

# Maternal Health Care Service utilization among Young Married Women in India, 1992-2016: Trends and determinants

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## Research article

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## Abstract

**Background:** Maternal deaths among young women (15-24 years) shares 38% of total maternal mortality in India. Utilizing maternal health care services can reduce a substantial proportion of maternal mortality. However, there is a paucity of studies focusing on young women in this context. This paper therefore aimed to examine the trends and determinants of full antenatal care (ANC) and skilled birth attendance (SBA) utilization among young married women in India.

**Methods:** The study analysed data from the four rounds of National Family Health Surveys conducted in India during the years 1992–93, 1998–99, 2005–06 and 2015–16. Young married women aged 15-24 years with at least one live birth in the three years preceding the survey were considered for analysis in each survey round. We used descriptive statistics to assess the prevalence and trends in full ANC and SBA use. Pooled multivariate logistic regression was conducted to identify the demographic and socioeconomic determinants of the selected maternity care services.

**Results:** The use of full ANC among young mothers increased from 27% to 46% in India, and from 9% to 28% in EAG (Empowered Action Group) states during 1992-2016. SBA utilization was 88% and 83% during 2015-16 by showing an increment of 20% and 50% since 1992 in India and EAG states, respectively. Findings from multivariate analysis revealed significant difference in the use of selected maternal health care services by maternal age, residence, education, birth order and wealth quintile. Additionally, Muslim women, women belonging to scheduled caste (SC)/ scheduled tribe (ST) social group, and women unexposed to mass media were less likely to utilize both the maternal health care services. Concerning the time effect, the odds of the utilization of full ANC and SBA among young women was found to increase over time.

**Conclusions:** Utilization of full ANC remained unacceptably low, specifically in EAG states. Programmatic interventions, targeting women residing in EAG states, adolescents, illiterate, poor and Muslim and SC/ST women would help to increase full ANC utilization and to maintain the increasing trend of SBA use.

## Background

Although the incidence of maternal mortality has decreased globally, it remains unacceptably high in many developing countries [1]. Approximately 810 women died every day during and following pregnancy and childbearing in 2017 [2]. A vast gap in maternal mortality ratios (MMR) still exists between rich and poor countries with 94% of all maternal deaths occurring in low and lower middle-income countries [2]. Most maternal deaths occur due to complications developed during pregnancy that are preventable or treatable [3]. In developing countries, eight out of ten maternal deaths are related to women's inability to receive emergency obstetric care from well-trained health professionals [4].

India had 35,000 maternal deaths in 2017 which is 12% of the global share [2]. MMR of India has come down to 122 per 100,000 live births in 2015-2017. However, there is still a long way to attain the target mentioned in the Sustainable Development Goals (SDGs), particularly in Empowered Action Group (EAG) states as they contribute to the maximum maternal deaths with MMR being 175 per 100,000 live births [5]. As per Census 2011, India had one-fifth (19.1%) of its total population as Youth (15-24 years), and the share is expected to be 34.33% by 2020 [6]. Young women face challenges of early marriage, unwanted pregnancies, abortions, and sexually transmitted diseases including HIV/AIDS among others [7-9]. For example, by the time a woman in India completes the period of youth, she already has on average, 1.5 children [6]. Moreover, the burden of maternal mortality is also higher among this group as the risk of developing serious complications and subsequent death during childbearing are higher for them [10,11]. In India, around 38% of maternal mortality occurred between the age group of 15-24 years during 2015-17 [12].

It is well documented that the use of maternal health care services is an efficient approach to reduce adverse pregnancy outcomes, especially in places where women are underprivileged [13-15]. Evidence shows that utilizing antenatal care during pregnancy and skilled attendance during delivery can lead to a pronounced reduction in maternal deaths [16-18]. According to the Indian Demographic and Health Survey, also known as National Family Health Survey (NFHS), nearly

21% and 79% of mothers reported receiving full antenatal care (full ANC) and skilled birth attendance (SBA) during 2015-16, respectively [19]. This elucidates that the scenario of full ANC is still very depressing in India. Although the overall coverage of SBA is high, there is a significant disparity between rural-urban residents and among different states of India [20].

Several studies in India have been conducted exploring factors associated with the utilization of maternal health care services and reported the significant influence of demographic and socioeconomic characteristics of women on the use [21-24]. However, no such studies have been conducted which primarily focused on the utilization of essential maternal health care services among young mothers. A recent systematic review of studies in low- and middle-income countries suggested community-based interventions targeting young married couples. The same study also revealed a pressing need for more research to fill the knowledge gaps that exist about the utilization of reproductive/maternal health care services among young married women [25]. None of the earlier studies have examined trends in the prevalence of maternal health care service utilization by using all the four rounds of NFHS. Knowledge of the underlying trends in the utilization of maternal health care services and of the key factors influencing the utilization is critical for the development of effective and targeted health care programs. The present study, therefore, aimed to assess the prevalence, trends and determinants of maternal health care service utilization among young married women in India, considering the dimensions of full antenatal care and skilled birth attendance.

The specific objectives of the study were: (i) to examine the trends in the percentage of young married women (aged 15-24 years) who availed themselves of full ANC during pregnancy and SBA during delivery between NFHS-1 (1992-93) and NFHS-4 (2015-16). (ii) to investigate the demographic and socioeconomic determinants of the utilization of full ANC and SBA among young mothers.

## Methods

### Data

This study has utilized data from the four rounds of National Family Health Survey (NFHS) conducted during the years 1992-93 (NFHS-1), 1998-99 (NFHS-2), 2005-06 (NFHS-3) and 2015-16 (NFHS-4). NFHS is a nationally representative, cross-sectional household survey and is the Indian version of Demographic Health Survey (DHS) conducted by International Institute for Population Science (IIPS) under the guidance of Ministry of Health and Family Welfare (MoHFW), Government of India. The survey covers a representative sample of women in the age group 15–49 and provides reliable estimates of fertility, family planning practices, reproductive health, maternal and child health care, utilization and quality of health and family planning services and other related indicators across all the states/union territories and India as a whole. In this study, data of the currently married young women aged 15–24 years (the United Nations has defined youth as female between the ages of 15 and 24) were considered for analysis in each round. Information on the indicators of maternal health care services has been collected for different reference periods in the different rounds of NFHS. For the purpose of retaining consistency, the sample for this study was confined to the information for the last live birth in the three years preceding the date of survey. Also, the samples from Sikkim and Tripura were excluded from the final analytic samples as the required information in states of Sikkim and Tripura were missing in NFHS-1 and NFHS-2, respectively. Appropriate sample weights were used taking cognizance of the survey design to make the estimates representative and comparable over all the survey rounds. The detailed description of the survey design including sampling weights and other information are provided in the round specific reports [19,26-28]. Table 1 shows total number of eligible women interviewed, response rates and the final analytic sample size (number of women that met our inclusion criteria) for all the four rounds of NFHS.

### Outcome Variables

The study used two indicators to measure the utilization of maternal health care services among young married women; full antenatal care (Full ANC) and skilled birth attendance (SBA). Keeping in mind World Health Organization's

recommendation and availability of information across all the four survey rounds, full ANC indicator was measured as those women who had four or more antenatal check-ups, had at least one tetanus toxoid injection and consumed iron and folic acid tablets or syrup for the last live birth during the three years preceding the survey period [29]. The SBA indicator includes those women who had their deliveries conducted either in public or private hospitals/health centres/clinics or at home assisted by trained health personnel (doctor/nurse/Lady Health Visitor (LHV)/Auxiliary Nurse Midwives (ANM)) [30]. Both the outcome indicators were measured with binary responses (used full ANC/SBA =1; otherwise= 0).

### **Study covariates**

Demographic and socioeconomic characteristics of women included as covariates in the analysis were type of residence, state-wise residence, religion, social group, wealth quintile, educational level, maternal age, birth order, and mass media exposure. Survey round was included as a factor for analysing the use of maternal health care services among young women over time.

Type of residence was classified as either rural or urban. State-wise residence was categorized as EAG states and other (non-EAG) states. Empowered Action Group (EAG) states are Indian States that have been identified as larger, poorer states with weak public health indicators and infrastructure that qualify for additional funding and programs. EAG states include Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Uttarakhand, Odisha, and Rajasthan. Based on religion, women were grouped into three categories as Hindu, Muslim, and 'Others' (Christians, Sikhs, Buddhists, Jain, Jewish, Parsi, and others). The social group variable was categorized as Scheduled Castes (SC), Scheduled Tribes (ST), and 'Others' (or non-SC/ST). Since the NFHS-1 data contained only these three categories of the social/caste group, we were compelled to pool other backward class (OBC) and the Other social group in the successive three NFHS rounds, which provided separate information for OBC. Wealth quintile is an indicator of household wealth and is calculated from the ownership of household assets including consumer items, dwelling characteristics and other characteristics that are related to wealth status. It was categorized into five quintiles: 1 (poorest), 2 (poor), 3 (middle), 4 (richer) and 5 (richest). The educational level of women was classified into four categories: no education, primary, secondary, and higher. Maternal age is defined as age (in completed years) of the mother at the time of delivery. We calculated maternal age by subtracting infant's age from the mother's age at the time of survey. It was coded as  $\leq 19$  and 20-24 years. These age categories were used since maternal health indicators of teenage mothers (aged  $\leq 19$  years) varies with those of adult young mothers (aged 20-24 years) [31,32]. The birth order was coded as 1 (first birth order), 2 (second birth order), and 3+ (birth order three and above). Lastly, exposure to mass media was assessed from women's exposure to any of the three modes of mass media namely newspaper/magazine, radio, television/cinema. Based on these three modes, women were categorized into two groups: no exposure (accesses none of the three media) and any exposure (access to any of the three media).

### **Statistical Analysis**

Descriptive statistics were obtained for the demographic and socioeconomic characteristics of women aged 15-24 who had a child in the three years preceding the surveys. The trends in the prevalence of full ANC and SBA utilization was analysed using weighted frequency percentages, stratified by the selected background characteristics. The trend was examined separately for the survey periods NFHS-1 to NFHS-2, NFHS-2 to NFHS-3, NFHS-3 to NFHS-4, and NFHS-1 to NFHS-4 to observe the changes over time.

Owing to the comparable sampling design of NFHS [33,34], we have pooled all the four rounds of NFHS datasets to observe changes in maternal health care utilization among young married women over time. Since both the outcome indicators used in this study were dichotomous variables, pooled logistic regression models were fitted to assess the influence of demographic and socioeconomic predictors on the likelihood of utilizing full ANC and SBA. Before including in regression analysis, all the predictor variables were verified for association with outcome variables at bivariate level using chi square tests. We considered  $p < 0.05$  as the criterion for statistical significance. The results of the regression analysis have been presented as odds ratios (OR) with their 95% confidence intervals (CI). The entire analysis has been carried out

using STATA version 14 (Stata Corporation, College Station, TX, USA) with svyset (SVY) commands to take into account the survey design (i.e. sampling weights with clustering and strata).

## Results

### Trends in sample characteristics

Table 2 presents the weighted percentage distribution of the study sample for each survey round by selected background characteristics. More than three-quarters of the women were from rural areas across all four surveys. According to the NFHS-4, nearly 47% of the young mothers were residents of EAG states, and this percentage was similar in the earlier three surveys. The majority of women were Hindu and from 'non-SC/ST' social group in all the four rounds of the survey. The distribution of women by wealth quintile remained more or less similar across all four surveys with more women in poor households than in richer households. On average, about half of the women had no education in the first three surveys (62% in NFHS-1, 50% in NFHS-2, and 43% in NFHS-3), while in NFHS-4 only 19% reported no education. The proportion of women with secondary education rose from 21% in NFHS-1 to 58% in NFHS-4. The proportion of young married women who had their last birth during teenage declined from 44% in NFHS-1 to 32% in NFHS-4. Birth order of women has undergone significant changes over the four survey periods; the proportion of women with first birth order increased from 48% to 58% while women with birth order three and above reduced from 22% to 9%. Exposure to any type of mass media among young mothers increased from 48% in NFHS-1 to 70% in NFHS-4.

### Trends in the utilization of maternal health care services

Figures 1 and 2 depict the trends in the use of full ANC and SBA, respectively, among young married women in India and EAG states during the period 1992-2016. The utilisation of full ANC was relatively less though the percentage of women who utilized full ANC increased from 25% in NFHS-1 to 45% in NFHS-4 in India, whereas in EAG states it was only 28% in NFHS-4 with an increase of more than 3 times since NFHS-1. There was a major shift in the proportion of women who had SBA between NFHS-1 and NFHS-4; increased from 38% in NFHS-1 to 88% in NFHS-4 in India and increased from 23% in NFHS-1 to 83% in NFHS-4 in EAG states.

Tables 3 and 4 present the trends in the proportion of young women availing themselves of full ANC and SBA by background characteristics during the study period. The trend period was divided into three phases; NFHS-1 to NFHS-2 (1992-98), NFHS-2 to NFHS-3 (1999-2005), and NFHS-3 to NFHS-4 (2006-16). Third phase showed the largest increment in the utilization of full ANC and SBA in India with 14 and 36 percentage point change respectively.

### Trends in the prevalence of full ANC utilization by background characteristics

Among urban residents, the largest increment of 7 percentage points in the use of full ANC was observed during the first phase (1992-98), whereas, among rural residents the highest absolute change was observed during the third phase (2006-16) with 16% increase. Pooled data showed that only 34% of rural women utilized full ANC and the percentage is 53 for the urban women. On average 55% of women residing in non-EAG states utilized full ANC and the proportion increased by 23 percentage points between 1992 and 2016, whereas, in EAG states the full ANC services were used by only about 21% of young mothers and an increment of 19% was observed during the study period. The ST women showed maximum increment in full ANC utilization between NFHS-1 and NFHS-4; during NFHS-1 only 15% of ST women go for full ANC but at the time period of NFHS-4 it rose to 43%. Regarding education, women with higher education showed greatest prevalence of full ANC utilization while the largest increment was observed among women with no education with a change of 12 percentage points. Although the proportion of women belonging to poorest wealth quintile who utilized full ANC has been increased by almost three times since 1992, it was still only 27% during 2015-16. Also a considerable increment in the level of use was observed in the middle and the poorer wealth quintiles. Proportion of adolescent mothers who availed

themselves of full ANC doubled; from 23% in NFHS-1 to 46.5% in NFHS-4. Women with first birth order showed greatest prevalence and increment in the prevalence of full ANC use over the study period. (Table 3)

### **Trends in the prevalence of SBA utilization by background characteristics**

The highest increment in the proportion of young women who had SBA was seen in the third phase (2006-16) of the study period in all the categories. The utilization of SBA increased from 30% to 86% among rural women and from 68% to 94% among urban women between 1992 and 2016. Pooled data showed that on average nearly 39% of women residing in EAG states did not receive skilled attendance at the time of delivery during the study period, however, the proportion underwent a sharp increase during the period, specifically during the third phase; from 23% in NFHS-1 to 37% in NFHS-3, and to 83% in NFHS-4. Hindu women showed highest increment in the use of SBA followed by Muslims with a rise of 53 and 44 percentage points respectively. Although the prevalence of SBA remained lowest in women belonging to Scheduled Tribe social group, this group showed largest increase of 63% between 1992 and 2016. Percentage of uneducated women who had SBA increased substantially during the study period; from 23% in NFHS-1 to 76% in NFHS-4. Women belonging to poorer wealth quintile showed largest increment in SBA utilization with an absolute change of 63 percentage points between 1992 and 2016 followed by poorest and middle class women. It is clear from the pooled data that on average 65% of adolescent mothers used SBA and the percentage is 72 for adult young mothers. Women with second birth order showed a larger increase in SBA utilization during the study period. The prevalence of SBA rose from 54% to 92% among women who had exposure to any media, whereas it increased from 23% to 75% among women unexposed to any kind of mass media. (Table 4)

### **Determinants of maternal health care service utilization among young married women**

Table 5 presents the results of pooled logistic regression for the utilization of selected maternal health care services by young married women. After adjusting for other covariates, the overall probability of young women practicing full ANC during their last pregnancy increased by 1.8 times (95% CI = 1.68 - 1.98) between NFHS-1 and NFHS-4, whereas the probability of young women availing themselves of SBA grew by 14 times (95% CI = 12.66 - 14.75) during the same period. Urban women were 27% (95% CI = 1.18 - 1.36) more probable to utilize full ANC and 87% (95% CI = 1.71 - 2.04) more probable to have SBA than rural women. Compared to women residing in EAG states, women residing in other states had 4.7 times (95% CI = 4.46 - 4.99) and 2.5 times (95% CI = 2.30 - 2.62) higher odds of full ANC and SBA utilization, respectively. Muslim women were 22% (95% CI = 0.72 - 0.84) and 42% (95% CI = 0.54 - 0.64) less likely to use full ANC and SBA respectively than their Hindu counterparts. Young women belonging to the ST social group were disadvantaged with 32% (95% CI = 0.60 - 0.75) less probability, whereas women belonging to non-SC/ST social group were 14% (95% CI = 1.06 - 1.22) more likely to avail themselves of SBA compared to SC women. The probability increased significantly with the economic level (that is, wealth quintile) and with the educational level of women, in both the unadjusted and adjusted models. After adjustment, women belonging to richest wealth quintile were 2.3 times (95% CI = 2.10 - 2.63) and 4.4 times (95% CI = 3.86 - 4.98) more likely to use full ANC and SBA, respectively, than the poorest group. Compared to women with no education, women with higher education had 3.4 times (95% CI = 3.04 - 3.84) and 4.5 times (95% CI = 3.72 - 5.44) higher odds of full ANC and SBA utilization, respectively. Young women who gave birth during the upper age group (20-24 years) were more likely to use full ANC (Adjusted Odds Ratio (AOR) = 1.18; 95% CI = 1.13 - 1.24) and SBA (AOR = 1.2; 95% CI = 1.14 - 1.27) compared to adolescent mothers. The odds for use of both the maternal health care services decreased with increasing birth order. Women with birth order three and above had lower odds of full ANC (AOR = 0.55; 95% CI = 0.51 - 0.59) and SBA (AOR = 0.41; 95% CI = 0.38 - 0.44) utilization compared to women with first birth order. Women who had exposure to mass media were more likely to utilize full ANC (AOR = 1.67; 95% CI = 1.57 - 1.78) and SBA (AOR = 1.30; 95% CI = 1.23 - 1.38) than women who did not have any mass media exposure.

## **Discussion**

This study has attempted to explore the utilization of maternal health care services among young married women in India by examining the underlying trends and determinants over a period of two and a half decades using nationally representative data sets. Specifically, our study focused on two indicators of maternal health care services, namely, full antenatal care and skilled birth attendance.

Although the utilization of full ANC is showing an upward trend since 1992, there exist a substantial proportion of young women who are not practicing full ANC during pregnancy. Moreover, utilization of full ANC is unacceptably low in EAG states as 72% of young mothers belonging to these states did not go for full ANC during 2015-2016. A remarkable increase in the proportion of young women who had SBA during birth was evident during 2005-2006 and 2015-2016, which may be attributed to a well-funded and well-publicized safe motherhood intervention named Janani Suraksha Yojana (JSY). JSY has led to an extensive and rapid increase in institutional deliveries, from 18% in 2008, to more than 80% 10 years later [35]. This trend is also validated by the results from multivariate analyses. Lesser growth in the utilization of full ANC compared to SBA among young women could be due to several facts, such as limited knowledge and understanding about the importance of antenatal care, social restrictions for the young married women, and lack of cash incentives as in the case of SBA [35,36]. Our study has also revealed a number of demographic and socioeconomic predictors of the utilization of maternity care services among young mothers.

Consistent with previous studies [20,37-40], urban women were more likely to use maternal health care services. Regarding state-wise residence, the present study has found that the gap between EAG and Non-EAG states in the utilization of both the maternity care services among young women is much more prominent than the rural-urban gap. Based on multivariate analysis, women belonging to Non-EAG states were almost 5 times and 2.5 times more likely to use full ANC and SBA, respectively, compared to women belonging to EAG states. To the authors' knowledge, disparity in the use of maternal health care services between EAG and Non-EAG states has not been reported in the literature, however many studies have observed regional inequalities [24,41,42]. There could be many explanations for the low coverage of maternal health care services in EAG states. In India, there is a substantial difference in accessibility and availability of health care from public health facilities between EAG and Non-EAG states [43-45]. EAG states (mostly northern and central region) have a high proportion of population below poverty line and a high proportion of women not exposed to education and mass media [20,46].

Religion and social group of young women also influence the use of maternal health care services among them. This study has found that Muslim women were less likely to opt for full ANC and SBA. Regarding the social group, young women belonging to other than SC/ST group were more likely to use both the maternal health care services. Several studies from India [41,47,48] and other countries [37,38,59,50] showed that the utilization of maternity care services is affected by ethnicity and religion of women. Religion-specific beliefs and traditional practices of Muslim women may lead to lower use of maternity care services among them [51]. The low usage of maternity care services among SC and ST women could be due to lack of access to health care services as women of these social groups have a higher probability of living under adverse circumstances [52,53]. Also, the low coverage of maternal health care services among young Muslim and SC/ST women could be linked to their lower autonomy and lower socioeconomic status [54-56].

The educational status of young women appeared to be a pertinent predictor of the use of full ANC and SBA. A sharp increase in the odds of the utilization of both the maternal health care services was observed as we move from uneducated women to higher educated women. Many previous studies conducted in India [39,57,58] and other developing countries [59-62] have found similar results. Educated women have the capability to access health care information and are more aware of the negative consequences of not practicing maternity care services. Moreover, higher education may empower women to make proper decisions for their health and to use health care inputs accordingly [59,61].

The present study has found a significant disparity in maternal health care service utilization across different economic groups. Young women belonging to wealthier households were more likely to practice maternal health care than those who

are from poor households. This rich-poor gap is consistent with the findings of many other studies from India [20,63,64] and elsewhere [59,62,65]. Poor young women are often turned out to be uneducated, unemployed, and detached from social networks; they are thus more difficult to be reached by maternity care programs, and they tend to underestimate the importance of maternal health care services and therefore prioritize spending their limited resources on daily basic needs over maternal health care [66,67].

Our study emphasizes the role of maternal age and birth order on the likelihood of utilizing maternal health care services. We found that adolescent mothers were less likely to use full ANC and SBA than older young mothers. This finding is supported by a study conducted in Kenya on young women [60]. Knowledge and experience of elder women encourage them to get maternity and childbirth care [68]. Additionally, older young women have higher decision making autonomy, which has a positive association with greater use of maternal health care services [56,69]. Therefore, delaying childbearing of young women would be beneficial for greater coverage of maternity care services. Concerning birth order, the likelihood of using full ANC and SBA decreases significantly with the increase in birth order. Several other studies have reported similar finding [39,41,48,70]. Primiparous women may have fear of first pregnancy and are more afraid of complications and difficulties during delivery. Whereas, during higher-order births, women may have developed self-confidence as they have prior experience of birth/births, which makes them less likely to seek maternal health care services [70,71]. The other reasons may be resource constraints due to having more children and prior bad health facility experiences [70].

In our study, young women with no exposure to any kind of mass media were found to be less likely to use full ANC and SBA. This result concurs with the findings from various other studies in which exposure to mass media had a positive association with the utilization of maternity care services [48,62,72,73]. Mass media is an important source of information on health and existing health care programs or policies. Women, who are exposed to mass media, may have a better understanding of maternal health complications and the importance of antenatal care and skilled birth attendance during delivery. Women's exposure to mass media may also be associated with other factors like higher wealth quintile, higher education, and urban residence, all of which are positively associated with an increased likelihood of utilizing maternal health care service.

The government of India has launched several programs to reduce inequity in health care services and improve reproductive, maternal, new-born and child health outcomes. These programs included the National Rural Health Mission (2005), the National Urban Health Mission (2008), and the Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCH+A) Strategy. The RMNCH+A strategy was introduced in 2013 to address the major causes of mortality among women and children and to strengthen health care services especially in the poor-performing regions of the country [74]. It is evident from this study that there is a quite significant and persistent gap in utilization of full ANC and SBA between EAG and other states in India among young mothers. Also the coverage of full ANC remained fairly low, even during 2015-16. These findings question the effective implementation of the ongoing programs and policies. Therefore, our study recommends a close monitoring of the ongoing programs and focused initiatives to reach out to the young women who are in need of essential maternal health care services. To address low coverage of full ANC, we suggest that the government should either launch new cash initiatives covering ANC services or include ANC services under existing schemes such as newly launched National Health Protection Scheme under Ayushman Bharat Yojana.

## **Strengths and Limitations**

The main strength of our study is that it is based on the four waves of a nationally representative survey, which covers a time period of more than two decades (1992-2016). Thus, the findings of this study are generalizable to the entire nation. The standardized methodology used by the DHS also allows comparisons with similar data across different countries. In spite of these strengths, the findings of this study should not be interpreted without acknowledging its limitations. Some of the potential limitations of our study include recall bias, reporting bias, and non-availability of required information in some or all of the survey rounds. The responses on age, antenatal care, skilled birth attendance were self-reported by women and

hence are prone to recall and reporting bias. During multivariate analysis, important variables representing women's decision-making autonomy were excluded due to lack of data on these variables. Since the information on maternal health care indicators was available only for pregnancies that resulted in a live birth, we were not able to analyse the section of population with adverse outcomes i.e. miscarriage, abortion or still birth. Also, there was no data on the quality and accessibility of maternal health care services which could have given a more informed idea on the adequacy of maternity care.

## Conclusions

Analysing data from all the four rounds of NFHS, our study has revealed that the utilization of full ANC remained unjustifiably low among young mothers in India during 1992-2016, and the use of SBA showed an appreciable increment during the period. The inadequate use of these maternity care services could lead to fatal health outcomes for both the mother and the infant. Our study revealed the educational and economic status of young women as the most significant determinant of maternal health care service utilization. The other underprivileged segments were adolescents, rural residents, Muslim, SC/ST, and mass media unexposed women. Therefore, targeting these disadvantaged sub-groups of the population while designing health interventions would help to improve coverage of antenatal care and to maintain the increasing trend of skilled birth attendance.

Another major finding of this study is a widespread disparity in the utilization of services between EAG and Non-EAG states. Regardless of various existing schemes and policies for the improvement of maternal health in EAG states, the low usage of maternity care services among young mothers of these states is a matter of concern. Consequently, there is a need to ensure effective implementation of ongoing programs by improving public health network and the quality of physical and human infrastructure in EAG states. Finally, interventions addressing maternal health education and counselling of young married couples may prove effective in raising awareness about the importance of planned parenthood and health care service utilization during pregnancy.

## Abbreviations

ANC: Antenatal Care, SBA: Skilled Birth Attendance, EAG: Empowered Action Group, NFHS: National Family Health Survey, DHS: Demographic and Health Survey, OBC: Other backward classes, SC: Scheduled Caste, ST: Scheduled Tribes, AOR: Adjusted Odds Ratio

## Declarations

### Ethical Approval and consent to participate

Ethical approval was not needed for this study as it was based on secondary data available freely, upon request in the public domain. All the surveys were conducted under the supervision of the Ministry of Health and Family Welfare, Government of India, with the International Institute for Population Sciences, Mumbai, serving as the nodal agency. The data collection procedures were also reviewed and approved by ICF Macro International. The survey agencies have collected the data with ethical standards being compiled including informed consent obtained from respondents.

### Consent for publication

Not Applicable

### Availability of data and materials

The dataset analyzed cannot be made publicly available by us as it belongs to the DHS program, but it can be accessed from the following link after acquiring permission from Measure DHS: <https://www.dhsprogram.com/data/available-datasets.cfm>

### Competing Interest

The authors declare that they have no competing interests.

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The research has not received any financial grant from any organization or funding agency.

### Author's Contribution

PS1: Conceptualized and designed the overall study, performed the data analyses and writes up, drafted the manuscript and prepared it for publication. Prof. KKS: Participated in designing the study, result writing and critically reviewing the manuscript for intellectual content. PS2: Participated in analysis and reviewed the final manuscript. All authors read and approved the final manuscript.

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## Tables

**Table 1** Number of women interviewed, response rates and final analytic sample size according to survey round.

	NFHS-1	NFHS-2	NFHS-3	NFHS-4
Number of women interviewed	89,777	91,000	124,385	699,686
Response rate (in %)	96.1	95.5	94.5	96.7
Final analytic sample size	17,335	14,243	16,047	63,351

**Table 2** Weighted percentage distribution of women aged 15-24 years who had given birth in the 3 years preceding the survey by analysis variables and survey round.

Variables	NFHS-1	NFHS-2	NFHS-3	NFHS-4	Total <sup>a</sup>
Number	17,335	14,243	16,047	63,351	110,976
<b>Type of residence</b>					
Rural	79.37	79.67	76.36	75.09	76.53
Urban	20.63	20.33	23.64	24.91	23.47
<b>State-wise residence</b>					
EAG states	45.48	46.74	49.84	47.50	47.43
Other states	54.52	53.26	50.16	52.50	52.57
<b>Religion</b>					
Hindu	81.39	81.30	80.64	80.02	80.49
Muslim	14.09	14.66	15.52	15.85	15.37
Others	4.52	4.03	3.83	4.13	4.13
<b>Social group</b>					
Scheduled caste	13.51	20.44	21.28	22.14	20.45
Scheduled tribe	9.85	9.75	9.32	11.19	10.53
Others	76.63	69.81	69.39	66.67	69.02
<b>Educational level</b>					
No Education	62.05	50.42	41.92	19.31	33.25
Primary	15.96	17.13	16.64	14.35	15.29
Secondary	20.62	26.36	38.63	58.22	45.43
Higher	1.37	6.09	2.80	8.12	6.03
<b>Wealth Quintile</b>					
Poorest	20.40	21.25	22.49	21.66	21.53
Poorer	23.17	23.47	23.55	24.62	24.09
Middle	22.54	22.22	22.07	23.01	22.70
Richer	20.21	19.95	19.73	19.40	19.64
Richest	13.69	13.11	12.14	11.32	12.04
<b>Maternal age</b>					
≤19	44.46	43.20	42.07	31.77	36.71
20-24	55.54	56.80	57.93	68.23	63.29
<b>Birth order</b>					
1	44.78	44.69	47.14	57.78	52.53
2	32.68	32.91	34.47	33.28	33.31
3+	22.54	22.40	18.39	8.94	14.16
<b>Mass media exposure</b>					
No exposure	51.75	44.03	28.02	21.91	30.29
Any exposure	48.25	55.97	71.98	78.09	69.71

a- percentage of total

Table 3 Percentage of young married women who utilized full antenatal care by demographic and socioeconomic characteristics, India, 1990-2016.

Variables	Prevalence ( %) of full ANC utilization					Percentage change			
	NFHS-1	NFHS-2	NFHS-3	NFHS-4	Total <sup>a</sup>	NFHS-1 to NFHS-2	NFHS-2 to NFHS-3	NFHS-3 to NFHS-4	NFHS-1 to NFHS-4
<b>Type of residence</b>									
Rural	21.23	22.19	26.27	42.53	34.02	0.96	4.08	16.26	21.3
Urban	42.05	48.96	52.02	56.36	52.94	6.91	3.06	4.34	14.31
<b>State-wise residence</b>									
EAG states	9.13	8.78	14.80	27.69	20.56	-0.35	6.02	12.89	18.56
Other states	39.21	44.17	49.80	62.53	54.60	4.96	5.63	12.73	23.32
<b>Religion</b>									
Hindu	25.26	27.14	32.56	45.55	38.08	1.88	5.42	12.99	20.29
Muslim	23.35	26.87	29.40	45.54	37.72	3.52	2.53	16.14	22.19
Others	37.22	40.30	39.98	55.95	48.65	3.08	-0.32	15.97	18.73
<b>Social group</b>									
Scheduled caste	20.31	22.06	27.95	46.20	37.68	1.75	5.89	18.25	25.89
Scheduled tribe	15.02	14.69	21.81	43.41	33.08	-0.33	7.12	21.6	28.39
Others	27.80	31.07	35.12	46.33	39.51	3.27	4.05	11.21	18.53
<b>Educational level</b>									
No Education	14.74	12.36	14.78	27.15	18.40	-2.38	2.42	12.37	12.41
Primary	31.83	28.12	29.54	39.17	34.87	-3.71	1.42	9.63	7.34
Secondary	50.21	46.67	49.44	52.13	51.25	-3.54	2.77	2.69	1.92
Higher	69.27	70.23	76.35	58.69	61.74	0.96	6.12	-17.66	-10.58
<b>Wealth Quintile</b>									
Poorest	9.94	9.94	13.05	27.03	20.22	0.00	3.11	13.98	17.09
Poorer	15.09	15.72	20.81	41.93	31.63	0.63	5.09	21.12	26.84
Middle	24.47	27.10	33.55	52.02	42.02	2.63	6.45	18.47	27.55
Richer	34.63	40.21	47.47	56.28	49.43	5.58	7.26	8.81	21.65
Richest	54.74	59.40	63.76	61.08	60.11	4.66	4.36	-2.68	6.34
<b>Maternal age</b>									
≤19	23.39	23.92	30.23	46.50	36.02	0.53	6.31	16.27	23.11

20-24	27.24	30.46	33.90	45.73	39.87	3.22	3.44	11.83	18.49
<b>Birth order</b>									
1	29.69	35.23	40.13	49.73	44.23	5.54	4.9	9.6	20.04
2	24.87	26.34	29.93	42.88	36.08	1.47	3.59	12.95	18.01
3+	18.21	14.36	16.96	33.27	22.62	-3.85	2.6	16.31	15.06
<b>Mass media exposure</b>									
No exposure	12.95	11.29	14.03	24.95	17.74	-1.66	2.74	10.92	12
Any exposure	39.02	40.49	39.48	51.88	47.46	1.47	-1.01	12.4	12.86
Total	25.53	27.63	32.35	45.98	38.46	2.1	4.72	13.63	20.45

a-full ANC use for the pooled data

**Table 4** Percentage of young married women who had skilled birth attendance by demographic and socioeconomic characteristics, India, 1990-2016.

Variables	Prevalence (%) of skilled birth attendance					Percentage change			
	NFHS-1	NFHS-2	NFHS-3	NFHS-4	Total <sup>a</sup>	NFHS-1 to NFHS-2	NFHS-2 to NFHS-3	NFHS-3 to NFHS-4	NFHS-1 to NFHS-4
<b>Type of residence</b>									
Rural	29.78	37.92	44.73	86.50	64.79	8.14	6.81	41.77	56.72
Urban	68.39	73.72	74.10	93.50	85.03	5.33	0.38	19.4	25.11
<b>State-wise residence</b>									
EAG states	23.48	29.17	36.76	83.45	60.50	5.69	7.59	46.69	59.97
Other states	49.65	59.28	66.50	92.58	77.69	9.63	7.22	26.08	42.93
<b>Religion</b>									
Hindu	37.01	44.88	52.57	89.66	70.16	7.87	7.69	37.09	52.65
Muslim	37.02	42.44	44.02	80.99	64.58	5.42	1.58	36.97	43.97
Others	53.33	61.80	63.77	88.61	75.90	8.47	1.97	24.84	35.28
<b>Social group</b>									
Scheduled caste	30.45	40.71	49.16	88.14	69.94	10.26	8.45	38.98	57.69
Scheduled tribe	18.08	26.28	32.93	80.98	59.12	8.2	6.65	48.05	62.9
Others	41.56	49.16	55.57	89.49	71.01	7.6	6.41	33.92	47.93
<b>Educational level</b>									
No Education	23.14	26.65	32.00	75.70	42.86	3.51	5.35	43.7	52.56
Primary	48.68	48.52	49.42	82.56	66.92	-0.16	0.9	33.14	33.88
Secondary	69.64	68.51	70.97	92.58	86.50	-1.13	2.46	21.61	22.94
Higher	92.08	88.58	93.39	97.01	95.50	-3.5	4.81	3.62	4.93
<b>Wealth quintile</b>									
Poorest	15.54	21.70	25.80	74.84	51.92	6.16	4.1	49.04	59.3
Poorer	22.73	30.30	39.93	86.20	63.14	7.57	9.63	46.27	63.47
Middle	34.23	45.24	54.61	92.54	72.22	11.01	9.37	37.93	58.31
Richer	53.27	63.07	69.68	95.48	80.72	9.8	6.61	25.8	42.21
Richest	79.12	82.73	87.78	97.17	90.57	3.61	5.05	9.39	18.05
<b>Maternal age</b>									
≤19	35.35	42.26	50.29	88.31	65.04	6.91	8.03	38.02	52.96
20-24	39.66	47.44	52.68	88.21	72.16	7.78	5.24	35.53	48.55
<b>Birth order</b>									
1	45.42	57.40	63.23	91.92	78.23	11.98	5.83	28.69	46.5
2	33.94	40.65	47.11	85.20	66.00	6.71	6.46	38.09	51.26
3+	28.01	27.54	30.62	75.79	45.62	-0.47	3.08	45.17	47.78
<b>Mass media exposure</b>									
No exposure	22.57	26.49	31.97	75.28	46.32	3.92	5.48	43.31	52.71
Any exposure	22.57	59.92	59.34	91.88	79.63	37.35	-0.58	32.54	69.31
Total	37.75	45.20	51.67	88.24	69.54	7.45	6.47	36.57	50.49

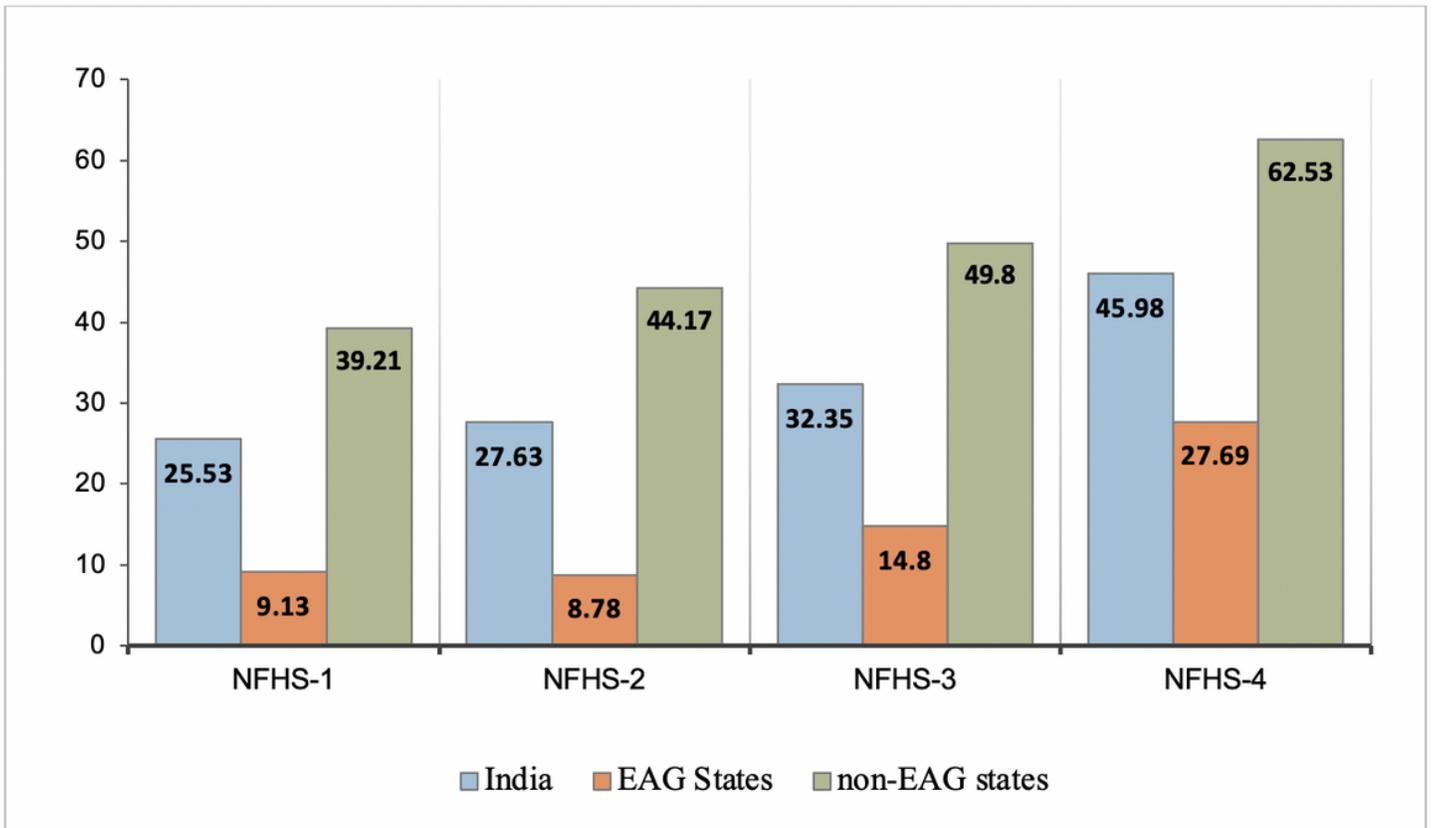
a-SBA use for the pooled data

Table 5 Demographic and socioeconomic determinants of maternal health care utilization among young married women in India, 1992-2016.

Variables	Full ANC		SBA	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<b>Survey round</b>				
NFHS-1 (ref)	1.00	1.00	1.00	1.00
NFHS-2	1.11* (1.02 - 1.21)	0.98 (0.89 - 1.06)	1.36** (1.25 - 1.48)	1.35** (1.25 - 1.46)
NFHS-3	1.40** (1.29 - 1.51)	1.21** (1.10 - 1.32)	1.76** (1.60 - 1.92)	1.73** (1.60 - 1.89)
NFHS-4	2.48** (2.33 - 2.61)	1.83** (1.68 - 1.98)	12.38** (11.53 - 13.29)	13.66** (12.66 - 14.75)
<b>Type of residence</b>				
Rural (ref)	1.00	1.00	1.00	1.00
Urban	2.68** (2.51 - 2.86)	1.27** (1.18 - 1.36)	3.80** (3.51 - 4.11)	1.87** (1.71 - 2.04)
<b>State-wise residence</b>				
EAG states (ref)	1.00	1.00	1.00	1.00
Other states	5.48** (5.16 - 5.81)	4.71** (4.46 - 4.99)	2.70** (2.51 - 2.90)	2.46** (2.30 - 2.62)
<b>Religion</b>				
Hindu (ref)	1.00	1.00	1.00	1.00
Muslim	0.95 (0.88 - 1.03)	0.78** (0.72 - 0.84)	0.85** (0.79 - 0.93)	0.58** (0.54 - 0.64)
Others	1.59** (1.44 - 1.75)	0.81** (0.73 - 0.91)	1.62** (1.45 - 1.80)	0.98 (0.87 - 1.11)
<b>Social group</b>				
Scheduled caste (ref)	1.00	1.00	1.00	1.00
Scheduled tribe	0.73** (0.66 - 0.80)	1.00 (0.90 - 1.10)	0.57** (0.52 - 0.63)	0.68** (0.60 - 0.75)
Others	1.26** (1.18 - 1.33)	1.10* (1.03 - 1.17)	1.20** (1.13 - 1.27)	1.14** (1.06 - 1.22)
<b>Educational level</b>				
No Education (ref)	1.00	1.00	1.00	1.00
Primary	2.58** (2.41 - 2.77)	1.50** (1.39 - 1.61)	2.74** (2.58 - 2.92)	1.53** (1.43 - 1.64)
Secondary	5.60** (5.28 - 5.93)	2.15** (2.02 - 2.30)	7.84** (7.41 - 8.29)	2.25** (2.10 - 2.40)
Higher	11.27** (10.17 - 12.48)	3.42** (3.04 - 3.84)	29.23** (24.32 - 35.13)	4.50** (3.72 - 5.44)
<b>Wealth Quintile</b>				
Poorest (ref)	1.00	1.00	1.00	1.00
Poorer	1.73** (1.60 - 1.87)	1.15** (1.06 - 1.24)	1.56** (1.47 - 1.66)	1.27** (1.18 - 1.37)
Middle	2.98** (2.76 - 3.21)	1.44** (1.33 - 1.56)	2.52** (2.35 - 2.69)	1.72** (1.58 - 1.87)
Richer	4.64** (4.28 - 5.04)	1.66** (1.52 - 1.82)	4.57** (4.26 - 4.91)	2.43** (2.22 - 2.67)
Richest	8.76** (7.98 - 9.62)	2.35** (2.10 - 2.63)	12.46** (11.30 - 13.73)	4.38** (3.86 - 4.98)
<b>Maternal age</b>				
≤19 (ref)	1.00	1.00	1.00	1.00
20-24	1.27** (1.22 - 1.32)	1.18** (1.13 - 1.24)	1.31** (1.26 - 1.36)	1.20** (1.14 - 1.27)
<b>Birth order</b>				
1 (ref)	1.00	1.00	1.00	1.00
2	0.69** (0.66 - 0.72)	0.72** (0.69 - 0.76)	0.55** (0.52 - 0.57)	0.51** (0.48 - 0.54)
3+	0.35** (0.33 - 0.38)	0.55** (0.51 - 0.59)	0.28** (0.26 - 0.29)	0.41** (0.38 - 0.44)
<b>Mass media exposure</b>				
No exposure (ref)	1.00	1.00	1.00	1.00
Any exposure	4.57** (4.31 - 4.85)	1.67** (1.57 - 1.78)	4.29** (4.10 - 4.49)	1.30** (1.23 - 1.38)

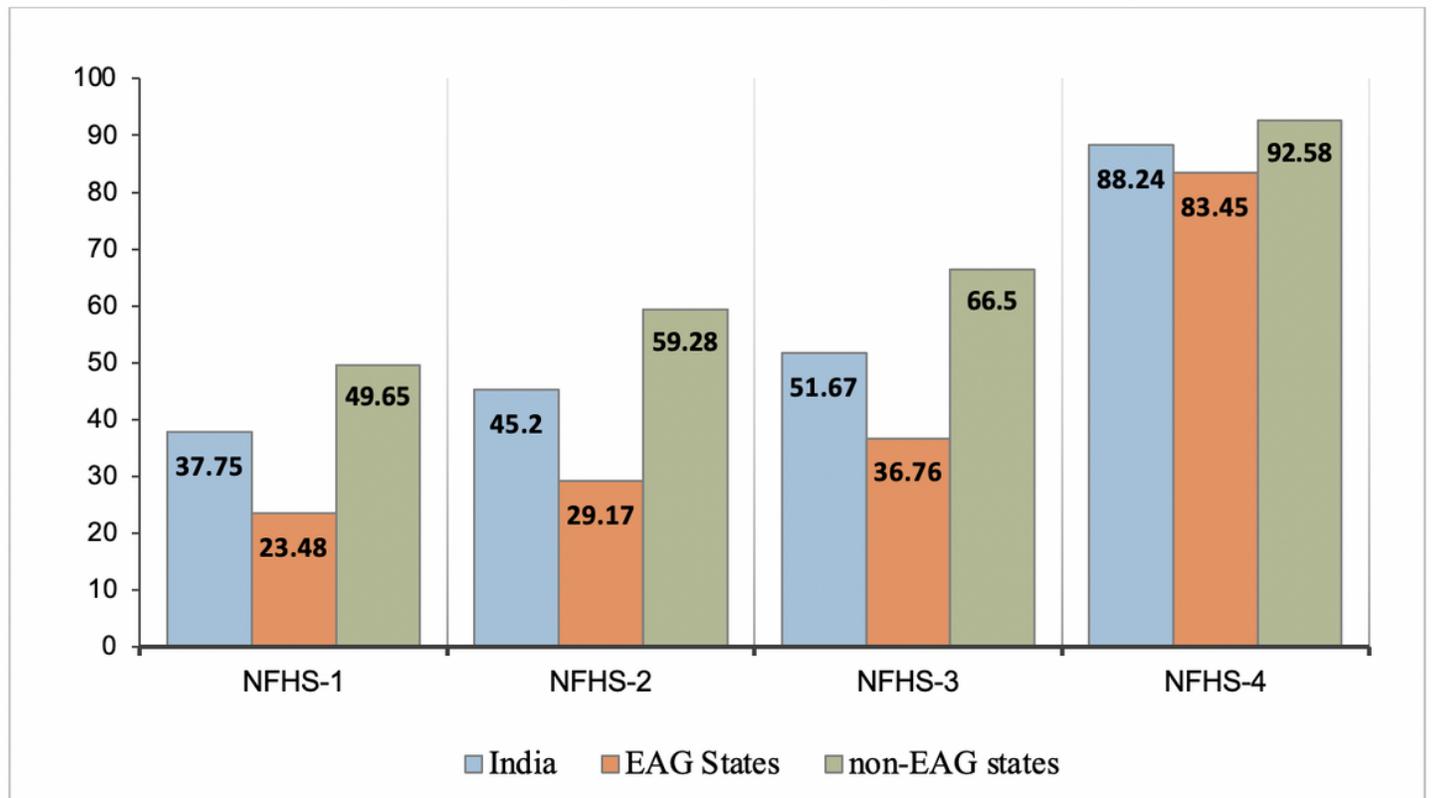
\*\* p<0.01; \*p<0.05

## Figures



**Figure 1**

Trends in the use of full antenatal care among young married women in India and EAG states, 1992-2016.



## Figure 2

Trends in the use of skilled birth attendance among young married women in India and EAG states, 1992-2016.