PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 09 (September 2025)

Original Article

Common Fetal Outcome among Women with Short Interpregnancy Interval

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ARTICLE INFO

Keywords:
Short Interpregnancy Interval, Early Birth, Underweight Neonates, Stillbirth, Neonatal Mortality, Maternal Health, Birth Spacing, Fetal Complications

How to Cite:
Rehman, A. U., Jehangir, S., & Rehman, F. (2025). Common Fetal Outcome among Women with Short Interpregnancy Interval: Fetal Outcome with Short Interpregnancy Interval. Pakistan Journal of Health Sciences, 6(9), 106-110. https://doi.org/10.54393/pjhs.v6i9.3351

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Received Date: 16th July, 2025
Revised Date: 28th August, 2025
Acceptance Date: 18th September, 2025
Published Date: 30th September, 2025

ABSTRACT

The interpregnancy interval (IPI) is the time between the previous childbirth and the subsequent gestation. The short IPI is known for having adverse effects on fetal outcomes. **Objectives:** To investigate the association of short IPI ≤18 months. **Methods:** This cross-sectional study was conducted in the Obstetrics and Gynecology Department of Northwest General Hospital, Peshawar, and it lasted for more than six months. Participants were 126 women (15 to 45 years) with singleton pregnancies and IPI ≤ 18 months. Adverse outcomes, which include preterm birth, low birth weight, stillbirth, and early neonatal death, were analyzed using multivariable logistic regression. **Results:** 68(54%) women experienced at least one adverse fetal outcome, including low birth weight 27(21%), premature births 25(20%), stillbirths 11(9%), and early neonatal death 5(4%). Additionally, younger mothers (15 to 19 years) had the highest rates of preterm birth 7 35%) and low birth weight 6 28%). Multi variable logistic regression (confounding factors age, parity, education and residence) showed short IPI (<6 months) was strongly associated with early birth (aOR 8.62, 95% CI 1.53-48.51, p=0.014) and short IPI (6-11 months) also increased early birth risk (aOR 6.28, 95% CI 1.10-35.89, p=0.039). For underweight neonates, short IPI (6-11 months) had an elevated risk (aOR 7.22, 95% CI 1.90-27.47, p=0.004). Associations with stillbirth and neonatal death were not significant after adjustment. **Conclusions:** To reduce these risks, comprehensive family planning programs, maternal health education, and antenatal counselling on optimal birth spacing need to be prioritized in developing countries like Pakistan.

INTRODUCTION

The time between the previous childbirth and the subsequent gestation is known as the interpregnancy interval (IPI). According to earlier research, the short IPI of less than eighteen months was associated with unfavorable outcomes, which included premature birth, underweight neonates, stillbirth, and neonatal mortality [1-3]. A meta-analysis of sixty-seven settings that were conducted in various countries across the globe also revealed a similar association between short IPI and adverse fetal outcomes [4]. A previous systematic review and meta-analysis also found that an interpregnancy interval of <6 months is associated with negative fetal outcomes. This includes 40%, 61% and 26% higher risk of preterm birth, low birth weight, and small for gestational age, respectively, in the subsequent pregnancy. Short interpregnancy intervals up to 17 months were also associated with greater risks for these outcomes [5]. A recent study on the multiethnic Pakistani population also suggests that the optimal birth spacing reduces risks of perinatal and neonatal deaths [6]. A similar investigation in the Ethiopian population reveals that the percentage of premature and preterm birth is 10.4% and 25.9% in patients with short IPI, whereas with an optimal pregnancy interval, the percentage of preterm birth reduces to 2.9% [7].

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DOI: https://doi.org/10.54393/pjhs.v6i9.3351

Another study conducted in Ethiopia compared the perinatal outcome in two groups (exposed and unexposed) of pregnant women based on their inter-pregnancy interval. The exposed group consists of women having an IPI<18 months, and the unexposed group consists of women having an IPI between 24 to 60 months. The results suggest the exposed group has a higher risk of adverse outcomes [8]. A short interpregnancy interval also adversely affects maternal health. It imposes the increased risk of diabetes and pregnancy in obese mothers [9]. It also increases the risk of maternal mortality, miscarriage, and induced abortion. In developing countries like Pakistan, social and cultural influences, along with low levels of maternal education, are the additional factors that lead to short IPI [4, 10]. Higher maternal education and better exposure to contraceptive counseling can improve postpartum contraceptive uptake. Younger maternal age and teenage pregnancy have repeatedly been linked to shorter birth spacing and worse perinatal outcomes. Socioeconomic disadvantage, high parity, and inadequate nutritional recovery are also crucial factors that can amplify the risk associated with short IPI [1, 2, 11, 12].

Although substantial international evidence links short interpregnancy interval (IPI) with adverse perinatal outcomes, context-specific data from tertiary care settings in Khyber Pakhtunkhwa remain limited. Many regional studies either combine maternal and fetal outcomes without stratified analysis or lack adjustment for key sociodemographic confounders. This limits the ability to determine the independent effect of short IPI on fetal outcomes within our population. Therefore, locally generated evidence is essential to guide targeted family planning strategies and obstetric care policies. This study aims to determine the frequency of adverse fetal outcomes associated with short interpregnancy intervals (IPI) and to evaluate their independent associations with maternal sociodemographic factors.

METHODS

This descriptive cross-sectional study was carried out in the Obstetrics and Gynecology Department of Northwest General Hospital and Research Center, Peshawar, Pakistan, over six months from 1st September 2023 to 20th March 2024, after obtaining ethical approval from the Northwest General Hospital and Research Center Institutional Review Board (Ref. No. IRB and EC/2023-GH/018) and from the College of Physicians and Surgeons Pakistan (Ref. No. CPSP/REU/OBG-2022-016-11507). A total of 126 women aged 15–45 years with single pregnancies and an interpregnancy interval (IPI) of less than 18 months were enrolled through consecutive non-probability sampling, with sample size calculated using OpenEpi software based on a 20% expected prevalence of short IPI, 95% confidence interval, and 7% error margin, conservatively derived from a meta-analysis reporting a pooled prevalence of 24.1% (95% CI 12.7–37.8%) [10]. Women with multiple pregnancies, diabetes mellitus (fasting blood glucose >126 mg/dL), active urogenital infections, or a history of cesarean section in their most recent delivery were excluded, while the inclusion criteria were an IPI of ≤18 months and presentation after 24 weeks of gestation. Data were collected through a structured proforma after obtaining informed consent in outpatient and emergency departments, with participants followed during routine antenatal visits until delivery; clinical examinations and ultrasound were performed to confirm eligibility. Data reliability was ensured by standardized training of collectors, use of calibrated weighing scales (LAICA BF-2025, Italy) and ultrasound machines (TOSHIBA TUS-X200, Japan), monthly calibration checks, cross-verification with antenatal and delivery records, refresher training, and periodic audits by senior obstetricians. Maternal and gestational age were quantitative variables, while categorical variables included parity, IPI category, residence, and education; outcome variables were premature birth, underweight neonates, stillbirth, and early neonatal death. Operational definitions included premature birth as delivery before 37 weeks, low birth weight as <2.5 kg, stillbirth as death of a viable fetus confirmed by absent cardiac activity on ultrasound, early neonatal death as death within the first week, and short IPI as pregnancy initiation within 18 months of a prior delivery. IPI months were categorized into four groups (Group 1: <6 months, Group 2: 6–11 months, Group 3: 12–17 months, and Group 4: ≥18 months [reference]). Continuous variables were summarized with mean and standard deviation, categorical variables with frequencies and percentages, and associations between short IPI and adverse outcomes were first assessed with crude logistic regression and then with multivariable models adjusted for maternal age, parity, education, and residence; results were reported as odds ratios (OR) with 95% confidence intervals and p-values, with $p < 0.050$ considered significant. Participants were briefed on the study benefits and informed that participation was voluntary and withdrawal at any stage would not affect their medical care, while this study offers important insights on short IPI, its use of consecutive non-probability sampling may limit the generalizability of findings.

RESULTS

The baseline characteristics of the study sample are: the mean age of the study population is 27.02 years with a standard deviation of 5.35. Out of 126 patients, 29 (23%) were nulliparous, 57 (45.2%) primiparous, and 40 (31.7%) multiparous, and their mean gestational age was 36.52

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weeks with a standard deviation of 3.187 (Figure 1).

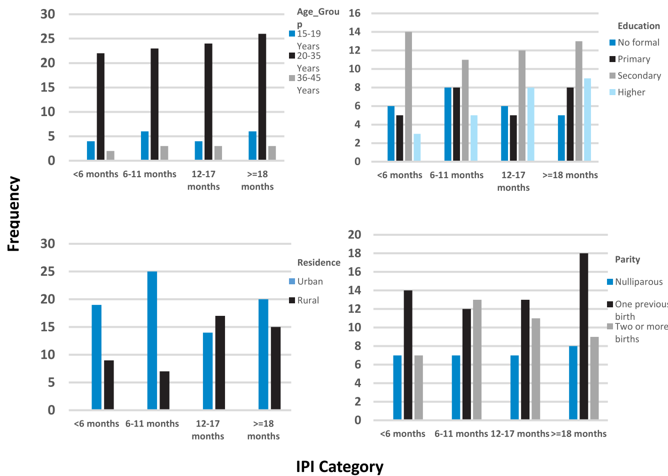

Figure 1: Characteristics of Study Population

Data were collected from patient enrollment until delivery for a comprehensive evaluation of fetal outcomes. A major portion of the study population, 68 (54%), experienced negative fetal outcomes, with the most common being low birth weight in 27 (21%) participants, followed by preterm birth in 25 (20%), stillbirth in 11 (9%), and early neonatal death in 5 (4%). To assess whether mother's age played a role in fetal outcomes, data were classified into three groups (Group 1: 15–19 years, Group 2: 20–35 years, Group 3: 36–45 years). The highest rates of adverse outcomes were observed in the youngest age group (Group 1: n = 20, 16%), where preterm birth (7, 35%) and low birth weight (6, 28%) were most common. The middle age group (Group 2: n = 95, 75%) also showed higher rates of adverse outcomes, including low birth weight (19, 20%) and preterm birth (17, 18%), while the oldest age group (Group 3: n = 11, 8%) had the lowest rates, with underweight neonates in 2 (18%) participants and preterm birth in 1 (9%). To evaluate how the duration of interpregnancy interval (IPI) affects fetal outcomes, participants were divided into four groups: Group 1 (<6 months), Group 2 (6–11 months), Group 3 (12–17 months), and Group 4 (≥18 months). To determine whether associations between short IPI and adverse outcomes were independent of maternal characteristics, multivariable logistic regression models were applied, including maternal age, parity, education level, and residence as covariates. Crude (unadjusted) and adjusted odds ratios (aOR) with 95% confidence intervals (CIs) were reported, model fit was examined using the Hosmer–Lemeshow test, and statistical significance was set at p < 0.050.

Table 1: Effect of Short IPI on Adverse Fetal Outcomes (Crude Vs Adjusted OR)

IPI (Months)		Frequency (%)	Crude OR	95% C.I.for EXP(B)		Adjusted OR	95% C.I. for EXP(B)		p-Value
				Lower	Upper		Lower	Upper	
Early Birth	< 6 (N=28)	9 (32.1%)	7.816	1.527	40.004	8.623	1.533	48.511	0.014
	6 – 11	8 (25%)	5.500	1.071	28.248	6.284	1.100	35.899	0.039
	12-17 (N=31)	6 (19.4%)	3.960	.736	21.302	4.490	.769	26.207	0.095
	>=18 (N=35) Reference	2 (5.7%)	—	—	—	—	—	—	0.104
Underweight Neonates	< 6 (N=28)	7 (25%)	2.000	.558	7.164	2.384	.604	9.409	0.215
	6 – 11	14 (43.8%)	4.667	1.439	15.134	7.215	1.895	27.471	0.004
	12-17 (N=31)	3 (9.7%)	.643	.140	2.943	.702	.146	3.384	0.660
	>=18 (N=35) Reference	5 (14.3%)	—	—	—	—	—	—	0.006
Still Birth	< 6 (N=28)	4 (14.3%)	1.778	.363	8.698	1.689	.322	8.872	0.536
	6 – 11	3 (9.4%)	1.103	.206	5.905	1.065	.184	6.167	0.944
	12-17 (N=31)	1 (3.2%)	.356	.035	3.608	.368	.035	3.885	0.405
	>=18 (N=35) Reference	3 (8.6%)	—	—	—	—	—	—	0.642
Early Neonatal Death	< 6 (N=28)	1 (3.6%)	1.259	.075	21.073	1.115	.060	20.612	0.942
	6 – 11	2 (6.3%)	2.267	.196	26.271	2.834	.197	40.814	0.444
	12-17 (N=31)	1 (3.2%)	1.133	.068	18.918	.850	.044	16.457	0.914
	>=18 (N=35) Reference	1 (2.9%)	—	—	—	—	—	—	0.803

After adjusting for potential confounding variables, the results showed that very short IPI (<12 months) remained strongly associated with early birth, with IPI <6 months showing markedly increased odds (Adjusted OR 8.62, 95% CI 1.53–48.51, p=0.014) and IPI 6–11 months also showing significantly higher odds (Adjusted OR 6.28, 95% CI 1.10–35.89, p=0.039) compared with IPI ≥18 months. For underweight neonates, IPI 6–11 months showed a substantial and statistically significant increase in risk (Adjusted OR 7.22, 95% CI 1.90–27.47, p=0.004), whereas IPI <6 months showed a non-significant trend (Adjusted OR 2.38, 95% CI 0.60–9.41, p=0.215). For stillbirth and early neonatal death, even very short IPI (<6 months) showed no statistically significant association (p>0.050) (Table 1).

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DISCUSSIONS

The baseline characteristics of participants are critical for understanding the study population. They ensure that the findings accurately reflect the demographic under investigation [5, 10]. A major portion of the study population experienced negative fetal outcomes. These adverse outcomes are preterm birth, low birth weight, stillbirth, and early neonatal death. The most common adverse outcome is low birth weight in 27 (21%) participants. Preterm birth in 25 (20%) participants is the second most occurring adverse outcome. Stillbirth in 11 (9%) participants and early neonatal death in 5 (4%) participants are also additional observed outcomes. These findings show a strong correlation between short IPI and neonatal complications. They emphasize the importance of optimal birth spacing for the better health of both newborns and mothers. Similar findings are also presented in previous studies that analyzed large metadata [1, 4, 11]. In Pakistan, Yousif *et al*. and Jameel *et al*. documented increased neonatal mortality and morbidities linked to short IPI [6, 12]. Brhane *et al*. and Jena *et al*. also reported increased preterm birth rates among Ethiopian women with short IPI [7, 8]. Maternal age also contributes to the risks associated with short IPI. Women of a younger age are at a higher risk of experiencing fetal complications. This study finds that women aged 15 to 19 years experienced the highest occurrence of premature birth (7, 35%) and underweight neonates (6, 28%). These trends show that maternal age also plays a crucial role in determining outcomes. Physiological weakness, underdeveloped reproductive systems, and socioeconomic factors challenge young mothers with higher risks of adverse fetal outcomes [13]. Studies conducted in India also confirm higher neonatal mortality and underweight neonates born to young mothers with short IPI [14]. Early marriage and poor family planning are also key drivers of short IPI in underdeveloped countries [15, 16]. For early birth outcomes, women with short IPI (<12 months) had markedly increased odds compared with those with IPI ≥18 months. For underweight neonates, the 6–11-month group showed a statistically significant increase in risk, whereas the IPI <6 months showed a non-significant trend. Crude estimates suggested elevated risks for stillbirth and neonatal death at shorter intervals, but these associations attenuated and were not statistically significant after adjustment. This suggests partial confounding by maternal sociodemographic factors. Overall, the pattern supports biological plausibility (nutritional depletion and incomplete recovery) and aligns with literature recommending longer spacing [5, 17-18]. The findings point to a particular vulnerability for preterm delivery and low birth weight when pregnancies are spaced under 12 months. Recent studies suggest that short IPI can be a detrimental factor for congenital anomalie. Environmental stressors such as air pollution further increase these risks [19]. These findings align with rates in other low-resource settings, and this study reinforces that an optimal IPI (≥18 months, ideally ≥24 months) substantially reduces the risk of adverse outcomes [20]. Although the current study effectively demonstrates the negative fetal outcomes of short IPI, it must be acknowledged that the limited sample size may hinder the generalization of the findings.

This study is limited by its single-center design, modest sample size, and use of consecutive non-probability sampling, which may restrict generalizability. Additionally, residual confounding from unmeasured factors such as maternal nutritional status and intercurrent infections cannot be excluded. Future multicenter prospective studies with larger samples and longer follow-up are recommended to validate these findings and to further explore biological and socioeconomic mechanisms underlying short IPI and adverse fetal outcomes.

CONCLUSIONS

This study effectively demonstrates that short IPI contributes to adverse fetal outcomes. These fetal complications are premature birth, underweight newborns, stillbirth, and early neonatal deaths. This study indicates that very short IPI, especially under 12 months, poses a significant risk for early birth and underweight neonates. Policies and clinical practice should reinforce family planning and postpartum contraceptive access to encourage optimal birth spacing (≥18 months). This study emphasizes the importance of enhancing maternal education and family planning in developing countries like Pakistan for mitigating the risks associated with short IPIs. It also recommends integrating postpartum family planning counseling into routine postnatal care and promoting community-level reproductive health education.

Authors' Contribution

Conceptualization: AUR
Methodology: AUR
Formal analysis: SJ
Writing and Drafting: AUR, SJ, FR
Review and Editing: AUR, SJ, FR

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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DOI: https://doi.org/10.54393/pjhs.v6i9.3351

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