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Short Birth Intervals In South India: Prevalence, Determinants And Inter-State Variation Using NFHS-5

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Abstract

Short birth intervals pose significant risks to mother and child health and remain a challenge in many parts of India, including the relatively advantaged South Indian states. The current study attempts to explore the factors associated with short birth intervals. In this study we have used fifth round of National Family Health Survey (NFHS) conducted in India during 2019-21 to examine the associations between short birth interval and independent variables (IIPS & ICF, 2021). The study used multivariable binary logistic regression to examine the associations. The results shown that substantial inter-state variation was observed, with Kerala showing the lowest prevalence of short intervals (6.1%) and Karnataka the highest (27.9%). Older maternal age, higher education, higher wealth, and surviving previous child were each linked with lower odds of a short birth interval. Current use of modern contraception was linked to higher likelihood of short intervals, whereas traditional method use and non-use were associated with lower likelihood. Differences by religion and state were statistically significant. Although overall progress has been made, short birth intervals remain prevalent in several South Indian states. Targeted postpartum family planning interventions particularly those promoting anticipatory contraceptive use and education for young, less-educated, and higher-parity women are needed to achieve further gains in maternal and child health. State-level approaches tailored to local contexts are recommended to address persistent inequalities.

Keywords: Odds Ratio, NFHS, Short Birth Interval, WHO

1. INTRODUCTION

Short birth intervals (SBI) is defined as the period between two successive live births being less than 24 months, pose significant risks to maternal and child health (de Jonge et.al., 2014). The World Health Organization (WHO) recommends an interval of at least 24 months to reduce adverse outcomes such as preterm birth, low birth weight, and increased neonatal and maternal mortality (WHO,2005). Despite these recommendations, SBIs remain common in many low and middle-income countries, including India. SBIs compromise the health of both mother and child and strain household resources, mainly in low and middle-income countries like India, where birth patterns and family-planning behaviours vary widely across socio-economic and demographic groups.

2. LITERATURE

The birth spacing is the most widely recognised and important determinant of maternal and child health and which was also mentioned by international health organisation like WHO. The recommendation of World Health Organisation (WHO) was to maintaining an adequate interval between the successive pregnancies in order to improve pregnancy outcomes and to reduce the health risks of the mother. The WHO had also mentioned that conception should be ideally after 24 months (2 years) of the live birth, which indicates that there should be approximately 33 months (2 years and 9 months) of average duration interval between birth of one child and the birth of next child. On the consideration of these recommendations helps

to contributes to the maternal recovery and enhance the health and survival of both mother and the child (WHO, 2005; Exavery et al., 2012)

Several studies have demonstrated that SBIs are associated with a range of adverse pregnancy and child health outcomes. Grisaru-Granovsky et al. (2009), using national data from Israel, found that short interpregnancy intervals were associated with adverse perinatal outcomes, including preterm delivery, small-for-gestational-age births, and early neonatal death. Similarly, de Jonge et al. (2014), in a study conducted in rural Bangladesh, examined both the determinants and consequences of SBI and reported their association with adverse pregnancy outcomes. Evidence from rural North India also indicates that SBIs are associated with substantially higher risks of stillbirth and neonatal death. Williams et al. (2008) found that intervals of less than 18 months were associated with higher odds of stillbirth and neonatal mortality compared with intervals of 36–59 months. Similarly, Gubhaju (1986) reported an association between birth spacing and infant and child mortality in rural Nepal, while Bhalotra and van Soest (2008) examined the relationship between birth spacing, fertility, and neonatal mortality in India.

In addition to the consequences of SBIs, previous research has identified factors that may contribute to their occurrence. For example, Ewemade et al. (2020) found that the death of a preceding child significantly increased the likelihood of a subsequent birth occurring sooner in Nigeria, suggesting that child survival is an important factor influencing birth-spacing patterns. Overall, the evidence suggests that inadequate birth spacing is an important reproductive health concern because closely spaced pregnancies are associated with elevated risks of adverse maternal, fetal, and neonatal outcomes.

Rutstein (2005) found that short preceding birth intervals were associated with increased risks of neonatal and infant mortality and undernutrition, highlighting the importance of adequate birth spacing for maternal and child health.

Maternal age and parity are also important factors associated with adverse maternal and child health outcomes. Kozuki et al. (2013), in a meta-analysis of 14 cohort studies from low- and middle-income countries, found that younger mothers, particularly those aged below 18 years, had higher odds of small-for-gestational-age birth, preterm birth, neonatal mortality, and infant mortality. The study also found elevated risks among women with higher parity, highlighting the importance of considering maternal age and parity in reproductive health interventions. Education is an important socioeconomic factor that may influence reproductive behaviour and birth-spacing practices. Higher educational attainment may improve women's knowledge of reproductive health and family planning and may increase their ability to participate in reproductive decision-making. However, the relationship between education and birth spacing may vary across different social and cultural settings. Karkee and Lee (2016), in a community-based study in Nepal, found that short preceding birth intervals were more common among younger women and women from lower caste groups, while maternal education was not significantly associated with birth spacing. The study also highlighted the importance of family planning knowledge in promoting appropriate birth spacing.

Chowdhury et al. (2023) examined the prevalence and associated factors of SBIs among rural women in India using data from the fourth round of the National Family Health Survey (NFHS-4). The study analysed data from 98,522 rural mothers and found that approximately half had experienced a SBI. The findings showed that mothers whose previous child had died, those who were not using contraception, and those who were not breastfeeding were more likely to experience a SBI. In contrast, women from richer and richest wealth groups and mothers aged above 30 years had lower odds of experiencing SBI. The study also identified considerable geographical variation in the prevalence of SBI across rural India, highlighting the need for interventions that consider socioeconomic, reproductive, and regional differences.

Most existing studies examine birth spacing at national level, which makes significant regional differences in reproductive behaviour. This study addresses this gap by focusing specifically on South Indian states using a regression model. This methodological gap provides the motivation for the present study.

3. Data and Methodology

In the current study the data is taken from NFHS-5 which is conducted from 2019-2021, it provides information on fertility, child health and maternal health, family planning and socio-demographic characteristics across India. NFHS employs a two-stage stratified sampling design and collects data through household interviews.

For this study a subset of the NFHS-5 birth data file was extracted, comprising currently married women aged 15–49 years from South Indian states namely Andhra Pradesh, Karnataka, Kerala, Telangana and Tamil Nadu. Only women with at least two live births were included, as the primary outcome variable, BI requires consecutive births for computation. After applying inclusion criteria and accounting for survey weights, the final weighted sample size was 142,102 women.

3.1.Dependent variable:

The outcome variable of interest was SBI, defined as an interval of less than 24 months between two successive live births. This was derived from the birth recode file of the NFHS-5 by calculating the difference in months between the date of the index birth and the preceding birth. BI less than 24 months is coded as short interval "1", while intervals of 24 months or longer is coded as normal interval "0".

3.2.Independent variables:

Independent variables on Mother, child, residence, household related variables were included in the statistical model. Mother related variables were Maternal age at birth (≤19 years, 20-24 years, 25-29 years, 30-34 years, ≥35 years), Mother's schooling (no schooling, primary, secondary, higher education), Contraceptive use (Not using, Modern, Traditional), Child-related variables were sex of the child (male, female) and household-related variables included wealth quintiles (poorest, poorer, middle, richer, richest), religion (Hindu, Muslim, others). Residence-related variables included urban-rural residence (urban, rural) and state-region (south states).

3.3.Binary logistic regression model:

Binary logistic regression model:

For a binary outcome Y, Where,

Y=1 is the SBI

Y=0 is not the SBI

The multivariable binary logistic regression model is

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k$$

Where,

p= P(Y=1) = Probability that a woman has SBI

1-p = P(Y=0) =Probability of no SBI

$\frac{p}{1-p}$ = odds of SBI

$\log\left(\frac{p}{1-p}\right)$ = log-odds

β_0 = intercept

$\beta_1, \beta_2, \ldots, \beta_k$ are the regression coefficients

$X_1, X_2, \ldots X_k$ are the independent variables

3.4. Odds Ratio (OR):

For a predictor X_j, the coefficient is converted to an odds ratio as

$$OR = e^{\beta_j}$$

If the OR = 1 then there is no association

OR > 1 then higher odds of SBI

OR < 1 then lower odds of SBI

4. Methods

To examine the factors associated with SBI, multivariable binary logistic regression was used. Logistic regression is appropriate for modelling a binary outcome variable in this case, whether a BI was short (<24 months) or not (≥24 months). The model estimates the odds of experiencing a short birth interval(SBI) based on multiple independent variables simultaneously.

Adjusted odds ratios (AORs) and their 95% confidence intervals (CIs) were calculated to assess the strength and significance of associations between predictors and SBI, controlling for potential confounders. Sample weights are applied to ensure representativeness.

Table 1: Logistic regression analysis of association between variables

Variable	Category	AORs	C.I (95%)		
			Lower	Upper	P-value
Maternal Age	15-19				
	20-24	0.65	0.46	0.90	0.011
	25-29	0.47	0.34	0.65	<0.001
	30-34	0.38	0.27	0.53	<0.001
	≥35	0.36	0.26	0.50	<0.001
Education	No education				
	Primary	1.04	0.99	1.09	0.091
	Secondary	0.88	0.84	0.92	<0.001
	Higher	0.61	0.57	0.66	<0.001
Wealth Index	Poorest				
	Poorer	1.10	1.02	1.19	0.008
	Middle	1.12	1.04	1.21	0.002
	Richer	1.09	1.01	1.17	0.019
	Richest	0.92	0.84	1.01	0.1
Residence	Urban				
	Rural	0.98	0.94	1.02	0.366
Religion	Hindu				
	Muslim	0.877	0.82	0.92	<0.001
	Other	1.10	1.02	1.18	0.007
Gender of child	Male				
	Female	0.93	0.90	0.97	<0.001
Child is alive	No				
	Yes	0.63	0.59	0.68	<0.001
Contraceptive use	Not using				
	Modern	1.264	1.20	1.32	<0.001
	Traditional	0.655	0.56	0.76	<0.001

Table 2: Distribution of Number of Living Children by Socio-Demographic Characteristics

Characteristics	Categories	South states		
		Number of living children		
		1(%)	2(%)	≥3(%)
Maternal age	≤19	0.0036	0.0023	0
	20-24	0.0702	0.0623	0.0181
	25-29	0.1417	0.1775	0.1056
	30-34	0.1434	0.208	0.5499
	≥35	0.641	0.5499	0.7176
Education	No education	0.3273	0.1802	0.3868
	Primary	0.1539	0.1229	0.1719
	Secondary	0.4426	0.5507	0.4051
	Higher	0.0762	0.1461	0.0363
Wealth index	Poorest	0.754	0.0316	0.0743
	Poorer	0.182	0.1311	0.2109
	Middle	0.3112	0.2761	0.3005
	Richer	0.2939	0.3163	0.2693
	Richest	0.1375	0.245	0.1449
Residence	Urban	0.3309	0.4097	0.3338
	Rural	0.6691	0.5903	0.6662
Religion	Hindu	0.8924	0.8529	0.7539
	Muslim	0.0545	0.0811	0.1913
	Other	0.0531	0.066	0.0548

5. Results

Distribution of Short Birth Interval (SBI) by state:

From the NFHS-5 birth recode file, a total of 1,42,102 women residing in South Indian states and having at least two live births, were included in the analysis. Among them, 19.9% (n = 28,255) had experienced a SBI (defined as <24 months), while 80.1% (n = 1,13,847) had a BI of 24 months or longer.

The prevalence of SBI varied notably across states. The highest proportion of SBI was observed in Karnataka (27.9%) and Andhra Pradesh (23.7%), while Kerala had the lowest prevalence (6.1%).

Table 1 presents the results of the multivariable binary logistic regression analysis examining the factors associated with SBIs among women in South India. Maternal age at the time of the index birth was significantly associated with SBI. Compared to women aged ≤19 years, the odds of SBI were 35 percent lower among women aged 20–24 years. For the women aged 25–29 years the odds of SBI decreased by 53 percent. Similarly, women aged 30-34 years have 61 percent lower adjusted odds. At last, women aged 35 years or older have 64 percent lower odds ratio.

Birth order (number of living children) was positively associated with SBI. Each additional child increased the odds of a short interval by 38 percent, suggesting that women with more births are more likely to have closely spaced births.

Educational attainment showed a protective effect. Compared to women with no formal education, those with secondary education have shown 11 percent lower odds and women with higher education have shown 38 percent lower odds of SBI. Primary education did not show a significant effect with 4 percent increase in adjusted odds.

Wealth status showed a mixed association. Compared to women in the poorest quintile, those in the poorer quintile shows 11 percent higher odds of SBI. Women in the middle quintile shown 12 percent higher odds, and women in the richer quintile have shown 9 percent higher odds of SBI.

Place of residence was not significantly associated with SBI. There was no difference in odds between rural and urban women as urban women have shown only 2 percent variation.

Religion also played a key role. Compared to Hindus, Muslim women had shown 12 percent lower odds of SBI. Conversely, women from other religions had shown 11 percent higher odds.

Women whose preceding child was female had shown 6 percent lower odds compared to male child. Possibly reflecting a son preference influencing reproductive behaviour.

Based on the results shows that women who use modern contraceptive shows 26 percent higher odds of SBI and women who uses traditional methods have shown 34 percent decrease in the odds of SBI. This indicates that many women adopt modern contraceptive after experience short spaced pregnancy. On the contrary traditional methods users may represent women who actively space or those residual fertility declines due to non-users of earlier in life.

Finally, the survival status of the previous child was a strong predictor. Mothers with a living previous child experience a 36 percent reduction in the odds of SBI and death of a previous child may lead to shorter spacing as couples seek replacement births.

Table 2 indicates that distribution of the number of living children among women in South India is stratified by key socio-demographic characteristics. For this study, the number of living children was categories into three major groups which are 1, 2, 3 or more children.

Based on the analysis Maternal age was strongly associated with the number of living children, and the majority of women who is age from ≥ 35 years had three or more living children (71.8%) while the younger women particularly those ages ≤ 24 years were more likely to have one or two children. Among the women aged 25–29 and those 30–34 years the proportions of those with two children were showing the highest representing 17.8% and 20.8% respectively which reflects a transactional stage of fertility.

The data related to education attainment was showing inverse relation towards living children. Women with no formal education had the highest proportion with three or more living children with 38.7% while those with higher education showed fewer children. Over half that is 55.1% of women with secondary education and 14.6% represent higher education having exactly two children. Only 3.6% of women with higher education had three or more children. The analyse thus indicates a clear and consistent relationship between education and fertility

The next parameter Wealth Quintile also shows a significant association and its supported by data showing women from poorest and poorer household had higher proportion of three or more living children of 7.4% and 21.1% respectively compared to women in the richest quintile with 14.5%. among that data women in the richest and richer quintile had exactly two living children with 24.5% and 31.6% respectively suggesting a fertility showed decline with improved economic conditions, ie., fertility decrease with increase in economic conditions.

Place of Residence revealed that women in rural areas were more likely to have higher parity. Approximately two-thirds of women with three or more children resided in rural areas (66.6%), while urban women were more likely to have one or two children.

Religion also exhibited variation. Hindu women comprised the majority of each fertility group; however, Muslim women had a notably higher representation among those with three or more children (19.1%), compared to 8.1% among those with two children and 5.5% among those with one child. This suggests possible cultural or normative influences on fertility behaviour.

Overall, these patterns reflect the persistent influence of age, education, economic status, and socio-cultural factors on fertility in South India. Higher education and wealth were associated with smaller family sizes, whereas younger age, low education, and rural residence correlated with higher numbers of living children.

6. Discussion

The current study analysed the prevalence and determinants of SBI among currently married women in South Indian states using NFHS-5 data. The results indicated that substantial variation among inter-state in relation to SBI, with Kerala exhibiting lowest rate and Karnataka the highest. The design-based F statistics confirmed that these differences are statistically significant which highlight the need for context specific family planning policies to be implemented by government and concerned authorities.

The multivariable analysis identified maternal age, number of living children, educational level, wealth, religion, contraceptive use, child survival status and state of residence act as a significant predictors of SBI. Women of older age groups and those with higher education qualification had shown significantly lower odds of short spacing which is consistent with previous research that indicated that education empowers women to make informed reproductive choices and delays early childbearing. On the contrary there is higher parity was allied with increased likelihood of short intervals which suggests that persistent preference for large family size or inadequate access to spacing method according to certain study contexts.

The use of contraceptive showed that complex relationship to short intervals. Modern method users were more likely to report short spacing likely due to many imitative contraception only after experiencing closely spaced birth rather than proactively for birth spacing. Traditional methods used was linked to lower odds of short intervals perhaps reflecting to deliberate planning or self-selection among women with the prioritizing birth spacing. This highlight that the need for postpartum family planning through counselling and better integration of birth spacing methods within maternal health awareness programs.

The state like Kerala's distinctive pattern with the lowest share if SBI may reflect its strongest health infrastructure, higher female literacy and supporting sociocultural acceptance for small family size. In contrast, the relatively higher rate is shown among states of Karnataka, Tamil Nadu, Andhra Pradesh and Telangana which suggest that there is gap in the reach or acceptance of spacing methods or residual socio-cultural factors supporting early and closely spaced childbearing.

These findings have several policy implications like expanding access to health care information and awareness of reversible modern contraceptive methods which is another critical factor especially among young and less educated women. Through reinforcing postpartum counselling and community level health worker outreach can help to ensure that women adopt to appropriate spacing behaviours even after short interval birth. By also giving tailored IEC (Information, Education and Communication) strategies and programs addressing persistent socio-cultural barriers particularly in rural and high fertility area which is essential for promoting optimal BIs.

The study despites the strength shows large representative sample with robust and analytical methods and context specific focus, also have limitations including its cross-sectional design which cannot prove with established causation and potential recall bias may also be inherent to birth history while data collections. Future research should consider longitudinal approaches or qualitative studies to further discover the untouched socio-cultural determinants and used of birth control methods like contraceptive while family planning decision making for birth spacing.

The study demonstrates that while South India leads the country in reproductive health indicators had marked internal heterogeneity is persistent across the BI patterns. There should be efforts and initiative to reduce SBI by prioritising education, comprehensive contraceptive awareness and along with its access and context sensitive health communication, all these can ensure the benefits of healthier birth spacing extending to all women regardless of social or geographical background.

7. Conclusion

The current study demonstrated that significant variation exists between short birth intervals and married women across south Indian states which highlights a persistent across intra-regional inequalities despite of its overall progress in reproductive health. Kerala shows low rate of SBI contrast with all other states such as Karnataka and Tamil Nadu where the risk remains higher. Model analysis confirmed that crucial roles of factors like age, education, wealth, parity, religion, child survival status and contraceptive use in shapes the birth spacing practices. Promoting awareness among individual especially for young and less educated individual is essential in order to reduce short spacing and its associated health risks.

The continued investment in female education is the major way to provide targeted messages for high-risk groups and culturally sensitive outreach region which remain a vital strategy for achieving optimal birth spacing. Through tailored approach can be used at state level based on realities can ensure that South India's maternal and child health gains are consolidated and equitably shared.

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