

Interpregnancy intervals and its maternal fetal outcome

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Abstract

Background: Inter-pregnancy interval is considered as the time elapsed between the pregnancies and is calculated as the number of months between the date of the last child birth and the date of last menstrual period of the index pregnancy. An interval under 12 months between the pregnancies is usually considered short. Long inter-pregnancy interval refer to an interval of greater than 40-60 months between pregnancies. **Aims:** The objective of this study was to evaluate the association between inter-pregnancy interval and the occurrence of adverse maternal and peri-natal outcomes. **Maternal and Methods:** The study was conducted in 2025 antenatal women admitted in the obstetrics and gynaecology department, Gandhi hospital during the period September 2014 to September 2016. In his study interpregnancy intervals were categorised as <6, 6-11, 12-17, 18-23, 24-59 and 60 months and more 17.8% conceived within 6 months of previous childbirth. the median interpregnancy interval was 27.8 months. In the present study 30% conceived within 6 months of previous childbirth. The median interpregnancy interval in our study was 14.8 months. **Results:** Premature rupture of membranes occurred in 10.2% of the subjects, Preterm birth was 32%. 40% of live births were low birth weight and 9% very low birth weight with interpregnancy interval less than 6 months. Only 12%, 4%, of the live births were LBW and VLBW in 18-23 months interval group. There is two-fold increase in fetal neural tube defects in women who conceived with very short intervals (3.2%). 24% of live births had NICU admissions of which 16% were early neonatal deaths in women who delivered with interpregnancy interval less than 6 months. only 6% were NICU admitted in the inter pregnancy interval group 18-23 months. **Conclusions:** Both short and long inter pregnancy intervals are associated with adverse maternal and perinatal outcomes. Women with interpregnancy intervals less than 6 months are at increased risk of anaemia, premature rupture of membranes, postpartum haemorrhages and maternal death. Women with longer inter pregnancy interval are at increased risk of preeclampsia.

Key Words: Inter-pregnancy interval,

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INTRODUCTION

Being born too early or too small are the most important determinants of mortality among otherwise normal infants. Therefore, development of effective strategies to prevent preterm birth and low birth weight can have a major impact on neonatal and infant death. Both short and

long inter-pregnancy intervals have been found to increase the risk of various adverse maternal and perinatal outcomes, such as maternal and perinatal outcomes, such as maternal anaemia, post-partum haemorrhages, puerperal fever, maternal mortality, low birth weight, preterm delivery, intrauterine growth restriction, still birth and neonatal death respectively. The risk of pre-eclampsia increased steadily with increasing interval between the pregnancies.¹ It is important to determine whether inter pregnancy interval is truly a significant independent biological risk factor for these adverse pregnancy events since women have some control over the spacing of their pregnancies and thus could potentially reduce their risk of such outcomes. we report the relation between inter pregnancy interval and pregnancy interval and pregnancy outcome in a cohort of 2025 women.

MATERNAL AND METHODS

The study was conducted in 2025 antenatal women admitted in the obstetrics and gynaecology department, during the period Sept 2014 to Sept 2016. Only parous women delivering singleton infants and whose previous pregnancy ended in live birth at term were included in the study. The patients who were second gravid were randomly selected from the first antenatal visit till the discharge of mother and the neonate data collected on reproductive history, maternal characteristics, antenatal care, labor management, maternal complications during pregnancy, delivery, puerperium and neonatal outcomes.

Exclusion Criteria: Miscarriages, multiple pregnancies, previous caesarean section, previous preterm delivery, previous h/o of preeclampsia. maternal age was denied as completed years at the time of previous delivery. maternal height and weight were recorded by recall at the patient 1st antenatal visit and BMI is calculated. It was categorized as underweight (18.5), normal (18.5-24.9), overweight (25-29.9) and obese (>30). gestational age was estimated from the date of LMP and amended by means of USG. Interpregnancy intervals were categorized as <-6 months, 7-12 months, 13-17 months, 18-23 months, 24-39 months, >39 months. adverse maternal outcomes were classified according to ICD-10. The adverse outcomes included were anaemia, premature rupture of membranes, premature rupture of membranes, preeclampsia and postpartum haemorrhage. Maternal death was defined as the death of a woman while she was pregnant or within 42 days after delivery from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. Perinatal outcomes evaluated were:

- Early neonatal death -death of live born infant in the first week.
- Fetal death-delivery of a dead fetus or death after 20 weeks of gestation.
- Low birth weight-birthweight<2.5kg
- Very low birth weight-birth weight<1.5kg
- Preterm birth-live baby delivered at gestational age<37weeks.
- Very preterm birth-live baby delivered at gestational age <32weeks.
- SGA-live baby with birthweight below the 10th percentile.
- Rates of adverse perinatal outcomes were calculated for each interpregnancy interval and the denominator was all live births in that interpregnancy interval.

RESULTS

Table 1: Maternal age- inter pregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Maternal age (yrs.)		
	≤19	20-29	≥30
≤6 (n-600)	40% (240)	59% (354)	1% (6)
7-12 (n-450)	32% (144)	62% (279)	6% (27)
13-17 (n-300)	24% (72)	69% (207)	7% (21)
18-23 (n-350)	14% (49)	76% (266)	10% (35)
24-39 (n-225)	7% (16)	79% (178)	14% (31)
≥39 (n-100)	2% (2)	78% (78)	20% (20)

In the present study women with interpregnancy interval of 6 months below age 19 years. 14% of women were below 19 yrs in women with interpregnancy interval of 18-23 months. 20% of women were above 30 yrs in women with interpregnancy interval ≥ 39 months. The mean age in the present study is 20.2 yrs

Table 2: Booked Vs Unbooked Cases

Inter pregnancy interval (n-number of pregnant women)	Booked cases	Unbooked cases
≤6 months (n-600)	30% (180)	70% (320)
7-12 months (n-450)	28% (126)	72% (324)
13-17 months (n-300)	43% (129)	57% (171)
18-23 months (n-350)	40% (140)	60% (210)
24-39 months (n-225)	44% (99)	56% (126)
≥39 months (n-100)	40% (40)	60% (60)

Maximum subjects were unbooked cases. 30%, 28%, 43%, 40%, 44%, 40% were booked cases in women with interpregnancy interval <-6, 7-12, 13-17, 18-23, 24-39, >39 months respectively. 70%, 72%, 57%, 60%, 56%, 60% were unbooked cases in women with the interpregnancy interval of <-6, 7-12, 13-17, 18-23, 24-39, >39 months respectively.

Table 3: Antenatal care onset – interpregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Antenatal care onset		
	1-13 wks.	14-26 wks.	≥27 wks.
≤6 months (n-600)	12.5% (75)	28.7% (172)	58.8% (353)
7-12 months (n-450)	14.6% (66)	32.0% (144)	53.4% (240)
13-17 months (n-300)	18.4% (55)	43.2% (130)	38.4% (115)
18-23 months (n-350)	24.2% (85)	44.8% (157)	31.0% (108)
24-39 months (n-225)	29.6% (67)	45.0% (101)	25.4% (57)
≥39 months (n-100)	32.0% (32)	50.0% (50)	18.0% (18)

In the present study, maximum subjects had late antenatal care onset about 58%, 53.4%, 38.4%, 31.0%, 25.4%, 18.0% had late antenatal care at >-27 wks in women who

conceived with their interpregnancy intervals of </-6,7-12,13-17,18-23,24-39,>39 months respectively. About 12.5%, 14.6%, 18.4%, 24.2%, 29.6%, 32.0% had antenatal care onset </-13 wks. in women who conceived with interpregnancy intervals of </-6,7-12,13-17,18-23,24-39,>39 months respectively.

Table 4: Number of antenatal visits – inter pregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Antenatal visits (percentage)		
	≤1	2-4	≥5
≤6 months (n-600)	49.0% (294)	30.6% (184)	20.4% (122)
7-12 months (n-450)	30.0% (135)	48.6% (219)	21.4% (96)
13-17 months (n-300)	24.0% (72)	46.3% (139)	29.7% (89)
18-23 months (n-350)	20.9% (73)	42.0% (147)	37.1% (140)
24-39 months (n-225)	16.8% (38)	43.0% (97)	40.2% (90)
≥39 months (n-100)	12.0% (12)	29.0% (29)	59.0% (59)

In the present study 49%, 30%, 24%, 20.9%, 16.8%, 12.0%, had </-1 antenatal visits in women who conceived with interpregnancy interval of </-6,7-12,13-17,18-23,24-39,>39 months. 30.6%, 48.6%, 46.3%, 42.0%, 43.0%, 29.0% had 2-4 antenatal visits who conceived with inter pregnancy interval of </-6,7-12,13-17,18-23,24-39,>39 months. 20.4%, 21.4%, 29.7%, 38.1%, 40.2%, 59.0% had >/-5 antenatal visits who conceived with inter pregnancy interval of </-6,7-12,13-17,18-23,24-39,>39 months.

Table 5: Pre-pregnancy BMI – inter pregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Pre-pregnancy BMI			
	<18.5	18.5-24.9	25-29.9	>30
≤6 (n-600)	42% (252)	38% (228)	14% (84)	6% (36)
7-12 (n-450)	36% (162)	34% (153)	23% (103)	7% (32)
13-17 (n-300)	27% (81)	42% (126)	22.0% (66)	9.0% (27)
18-23 (n-350)	18% (63)	54% (189)	19% (66)	9.0% (32)
24-39 (n-225)	17% (38)	50% (113)	20% (45)	13% (29)
≥39 (n-100)	15.0% (15)	44% (44)	22% (22)	19.0% (19)

In the present study pre-pregnancy BMI <18.5 is 42%, 36%, 27%, 18%, 17.0%, 15.0% in women with inter pregnancy interval of </-6,7-12,13-17,18-23,24-39,>39 months. Pre-pregnancy BMI 18.5-24.9 is 38%, 34%, 42%, 54%, 50%, 44% in women with inter pregnancy interval of </-6,7-12,13-17,18-23,24-39,>39 months. Pre-pregnancy BMI >30 in 6.0%, 7.0%, 9.0%, 9.0%, 13%,

19%, in women with interpregnancy interval of </-6,7-12,13-17,18-23,24-39,>39 months.

Table 6: Pre-eclampsia – inter pregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Pre-eclampsia
≤6 (n-600)	3.7% (20)
7-12 (n-450)	3.2% (14)
13-17 (n-300)	3.3% (33)
18-23 (n-350)	3.4% (11)
24-39 (n-225)	4.2% (9)
≥39 (n-100)	6.9% (7)
Severe anaemia (<6.9 gm %)	
≤6 months (n-600)	20.2% (121)
7-12 months (n-450)	16.8% (76)
13-17 months (n-300)	11.2% (34)
18-23 months (n-350)	9.2% (32)
24-39 months (n-225)	8.2% (18)
≥39 months (n-100)	8.0% (8)

In the present study, the new onset of preeclampsia (no history of preeclampsia in the first pregnancy) occurred in 3.7%, 4.2%, 6.9% of women who conceived with inter pregnancy intervals of </-6,7-12,13-17,18-23,24-39,>39 months. Rates of severe anaemia in women with varying inter pregnancy intervals. high percentages (20.2%) of women were severely anaemic in women who conceived with inter pregnancy interval of 7-12,13-17,18-23,24-39,>39 months respectively.

Table 7: Premature rupture membranes interpregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Premature rupture of membranes (percentage)
≤6 months (n-600)	10.2% (61)
7-12 months (n-450)	9.4% (42)
13-17 months (n-300)	8.2% (25)
18-23 months (n-350)	5.4% (19)
24-39 months (n-225)	6.8% (15)
≥39 months (n-100)	6.0% (6)
Post-partum haemorrhage (percentage)	
≤6 months (n-600)	10% (60)
7-12 months (n-450)	9.8% (44)
13-17 months (n-300)	5.2% (16)
18-23 months (n-350)	5.0% (18)
24-39 months (n-225)	5.0% (15)
≥39 months (n-100)	6.0% (6)

Rates of premature rupture of membranes in women who conceived with varying inter pregnancy intervals. The maximum subjects 10.2% had premature rupture of membranes who conceived within 6 months of previous childbirth. 9.4%, 8.2%, 5.4%, 6.8%, 6.4% had premature rupture of membranes who conceived with inter pregnancy intervals of 7-12,13-17,18-23,24-39,>39 months. Postpartum haemorrhage is highest in interpregnancy group less than 6 months, least in 18-23 and 24-39 months.

Maternal Deaths: 5 maternal deaths occurred in the interpregnancy interval group </- 6months.all the cases were unbooked admitted during labor,3 patients were severely anaemic with left ventricular failure.2 patients died due to postpartum haemorrhage.

Table 8: Inter pregnancy interval – pre-term weight

Inter pregnancy interval (n-number of pregnant women)	Number of live births	Preterm birth (<37 wks.)	Very preterm birth (24-32 wks.)
≤6 months (n-600)	539	32% (172)	9% (49)
7-12 months (n-450)	422	24% (101)	7% (30)
13-17 months (n-300)	285	16% (46)	3% (9)
18-23 months (n-350)	343	6% (21)	2% (7)
24-39 months (n-225)	218	10% (22)	3% (7)
≥39 months (n-100)	94	14% (13)	4.2% (4)

32% of preterm births occurred in women who conceived within 6 months of previous child birth. Preterm birth rates are 24%,16%,6%,10%,14% in women who conceived with inter pregnancy intervals of 7-12,13-17,18-23,24-39,>39 months respectively. Very preterm birth rates (24-32) weeks are 9%,7%,3%,2%,3%,4.2% in women concerned with interpregnancy intervals of 7-12,13-17,18-23,24-39,>39 months respectively.

Table 9: Interpregnancy interval – low birth weight

Inter pregnancy interval (n-number of pregnant women)	Number of live births	LBW (<2.5kg)	VLBW (<1.5kg)	>2.5kg
≤6 months (n-600)	539	40% (216)	9% (49)	51% (274)
7-12 months (n-450)	422	20% (84)	7% (30)	73% (312)
13-17 months (n-300)	285	12% (34)	3% (9)	85% (242)
18-23 months (n-350)	343	8% (27)	1% (4)	91% (312)
24-39 months (n-225)	218	14% (31)	5% (11)	81% (176)
≥39 months (n-100)	94	18% (16)	6.3% (6)	76.7% (72)

Birth weights with inter pregnancy intervals. About 40% of live births were low birth weight among the women who conceived within 6 months of previous childbirth. About 20,12,8,14,18% of live births were low birth weights among the women who conceived with inter pregnancy intervals of 7-12,12-17,18-23,24-39,>39 months respectively. Very low birth weight babies (weight less than 1.5kgs) are highest among the women who conceived within 6 months of previous childbirth which is 9% in the present study. The least was among the women who conceived with interpregnancy interval of 18-23 months is 1% in the present study.

Table 10: Fetal outcomes in comparison with interpregnancy interval

Inter pregnancy interval (n-number of pregnant women)	Neural tube defects
≤6 months (n-600)	3.2% (19)

7-12 months (n-450)	2.2% (10)
13-17 months (n-300)	2.0% (6)
18-23 months (n-350)	0.9% (3)
24-39 months (n-225)	0.9% (2)
≥39 months (n-100)	2.0% (2)

Fetal deaths

≤6 months (n-600)	7% (42)
7-12 months (n-450)	4% (18)
13-17 months (n-300)	3% (9)
18-23 months (n-350)	1.1% (4)
24-39 months (n-225)	2.2% (5)
≥39 months (n-100)	4% (4)

SGA

≤6 months (n-600)	22% (119)
7-12 months (n-450)	18% (76)
13-17 months (n-300)	13% (37)
18-23 months (n-350)	4.9% (17)
24-39 months (n-225)	10% (22)
≥39 months (n-100)	12.5% (12)

Fetal neural tube defects were maximum (3.2%) in women with inter pregnancy intervals less than 6 months. The defects were least observed in the interval of 18-23 months. In this study 7% of the fetal deaths occurred in women who conceived with interpregnancy interval of </- 6 months,4%,3%,2.2%,4%, of the fetal deaths occurred in women who conceived with interpregnancy interval of 7-12 months,13-17,18-23,24-39,>39 months respectively. Only 1% of fetal deaths occurred in women whose inter pregnancy interval is 18-23 months. 14% of live births were SGA is women who conceived with inter pregnancy interval of less than 6 months, greater than 39 months respectively. About 18%, 13%,5%,10% of live births were SGA who conceived with interpregnancy interval of 7-12,13-17,18-23,24-39 months respectively.

Table 11: Inter pregnancy interval – NICU admissions, early neonatal deaths

Inter pregnancy interval (n-number of pregnant women)	NICU Admissions	Early neonatal death
≤6 months (n-600)	24% (129)	16% (86)
7-12 months (n-450)	16% (67)	9% (38)
13-17 months (n-300)	9% (26)	5% (14)
18-23 months (n-350)	6% (20)	3% (10)
24-39 months (n-225)	8% (17)	5% (11)
≥39 months (n-100)	8.5% (8)	6.3% (6)

NICU admissions were maximum, 24% who delivered with interpregnancy interval of less than 6 months. About 9%,5%,3%,5%,9% early neonatal deaths occurred in women who delivered with inter pregnancy interval of 6-12,13-17,18-23,24-39,>39 months respectively.

DISCUSSION

In the present study 2025 antenatal women with were second gravida whose previous pregnancy ended in a live birth were studied in accordance to varying

interpregnancy intervals whose maternal and perinatal outcomes were analysed. Inter pregnancy interval were categorized <6 months, 7-12, 13-17, 18-39, >39 months. The results of present study were compared with the study conducted by Augustin conde-aguledo.² In his study interpregnancy intervals were categorized as <6, 6-11, 12-17, 18-23, 24-59 and 60 months and more 17.8% conceived within 6 months of previous childbirth. The median interpregnancy interval was 27.8 months. In the present study 30% conceived within 6 months of previous childbirth. The median interpregnancy interval in our study was 14.8 months.

Maternal Outcome: In our study 20.2% were severely in the women who conceived in the 6 months of the previous childbirth, 9.2% in the group of 18-23 months. Preeclampsia incidence was 3.7% in the interpregnancy interval of <6 months and 6.9% in <39 months group. In Dr. Augustin conde-agudelo study 9.5% of women were severely anemic in women who conceived within 6 months of previous childbirth, 6.1% in the 18-23 months group. Preeclampsia incidence was 3.4% in the interpregnancy interval <6 months and 6.6% in >39 months group. Postpartum hemorrhage was 5% in women who delivered with interpregnancy interval <6 months and 5% in 18-23 months group.

Short interpregnancy intervals-maternal outcome: Our findings of higher rates of anemia among women with short interpregnancy intervals agree with the findings of the Lazons N *et al.*³ Most of our findings might be explained by the maternal depletion hypotheses which suggest that short intervals don't allow to the mother to recover from physiological stress imposed by the previous pregnancy. This results in the depletion of maternal nutrient stores and anemia which have been found to result in the pathogenesis of premature rupture of membranes, high incidence of fetal neural tube defects due to folic acid deficiency. With regard to PPH, short interval between the pregnancies might interfere in normal process of remodeling of endometrial blood vessels which account for more bleeding.

Long interpregnancy intervals-maternal outcomes: Results from our study corroborate the findings from earlier report that showed that women with long intervals between the pregnancies are at increased risk of preeclampsia. Eastman⁴ reported that compared with interpregnancy interval of 12-23 months mother with longer intervals >48 months had significant risk of preeclampsia was compared with interval of 18-23 months and >40 months, the latter group had significant risk (95% confidence interval 1.1 to 1.5 relative risk 1.3). In our study the risk of preeclampsia was compared with interval of 18-23 months and >40 months, the latter group had significant risk (95% confidence intervals 1.1 to 1.3

relative risk 1.2). It would see that parous women with long interpregnancy intervals behave as nulliparous women with regard to risk of preeclampsia as the protective effect for preeclampsia acquired through a previous birth is lost after a long interval.

Long interpregnancy interval fetal outcomes: In our study 8% of fetal deaths and 16% early neonatal deaths occurred in women with interpregnancy interval less than 6 months. A study conducted by Dr. Malavankar⁵ -levels and risk factors for perinatal mortality in India bull, 10.4% of fetal deaths and 15% of early neonate deaths occurred in women with interpregnancy interval less than 6 months. In our study 40% of live births were LBW in women with interpregnancy interval less than 6 months. A study conducted by K.S Negia⁶ -epidemiological factors affecting LBW. 34.5% of live births were LBW in women with interpregnancy less than 6 months. In the present study, the graph plotted when the risk for three adverse birth outcomes (LBW, preterm birth and SGA) was examined according to interpregnancy intervals J shaped curve resulted. All the three outcomes were high when interpregnancy intervals was short (<6 months). the risk declined sharply and reached a lowest point when the interpregnancy interval reached approximately 18-23 months. After that all the three outcomes slowly increased as the interval increased. The present study is corroborated with the study conducted in Utah-prevalence of adverse perinatal outcomes according to interpregnancy interval in 1996. when the graph is plotted to same variables J shaped curve is obtained.⁷

CONCLUSIONS

Both short and long inter pregnancy intervals are associated with adverse maternal and perinatal outcomes. Women with interpregnancy intervals less than 6 months are at increased risk of anemia, premature rupture of membranes, postpartum hemorrhages and maternal death. Women with longer inter pregnancy interval are at increased risk of preeclampsia. A short interval between the pregnancies increases the risk of preterm birth, low birth weight and growth restricted fetus. Two-fold increase in fetal neural tube defects is observed in women with short inter pregnancy intervals. The risks for maternal and perinatal morbidity associated with short inter pregnancy intervals underscore the importance of birth spacing to promote safe motherhood and achieve better pregnancy outcome in addition, women should be warned about the potential harm to them and their infants of short and long intervals between the pregnancies. We conclude the optimum birth to conception interval for preventing adverse perinatal outcomes is 18-23 months. Encouraging child spacing by use of contraceptive

methods that can lengthen the interpregnancy shall be a good health policy.

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