study aims to analyze the trend of C-section delivery over the period of time from 1990 to 2019 in each province of Pakistan separately. Region-wise distribution has not been studied in any study, and is necessary to know region-wise C-section delivery trend in order to plan targeted intervention based on the specific region's needs.

2. Materials and Methods

Study design, Settings, and data sets

The present study is based on an analysis of secondary data from the Pakistan Demographic and Health Survey (PDHS). The study used data from five waves of PDHS from1990-2019, which helps to get a clear view of the trends of C-section delivery over time.

Study Variables

The dependent variable in the present study was the C-section as delivery mode for the last birth. From the first four rounds of PDHS (1990-91; 2006-07; 2012-13; and 2017-18) the variable V401 was used while from PDHS 2019 the variable Q425 was used. These variables report the delivery mode of the last child birth of the women. Missing responses were excluded from the final data analysis.

Study population

The population in thousands was included in each round of PDHS. But in our study, we included only those women who responded to that particular question of last birth by C-section for all data sets that include the total population of 3927 from 1990-1991, 5721 from 2006-2007, 7447 from 2012-2013, 8280 from 2017-2018, and 4561 from 2019. The total of 29,936 of the population was included from the PDHS 1990-2019 rounds, which represents a significant population to evaluate the trend of C-section delivery. Other study variables include the region question from all PDHS data sets.

Data Analysis

Descriptive statistics were performed using SPSS version 22. The trend of C-section delivery from 1990-2019 was presented using frequency and percentages with region-wise distribution. The trend of C-section delivery was represented through a graph. While the region-wise C-section delivery trend, percentage difference, and percentage increase are mentioned in table below. Rate difference (highest- lowest value) and rate ratio (highest value/lowest value) were calculated for the overall region of residence for each year. Difference in percentage and change in percentage were also calculated for the type of residence. The percentage increase was calculated using the formula:

Change in percentage= [(starting value-final value)/starting value]*100

In the formula, starting and final values include the percentage of women who respond yes to C-section question for their last delivery, recruited from data from all available PDHS waves from 1990 to 2019. The difference in percentage was calculated by subtracting the starting value (C section during last delivery from PDHS 1990) from the final value (C section during last delivery from PDHS 2019) for each region separately.

3. Results

Among regions, the highest C-section rate was observed in Punjab with percentage of 4.8 percent in 1990-1991, which shows a rising trend with 11.4 percent in 2006-2007. The percentage

of delivery by C-section in Punjab decreased in 2012-2013, with a percentage of 10.6, while after that, the percentage continued to increase, with 31 percent of respondents in 2017-2018 and 40.4 percent of respondents in 2019 responding yes to C-section delivery, with a percentage increase of 741.66 and a difference of 35.6 from 1990 to 2019. In the region Sindh, the trend of C-section delivery in 1990 was 2.5%, with a major rise in percentage observed from 2006-2007 to 2012-2013 from 7.4 to 19.3 percent, which then goes on increasing trend after that (2017-19: 27%, 2019: 34.1%). The percentage increase observed was 1264, and the difference of 31.6.

A rising trend was observed in C section delivery in NWFP/KPK region from 1990-2019 (1990-1991: 2.1%, 2006-2007: 4.4%, 2012-2013: 6.9%, 2017-2018:10%, 2019: 11.7%), in Baluchistan region (1990-1991: 0.7%, 2006-2007: 2.2%, 2012-2013: 2.2%, 2017-2018:5.7%, 2019: 11.5%), in Gilgit Baltistan (2012-2013: 5.4%, 2017-2018:12.1%, 2019: 15.3%), ICT ((2012-2013: 26.8%, 2017-2018:31.7%), in AJK (2017-2018:25.4%, 2019: 43.0%) with highest percentage increase of 1571.42 with percentage difference 10.8 in Baluchistan region followed by percentage change of 1264 and percentage difference of 31.6 in Sindh region and then followed by region Punjab region with 741.66 percentage increase percentage difference of 35.6.

The rate difference for the year 1990-91 was 4.1, which increased to 9.2 in 2006-07. The rate difference then shows a major increase from 2006-07 to 2012-13 and becomes 24.6 from 9.2. In 2018-17, the rate difference value increased to 27.9, and in the last PDHS wave, it was 31.5. The rate difference value increases as the C-section delivery trend increases over time. Likewise, the rate ratio was 6.9 in 1990-91 that decreased to 5.2 in 2006-07, then increase to 12.2 in year 2012-13, which then decreased to 8.3 in year 2017-18. The rate ratio observed in 2019 was 3.7 with highest C section prevalence in AJK (43%), followed by Punjab (40.4%), then Sindh (34.1%), Gilgit Baltistan (15.3%), NWFP/KPK (11.7%), Baluchistan (11.5%) (Table 1 and Figure 1).

Table 1: Region-wise Trend in C-Section Deliveries (PDHS 1990-2019)

	1990-1991		**2006-2007**		**2012-2013**		**2017-2018**		**2019**		**% increase**	**% difference**
	n	%	n	%	n	%	n	%	n	%		
Region												
Punjab	64	4.8	263	11.4	413	10.6	539	31	549	40.4	741.66	35.6
Sindh	37	2.5	120	7.4	307	19.3	398	27	307	34.1	1264	31.6
NWFP/KPK	22	2.1	49	4.4	105	6.9	138	10	110	11.7	457.14	9.6
Baluchistan	4	0.7	15	2.2	25	2.2	57	5.7	51	11.5	1571.42	10.8
Gilgit Baltistan	-	-	-	-	38	5.4	74	12.1	63	15.3	183.33	9.9
ICT	-	-	-	-	126	26.8	173	31.7			18.28	4.9
AJK	-	-	-	-	-	-	221	25.4	219	43.0	69.29	17.6
FATA	-	-	-	-	-	-	25	3.8	-	-	-	-
Rate difference	4.1		9.2		24.6		27.9		31.5		-	-
Rate ratio	6.9		5.2		12.2		8.3		3.7		-	-

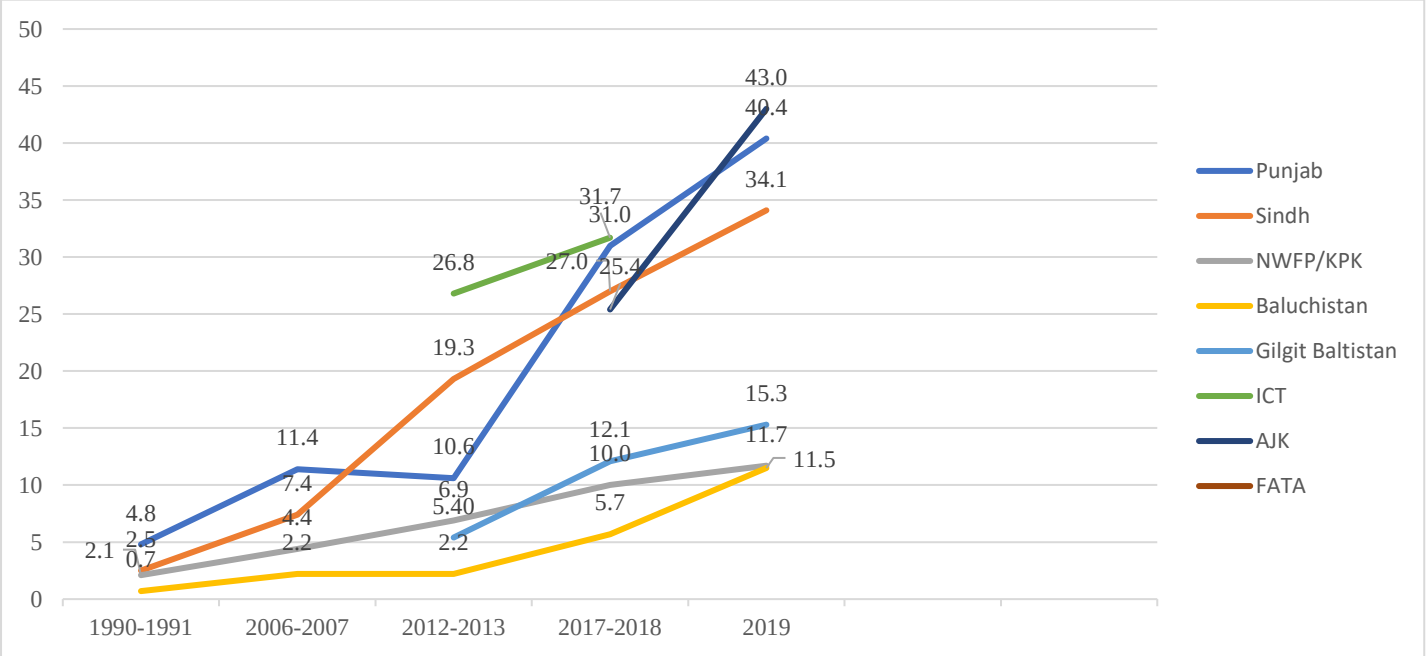

Figure 1: Trends of C-section delivery over time (PDHS 1990-2019)

4. Discussion

The trend analysis of Cesarean section delivery over time in Pakistan highlights that women are now using C-section delivery more, with increased observed rates from the past. The greatest increase was observed in the Baluchistan region, a 1571.4 percentage increase from 1990 to 2019. While Sindh comes next with 1264 percentage increases over time. Another major point of change to notice in Sindh is that the percentage of C-sections rises from 7.4 in 2006-07 to 19.3 in 2012-13. Here, the percentage change is more than double. Then, Punjab came with a 741.66 percentage increase. All the provinces' trends were found to be increasing continuously. The study findings correlate with the results of a study that mentions that about 21.1 percent of women undergo C-section, and the greatest rise was observed in Eastern Asia, Western Asia, and Northern Africa (44.9, 34.7, and 31.5 percentage increase, respectively). While the lowest rise was observed in Sub-Saharan Africa and North America (3.6 and 9.5 percentage increase, respectively). Moreover, they also highlight that 28.5 percent of women will give birth by C-section, which is about 38 million C-sections which and of this, 33.5 million occur in low middle-income countries by 2030 (Betran et al., 2021).

The study findings reveal that none of Pakistan's provinces has C C-section delivery rate below 15 percent (based on WHO's recommendations). These findings correlate with the findings of another study, whose results highlight that urban areas had high C-section rates (17.75%) as compared to rural areas in Pakistan. While taking institutional deliveries data, Urban areas of Pakistan had rate of C section was 27.79 percent, while the rate was 20.46 percent in rural areas (Verma et al., 2020). These results correlate with Punjab, Sindh, Gilgit Baltistan, FATA, and ICT (Islamabad), C-section rates as all were above 15 percent. Only NWFP/KPK and Baluchistan had a C-section rate below 15 percent.

Another study conducted in Pakistan using retrospective record review at Aga Khan University hospital reveals that out of 2616 deliveries, 1198 were delivered by the C-section method. This study was conducted using Robinson Cesarean section criteria, which uses 10 groups with further subdivisions based on pregnancy categories, gestational age, and progress of labor. The results indicate that C-section delivery rates were 45 percent, and group 5, followed by group 10, was found to be the primary contributor (Arshad et al., 2024). Additionally, another study's results indicate a high prevalence of C-section in the private sector as compared to the public (Shaikh et al., 2022). Similarly, another Pakistani study was conducted to analyze whether women themselves go for C-section delivery and the results indicated that the majority of women (87.5%) prefer vaginal birth over cesarean. The C-section rising trend was not the women's choice or demand (Qamar et al., 2021).

A major strength of this study is the use of nationally representative secondary data from five waves of the Pakistan Demographic and Health Surveys (1990–2019), which ensures large sample sizes, robust methodology, and high external validity. The use of standardized PDHS

questionnaires across all rounds enhances comparability of C-section trends over time and across regions. Additionally, the long study period of almost three decades provides a reliable picture of how C-section practices have evolved nationally and regionally. Despite these strengths, the study has certain limitations. As a secondary data analysis, it is restricted to variables available in the PDHS datasets; therefore, important clinical factors (e.g., medical indications for C-section, maternal comorbidities, facility readiness) could not be assessed. The study relies on self-reported information, which may introduce recall bias, particularly for older birth histories. Additionally, the cross-sectional nature of each PDHS round limits the ability to establish causal inferences regarding determinants of rising C-section rates.

5. Conclusion

This study demonstrates a clear and consistent rise in C-section delivery across Pakistan from 1990 to 2019, with notable regional variations. The findings highlight that while some regions show a gradual increase, others experience disproportionately rapid growth in C-section use. These trends point toward potential inequalities in access, differences in clinical practices, and variations in healthcare-seeking behavior. The results emphasize the need for region-specific policies aimed at promoting safe, evidence-based obstetric care and preventing unnecessary C-sections.

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Institutional Review Board Statement: The present study is based on the secondary data analysis of PDHS.

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Conflicts of Interest: The authors declare no conflict of interest.

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